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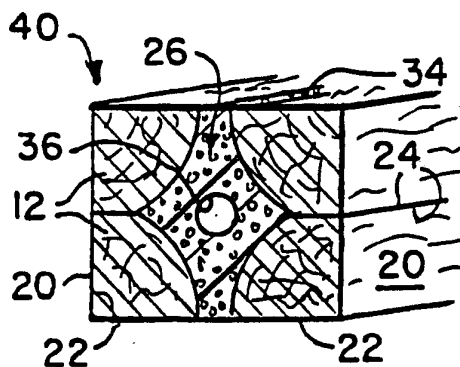
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(54) Title: METHOD OF CONVERTING LOGS AND RESULTANT PRODUCT



(57) Abstract

The method of converting logs (10) involves cutting each log (10) longitudinally and diametrically at right angles into equal quarter-log segments (12), then rearranging the quarter-logs (12) so that the arcuate surfaces of the segments face inwardly toward each other, while their cut flat surfaces (20, 22) are positioned to form a rectangle in cross-section. The segments so positioned may be joined together as such, rigid foam plastic insulation (26) may be introduced into the space remaining between the segments, or support bracing (60) and other insulation (64) may take the place of the rigid foam. The resultant converted logs may be used as beams, joists or bearing-wall members; devices (46, 50, 56) for aligning, registering and sealing the converted logs together are provided.

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METHOD OF CONVERTING LOGS AND RESULTANT PRODUCT

Wood has been the preferred building material for homes, bungalows, cottages and cabins for hundreds of years. Log structures are now extremely popular for their beauty, efficiency and comfort; many log buildings are being offered for sale and can be erected from plans and pre-cut log timbers provided by suppliers.

Figs. 1A - 1C of the accompanying drawings show a range of conventional prior art log wall assembly methods in present use. In Fig. 1A, each log L has an arcuate cut-out C along its entire length to accommodate the next log L in nesting relationship. This assembly method is called "Swedish Cope", and the logs are fixed into place by vertical rods or bolts R, extending through aligned bores B.

The logs L' of Fig. 1B are provided with dual tongues T and dual grooves G for interlocking relationship with each other; and Fig. 1C illustrates an assembly method which combines the arcuate cut-outs C of Fig. 1A with the tongue-and-groove technique of Fig. 1B. Logs L" of Fig. 1C are all bored axially as at 0 for the insulative effect of air space and to provide a conduit for concealed wiring, piping or the like.

Walls constructed according to the above methods are adequate for a rough camping cabin or the

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like, but all share the disadvantages of diminished insulative effect resulting from the reduced wall thicknesses D, D' and D'', which control the transfer of heat or cold through each respective wall. In addition, dirt and dust collecting in the crevices where the logs meet is difficult to prevent or remove. For more comfortable living, the inner wall surface must be covered with plasterboard or other drywall construction, which adds very considerably to the building's costs and eliminates the option of maintaining the charm and beauty of a clear interior wood finish.

Fig. 1D illustrates a form of wood exterior wall construction currently in use, which features laminated wood panels P formed with interlocking tongues T' and grooves G', and with centrally disposed foam insulating core I. Structures built with this system are very satisfactory in appearance and performance, but are considerably more expensive, largely due to the extensive milling operations and processes required to form this composite laminated building material.

It is the principal object of this invention to provide a method of preparing logs for making a product free of all the disadvantages of the above-described prior art, and which has its own distinct advantages as follows: 1) Smaller logs, requiring less growing time and therefore less expensive than the logs of conventional log construction are used. 2) The converted logs of this invention, when erected as a wall, present both interior and exterior smooth and flat for easy finishing, without the need for installing plasterboard or the like as the inside facing of the wall, and retaining the warmth and beauty of wood grain optionally inside and out. 3) The

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converted logs of this invention are much lighter in weight than conventional logs, and far easier to handle and install. 4) The strength of the converted logs is at least as great as that of much larger conventional logs and sufficient to permit their use as beams, joists or in load-bearing walls with the novel converted logs oriented either vertically or horizontally. 5) The insulation value of the converted logs is greater than that of conventional logs at least one and one-half times larger in diameter. 6) No significant portion of the original log is cut away or wasted. 7) All the above features contribute to lower material, handling and construction labor costs, and therefore logs converted according to this invention can produce structures significantly less expensive than comparable conventional log buildings.

Trimmed debarked logs are quartered lengthwise by two diametrical cuts at right angles to each other and optionally at least one outer edge of each quartered log flattened simultaneously. The quartered logs are sawed into desired lengths, then optionally treated with preservatives by conventional methods, followed by kiln-drying and smoothing the cut surfaces in a planing mill. The quartered log pieces are matched, some reversed end-to-end or top-to-bottom if necessary to balance out any significant diameter change along their length, then placed in a rotated position so that the pointed end of each segment (originally the central longitudinal axis of the log) becomes the outer corner of a rectangle, with the arcuate surfaces of all four segments facing inwardly toward each other, and the flattened edges of each pair facing each other parallelly. If desired, the four quadrant pieces may now be assembled in this position by conventional attachment methods (adhesives, bolts,

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etc.) to form finished "dressed lumber" pieces rectangular in cross-section; these converted logs, made from smaller diameter timber than conventionally used, are suitable for interior walls, possibly
5 temporary and removable, with small insulation and no load-bearing requirements. For larger load-bearing timbers to be used for outer walls, beams, joists and the like with rectangular cross-sections, the interior substantially quadri-arcuate space formed when the four
10 log quadrants are assembled, may be filled with insulation. Optionally, support elements or braces may be inserted in the space at selected intervals along the length of the converted log for increased strength. Insulation may take the form of rigid extruded foam
15 plastic shaped to conform to the interior space, and to fit complementarily to the four arcuate log surfaces which face inwardly and define the space; alternately loose insulation particle packed in vapor-barrier plastic bags or even poured into the assembled
20 converted logs' spaces during the erection of a building may be employed selectively.

Where maximum strength and stability are required, such as in earth-retaining walls conventionally built with railroad ties, the interior
25 space in the converted logs of this invention may be filled with concrete, reinforced if desired, either before or during the erection of a retaining wall.

Details of all the preferred embodiments of this invention and of the methods used to create them
30 will be fully described in connection with the accompanying illustrative drawings, wherein:

Figs. 1A - 1C are schematic cross-sectional diagrams of prior art log wall construction;

Fig. 1D is a schematic cross-sectional
35 diagram of a wood-laminated wall construction;

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Fig. 2 is an end elevational view of a log to be cut and converted in accordance with the method of this invention;

5 Fig. 3 is a perspective partial exploded view of the log of Fig. 2 after it has been quartered and the segments re-oriented;

10 Fig. 4 is a perspective partial view of a rigid foam plastic extrusion to be used as an insulating core element in the practice of this invention;

15 Fig. 5 is a cross-sectional and perspective view of the log segments of Fig. 3 combined with the foam extrusion of Fig. 4 to form a completed rectangular piece of dressed lumber representing a preferred embodiment of this invention;

Fig. 6 is a cross-sectional and exploded view of two horizontally disposed pieces of another embodiment of this invention's product, assembled as if part of a wall being erected;

20 Fig. 7 is a cross-sectional view of two pieces of dressed lumber similar to the view of Fig. 5, but with fastening means added;

25 Fig. 8 is a cross-sectional view of two pieces of dressed lumber similar to that of Fig. 5, but with aligning and sealing means added;

Fig. 9 is a perspective view of two of the log segments of Fig. 8, with one reversed to balance out the change in diameter from one end of the original log to the other;

30 Fig. 10 is a perspective view of a piece of dressed lumber, with two of the four segments offset in length to provide a locking means between two laterally joined pieces of dressed lumber;

35 Fig. 11 is a rear elevational view of the piece of dressed lumber of Fig. 10;

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Fig. 12 is an end perspective view of another embodiment of the product of this invention;

Fig. 13 is a sectional view taken along line 13-13 of Fig. 12;

5 Fig. 14 is an end perspective view of still another embodiment of a product of this invention;

Fig. 15 is a sectional view taken along line 15-15 of Fig. 14;

10 Fig. 16 is an end perspective view of still another embodiment;

Fig. 17 is a simple form of the product of this invention;

15 Fig. 18 is a diagrammatic flow sheet outlining the steps in the alternative paths to convert logs in accordance with this invention; and

Fig. 19 is an end elevational view of a log cut to be converted in accordance with an alternative method of this invention.

20 Figs. 2 and 3 show trimmed debarked log 10, to be processed first by dividing it longitudinally into quarter segments 12 by two diametrical cuts at right angles along planes 14 and 16. In the same operation, trimming cuts along planes 18, 18', parallel to plane 14 as shown, optionally may be performed; it
25 is obvious that similar trimming cuts may be made in planes parallel to plane 16 as well if desired. Thereafter, the quarter logs may be treated with preservatives either by soaking or pressure-impregnation, then kiln-dried for dimensional stability (see
30 Fig. 18).

As Fig. 3 illustrates, when quarter segments 12 are rotated so that perpendicular cut surfaces 20 and 22 face outwardly and each trimmed flat surface 24 faces another, a rectangular cross-sectional
35 configuration is achieved (with the second trimming

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cuts noted above, a square configuration can result).

A preferred embodiment of this invention uses the rigid foam plastic extrusion 26 of Fig. 4 as the core filling space 28 between the quarter logs 12 when assembled (Fig. 5). Foam plastic extrusion 26 is shaped with four concave surfaces 30, each meeting another at cusps 32. The top and bottom ends of concave surfaces 30, as shown, terminate and are connected by horizontal surfaces 34. Extrusion 26 may be formed with a centrally disposed bore 36 as a conduit for cables, wiring, piping or the like. When elements 12 and 26 shown in Figs. 3 and 4 are combined by conventional attachment methods (adhesive, adhesive with heat/pressure, bolts, screws, etc. - not shown), the resultant piece of converted log dressed lumber 40 shown in Fig. 5 is created.

The converted logs 40a of Fig. 6 are similar to log product 40 of Fig. 5, but elements 40a have the foam insulation cores 26a offset so that tongues 42 projecting outwardly and grooves 44 extending inwardly are formed to permit the interlocking of elements 40a when erecting a wall, either as illustrated or with converted logs 40a vertically aligned.

In Fig. 7, converted log elements 40b are identical to elements 40, except for splines 46, bores 48 and dowels 50. Splines 46 are installed between quarter-logs 12b during assembly of elements 40b to strengthen them; bores 48 may be drilled at the same time; dowels 50 are to be installed and glued into place during wall assembly to facilitate alignment and registration, and to improve bonding between each pair of converted log elements 40b.

Converted log elements 40c shown in Fig. 8 have their quarter-logs 12c each grooved longitudinally at 52 and 54 to accommodate seals 56 and 58,

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respectively. Seal elements 56, corresponding in shape to grooves 52, serve to align, insulate, act as a vapor barrier and seal quarter-logs 12c within each converted log element 40c; seal elements 58 perform the same functions between converted log elements 40c as they are used in the erection of a wall.

Fig. 9 illustrates two quarter-log segments 12c which are somewhat tapered along their lengths. The upper segment 12c as shown tapers down from left to right, the lower one oppositely. When assembled, the opposing tapers of the two log quarters will cancel each other out, and a uniform rectangular cross-section will result when this pair of log quarters 12c is put together and joined to a second pair which has been similarly oriented.

A means for interlocking converted logs to be assembled end-to-end is illustrated in Figs. 10 and 11. Here, converted log 40d has alternating log quarters 12d offset in length with respect to the other two log quarters 12d', permitting lateral interlocking between adjacent converted logs 40d.

The converted log product 40e shown in Figs. 12 and 13 has log quarters 12e secured to each other and to spaced ring-shaped support braces 60 by means of screws 62. Support braces 60 may be made of metal, plastic or wood, and may be fastened to log quarters 12e by conventional means other than that shown (adhesives, bolts, etc.). Space 28e formed between quarter-logs 12e and extending between support braces 60 may be filled with loose insulation particles 64, retained within converted log structure 40e by vapor-barrier plastic film 66 covering top and bottom openings 67 in 40e; end caps 68 may be applied and secured to either or both ends as required. Plastic vapor-barrier film may be made of Tyvek (Reg. TM of E.

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I. DuPont de Nemours, Inc., Wilmington, Del.) or equivalent. Fiberglass batts (not shown) may replace insulation particles 64.

5 Still another embodiment of converted log product is illustrated in Figs. 14 and 15, wherein the dressed lumber product 40f comprises log quarters 12f assembled and surrounding selectively spaced support braces 60f. In this case, supports 60f are shaped to conform to the curvatures of log quarters 12f s'

10 interior surfaces, and the spaces 28f between braces 60f are filled with pre-assembled bags 70 filled with insulation particles 64. Bags 70 also conform in shape and size to spaces 28f and may be made conveniently of Tyvek or equivalent vapor-barrier film.

15 Fig. 16 shows a variation of the structure of Figs. 14 and 15. Here, converted log elements 40g have support braces 60g which are offset in two directions with respect to quarter-logs 12g to provide each element 40g with a projecting tongue 72 and

20 corresponding groove 74 for interlocking the converted logs in erecting a wall. Loose insulation particles 64 are shown being introduced by pouring them into spaces 28g during the erection of wall W, to be followed by sealing filled spaces 28g with vapor-barrier film 66 as

25 in Fig. 12 and end caps 68 as in Fig. 13 (not shown).

A simple basic embodiment 40h of the converted log product is illustrated in Fig. 17, wherein quarter-logs 12h, of relatively smaller diameter than those used in previously described

30 versions, are assembled with interior space 28h providing the insulative effect of air. The resulting lumber product 40h, substantially square in cross-section, is useful for erecting interior walls or partitions which may be installed as permanent or

35 temporary room dividers, or the like. Means for

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interlocking, aligning and sealing converted log timbers 40h, previously described herein for other embodiments, may be employed.

5 The flow sheet diagram of Fig. 18 describes the steps to be taken to practice alternative forms of the methods for practising this invention and the resultant various converted log products prepared thereby. In combination with the descriptions of the embodiments hereinabove presented, the diagram of Fig.
10 18 should be substantially self-explanatory.

The converted log products of this invention have many advantages over regular logs and their prior art handling. Since an 8 inch diameter log, for example, can be converted into a finished timber 7"x12"
15 which has the capacity to be used for load-bearing exterior wall construction, or as beams or joists, the growing cycle for a tree to be used for this purpose is therefore greatly reduced, thus minimizing the raw material cost, no matter which species of wood is
20 chosen. The smooth, attractive wood interior and exterior wall surfaces provided require neither siding on the outside nor drywall, such as plasterboard on the inside, further reducing construction costs markedly. The converted logs themselves are significantly lighter
25 in weight, easier and less expensive to handle; they are stronger, and make a wall with an insulation value exceeding that of conventional logs almost twice the diameter of those used for the converted log products of this invention.

30 Fig. 19 illustrates an extension of the concepts and method of this invention for logs of larger diameter than those discussed above, which are generally in the 6-9 inch diameter range. While larger logs obviously take longer to grow, the advantage of
35 little or no waste in cutting them according to this

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invention should make the converted logs derived therefrom economically desirable. As shown, four equal right-angled segments 12i may be produced, by symmetrical cuts in perpendicular directions, from log 10i. Segments 12i may be utilized exactly as quarter-logs 12-12h described above to form converted logs; the remaining longitudinal pieces 76 and 78 of log 10i may be readily trimmed for use as conventional beams, planks or other lumber products with minimal waste.

The method of converting logs, and the product resulting therefrom, have been described in full detail. Various other combinations, substitutions and alternative procedures in the practice of this invention are possible without departing from its concepts, spirit or scope, which is defined and limited only by the ensuing claims, wherein:

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C L A I M S

1. The method of converting logs into finished dressed lumber which comprises the steps of: trimming and debarking the logs; cutting each log longitudinally and diametrically into four equal right-angled segments; transversely cutting quartered logs into selected lengths; and assembling the lengths of quartered logs into position so that the arcuate surfaces of four log quarters from each log length face toward each other, while the longitudinal cut surfaces thereof face outwardly and are arranged to form a rectangular cross-sectional configuration.
2. The method of converting logs as defined in claim 1, further comprising at least one step following the transverse cutting step and selected from the group consisting of: treating the quartered log lengths with preservatives, kiln-drying the quartered log lengths and plane-milling the cut surfaces of the quartered log lengths, in the order here listed.
3. The method of converting logs as defined in claim 1, further comprising the step of filling the interior space, created when the quartered log lengths have been assembled in the arranged rectangular configuration, with insulative and strengthening means.
4. The method of converting logs as defined in claim 3, further comprising the step of inserting and securing selectively placed support braces into said interior space before the step of filling said space with insulative and strengthening means.
5. Converted log product, which comprises:
a log, longitudinally divided by two diametric cuts at right angles to each other to form four equal quarter-log segments; and
means for fastening said quarter-log segments together, said quarter-log segments being positioned so

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5 that the arcuate surfaces of said segments face inwardly toward each other, and so that each cut surface of said segments face outwardly, so oriented that the cross-sectional peripheral outline of the converted log product is rectangular.

6. Converted log product as defined in claim 5, wherein each said quarter-log segment has at least one of its two corners connecting said arcuate surface with one of its cut surfaces trimmed off and flattened to
10 produce a flat surface perpendicular to said one of said cut surfaces.

7. Converted log product as defined in claim 5, further comprising insulating and strengthening means filling the interior space remaining between said
15 quarter-log segments and being secured thereto, thus forming a unitary converted log product, said insulating and strengthening means being selected from the group consisting of: foam plastic; preformed rigid extruded foam plastic conforming in shape and size to
20 said interior space; loose insulation particles; loose insulation particle retained in vapor-barrier plastic film bags, said bags fitting within said interior remaining space; fiberglass batts; concrete; and reinforced concrete.

25 8. Converted log product as defined in claim 7, further comprising support bracing means positioned in fitting engagement with said arcuate surfaces of said quarter-log segments and fixedly attached thereto by said fastening means, said bracing means being
30 selectively spaced when installed, prior to the insertion of said insulating and strengthening means, along the length of the converted log product.

9. Converted log product as defined in claim 5, further comprising means for aligning, registering and
35 sealing together said quarter-log segments as well as

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assembled finished converted log products.

10. Converted log product as defined in claim 5, further comprising means for interlocking any two converted log products in any direction.

5 11. Converted log product, which comprises:
 four equal selectively-sized right-angled segments cut symmetrically and longitudinally from a log, the remaining portions of said log being available for use as conventional lumber in the form of beams,
10 planks and the like; and

 means for fastening said four equal right-angled segments together, said right-angled segments being positioned so that the arcuate surfaces of said segments face inwardly toward each other, and so that
15 each cut surface of said segments face outwardly, oriented so that the cross-sectional peripheral outline of the converted log product is rectangular.

FIG. 1A
PRIOR ART

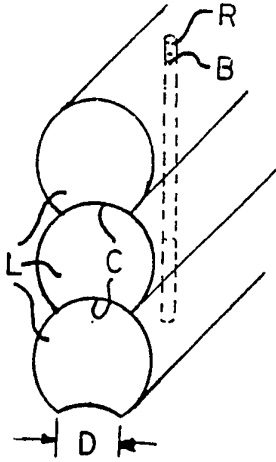


FIG. 1B
PRIOR ART

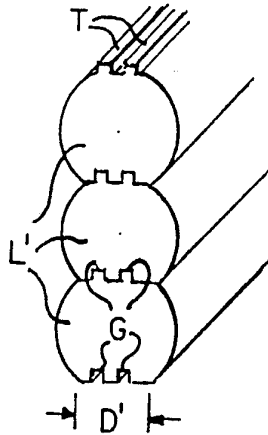


FIG. 1C
PRIOR ART

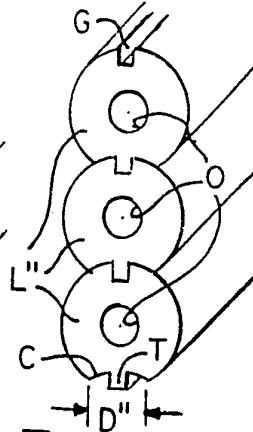


FIG. 1D
PRIOR ART

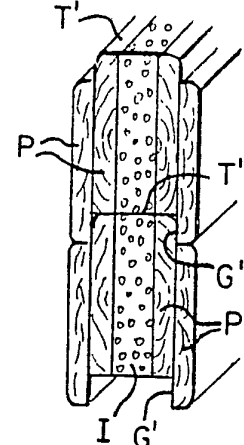


FIG. 2

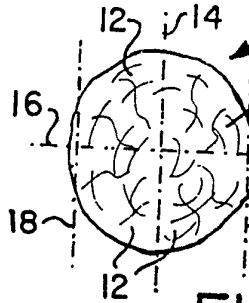


FIG. 3

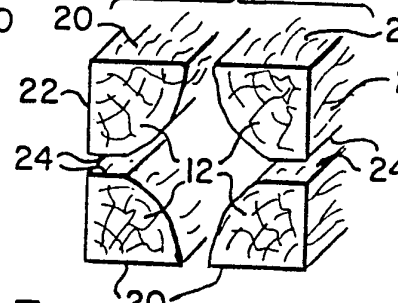


FIG. 4

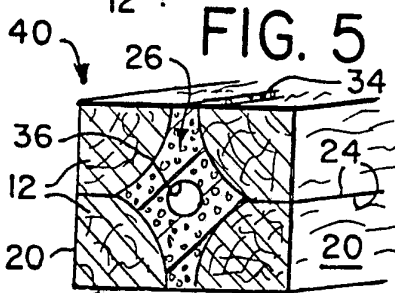
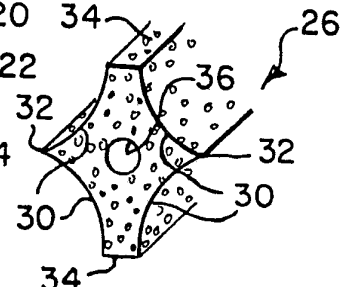


FIG. 5

FIG. 6

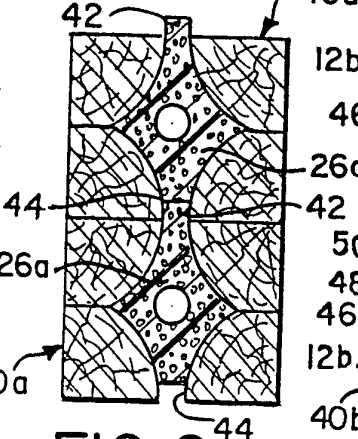


FIG. 7

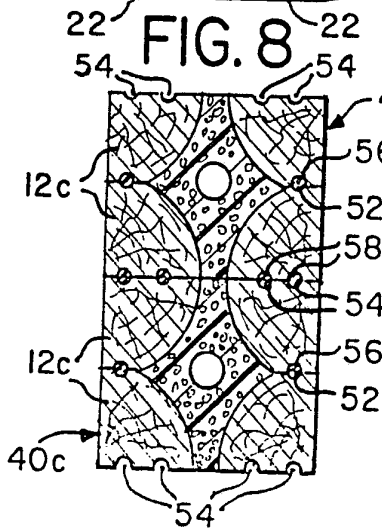
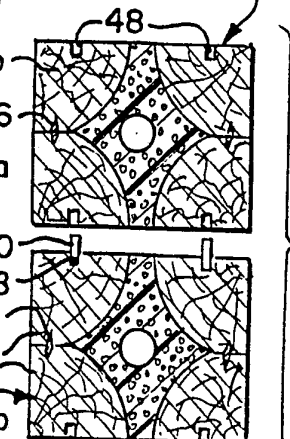
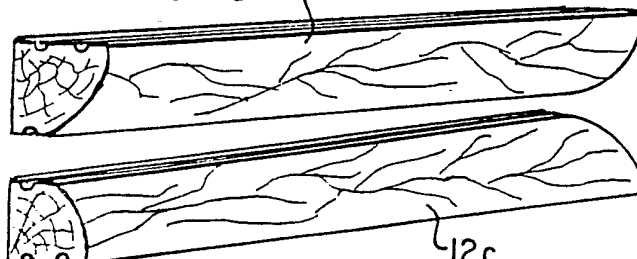


FIG. 8

FIG. 9



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FIG. 10

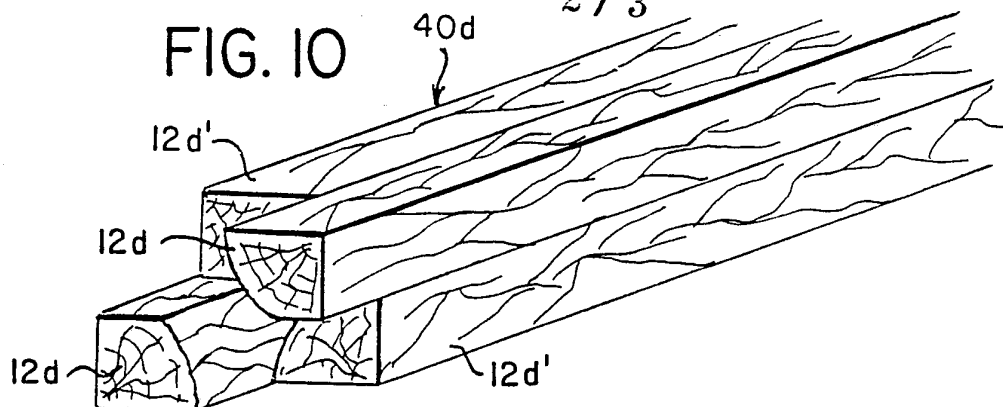


FIG. 11

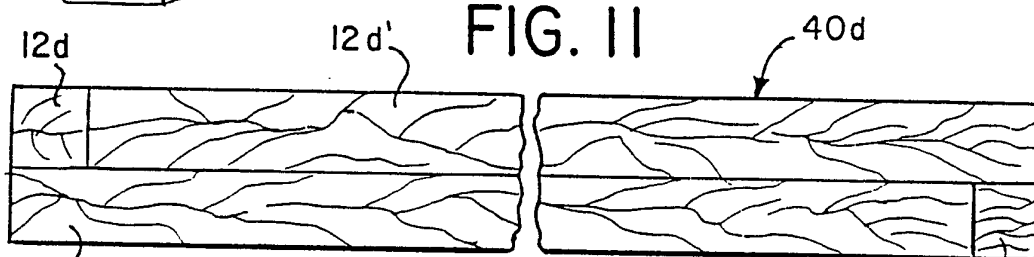


FIG. 12

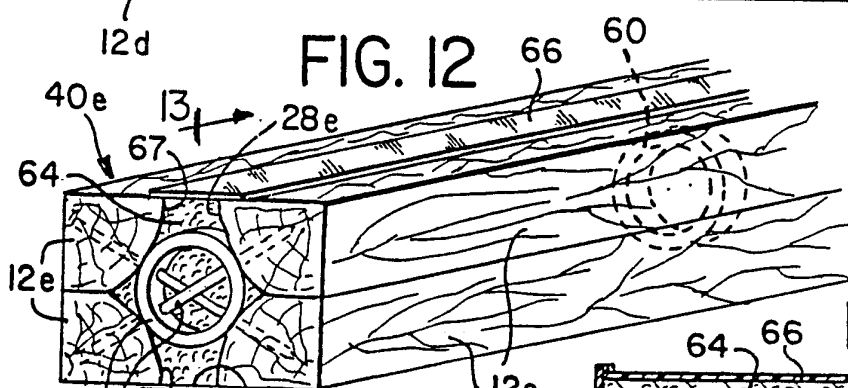


FIG. 13

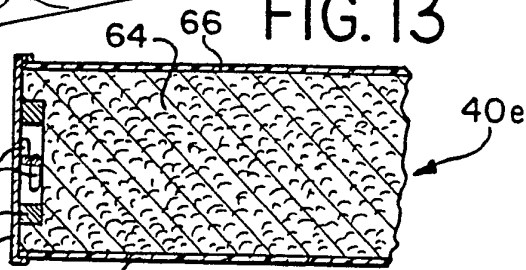


FIG. 14

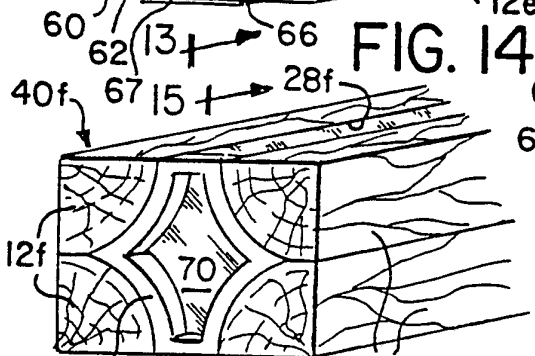


FIG. 15

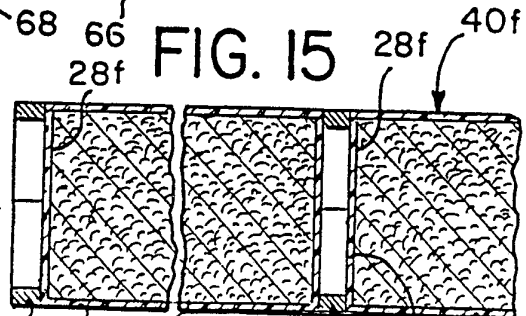


FIG. 16

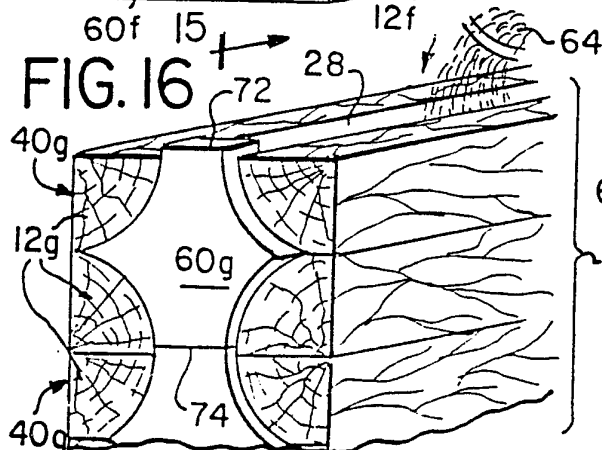
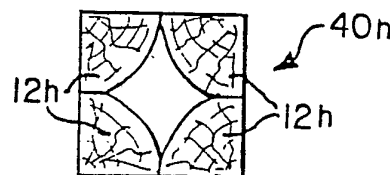
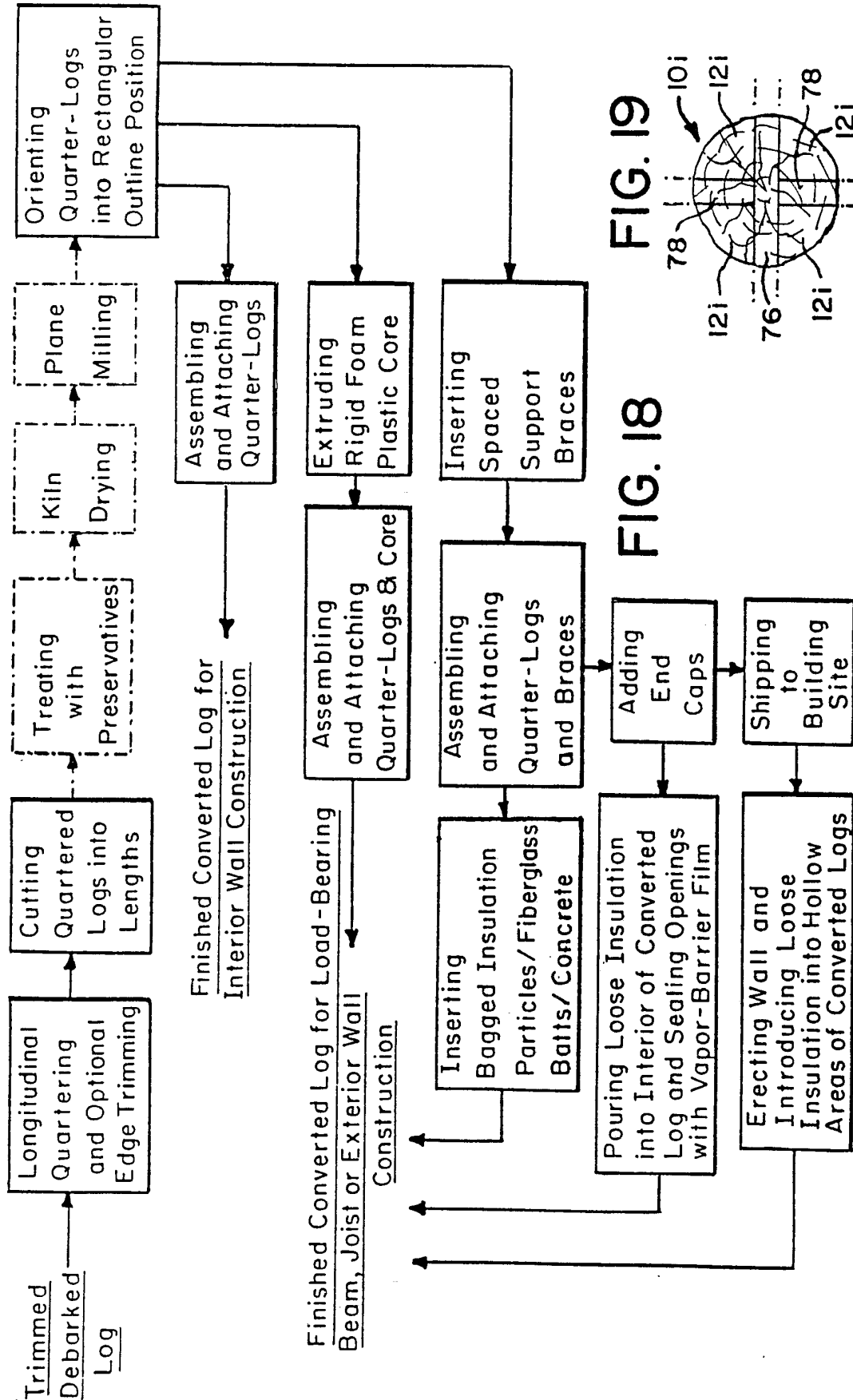


FIG. 17





INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/04085

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B29C 9/00; E04C 1/00

US CL :52/309.9

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 52/233, 309.14, 309.15, 309.16, 404, 730; 29/428, 457, 459, 525; 144/3.R, 136.H, 347, 340, 353, 354, 364, 367, 370, 380,

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NONE**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AT, A 262,567 (Rosen) 25 June 1968 (see: Fig. 3)	1-11
A	GB, A 189,073 (Wallfisch) 23 November 1972	1-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be part of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search

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