

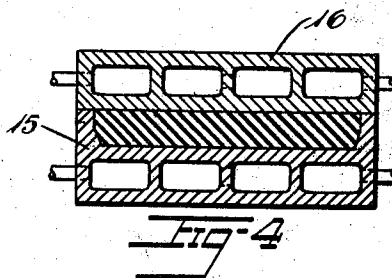
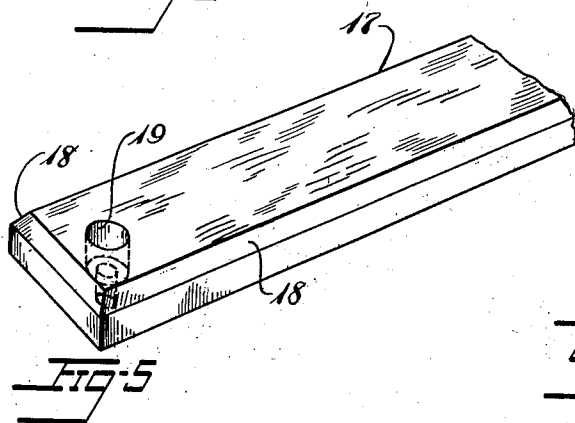
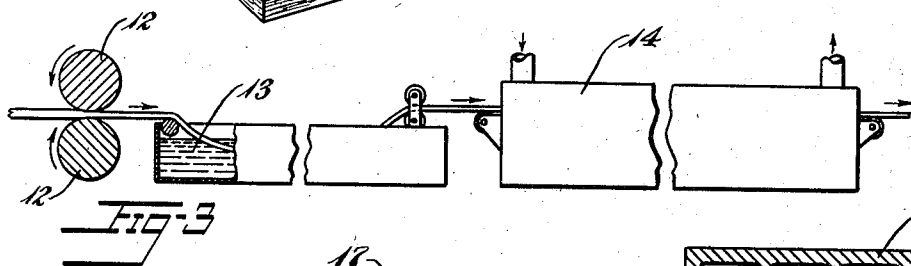
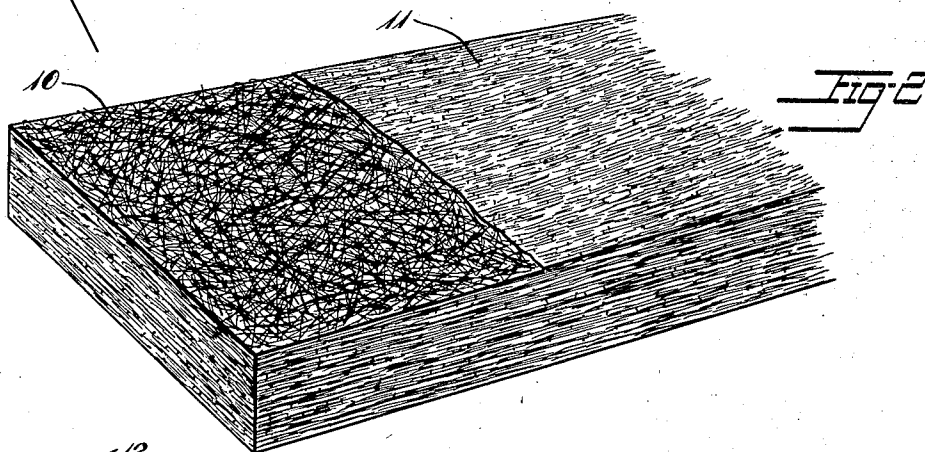
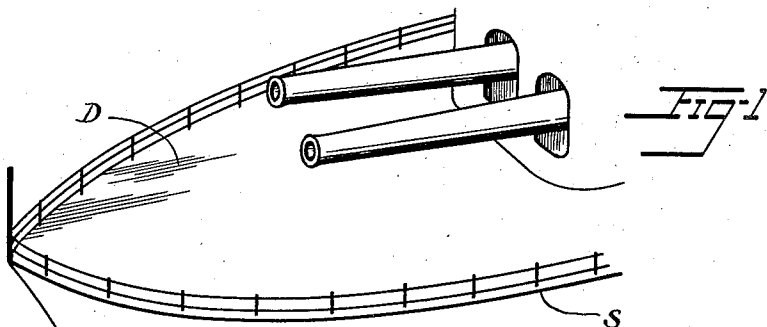
April 9, 1946.

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2,397,936

SHIP-DECK PLANKING

Filed Sept. 22, 1942



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UNITED STATES PATENT OFFICE

2,397,936

SHIP-DECK PLANKING

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Application September 22, 1942, Serial No. 459,270

5 Claims. (Cl. 154—45.9)

This invention relates to ship-deck planking and similar board or lumber material.

Weather decks of ships as usually constructed include steel deck plates over which are mounted wood planks. Teak wood has long been considered the most desirable deck-planking material although other woods such as long leaf yellow pine and white oak have been used, even though inferior to teak in some respects, because of the higher cost and relative scarcity of teak wood. Because of the turbulent international situation, it is now especially difficult to obtain sufficient quantities of teak wood from the tropical regions where it grows.

Furthermore, all such wood planking heretofore used for decks has been subject to a number of disadvantages, especially for use on ships subject to attack in war times. When struck by shells or bombs, natural wood planking splinters badly and the splintered wood often ignites and burns freely. Even unsplintered teak wood is burned by incendiary bombs. Also, natural wood planking absorbs water to a greater or lesser degree and consequently is subject to shrinking and swelling so that caulking between the planks is often loosened, thus permitting sea water to come in contact with the steel plates underneath and cause corrosion. The latter problem is aggravated by the fact that teak wood, because of its nature, is obtainable only in the form of relatively narrow planks not more than four or five inches wide, so that many caulked seams are necessary.

The present invention aims to provide ship-deck planking comprising synthetic board material substantially free of all the foregoing objections inherent in natural wood planking and, in addition, exhibiting several outstanding superiorities over natural wood planking. The manner in which this aim is accomplished will appear from the following detailed description of the invention in a preferred embodiment as illustrated in the accompanying drawing.

Of the drawing,

Fig. 1 is a conventionalized fragmentary perspective view of the forward portion of a war ship provided with deck-planking made in accordance with the present invention.

Fig. 2 is a fragmentary perspective view illustrating a preferred type of fibrous material utilized in making the present ship-deck planking.

Fig. 3 is a diagrammatic side elevation illustrating steps in the manufacture of the ship-decking material and more particularly showing the steps of saturating the fibrous material of Fig. 2 with resinous or other binder material.

Fig. 4 is a diagrammatic vertical cross-sectional view illustrating the step of molding the treated fibrous material to produce ship-deck planking.

Fig. 5 is a fragmentary perspective view showing a finished piece of ship-deck planking embodying the invention.

In manufacturing ship-deck planking in accordance with a preferred embodiment of our invention, we first prepare a mass of relatively coarse, resilient vegetable or other fibers arranged in helter-skelter fashion in compact sheet form. A variety of coarse, resilient and relatively long fibers may be utilized for this purpose including preferably the hard or vascular fibers such as sisal, abaca, henequen, henequen bagasse, cantala, Phormium, Piteira, istle, palma, pita floja, pina, pineapple and coconut, sisal fibers being especially satisfactory for general use. The crude fibers should be combed out into lengths and then arranged in helter-skelter fashion in the form of a web or sheet of such weight as to be handled conveniently, usually about 15 to 20 oz. or sometimes as high as 30 oz. per square yard.

For reasons hereinafter more fully explained, it is preferred next to apply to one or both faces of the sheet of coarse fibers a thin tenuous web of finer and less-resilient fibers. Thus, the web preferably comprises cotton fibers but may be formed of other soft fibers such as flax, ramie, wool, silk, rayon, nylon and the like. The soft fibers preferably, although not necessarily, are carded and thereafter drawn out to form a thin web weighing from about 0.3 oz. to about 1 oz. per square yard, the fibers in the web being arranged in parallel relation. Desirably, the tenuous web is pre-treated with resin or other binder material compatible with, and preferably although not necessarily of the same character as, that to be used in saturating the composite fibrous structure as hereinafter described.

The prepared fibrous structure as shown in Fig. 2 is then desirably compacted as by passage between presser rolls after which the sheet is passed through a bath of binder material which preferably should be a liquid composition comprising a heat-setting resin. An alcohol solution of a phenol-formaldehyde resin in an unpolymerized stage is very satisfactory although water dispersions of resins may also be used. After being thoroughly saturated and impregnated with the resin, the fibrous material is passed through a conventional hot air oven or other heating means where all the alcohol or other solvent is dried from the material and the

resin preferably is partially, but not completely, polymerized, the polymerization being carried only to a point where the resin will temporarily plasticize under further heat and pressure.

To assist in handling the fibrous sheet during the saturating and drying operations, sheets of paper may be placed on either face thereof and fed through the operations along with the fibrous sheet. Also, the fibrous sheet may be needleloomed, preferably only lightly and only sufficiently to hold the sheet together while it is being handled. Needleloomed webs of sisal fibers of the required 15 to 20 or 30 ounce per square yard weights are available commercially and may be used quite satisfactorily. It has been found, however, that needleloomed of the fibers prevents, to some extent, the desired even penetration and saturation of the fibrous structure with resin. This condition is greatly improved by utilizing surface webs of tenuous cotton fibers treated with resin as hereinabove described, the tenuous webs being applied to the fibrous sheet prior to the needleloomed operation so that the resin treated cotton fibers are carried transversely through the fibrous sheet by the needles, thus providing firm adhesive contact with the coarse fibers constituting the main portion of the sheet.

An appropriate quantity of the resin-treated fibrous material then is placed in the cavity of any suitable heat-molding device and subjected to heat and pressure to integrate the structure and complete polymerization of the resin to a hard stage. A suitable mold is illustrated diagrammatically in Fig. 4 as comprising a lower steam-heated platen 15 provided with a cavity of the proper shape and an upper steam-heated platen 16 adapted to function as a cover plate for the mold.

The molding conditions, of course, will vary somewhat depending upon the particular resin chosen, but in a typical example utilizing a phenol formaldehyde resin, pressure sufficient to close the mold and thus produce the desired volume is applied, this requiring about 100 lbs./sq. in. in a typical case. Such pressure is maintained and a temperature of about 300° F. is applied for a time sufficient to integrate the material and harden the resin, a period of about three hours being necessary for a deck plank such as a 3 in. thick board. Thereafter, the material is cooled while the pressure is maintained and, finally, the finished board is removed from the mold.

Usually, the mold cavity will be shaped to produce a finished board having the configuration of the board 17 shown in Fig. 5, the opposed longitudinal edges on one face of the board being substantially bevelled as shown at 18, 18 so that adjacent boards will mate together to form caulking grooves. Also, recessed apertures 19 should be provided in the boards for receiving bolts or other deck attaching means customarily employed for fastening the planks to the steel deck plates. These recessed apertures may be molded in the boards or they may be machined in them after the molding operation is completed.

In order to secure satisfactory physical characteristics in the planking and especially to secure satisfactorily low heat-conducting properties, we have found that it is highly important to control the specific gravity of the planking material within close limits. Satisfactory properties are secured when the specific gravity is not lower than 0.7 nor higher than 1.1. Best results are attained when the specific gravity ranges from 0.9 to 1.0, a specific gravity of 0.96 having been adopted for actual use. Ship-deck planking of the character

described having a specific gravity of 0.96 exhibits low heat conductivity comparable to that of white oak and teak wood, a characteristic not heretofore obtained in any synthetic planking material.

In order to produce material of the desired specific gravity the volume of the mold cavity should be determined and an appropriate weight of the resin-treated fibrous material loaded in the mold to produce material of the proper density.

Planking made in accordance with the invention may be laid in the same manner as natural wood planking on the weather-deck D of a warship S or other ship, boat or similar craft.

A typical ship-deck plank embodying sisal fibers and phenol formaldehyde resin and having a specific gravity of approximately 0.96 has been shown by actual test not only to be free of the objections inherent in natural wood planking as hereinabove described but also to exhibit outstanding superiorities over natural wood in many respects. The present material has been shown to outwear teak wood as much as 2½ times. In hardness and compressive strength it is definitely superior to teak wood. Its thermal conductivity is comparable to that of teak wood and white oak and in a specific comparison was found to be exactly the same as a particular sample of white oak. Exemplary samples of the present artificial planking exhibit a tensile strength of over 10,000 lbs./sq. in. and a block compression strength of over 20,000 lbs./sq. in. The planks may be sawed, planed, drilled, bored, threaded, and generally worked in the same manner as wood. Whereas natural wood planking burns readily under favorable conditions, the present planking does not burn when subjected to a hot flame but merely chars. The present planking does not splinter as does natural wood when hit by explosive bombs or shells. Also, it has an extremely low water absorption and consequently is not subject to shrinking and swelling so that it retains caulking much better than does natural wood. The synthetic material may be molded in the form of planks many times as wide as the widest practically available in teak wood, with consequent great reduction in the number of individual planks required to cover a given deck area. As a result, the number of caulked seams and troubles incident thereto are reduced to a fraction of the number formerly met, the number of attaching bolts is similarly reduced, and the overall labor and expense of installation and maintenance is cut to a fraction of the former cost.

The presence of the tenuous cotton or other soft fiber webs on either face of the body of coarse fibers, and contiguous to the surface of the molded planks, assists materially in providing at the surface the qualities of toughness, wear-resistance and freedom from splintering exhibited by the present material.

Although the heat-setting resins should be used for ship planking, it is possible in other applications to utilize heat-plastic as well as heat-setting resins and other heat-moldable binders as well. Other modifications and variations in details of the invention as hereinabove described may be effected without departing from the spirit and scope of the invention as defined by the appended claims.

We claim:

1. Synthetic lumber comprising a dense and substantially incompressible, rigid body of heat-molded composition comprising a continuous uninterrupted mass of heat-set resin and fibrous material interspersed therethrough, said fibrous

material comprising coarse, resilient vegetable fibers of the hard or vascular type arranged in unwoven helter-skelter fashion but with substantial uniformity through the resin, said board having a specific gravity of from 0.7 to 1.1, heat conductivity comparable to that of teak wood, hardness substantially greater than teak wood, compressive strength at least equal to teak wood, and abrasive wear characteristics substantially exceeding teak wood, said synthetic lumber including at a surface thereof an embedded web or thin sheet of fibers which are relatively fine and less resilient than the coarse resilient vascular fibers.

2. Synthetic lumber as defined by claim 1 in which the hard or vascular fibers are sisal fibers and in which the surface embedded web or thin sheet comprises cotton fibers.

3. A composite product comprising a mass of sisal fibers in helter-skelter arrangement, a web

of cotton fibers needle loomed therewith, and resin material substantially permeating the entire fibrous mass.

4. A composite product comprising a mass of relatively coarse resilient fibers in helter-skelter arrangement, a web of relatively fine fibers on a face of said mass, portions of said web extending into said mass, and a body of resin material substantially permeating the entire fibrous mass.

5. A composite product comprising a mass of relatively coarse resilient fibers in helter-skelter arrangement, a web of parallel cotton fibers on a face of said mass, portions of said cotton fiber web extending into said mass, and a continuous uninterrupted body of heat-set resin material uniformly permeating the entire fibrous mass in a uniform manner.

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