United States Patent [19]

Kaswell

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[54] **SYNTHETIC END GRAIN BLOCK DEFINING A WEAR SURFACE**

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[73] Assignee: **Fabric Research Laboratories,** Dedham, Mass.

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[52] **U.S. Cl.** **428/87;** 52/181; 52/390; 428/295

[51] **Int. Cl.** **B32b 5/02;** E04f 13/18; E04f 15/10

[58] **Field of Search** ..... 161/56, 62, 67, 69, DIG. 5; 52/390–392, 177, 181, 309; 17/1 R; 264/257–258

[56] **References Cited**

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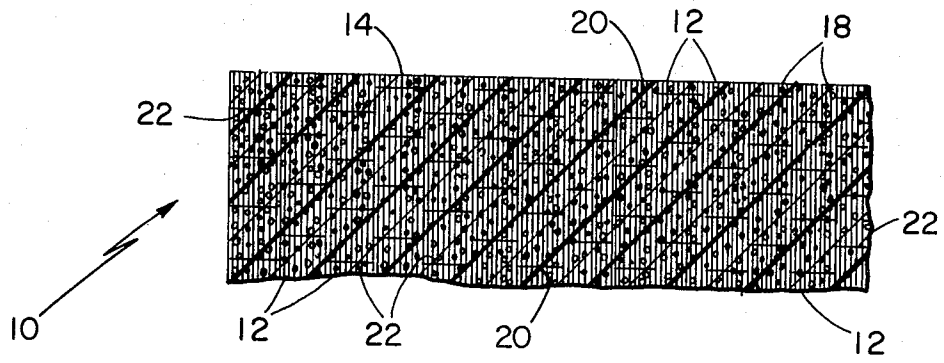
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Primary Examiner—Philip Dier

[57] **ABSTRACT**

An end grain block having a top surface, a bottom surface parallel to and spaced from the top surface and a peripheral surface extending between and connecting the top and bottom surfaces. The block comprises a plurality of wear fibres extending therewithin substantially perpendicular to the top and bottom surfaces, and an organic plastic material binding the fibres together. The wear fibres constitute greater than 40 weight percent of the block.

13 Claims, 3 Drawing Figures



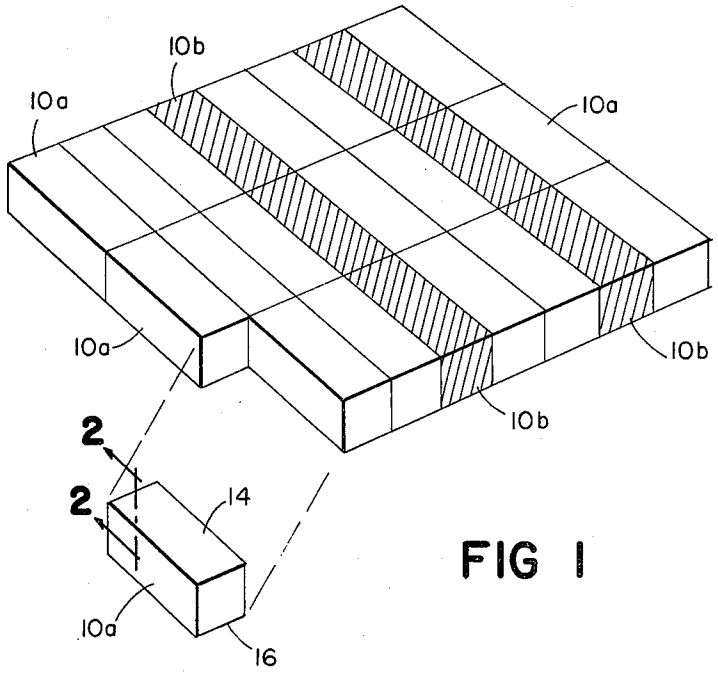


FIG 1

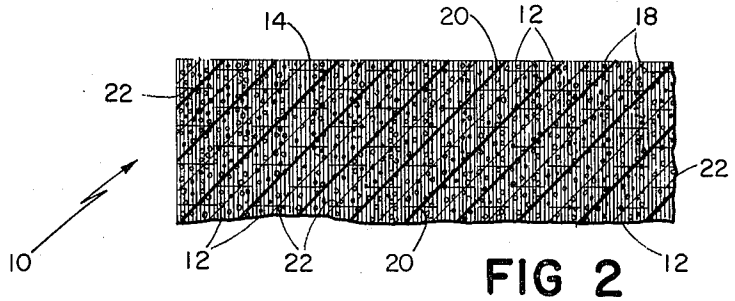


FIG 2

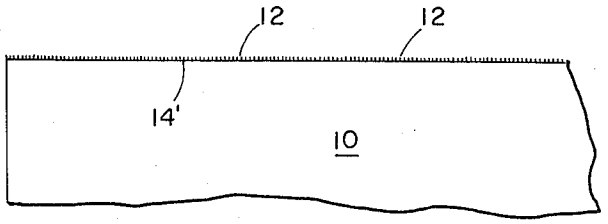


FIG 3

SYNTHETIC END GRAIN BLOCK DEFINING A WEAR SURFACE

This invention relates to working surfaces, and more particularly to such surfaces defined by end grain wood blocks.

For at least the past century, end grain wood blocks have been used to make heavy duty work surfaces. Two well-known examples of such surfaces are butcher's blocks, and the wood block floors used in industrial plants, particularly where heavy machinery and trucks are moved about. The industrial floors are made of wood blocks, impregnated with cresote, asphalt, or coal tar pitch to preserve and seal the wood from decay, moisture, or water swelling. Typically, each block is a pine wood impregnated with cresote, and is about 6 inches long, 4 inches wide, and 2 inches thick. The grain of the wood forming the block runs in the 2 inches thick direction, and the blocks forming the floor are installed such that this thickness becomes the depth of the floor. Thus, and this is also the case in butcher's blocks, the wood fibres are oriented perpendicular to the plane of the floor, and the fibre ends define the top or working surface of the floor.

The resistance of such surfaces to abrasion and wear is far greater than is the case with conventional wood floor planks in which the natural wood fibres run parallel to the top working surface. Another advantage of end grain surfaces is that, when wear or abrasion takes place in an area that is subject to extra heavy use, the entire surface can be ground down, perhaps ⅛ or ¼ inch, to present an entirely new working surface. This grinding down can be repeated many times until the overall block thickness finally becomes too thin for continued use. Additionally, if any single block or group of blocks becomes broken or worn out, it can be removed and replaced at minimum cost, since the whole floor does not need replacing.

The major disadvantages of working surfaces formed with end grain wood blocks is that they are natural products cut from ever more scarce wood. Each block thus must be carefully inspected to insure that there are no holes, knots, or other imperfections, and that the grain runs truly perpendicular to the surface of the block which will define the working surface. Additionally, such blocks are extremely susceptible to moisture and will easily swell and ruin the working surface.

The primary object of the present invention is to provide a synthetic end grain block which will not swell and which has wear characteristics equal to or greater than those of natural wood blocks. Other objects include providing such blocks in different colors for use in decorative surfaces or to define particular zones in industrial floors.

The invention features an end grain block having spaced, planar, parallel top and bottom surfaces, a plurality of wear fibres extending within the block substantially perpendicular to the top and bottom surfaces, and an organic plastic material binding the fibres together. The wear fibres constitute greater than **40** weight percent of the block. In preferred embodiments in which the plastic material is low melting point fibres or a resin such as an alkyd, phenol formaldehyde, resorcinol formaldehyde, polyamide, epoxy, or polyester; the wear fibres are either natural or synthetic; and over 80% of the wear fibres within the block extend generally perpendicular to the top and bottom surfaces.

Other objects, features and advantages become apparent from the following detailed description of preferred embodiments of the invention, taken together with the attached drawings, in which:

FIG. **1** is a perspective view of the portion of an industrial floor constructed according to the invention;

FIG. **2** is an enlarged cross-sectional view of a portion of a block of the floor of FIG. **1**; and

FIG. **3** is an enlarged cross-sectional view of a top surface portion of a block of the floor of FIG. **1.**

Referring more particularly to the drawings, there is shown a floor constructed of a plurality of generally identical abutting rectangular blocks **10***a* and **10***b*, each being 6 inches long, 4 inches wide, and 2 inches thick. The blocks are generally designated **10,** with an identifying further letter designation to indicate differences in color. Blocks **10***a* are black; blocks **10***b* are yellow. It will be seen in the drawing that the blocks are arranged such that the majority of the floor is formed of black blocks **10***a*, with yellow blocks **10***b* marking safety travel lanes.

As shown most clearly in FIGS. **2** and **3,** each of blocks **10** comprises a plurality of wear fibres **12,** extending generally parallel to each other and perpendicular to the top surface **14** and bottom surface **16** of the block, a plurality of glass microspheres **18** distributed throughout the block to reduce its density, and an organic plastic **20** impregnating the entire block and bonding the wear fibres and spheres together. The top and bottom working surfaces of block **10** are defined by the ends of fibres **12.** When the block is used to form a floor or other working surface, the plastic material at the top wears away quickly, leaving (FIG. **3**) the fibre ends projecting a few thousandths of an inch above the remaining plastic surface **14'**. In further use, the resulting wear is taken by the fibre ends, in much the same manner as in a dense cut-pile carpet.

In the manufacture of blocks **10,** wear fibres **12** may comprise practically any flexible fibrous material which can be arranged to provide the required parallel fibrous strands. For economy, waste fibres are especially desirable. Whether waste or new, the fibres may be of either natural or synthetic material. Typical synthetics include rayon, acetate, protein, nylon, polyester, acrylic, olefin, glass, modacrylic, saran, tetrafluoroethylene, vinyon, vinyl, nytril, polystyrene, rubber, spandex and extruded monofilaments. Useful natural materials for the fibres are cotton, linen, jute, abaca, sisal, rubber and henequen. Whatever material is used, the vast majority (at least 80%) of the fibres in the block should be essentially perpendicular to the top and bottom surface of the block so that the fibre ends will present and define the long-wearing working surfaces. In many instances, individual fibres, all positioned generally perpendicular to the block top and bottom, will be used. In others, such as in FIG. **2,** the blocks may be constructed using a so-called unidirectional fabric which includes a great preponderance of wear fibre yarns **12** in the warp direction, and only a few fill yarns **22** to hold the warp yarns together during manufacture. In fabrics of this latter type, which typically weigh about 10 oz. per square yard, the fill yarns are only about 5 to 10 to the inch and make up no more than 20, typically less than 10, weight percent of the fabric as a whole.

The blocks may also be constructed of any of a large number of organic plastics. Typical materials useful in-

clude resins such as phenol formaldehyde, resorcinol formaldehyde, alkyd, polyamide, epoxy, and polyester. Normally, the blocks are constructed by impregnating the wear fibres with the chosen resin by an immersion or other impregnating process, and then curing the mixture to produce the hard, solid block.

Alternatively, blocks may be made by mixing the wear fibres with thermoplastic binding fibres of relatively low melting point. The fibres are all laid parallel to each other, and the mixture then heated to a sufficiently high temperature to cause the binding fibres to become tacky. The tacky binding fibres will stick to each other and, when the mixture is cured, bond themsleves and the wear fibres together into a solid mass. The entire process is accomplished below the temperature at which the wear fibres would be affected.

Regardless of the method of construction, glass microspheres or some other suitably filler material may be dispersed in the block to reduce its overall density. The basic requirements for the filler is that it be inert with respect to, and have a higher melting point and lower overall density than, the plastic material used to bind the wear fibres together.

Typical examples of blocks constructed according to the present invention are set forth in the following examples.

EXAMPLE I

A high density filament nylon yarn was continuously passed through an uncured liquid epoxy resin bath, and wound on a four-sided reel until the parallel yarn layup was about 1 ¼ inches thick. The layup was cured at normal room temperature, following which rectangular blocks were cut from each of the four sides of the resulting cured layup. The blocks were very hard and dense, having a density of approximately 1.02 grams per cubic centimeter.

EXAMPLE II

A sheet of (a synthetic "grass" football field material sold by American Biltrite Co. under the trademark "Polyturf") was immersed in an uncured liquid epoxy resin, and then allowed to air cure. The top of the resulting hard thick sheet was machined down so that the top ends of the synthetic grass fibres were evident at the top surface, and the sheet was then cut into rectangular blocks. The density of the blocks was approximately 1.1 grams per cubic centimeter.

EXAMPLE III

Example II was repeated, but approximately 30% by volume glass microspheres (Emerson & Cuming, IG **101** microballoons) were introduced into the uncured resin to introduce voids in the resulting structure and thereby reduce its overall density. Again the sheet was machined down and cut into blocks. Density of the resulting blocks was approximately 0.81 grams per cubic centimeter.

EXAMPLE IV

Example I was repeated, but with the addition of 30% by volume glass microspheres as just described with respect to Example III. The resulting blocks had the density of 0.78 grams per cubic centimeter.

EXAMPLE V

Example I was repeated, but using polyester yarn in lieu of the high tenacity filament nylon yarn, and polyester resin in lieu of epoxy resin. The blocks resulting had a density of 1.26 grams per cubic centimeter.

EXAMPLE VI

Jute Slivers were laid parallel to each other in a mold **8½** in. long, **3** in. wide and ⅜ in. deep, and the mold was filled with phenol formaldehyde resin. The resulting fibre-resin mixture was cured under 2000 lbs. of platen force for 30 min. at a temperature of 300°F. The density of the resulting block was 1.0 grams per cubic centimeter.

EXAMPLE VII

Three hundred thirty grams of polyester yarn (sold by E. I. DuPont under the trademark "Dacron"), was laid in an 8 × 4 × 2½ inch mold with the yarn strands parallel to each other. The mold was filled with **600** grams of epoxy resin (sold by Shell Chemical Corp. under the trademark "Epon **828**") and 112.5 grams of an aliphatic polyamine curing agent (sold by Shell Chemical Corp. under the trademark "Epon T–**1**"), and cured under 6000 lbs. of platen force at 170° for 40 min. The resulting block had a density of 1.21 grams per cubic centimeter.

EXAMPLE VIII

Example VI was repeated using 500 grams of Epon 828 resin and 94 grams of Epon T–1 curing agent, and mixing in 200 milliliters of glass microballoons (Emerson and Cuming, IG101). The mixture was cured under 5000–6000 lbs. of platen pressure for 60 min. at 160°F. to produce a block having a density of 1.13 grams/cm^3.

EXAMPLE IX

Single ends of nylon yarn (DuPont 1050–14-0–O–N–56) and acetate yarn (Eastman Acetate Rayon - UODA) were concomitantly wound side-by-side onto a yarn reel such that a skein composed of approximately 75 percent by weight of nylon and 25 percent by weight of acetate resulted. Care was taken to insure that the nylon and acetate yarns were in intimate parallel contact with each other. The juxtaposed yarns were then cut into **8** inch long bundles, laid in an **8** × **3** × ⅜ inches mold, and placed in a 400°F. oven for 45 min. The acetate yarn fibres became tacky and, when the mold was heated, bound to each other and to the adjacent nylon yarn fibres to form the mixture into a solid block having a density of 0.95 grams per cubic centimeter. The 400°F. temperature is above the tack temperature of the acetate, and below the temperature at which the nylon is affected.

EXAMPLE X

Example IX was repeated, except that 17 grams of Epon 828 resin and **2** grams of Epon T-1 curing agent were added to the mold before curing, and the curing time was 1 hour, 45 minutes of which was required to bring the oven to 400°F. The density of the resulting block was 1.24 grams per cubic centimeter.

EXAMPLE XI

Seven layers of unidirectional cotton fabric with the predominant warp yarns of each layer lying in the same direction and having a total weight of 40 grams, 130 grams of Epon 828 resin and 25 grams of Epon T-1 were placed in an 8 × 3 × ⅜ inches mold. The mixture

was cured overnight under 4000 lbs. of platen pressure in a 160°F. oven, resulting in a block having a density of 1.24 grams/centimeter.

From the foregoing examples, it is plain that blocks constructed according to the present invention may be manufactured using a wide variety of fibres, resins, and manufacturing techniques.

Other embodiments will be within the scope of the following claims.

What is claimed is:

1. A synthetic end grain block of the type adapted to be abutted with similar blocks to define a working surface and having a top surface adapted to define a portion of said working surface; a bottom surface parallel to and spaced from said top surface; a plurality of wear fibers extending within said block substantially perpendicular to said top and bottom surfaces; a plurality of other fibres extending other than generally perpendicular to said top surface and said bottom surface and interconnecting said wear fibres; and an organic plastic material extending substantially throughout said block and bonding said wear fibres together, ends of said wear fibres defining at least a part of said top surface, said wear fibres being at least 40 weight percent of said block, and at least 80% of all fibres within said block extending generally parallel to each other and perpendicular to said top surface and said bottom surface.

2. A synthetic end grain block of the type adapted to be abutted with similar blocks to define a working surface and having a top surface adapted to define a portion of said working surface; a bottom surface parallel to and spaced from said top surface; a plurality of wear fibres extending within said block substantially perpendicular to said top and bottom surfaces; an organic plastic material extending substantially throughout said block and bonding said fibres together; and a plurality of discrete fillers of density less than the density of said organic material distributed within said block; ends of said wear fibres defining at least a part of said top surface, and said wear fibres being at least **40** weight percent of said block.

3. The block of claim **2** wherein said fillers are glass microspheres.

4. The block of claim **2** wherein said block is substantially rectangular having a length greater than the distance between said top and said bottom surfaces.

5. The block of claim **1** wherein the top surface of said block is defined by end portions of said wear fibres and said plastic material lies slightly below said top surface.

6. The block of claim **1** wherein said plastic material is selected from the group consisting of phenol formaldehyde, alkyd, resorcinol formaldehyde, polyamide, epoxy, and polyester.

7. A synthetic end grain block of the type adapted to be abutted with similar blocks to define a working surface and having a top surface adapted to define a portion of said working surface; a bottom surface parallel to and spaced from said top surface; a plurality of wear fibres extending within said block substantially perpendicular to said top and bottom surfaces; and an organic plastic material comprising a plurality of thermoplastic bonding fibres interspersed with said wear fibres substantially throughout said block and bonding said wear fibres together, the tack temperature of said bonding fibres being less than that of said wear fibres, ends of said wear fibers defining at least a part of said top surface, and said wear fibres being at least **40** weight percent of said block.

8. The block of claim **1** wherein said wear fibres are a synthetic material chosen from the group consisting of rayon, acetate, protein, nylon, polyester, acrylic, olefin, glass, modacrylic, saran, tetrafluoroethylene, vinyon, vinyl, nytril, polystyrene, rubber, spandex and extruded monofilaments.

9. The block of claim **1** wherein said wear fibres extend generally between said top and said bottom surfaces.

10. The block of claim **1** having a density less than about 1.25 grams per cubic centimeter.

11. The block o claim **2** having a density less than about 1.0 grams per cubic centimeter.

12. The block of claim **7** having a density of less than about **1.0** grams per cubic centimeter.

13. The block of claim **1** wherein said wear fibres are a natural material chosen from the group consisting of cotton, linen, abaca, sisal, jute, rubber, and henequen.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,887,736
DATED : June 3, 1975
INVENTOR(S) : Ernest R. Kaswell

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 2, delete "wood";

Column 3, lines 14-15, "themsleves" should be --themselves--,
line 18, "suitably" should be --suitable--,
line 41, the "(" should be deleted,
line 43, after "Polyturf" delete ")";

Column 4, lines 36-37, "14-0" should be --140--;

Column 6, line 1, Claim 11, "o" should be --of--.

Signed and Sealed this

twenty-sixth Day of *August 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks