

- [54] **PANEL WITH DECORATIVE BARK SURFACE AND METHOD OF MAKING THE SAME**

2,627,375	2/1953	Grondal et al.....	241/28 X
3,323,935	6/1967	Snyder.....	156/279 X
3,798,098	3/1974	Ogawa et al.....	156/154
- [75] Inventors: **Armin Elmendorf**, Portola; **Roland Etzold**, Mountain View, both of Calif.

[73] Assignee: **Elmendorf Research, Inc.**, Palo Alto, Calif.

[22] Filed: **May 16, 1973**

[21] Appl. No.: **360,704**

[52] U.S. Cl. **156/154**; 117/19; 156/63; 156/256; 156/264; 156/279; 156/298; 161/41; 161/116; 161/162; 161/164; 161/268; 161/270; 241/28

[51] Int. Cl... **B32b 31/32**; B32b 31/14; B32b 5/16; B27l 11/00

[58] **Field of Search** 156/63, 265, 256, 264, 156/276, 279, 295, 298, 312, 154; 241/28; 117/16, 19

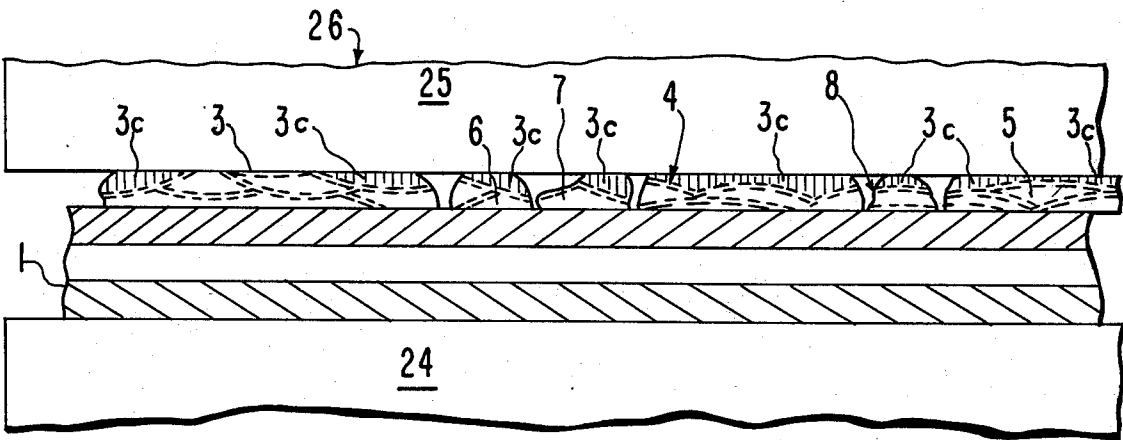
Primary Examiner—George F. Lesmes
Assistant Examiner—Alan T. McDonald
Attorney, Agent, or Firm—Townsend and Townsend

[57] **ABSTRACT**

A panel formed from a substrate such as a ligno-cellulosic board including insulation board, softwood plywood and particle board, and a protective surface for the substrate comprised of bark chips. The surface is harder than the natural, weathered bark of trees and imparts a mottled and textured surface to the substrate so that the resulting panel has superior decorative values. The method includes placing flakes and chips of bark on an adhesive coating on the face of the substrate, applying pressure to the bark to form a relatively flat surface, then abrading such surface to remove the phloem and excess chips and to relief-texture the surface.

- [56] **References Cited**
UNITED STATES PATENTS
2,444,929 7/1948 Hatch 241/28 X

8 Claims, 4 Drawing Figures



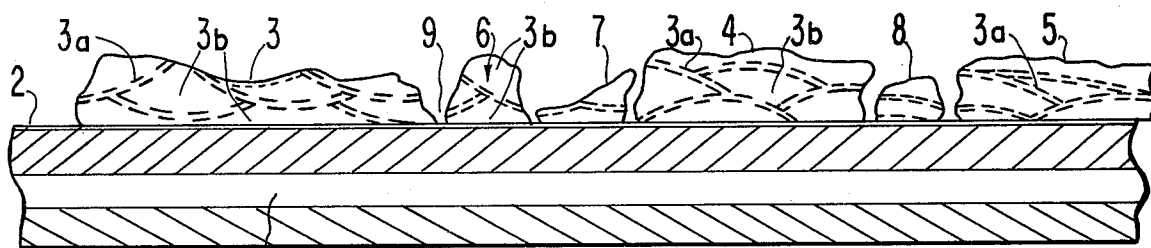


FIG. 1

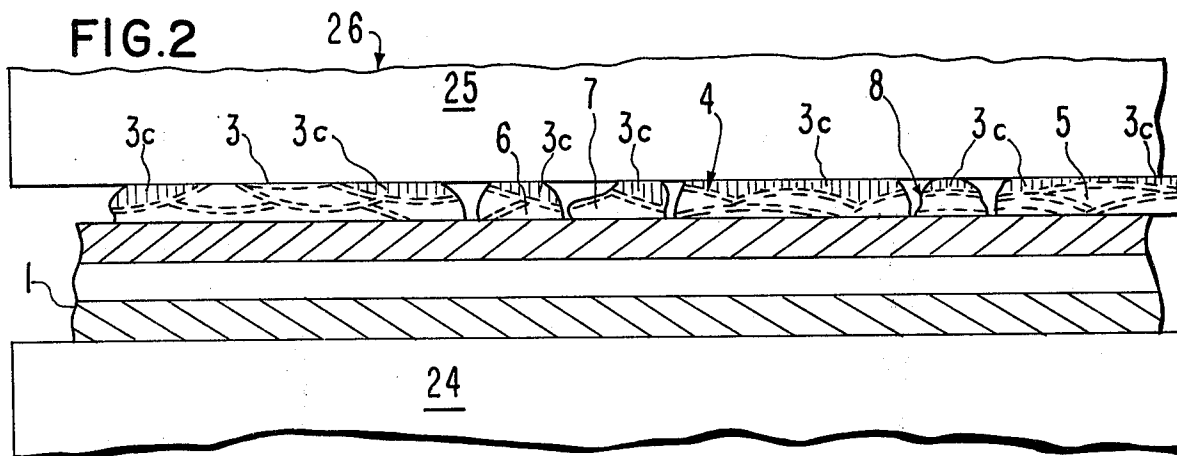


FIG. 3

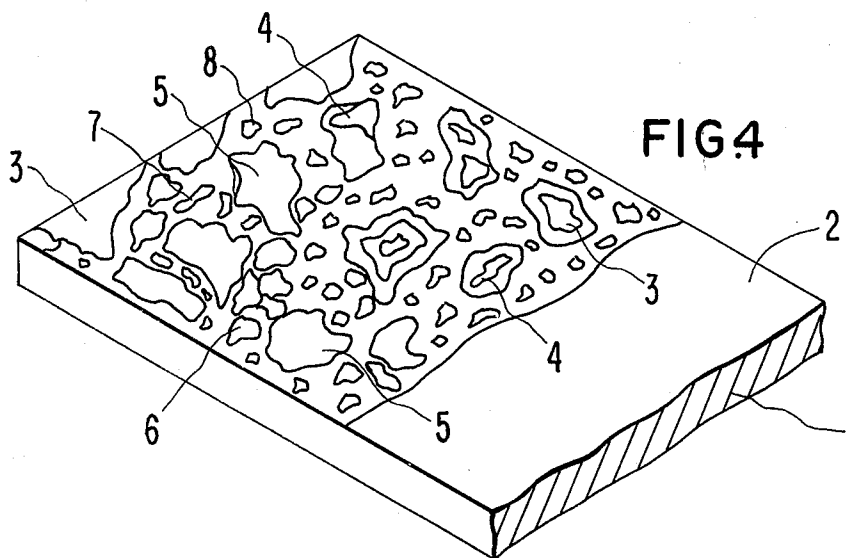
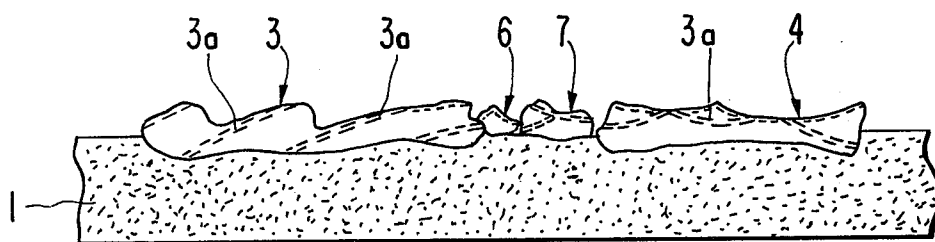


FIG. 4

PANEL WITH DECORATIVE BARK SURFACE AND METHOD OF MAKING THE SAME

BACKGROUND OF THE INVENTION

The anatomy of bark is very complex and its possible uses have been only partially exploited. It is currently used to some extent for garden cover, mulch, fuel, and particle boards. It is available in immense tonnage, second only in volume to the residues of wood developed in the manufacture of lumber and plywood. The thick bark of softwood trees such as pines and firs is particularly useful for the process of the present invention.

For a good understanding of the present invention it is necessary to examine bark under a microscope although some of the basic components of bark, of importance to the present invention, can be seen without a microscope. Reference should be made to test books on botany in which the following components of bark are described: Phloem, periderm, rhytidome, xylem, inner bark, stone cells, phelloderm, phellem, cork cambium, phellogen, cork cells, vascular cambium. A comprehensive discussion of the nature of bark is given in an article by Elaine T. Howard entitled "Bark Structure of the Southern Pines" Wood Science, Vol. 3, No. 3, January 1971.

SUMMARY OF THE INVENTION

We have found that the phellogen or bark cambium is easily split by wedging action when cutting the bark tangentially with a knife. It is very thin and is flanked on either side by tissue that is hard, on the side toward the wood by thickened unexpanded phelloderm cells and on the opposite side by stone cells. The unexpanded hard phelloderm cells are succeeded in the direction toward the wood by relatively weak thin-walled phelloderm cells. The hard stone cells on the opposite side of the phellogen are flanked by thin-walled cork cells. Phloem tissue follows the thin-walled phelloderm cells on the side toward the wood and on the outer side, toward the exterior of the tree, it follows the thin-walled cork cells. The layers of phloem tissue are soft and relatively thick. The combined tissue between two layers of phloem is referred to as the periderm.

The periderm is readily recognized, generally as a very thin layer, by the naked eye. The layer of stone cells and the layer of unexpanded phelloderm are relatively hard and often differ in color from the phloem. The periderm is roughly parallel to the annual rings of the tree stem. The phloem between two periderms being soft is readily crushed, whereas the cork tissue is elastic and resembles commercial cork in this respect. In some barks as in the firs, the cork tissue may be conspicuous. The color of the periderm varies somewhat with the species and with the particular tissue exposed. It differs from the color of the phloem which is generally darker. These color variations as well as the differences in hardness, in texture and crushability, have a bearing on the eye appeal of the product of the present invention.

The first step in carrying out the method of the invention is to obtain a quantity of bark after it has been removed from a log. The bark of some pines and firs is often very thick and its anatomy lends itself particularly well to the process of this invention. Bark of the gymnosperms (softwoods) is generally usable while that of the angiosperms (hardwoods) is not. Bark may be re-

moved from a log by means of a debarking machine or a spud.

As the next step of the method, blocks of bark are reduced to thin sheets each containing at least one periderm. This can be done on a disc machine of the type used for cutting shavings of wood, or by means of a gang saw. The thickness of the sheets may range from one-sixteenth inch to one-fourth inch, the cut being made approximately tangential to the periderm. Some tearing of the phloem often takes place so that the faces may not be entirely flat. Tearing is reduced by sawing the bark into thin sheets. While the cut may be made tangentially, radially or in cross section, the tangential cut results in the most pleasing surface in the completed product and is preferred. Moreover, compression of flakes cut tangentially requires less pressure than do flakes cut either radially or in cross section. Crushability is needed to bring pressure on small chips between the flakes, and bonding of the small chips is highly desirable and can only be achieved with adequate pressure.

The thin sheets of unweathered bark are next reduced in size as by flailing with swinging chains and breaking the sheets into flakes and chips, or by breaking the sheets with the hammers of a hammermill. The relatively larger pieces of bark produced in this way have approximately parallel surfaces and are here referred to as "flakes." The relatively smaller pieces are here referred to as "chips." Some of the chips may have parallel surfaces. Some phloem tissue, thin-walled cork tissue and thin-walled phelloderm may be removed in this breaking operation. The harder tissue adjacent to the phellogen remains. The flake thickness is generally uniform and the faces are substantially parallel. The size of the flakes is effectively controlled when using a hammermill by changing the screen size, and when using swinging chains by changing the speed or time of flailing. Most of the flakes are relatively large, and may be up to 3 inches in size. Chips of sawdust size may be used.

Of the various conifer barks, those of the pines are preferred to carry out the method. The flakes are readily compressed, they are large, and upon removal of the phloem many flakes revealing the periderm show an irregular contour and a warped surface which adds to the attraction and decorative effect of the completed product. A single layer of flakes with chips in the spaces between them yields pleasing effects. The smaller pieces of bark produced by reducing the sheets of bark to flakes referred to herein as chips often lean against flakes and when uncompressed are generally without parallel faces and do not lie in fixed positions on the substrate to which the flakes and chips are to be bonded; whereas, the flakes lie on one of the parallel faces.

In producing the bark facing, a heavy coat of adhesive appropriately extended with a filler is applied to one face of a base panel or substrate. The adhesive can be a coat of urea adhesive, preferably pigmented, upon which a single layer of flakes is deposited on the adhesive with open spaces between the flakes. Chips are then allowed to slip into these spaces after which chips of still smaller size are added to fill the spaces between the chips of the first deposit. The chips of smaller size are deposited in excess so that some of the first deposited chips and flakes may be covered with fine material. The assembly of the base panel with flakes and chips is

vibrated to settle the chips after which the assembly is subjected to pressure, preferably in a hot plate press, the pressure being maintained until the adhesive has set. Adhesives that set at room temperature may also be used.

As substantially all flakes are partly composed of soft phloem or soft periderm tissue, they may be compressed. The pressure applied is adequate to compress the flakes to the point where some pressure is taken up by the chips between the flakes so that the small chips in contact with the adhesive are bonded as well as the large flakes. The small chips not in contact with the adhesive are subsequently removed by wire brushing. In this manner the base panel is provided with a single layer of large flakes and chips all of which are firmly bonded to the base panel so that the surface of the panel is completely covered with bark in a single layer.

The panel having the unabraded surface with which it leaves the press may also be used for decorative purposes, even though it lacks the relief texture resulting from wire brushing. It incorporates the mottled appearance and wear differences inherent in different flakes that are not weathered.

By wire-brushing or sandblasting the bark surface, most of the phloem tissue and the soft phelloderm and phellem tissue of the periderm are removed thereby exposing the harder pheloderm cells and stone cells. The resultant panel surface is harder and much more scratch resistant than the original bark surface of the tree.

In flakes where the layers of hard cells of the periderm are exposed the surface of the flake often takes on a luster which enhances the decorative value of the panel. Where phloem tissue remains attached to flakes, there, light will reflect different than from the glossy surfaces. A further feature of the bark surface that contributes to eye appeal lies in the fact that the exposed periderm surfaces lie in different planes, so that texture is enhanced. The surfaces of the brushed flakes may lie in planes that are slightly tilted in respect to each other, thereby adding variety to the panel surface, and so contributing to the mottled appearance.

Some barks are rich in cork which shows as streaks of yellow in the predominant reddish brown color of the flakes. Some differences in shade also show in the predominant color of the flakes. These may take on a purplish hue or a tinge of grey. From this it will be seen that great variety exists in the natural bark color and texture resulting from removing soft tissue and exposing underlying harder tissue.

The compressibility and crushability of the phloem and of the thin-walled phelloderm cells have bearing on the pressure required for bonding the flakes, but the hardness of the substrate used must also be considered in determining the pressure for good bonding. Soft boards of the insulation board type are readily indented and are preferred to harder products such as plywood and particle boards. Short time, hot plate pressures up to 100 psi generally do not compress insulation boards unduly. The hardness of the surface of bark on board products after wire-brushing to remove soft tissue always exceeds the hardness of the original uncompressed and unabraded bark and exceeds the requirement of scratch resistance in wall paneling.

While bark of conifers is preferred, and particularly that of pine, bark of some genera of conifers is stringy or fibrous such as that of redwoods and cedars and

tends to be pulverized in failing. Barks that are fibrous are, therefore, unsatisfactory.

In place of depositing the flakes and chips on a substrate, they may be deposited as a thick bed of flakes and chips, each of which have been coated with an adhesive as in conventional particle board manufacture. Upon removal from the press, the resulting flat surface can be brushed to remove soft tissue, leaving the harder tissue exposed as in the case previously described in which a separately manufactured substrate is used. The bonding together of the flakes in the bed of such a panel and the bonding of the surface flakes and chips to this bed take place simultaneously.

The primary object of this invention is to provide a decorative panel and method of making the same wherein the panel has a surface formed of unweathered bark arranged in a manner to provide an attractive appearance permitting the panel to be used for decorative purposes.

Another object of this invention is to provide a panel as described which has a number of relatively large flakes of bark and a number of relatively small chips of bark adhering to one face of a substrate and having irregular mottled surfaces formed by removing portions of the phloem from the outer faces thereof to provide the decorative appearance for the panel and to present a surface which is harder than the natural, weathered bark of trees.

A further object of this invention is to provide a method for making the decorative panel as described wherein flakes and chips of bark are deposited on an adhesive coated surface of a substrate and compressed to form a relatively flat surface which is thereafter abraded to remove the outer phloem of the flakes and chips to produce a textured, mottled face and thereby to provide a relief-textured surface.

Other objects of this invention will become apparent as the following specification progresses, reference being made to the accompanying drawing for an illustration of the panel.

In the drawing:

FIG. 1 is a vertical section through a plywood substrate having a layer of flakes and chips of bark on an adhesive coated surface thereof;

FIG. 2 is a view similar to FIG. 1, showing the same assembly between the platens of a hot press;

FIG. 3 is a view similar to FIGS. 1 and 2 but showing insulation board as the substrate with the upper surface of the board indented due to the pressured applied to the bark flakes and chips and after the flat surface of the bark has been abraded; and

FIG. 4 is a perspective view of a portion of a panel obtained by carrying out the method of the invention.

To illustrate the method of the invention, reference is made to FIGS. 1 and 2 which show a base panel or substrate 1 which can be any ligno-cellulosic panel such as insulation board, plywood, particle board and even paper. In FIGS. 1 and 2, the substrate is plywood. Base panel 1 is provided with a coating 2 of a heavy bodied adhesive. A number of selectively large flakes of bark 3, 4 and 5 are first deposited on coating 2 and are spaced apart as shown in FIG. 1. Each flake has at least one periderm 3a. However, for purposes of illustration, a number of periderms are shown for each flake. Between the periderms is the phloem 3b.

Next, relatively small bark chips 6, 7 and 8 are deposited in the spaces between flakes 3, 4 and 5, the chips

being smaller than the flakes and fitting in open spaces 9 between the flakes essentially to fill such open spaces. Each chip can contain one or more periderms, with the material on the opposite sides of each periderm consisting of phloem. An excess of chips is generally applied to completely fill spaces 9 although such excess is not illustrated in FIG. 1. The assembly of the substrate, flakes and chips is then placed in a hot press 26 (FIG. 2) comprised of a lower plate 24 and upper plate 25. The press applies pressure to the assembly as shown in FIG. 2 to compress the flakes 3, 4 and 5 sufficiently to bring some pressure on chips 6, 7 and 8. The compression also operates to bond the flakes and chips to the substrate 1. The flakes are compressible primarily due to the presence of relatively thick phloem. When taken from the press, the assembly has a generally, flat, upper surface. When an insulation board is used as the substrate, the upper surface of the substrate is indented by flakes and chips under pressure as shown in FIG. 3.

The next step of the method is to abrade the flat, upper surface of the exposed assembly, as by a rotating steel brush. This action removes phloem 3c (FIG. 2) and soft portions of periderm and excess unbonded chips, resulting in a relief-textured surface of the type shown in FIG. 3. The panel is then completed and can be readily used in a wide variety of different decorative applications as, for example, a wall panel. FIG. 4 shows the completed panel in perspective and illustrates the relative sizes of the flakes with respect to the chips therebetween.

We claim:

1. A method of producing a panel having decorative bark facing which comprises the following steps:
placing bark flakes and chips on an adhesive-coated ligno-cellulosic substrate in a single layer; and
applying pressure and compressing the flakes until pressure is exerted onto most of both the flakes and the chips and until both are bonded to the substrate in a single layer.
2. A method as set forth in claim 1, wherein is included the step of abrading the bark surface, after said surface has been bonded to the substrate, to remove soft tissue from the flakes and the chips.
3. A method as set forth in claim 1, wherein said substrate comprises a ligno-cellulosic board of the insulation board type, and wherein the thicker ones of said flakes and chips are partly embedded during said pressure applying step.

4. A method as set forth in claim 1, wherein said substrate is comprised of a bed of adhesive-coated bark flakes and chips.

5. The method of producing a decorative bark facing for a ligno-cellulosic board which includes the following steps:

- reducing bark of conifers generally tangentially to flakes and chips, the flakes containing at least one periderm layer, the periderm layer being generally parallel to the facets of the flakes, and the chips being smaller in size than the flakes;
- placing the flakes on the adhesive of an adhesive coated substrate with spaces between the flakes;
- introducing chips in the spaces;
- applying pressure and compressing the flakes until pressure is exerted onto most flakes and chips; and
- bonding the flakes and chips to the panel.

6. The method as set forth in claim 5, wherein is included the step of abrading the entire bark surface after said bonding step and removing phloem, thin-walled cork tissue and expanded phelloderm tissue as well as less well-bonded chips.

7. A method as set forth in claim 5, wherein is included the steps of compressing the flakes and chips beyond their elastic limit, abrading the entire surface to remove all soft and loose material from the same to thereby expose hard, densified, irregularly-shaped periderm layers.

8. A method of producing a hard, decorative bark facing on a ligno-cellulosic substrate which includes in part the following steps:

- placing bark flakes in a single layer on an adhesive-coated substrate with open spaces between the flakes;
- depositing bark chips in two or more layers onto the surface with most of the chips in the spaces between the flakes;
- applying pressure to compress the flakes until pressure is exerted onto all of the flakes and chips in contact with the adhesive coat;
- maintaining the pressure until all the flakes and chips in contact with the adhesive coat are bonded to the substrate in substantially a single layer; and
- abrading the surface to remove the chips not bonded to the substrate and to remove soft tissue from the flakes and chips bonded to the substrate.

* * * * *

50

55

60

65