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COMPOSITE FLEXIBLE MOISTUREPROOF WRAPPING TAPE OR SHEET

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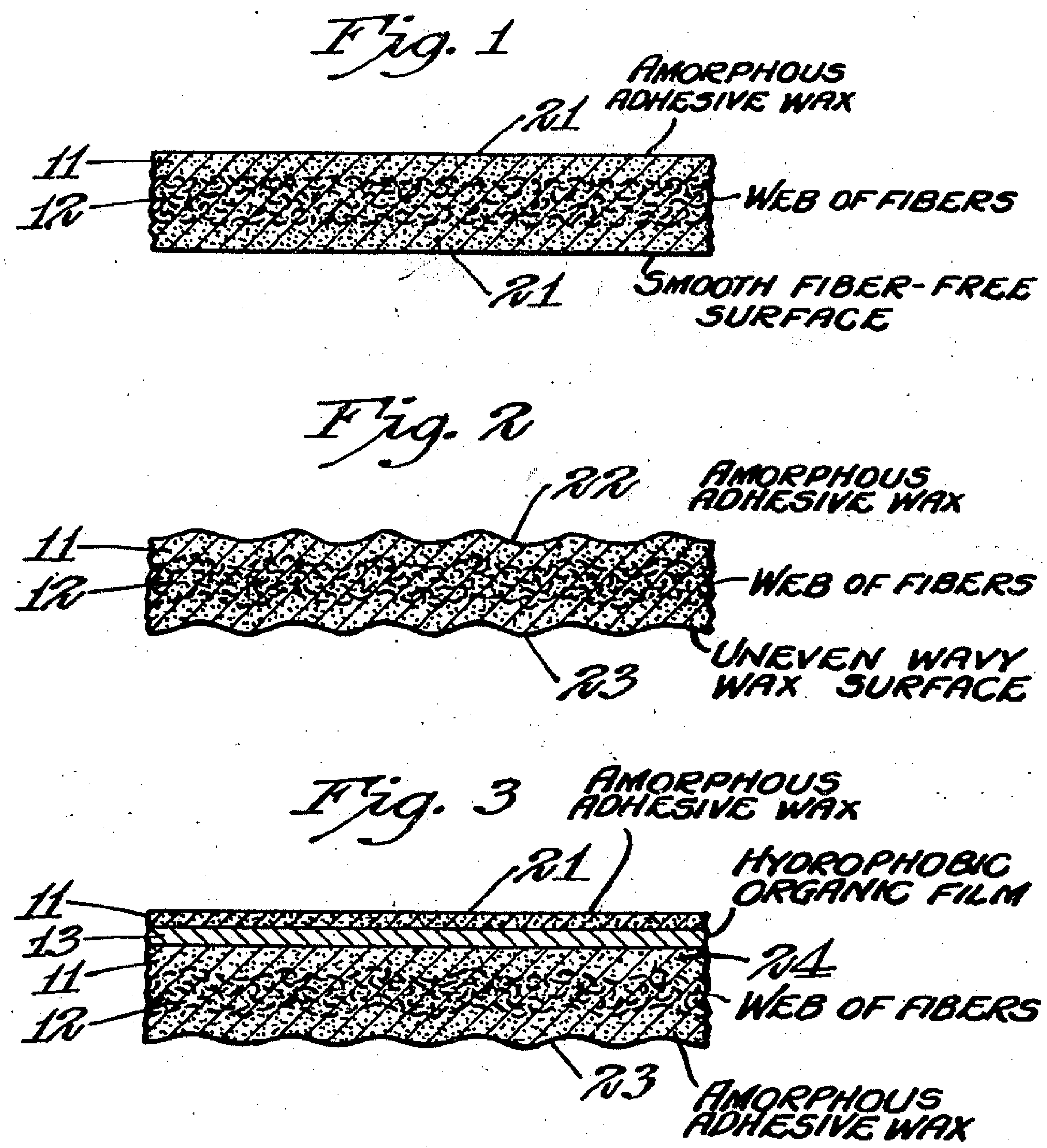

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COMPOSITE FLEXIBLE MOISTUREPROOF WRAPPING TAPE OR SHEET

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2 Claims. (Cl. 154—50)

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My invention relates to the production of waterproof and moisture vapor resistant, flexible, protective wrapping material, especially a wrapping sheet having the characteristic of being self-sealing. The wrapping material may be in sheet or tape form.

Waxes, whether vegetable, animal, or mineral, have of course long been used as waterproofing agents for one purpose or another. Wax films of themselves, as heretofore known, have been fragile and hard to handle, and the films were therefore commonly applied to the surfaces of carrier webs such as paper or cloth, in order to provide for the handling and support thereof. In pursuit of a wrapping material of improved type as compared with ordinary surface-coated wax paper, and the like, various combinations of webs were used, the combination being effected by the use of various adhesives and by the waxes themselves. Thus a glassine sheet has been attached to a paper sheet by means of wax; Cellophane has been similarly combined with paper. However such composite constructions leave much to be desired, particularly for uses as hereinafter discussed.

The most widely used waxes have been of petroleum origin. Paraffin, a crystalline wax, represents one type. "Amorphous" wax, viz. a microcrystalline type of greatly improved ductility, has also been employed in some constructions, e. g., as a thin center layer between unwaxed sheets of papers, and when compounded with other materials, as a surface coating on paper.

Even an unbroken film of wax will allow the passage of moisture vapor, at a rate dependent on the type of wax or wax mixture, the difference in relative humidity on opposite sides of the film, the temperature, and the thickness of the film. Microcrystalline wax shows less moisture vapor transmission than does ordinary paraffin wax, i. e. the ordinary crystalline type of wax. Further, the microcrystalline product is much less susceptible to breakage, as by creasing or folding or shattering of a thin film, whether by itself or supported on a carrier web. However, when coated or rolled out in a thin film in practice, or when applied to a carrier web, particularly from a solution, but also from a hot melt, this wax tends to be discontinuous to some extent and to contain a substantial number of pinholes which will allow moisture vapor and also liquid water to pass. Therefore, as a practical matter, such wax films, per se, do not provide a fully effective barrier to moisture and water transmission. Films of glassine or Cellophane applied to such a layer or film, so long as the resulting laminated sheet remains integral, aid in retarding the penetration of water or moisture, but are themselves hydrophilic and susceptible to the action of moisture to a considerable degree; hence they do not prevent moisture transmission therethrough, but only retard it for a time. A further drawback of such materials as glassine and Cellophane is that, if water contacts them while in use in such laminated sheet structures, the wax films or coatings tend to peel off of the same, i. e. the composite sheet delaminates. This may be demonstrated by forming a wax film on one surface of a Cellophane sheet, then placing the composite sheet in water; the wax film, which at first was firmly adherent to the cellophane, may after a few moments soaking be removed with ease.

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Surface coating, and even partial impregnation, of paper leaves an untreated area at the center of the web through which water or moisture vapor may readily pass and into which it may penetrate. The cellulosic fibers of that area, being free or relatively free of wax, are swelled and weakened by the moisture reaching them. After prolonged exposure to conditions of high humidity or to contact with liquid water, the web will therefore have permitted the passage of considerable moisture and will also have an increased tendency toward delamination or splitting within the fibrous sheet. Swelling tends to break sealed joints and is otherwise deleterious. These defects are also progressive, i. e. tend to aggravate themselves.

In using moisture-resistant wrapping material of this invention for the protection of metal or other objects, e. g. gun barrels, motor parts, etc., which may be shipped long distances or stored for long periods of time, the web is sometimes formed into a box or bag or other type of container, the edges of which may be sealed simply by folding and pressure, and, where desired, by the application of an additional coating of wax, the final closure being made similarly. For irregularly shaped articles, however, a method often found to be more convenient and advantageous, and for which my wrapping sheet material in its preferred form is suitable, is the application of the wrapper in strip or tape form. Various wrapper sheet materials available in the past did not lend themselves to this usage, e. g. because of the difficulty of obtaining an effective smooth coverage of the article and sealing of the edges of the wrapping. My wrapping material overcomes this difficulty, among others, as will be seen from the description as a whole.

It is therefore an object of the present invention to provide a flexible waterproof and moistureproof wrapping material in tape or sheet form. A further object is to provide a waterproof and moisture vapor resistant sheet comprising a film of ductile wax reinforced by a fibrous material or base. Another object is to provide a reinforced film or sheet of ductile wax or equivalent which is laminated to, and covered on at least one surface thereof by, a continuous film of substantially non-porous and moisture-resistant material, e. g. cellulose acetate. A further object is to provide a flexible, waterproof and moistureproof, wrapping material in tape or sheet form which is self-sealing. A still further object is to provide such a wrapping sheet material, i. e. of self-sealing character, in the form of rolls which may be readily unwound when desired. These and other objects and advantages will be understood from the description as a whole.

For the sake of a quick understanding of illustrative embodiments of constructions of the present invention, and of portions of such constructions, reference is made to the accompanying drawing, in which:

Figure 1 represents a film of amorphous adhesive wax **11** reinforced and supported by a web of fibers **12**, the surfaces **21** of the film being free of fibers and relatively smooth.

In Figure 2, the web composed of fibers **12** embedded in the wax layer is in the form of a creped or embossed sheet, so that the wax surfaces **22** and **23** are uneven and wavy.

In Figure 3, a thin continuous film of moisture-resistant material **13**, previously coated on both sides with wax, has been applied to surface **22** to form an intermediate continuous smooth wax phase **24** and to leave a smooth external surface **21** of wax **11** on the composite sheet.

For the sake of clarity in illustrating the invention the thickness of my wrapping sheet has been greatly exaggerated in the drawing, as will be obvious.

For producing the films of this invention, a microcrystalline or amorphous wax, for example one having a melting point of approximately 155° F. as determined by A. S. T. M. method D—127, or an equivalent material, may be used. Since the presence of water or high humidity is generally conducive to the growth of organisms such as molds, it is desirable to include in the wax a mold inhibitor, such as pentachlor phenol, for example 0.1% based on the weight of the wax. In some cases it is desirable to control the acidity of the final product; this may be done by adding sufficient alkaline material, for example triethanolamine, so that the pH of a water extract of the final product will be within the limits desired. For example, addition of about 0.03% of triethanolamine has been sufficient with some lots of material to give a final pH value of 6.5–7.5. These materials are conveniently added to the melted wax before the formation of the final film. They may of course be omitted where their presence is unnecessary.

As a convenient method of producing the reinforced wax films of this invention, a pre-formed web of fibrous material is pre-heated to remove excess moisture, is drawn through a bath of melted compounded wax, is passed between rolls or bars to control the weight of wax, and is then cooled, either by air or by water. Any or all of the aforementioned steps may be varied, modified, deleted in part or replaced by others, according to procedures well understood in this art; for example, note the disclosures of the patents hereinafter designated. However, various other procedures well known in the earlier prior art may also be used. The temperature of the wax should be so adjusted as to provide complete saturation of the fibrous web during its passage through the bath, and, at the same time, to maintain a sufficiently high viscosity so that an effectively thick film will be obtained. For the wax as described in the preceding paragraph, a temperature of 165–175° F. has been found suitable and advantageous. The final film of a common embodiment hereof will weigh in the neighborhood of 50–60 grains per 24 square inches, of which the wax will constitute about 35–50 grains, the remaining weight being mainly the embedded fibrous or reinforcing material.

For the further protected film of Figure 3, the fiber-reinforced wax film is prepared as before. Simultaneously, a film of moisture-resistant and, preferably, relatively hydrophobic character, such as a suitably plasticized cellulose acetate film, is passed through the same or an equivalent bath of melted compounded wax, and is then placed in contact with one face of the first film by passing the two together between the weight-controlling rolls or bars. The composite film is then cooled, which should be done as soon as possible after the combination has been effected in order to chill the wax below the temperature at which its internal strength would be insufficient to prevent delamination of the composite.

The pre-formed fibrous web is preferably of a soft, porous, flexible nature, and may be formed in any of the usual ways, as by deposition from suspension, carding, or even weaving. It may be in a flat or smooth state, or may be wrinkled, creped, or otherwise mildly corrugated. The fibers may consist of cellulose fibers, especially alpha cellulose fibers as obtained from wood; but they may also be composed of such relatively hydrophobic fibers as those of cellulose derivatives such as cellulose acetate; glass fibers or various of the synthetic fibers of resinous or other nature may also be used. A preferred form of fibrous web is typified by the absorbent crepe paper known as white Walpole crepe, weighing 35 lbs. per ream of 480 sheets 24 in. x 36 in.

For the additional film of Figure 3, a film is selected which is moisture-resistant, flexible, and possesses a surface to which the wax film will exhibit sufficient adhesion. Cellulose acetate, cellulose acetobutyrate, Pliofilm (rubber hydrochloride), etc., are examples of such films. Cellulose acetate film is a preferred material.

While the flat surfaces **21** of Figures 1 and 3 are effective and desirable for some purposes, there is additional advantage to be gained in having at least one surface wavy and irregular as at **23**. When the product of Figure 3 is wound up into roll form, or laid in a stack as individual sheets, with due precautions being taken to avoid the application of unnecessary pressure to such roll or stack, the waviness of surface **23** is effective in preventing complete contact with surface **21**, and the roll or stack is thus more easily unwound or unpiled. But due to the soft nature of the fibrous web and the ductility and adhesiveness of the wax, increased pressure, such as is applied to the edges during the covering of a package with this flexible wrapping material, is sufficient to establish an effective bond.

An illustrative embodiment of my preferred material constructed in accordance with the above disclosures is therefore composed of mold-resistant and substantially neutral amorphous, microcrystalline wax having white Walpole 35 lb. crepe paper embedded therein, and No. 88 cellulose acetate film laminated thereto with a film of wax, with a thin exposed wax coating on the other surface of said acetate film. Such a composite sheet will have a total weight of 68–70 grains per 24 square inches, of which at least 47 grains will be wax. It will have an overall thickness of approximately fifteen thousandths of an inch, and a moisture permeability value of as low as 7 grains per square meter per 24 hours, measured at 120° F. with a 100% relative humidity differential, i. e. 100% relative humidity on one side of the wrapping sheet and approximately zero humidity on the other side thereof. The material is also resistant to the passage of grease or oils. Opposing surfaces of this sheet may be easily sealed together at ordinary room temperatures by moderate pressure, as with the fingers; yet the seal may be readily broken when desired, e. g. for inspection. The sheet is flexible and may easily be made to conform to irregular shapes and objects. It is also relatively translucent, which permits identification or rough inspection of the contents without unsealing. Bending or folding of the sheet produces some disruption of the wax film when carried to extremes, and causes whitening and opacity; but does not break the acetate film. If this last-mentioned condition arises, my wrapping sheet material continues to give an extent of protection much superior to that of prior art wrapping sheets under such a condition.

The waterproofness of the edge bond between surfaces **21** and **23** of Figure 3, for example, or even between flat surfaces, may be further improved by the application of additional quantities of the wax to one or both of the contacting surfaces prior to their being pressed together. The wax may be applied hot by means of a brush. If desired, an article so wrapped may be unwrapped for inspection merely by breaking the wax bond, and may then be re-wrapped and re-sealed by again pressing the waxed surfaces together and without the application of any further coating of wax or other adhesive.

Materials such as Cellophane sheets or glassine paper sheets are not the equivalent of the cellulose acetate or like sheets or films in my combination, for reasons already indicated hereinabove. In composite sheets including one or more wax layers or films and a sheet of Cellophane, glassine, parchment or the like, if the Cellophane or glassine paper, etc., becomes wetter with water at a cut edge, the same loses its bond to the wax and as a result the composite sheet starts to delaminate; and, when delamination once begins, deterioration of the composite sheet by further delamination, etc., is quite rapid upon further contact with water and various other materials.

Heretofore, in an attempt to secure greaseproofness in food packages, and to resist loss of water from the foods, Cellophane, glassine and the like have been laminated to sheets of paper having a surface coating of wax, or which are impregnated somewhat with wax. For example, note generally Wilshire U. S. Patent No. 2,123,760 and Dreymann U. S. Patents Nos. 2,031,035 and 2,152,732. These and like structures constituted an improvement in a number of respects over ordinary wax paper for certain uses, but left much to be desired in the way of a flexible wrapping sheet, particularly in the respects just indicated. The use of a hydrophilic sheet such as Cellophane or glassine paper was fairly satisfactory for certain uses in providing the single quality of greaseproofness, but composite structures comprising such sheet materials had a restricted utility and, for many uses, a rather limited durability, as will be seen from the above.

By the use of a sheet material such as the acetate film herein described, particularly when employed in combination with a reinforced film or layer of amorphous wax, beeswax or the like, or combinations containing the same, I have been able to produce a wrapping tape or sheet material which is thin, flexible and serviceable and, at the same time, one which is highly moisture-resistant, resists delamination and, incidentally, is also greaseproof. However the quality of greaseproofness is not so important as high moisture-proofness and durability where my wrapping sheet is employed to protect metal parts against rusting, corroding, etc., during long periods of shipment and/or storage. In addition to obviating the defects of Cellophane, etc., of prior constructions by the employment of the relatively hydrophobic acetate film, or the like, as hereinabove described, I also have found I can secure a strong bond between the acetate film and the reinforced wax film and can thus secure an integral tough and mechanically strong composite wrapping sheet, which also has the other virtues above set forth.

While my invention has been described and illustrated by specific examples and description, it will be understood that all embodiments and variations within the scope of this specification and the appended claims are contemplated.

What I claim is:

1. A flexible water and moisture vapor resistant sheet material of the class described comprising a film of microcrystalline amorphous wax supported and reinforced by a porous fibrous web which is completely and continuously impregnated and covered by the wax throughout, the weight of the wax being at least twice the weight of the fibrous web, the said sheet material being free of any continuous film of hydrophilic material in the interior thereof, its two surfaces being fiber-free and mutually adherent when pressed together under moderate pressure and its water and moisture vapor resistance being substantially equal in all directions within the sheet throughout its extent.

2. A laminated sheet material comprising the material of claim 1 adhered by the wax to a continuous film of film-forming hydrophobic organic material, and a coating of wax on the outer surface of the said continuous film.

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