Nov. 12, 1968 S. A. HIDER ET AL 3,409,927

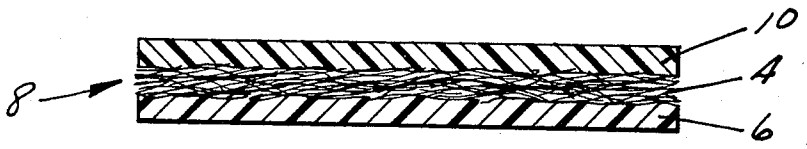
SCOURING COMPOSITION BOARD

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FIG. 1



FIG. 2



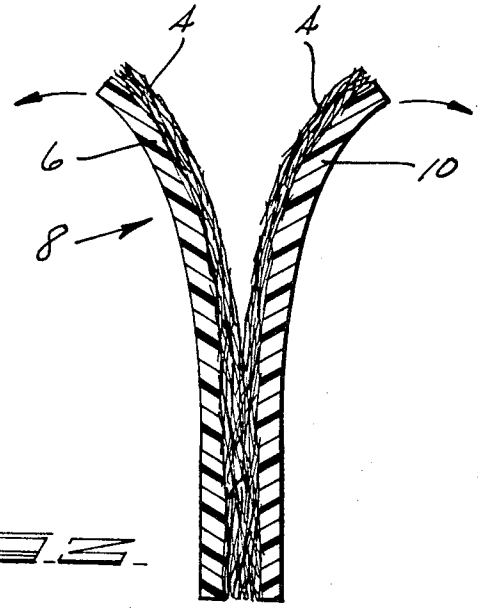


FIG. 3

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SCOURING COMPOSITION BOARD

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This invention is concerned with scouring composition boards. More specifically, this invention is concerned with a scouring composition board that is formed from one layer of a pulp-thermoplastic board and one fibrous layer.

Scouring devices wherein a fibrous pad is bound to sheets, for example plastics, foams, paper, etc., are known in the prior art. These prior art pulp-thermoplastic boards are usually produced by securing a fibrous sheet to a backing sheet via an adhesive. The scouring composition boards of this invention are distinguished from the prior art structures in that a fibrous pad is bound to a pulp-thermoplastic board with the result that a superior product is produced. Likewise, the scouring composition boards of this invention are advantageous because they can be cheaply manufactured on a continuous basis.

The primary object of this invention is the production of a superior scouring composition board. More specifically, an object of the invention at hand is a superior scouring composition board that contains a pulp-thermoplastic board and a fibrous pad.

A plurality of pulp-plastic boards which are formed from a wood pulp and a plastic are known in the prior art. This invention is adapted to utilize these prior art structures. However, this invention is particularly adapted to utilize a superior pulp-thermoplastic board that is produced from a fibrillated pulp. These superior pulp-thermoplastic boards will be described in detail herein below.

The scouring composition board of the subject invention is generally illustrated in FIGURES 1 through 3.

FIGURE 1 shows an embodiment **2** of this invention wherein a fibrous member **4** is bonded to a single pulp-thermoplastic board.

FIGURE 2 represents another embodiment **8** of this invention wherein a fibrous member **4** is bonded to two pulp-thermoplastic boards **6** and **10**.

FIGURE 3 illustrates how embodiment **8** of FIGURE 2 may be utilized.

To be more specific, the scouring composition board structure as is illustrated in FIGURE 1 comprises a pulp-thermoplastic board to which is bonded a fibrous member **4** which may be, for example, a metal wool.

In the embodiment of the invention at hand, as is illustrated in FIGURE 2, a composite scouring composition board comprises two pulp-thermoplastic boards **6** and **10** which are bonded to a central fibrous member **4**.

FIGURE 3 illustrates how composite structure **8** can be divided to form two scouring composition boards just prior to use by the consumer.

Pulp-thermoplastic board layers **6** and **10** are formed from a mixture of at least one cellulosic material and at least one thermoplastic material.

Examples of cellulosic materials which are adopted to this phase of the subject invention include wood cellulose and pulps derived from hardwoods, softwoods, and woody annular plants such as balsam fir, eastern hemlock, jack pine, eastern white pine, red pine, black spruce, red spruce, white spruce, tamarack, cyprus, quaking aspen, American beech, paper birch, yellow birch, eastern cottonwood, sugar maple, silver maple, yellow poplar, black cherry, white oak, bagasse, hemp, cotton and jute; mixtures of cellulosic materials can also be used. Preferred pulps adapted for the preparation of pulp-thermoplastic boards **6** and **10** are softwood pulps produced from woods such as pine, spruce, etc. No special prior refining is necessary for the pulps to be used in the practice of the present invention. The pulp-particulate thermoplastic mixture can contain from about 20 to about 90 weight percent pulp. A more preferred range for pulp concentration is from about 40 to about 60 weight percent with a most preferred percentage being 50 weight percent. Mixtures of cellulosic material can also be utilized.

The above-described pulps are blended with from about 20 to about 90 weight percent of a thermoplastic material. A more preferred fiber-thermoplastic mixture contains from about 40 to about 60 weight percent of a particulate thermoplastic material with a most preferred composition containing 50 weight percent of a particulate thermoplastic material. Examples of thermoplastics which are suited for use in this phase of the subject invention include both homopolymeric and copolymeric resins, such as (1) vinyl resins formed by the polymerization of vinyl halides or by the copolymerization of vinyl halides with unsaturated polymerizable compounds, e.g., vinyl esters, α,B-unsaturated esters, α,B-unsaturated ketones, α,B-unsaturated aldehydes and unsaturated hydrocarbons such as butadienes and styrenes; (2) poly-α-olefins, such as polyethylene, polypropylene, polybutylene, polyisoprene and the like, including copolymers of poly-α-olefins; (3) polyurethanes such as are prepared from polyols and organic polyisocyanates; (4) polyamides such as polyhexamethylene adipamide; (5) polyesters such as polymethylene terephthalates; (6) polycarbonates; (7) polyacetals; (8) polyethylene oxide; (9) polystyrene, including copolymers and terpolymers of styrene with monomeric ompounds such as acrylonitrile and butadiene; (10) acrylic resins as exemplified by the polymers of methyl acrylate, acrylamide, methylol acrylamide, acrylonitrile, and copolymers of these with styrene, vinyl pyridines, etc.; (11) neoprene; (12) condensates of aldehydes, especially formaldehyde and formaldehyde engendering substances such as paraformaldehyde; (13) silicones such as dimethyl and methyl hydrogen polysiloxanes; (14) unsaturated polyesters; and (15) cellulose esters including the nitrate, acetate, propionate, etc. This list is not meant to be limiting or exhaustive but merely to illustrate the wide range of polymeric materials which may be employed in the present invention.

Preferred thermoplastic polymers adapted for use in this invention are generally of low polarity and density. Examples of these preferred polymers are hydrophobic polymers such as those derived from olefinic hydrocarbons having from one to twelve carbon atoms, homopolymers and copolymers of ethylene, propylene, 1-butene, nylon, styrene, vinyl chloride, polybutadiene, and polyisoprene. However, the thermoplastic can be low density or high density, low molecular weight or high molecular weight, and low melting or high melting. Mixtures of polymers can also be used.

Fibrous member **4** can be any fibrous material which is

suitable for scouring. Fibrous member **4** can have both a random and an orderly structure. For example, it can be an orderly structure such as a woven metal mat or a random structure such as a metal wool. More specifically, member **4** can be a woven mat or a wool of a metal such as steel, stainless steel, brass, copper, aluminum, etc. Inorganic substances such as glass can also be utilized in the formation of fibrous member **4**. That is, member **4** can be a woven glass fiber mat or glass wool.

It is to be noted that fibrous member **4** can also be corrugated in order to increase its scouring efficiency. Likewise, it is obvious to one skilled in the art that many other types of designs can be pressed into member **4** in order to increase its scouring efficiency.

In order to increase the cleaning efficiency of the subject scouring composition boards, fibrous member **4** can be coated with or impregnated with a soap. In this connection, the term "soap" is intended to embrace not only the salts of one or more of the higher fatty acids with an alkali metal but also the newer detergents, some of which are not salts of fatty acids, e.g., those based on sodium dodecyl benzene sulfate, sulfonsate fatty acid amides and the like. Fibrous member **4** can likewise be coated with an antioxidant which will prevent its oxidation when used in an oxidizing environment.

Preferred scouring composition boards **2** and **8** in accordance with the embodiments with this invention as are illustrated in FIGURES 1 and 2, are prepared by the combination of at least one pulp-thermoplastic board **6** and/or **10** that is formed from about 40 to about 60 percent kraft pulp and from about 60 to about 40 percent polyethylene, polystyrene or polyvinyl chloride.

The most preferred embodiments **2** or **8** of this invention as are illustrated by FIGURES 1 and 2, comprises a pulp-thermoplastic board **6** and/or **10** which comprises from about 40 to about 60 percent kraft pulp and from about 60 to about 40 percent polyethylene. To this pulp-thermoplastic board is bonded a fibrous member **4** which is steel wool.

The above-described pulps and thermoplastics can be combined to form pulp-thermoplastic board layers **6** and **10** by many methods. For example, a powdered thermoplastic can be blended with a dry pulp and subsequently fused by the application of heat and pressure. Likewise, a dry pulp can be kneaded into a thermoplastic material which is in a semi-plastic state. The thermoplastic material can also be blended into a slurry which comprises a pulp and a slurry media, dried and then fused.

As mentioned above, a superior pulp-thermoplastic board can be prepared by the beating of a slurry which comprises a particulate thermoplastic material, pulp and a slurry medium. This beating effects the fibrillation of the pulp and the entrapment of the particulate thermoplastic material. When using this fibrillation technique to produce a pulp-thermoplastic board, the thermoplastic is in a particulate form and should range in size between 40 and 300 mesh. Within the useful range of 40 to 300 mesh, there is a preferred range of 100 to 200 mesh.

Liquid slurry media which are adapted for use to produce the pulp-thermoplastic board using fibrillation include for example, hydrocarbons such as benzene, toluene, and heptane; mildly polar substances, for example, ethers such as ethyl ether and tetrahydrofuran; ketones such as 2-butanone; and highly polar solvents, for example, hydroxy compounds such as water, methanol, and ethanol. Although convenience determined by routine test will usually establish the preferred medium in a particular application, the only substantial limitation on the medium is that it must not decompose or completely dissolve the cellulosic or the thermoplastic component under the conditions selected. Non-aqueous media which meet this requirement are suitable, but aqueous media have practical advantages because of their lower cost and customary use in the art for paper-making processes.

The fibrillation necessary to produce the preferred pulp-thermoplastic boards for use in this invention is that which provides a decrease of TAPPI freeness value of the pulp alone of at least 25 ml. below the freeness value prior to treatment, and provides a final TAPPI freeness value of the pulp alone of from about 300 ml. to about 600 ml. A preferred range for the final value of the pulp is a TAPPI freeness of from about 375 ml. to about 425 ml. It is to be noted that the freeness of the resulting mixture can also be measured. However, these values are usually slightly higher due to the effect of the particulate thermoplastic. When measuring the freeness of the composite mixture, the preferred final freeness falls within the range of from about 425 ml. to about 475 ml.

It will be apparent from the foregoing that not all types of agitation are applicable to provide the fibrillation necessary to obtain the products of the present invention. The degree of fibrillation suitable for the practice of this invention, however, can be defined in terms of the TAPPI freeness or Williams Slowness. Specifications for the TAPPI test T 227 m–58, "Freeness of Pulp," as revised August 1958, are available from the Technical Association of the Pulp and Paper Industry, 360 Lexington Avenue, New York 17, N.Y. The test is based on a measurement of rate of water drainage from a standardized pulp suspension through a perforated plate. The filtrate enters a funnel which is equipped with side and bottom orifices; the quantity of water which is collected from the side orifice is a measure of drainage rate, and this quantity in milliliters is TAPPI freeness. Tests for the present invention were made on a Williams Precision Freeness Tester (Williams Apparatus Co., Watertown, N.Y.), which allows measure of drainage time rather than volume. Values from the two freeness tests are interconvertible by scales available from TAPPI at the address given above.

The fibrillation as described above is carried out on a slurry that is formed between a fiber-particulate thermoplastic mixture and a liquid medium as described above. As is mentioned, aqueous media are preferred for use in this invention.

The slurry concentration can range from about 0.01 to about 2 percent. A preferred range is from about 0.5 to about 1 percent. Generally, the slurry should be of such a consistency that it is possible to form a paper-like sheet on a conventional paper making machine such as a fourdrinier.

Upon formation of the fibrillated fiber-particulate thermoplastic mixture as described above, said mixture is fed directly into a conventional paper making machine such as a fourdrinier machine. The coating of particulate thermoplastic on the fibrillated fibers is such that it is still possible to form fiber-to-fiber contact. Because of this fiber-to-fiber contact, a wet sheet of suitable strength to allow the use of a conventional paper making machine can be formed. The wet sheet upon formation can be dried with the dryers that are used to dry conventional paper. It is recognized by one skilled in the art, the temperature of the dryers and feed speed must be adjusted to cause the drying of the wet sheet. Upon drying, the sheet is formed into a finished product by the addition of heat and/or pressure.

The above-described preferred pulp-thermoplastic boards which are produced by fibrillation are described in detail in U.S. Patent No. 3,325,345.

Upon formation, the above-described pulp-thermoplastic boards are formed into the scouring composition boards of this invention by the application of at least one of heat and pressure. In the production of scouring composition boards **2** and **8** as are illustrated in FIGURES 1 and 3, the individual pulp-thermoplastic boards **6** and **10** may be combined with fibrous member **4** in an unfused state. Likewise, the pulp-thermoplastic boards **6** and **10** may be fused by the exposure to a temperature of from about 250 to about 400° F. at a pressure of from about 50 to about 1000 p.s.i.g. prior to their combination with the fibrous member **4**. During bonding with the

pulp-thermoplastic board, fibrous member 4 may be protected with a non-adherent sheet such as Teflon. This protection allows the fibrous sheet to retain its fluffy nature after bonding.

In regard to the above-described fabricating techniques, it should be noted that it is preferred that the pulp-thermoplastic boards be in an unfused state when combined with fibrous member 4. This procedure produces a superior bond between the pulp-thermoplastic board and the fibrous member.

It is within the purview of this invention to add to the compositions of this invention compatible materials which do not affect the basic and novel characteristics of the composition of this invention. Among such materials are coloring agents, including dyes and pigments, fillers and similar additives. Additives such as antioxidants, antistatic agents, stabilizers and anti-foaming agents may also be added. The upper limit of the quantity of additives is usually about 25 weights percent of the product.

It is to be noted that upon production of the finished fused material of this invention, said material is in sheet form. This sheet can then be corrugated, heat sealed, sealed with adhesives, formed into a roll, perforated, printed, embossed, etc.

The composition boards of this invention can be manufactured on a continuous or batch basis. If the preferred fibrillation pulp-thermoplastic board is utilized and said sheet is manufactured on a fourdrinier paper making machine, the board from the fourdrinier machine can be easily combined with the other components of the product composition board on a continuous basis.

The following examples will illustrate the invention. These examples are given for the purpose of illustration and not for the purpose of limiting this invention.

Example I

Two unfused sheets of 30% kraft pulp and 70% low density polyethylene were sandwiched with a layer of grade 0 steel wool. A cut-out metal plate was used as a spacer to prevent compacting of the steel wool layer. The assembly was pressed using a Carver press between heated platens at a pressure of 300 p.s.i.g., for 75 seconds at 375° F. The resulting sandwich was removed, then lightly pressed without the metal spacer at 360° F. for 60 seconds.

The resulting sandwiched laminate was then pulled apart, producing two fused pulp-plastic boards with steel wool facings. The individual scouring composition boards functioned as a wet-or-dry abrasive and were non-clogging.

Example II

A square mat of grade 0 steel wool was placed on an unfused pulp-thermoplastic board which was formed from 30% kraft pulp and 70% low density polyethylene. A sheet of Teflon was then placed over the steel wool. A picture frame spacer of approximately 1/16" thick with a square hole in its slightly smaller than the piece of steel wool was placed around the steel wool mat. This assembly was pressed using a Carver press between platens at 450 p.s.i.g. for 90 seconds at 385° F. This method produced a pulp-thermoplastic board having a thick fluffy steel wool mat. Since the hole in the frame is slightly smaller than the size of steel wool mat, the edges of the mat were tightly sealed to pulp-thermoplastic board. The other surfaces of the steel wool mat were secured to the pulp-thermoplastic board to a lesser degree.

The resulting scouring composition board functioned as a wet or dry scouring agent.

Example III

Two unfused pulp-thermoplastic boards consisting of 50% high density polyethylene (density .960 and melt index 14) and 50% pine kraft pulp were sandwiched around a non-woven mat (1/4" thick) of glass wool. The composite was fused using a Carver press between heated platens at 375° F., and 600 p.s.i.g. for 1 minute. The fused pulp-plastic boards were then separated with a glass wool layer adhering to each. The resulting two abrasive boards exhibited mild abrasive action when rubbed against a painted surface under both dry and wet conditions.

What is claimed is:

1. A scouring composition board which comprises a pulp-thermoplastic board and a fibrous layer wherein the pulp-thermoplastic board, having a discrete fibrous web, is produced by the agitation of a slurry for a period of time sufficient to cause fibrillation, said fibrillation being sufficient to decrease the TAPPI freeness of said pulp according to TAPPI test T 227 m–58 by at least about 25 ml. to a final value of from about 300 ml. to about 600 ml., wherein the slurry comprises from about 0.01 to about 2 weight percent of a composition having intermingled therein from about 20 to about 90 weight percent of a particulate thermoplastic, which will pass through a 40-mesh screen and be retained by a 300-mesh screen and from about 80 to about 10 weight percent of a fibrous cellulose material, the balance of the slurry being slurry medium, and draining the resulting mixture; wherein the fibrous layer is steel wool, brass wool, copper wool, aluminum wool or glass wool and is bonded to the pulp-thermoplastic board.

2. The scouring composition board of claim 1 wherein the pulp-thermoplastic board, having a discrete fibrous web, is produced by the agitation of a water slurry for a period of time sufficient to cause fibrillation, said fibrillation being sufficient to decrease the TAPPI freeness of said pulp according to TAPPI test T 227 m–58 by at least 25 ml to a final value of from about 375 ml. to about 425 ml., wherein the slurry comprises from about 0.5 to about 2 percent of a composition having intermingled therein from about 40 to about 60 weight percent of a particulate thermoplastic polymeric alphaolefin having from one to twelve carbon atoms, which will pass through a 40-mesh screen and be retained by a 100-mesh screen and from about 60 to about 40 weight percent of a wood pulp, the balance of the slurry being slurry medium and draining the resulting mixture; wherein the fibrous layer is steel wool, and is bonded to the pulp-thermoplastic board.

3. The scouring composition board of claim 1 wherein the pulp-thermoplastic board, having a discrete fibrous web, is produced by the agitation of a water slurry for a period of time sufficient to cause fibrillation, said fibrillation being sufficient to decrease the TAPPI freeeness of said pulp according to TAPPI test T 227 m–58 by at least 25 ml. to a final value of from about 375 ml. to about 425 ml., wherein the slurry comprises from about 0.5 to about 2 weight percent of a composition having intermingled therein from about 40 to about 60 weight percent of a particulate polyethylene, which will pass through a 100-mesh screen and be retained by a 200-mesh screen; and from about 60 to about 40 weight percent of pine kraft pulp, the balance of the slurry being water and draining the resulting mixture; wherein the fibrous layer is steel wool, and is bonded to the pulp-thermoplastic board.

4. The scouring composition board of claim 1 wherein the pulp-thermoplastic board, having a discrete fibrous web, is produced by the agitation of a water slurry for a period of time sufficient to cause fibrillation, said fibrillation being sufficient to decrease the TAPPI freeness of said pulp according to TAPPI test T 227 m–58 by at least 25 ml. to a final value of from about 375 ml. to about 425 ml., of a slurry which comprises from about 0.5 to about 2 weight percent of a composition having intermingled therein from about 40 to about 60 weight percent of a particulate polystyrene, which will pass through a 100-mesh screen and be retained by 200-mesh screen; and from about 60 to about 40 weight percent

of pine kraft pulp, the balance of the slurry being water and draining the resulting mixture; wherein the fibrous layer is steel wool, and is bonded to the pulp-thermoplastic board.

5. The scouring composition board of claim 1 wherein the pulp-thermoplastic board, having a discrete fibrous web, is produced by the agitation of a water slurry for a period of time sufficient to cause fibrillation, said fibrillation being sufficient to decrease the TAPPI freeness of said pulp according to TAPPI test T 227 m–58 by at least 25 ml., to a final value of from about 375 to about 425 ml., wherein the slurry comprises from about 0.5 to about 2 weight percent of a composition having intermingled therein from about 40 to about 60 weight percent of a particulate polyvinyl chloride, which will pass through a 100-mesh and be retained by a 200-mesh screen; and from about 60 to about 40 weight percent of pine kraft pulp, the balance of the slurry being water and draining the resulting mixture; wherein the fibrous layer is steel wool, and is bonded to the pulp-thermoplastic board.

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