

UNITED STATES PATENT OFFICE

2,071,360

WATERPROOFED PAPER

James Reid, Darien, Conn.

No Drawing. Application August 7, 1934,
Serial No. 738,829

9 Claims. (Cl. 154—33)

For many years box makers have sought to produce a corrugated paper board (that is, a corrugated sheet with two flat facing sheets or liners) which would substantially withstand moisture and also would withstand variations in temperature within atmospheric ranges and which could be produced relatively inexpensively. Many waterproofed papers have been made by impregnating or by applying a layer of waterproofing material such as asphalt between two sheets of paper, but these materials do not lend themselves to making corrugated board having the necessary requirements. If an ordinary waterproofed sheet made by assembling two plies of paper with asphalt between them is run through a corrugating machine, the asphalt bleeds through the paper and tends to gum up the corrugating rollers; at the same time the asphalt is absorbed into the paper and its adhesive qualities are lost so that the two sheets of paper readily separate. It is also recognized that when this type of paper is chilled, the asphalt may crystallize, losing its adhesive qualities so that the two sheets separate. In order to be satisfactory for making containers of the type here contemplated, the corrugated board must be capable of withstanding the effect of dry cold and sudden changes to wet, moist air, as when foods are brought out of cold storage in the summer; this is a very severe test. I have solved this problem and have succeeded in making a waterproofed sheet of paper which readily lends itself to the manufacture of corrugated board through my discovery that if two sheets of paper are cemented together by an intervening layer of material of a bituminous nature but comprising a substantial percentage of stearine pitch, these difficulties are overcome.

Stearine pitch is a by-product material having relatively little value and of limited use. It is obtained as a residue when the fatty acids from natural glycerides are distilled and it probably is largely made up of polymerization products of these fatty acids. This material has the quality that when it is hot it oxidizes quite rapidly so that if it is melted it will tend to form a skin over the surface. I have found that if the stearine pitch (in the blown form) is melted and spread out on paper, it tends to coat the individual fibers of the paper for it is known to have a particularly efficient wetting quality) and the large area thus obtained assists in the rapid oxidation of the surface. This oxidation is sufficient so that when the material is reheated it will not melt or flow but at the same time the film which is formed is not a brittle one but on

the contrary is somewhat tacky so that the coating remains elastic to withstand bending strains even at low temperature but remains in place so that even if the compound sheet is heated, the two members will not separate, and no bleeding results, even at temperatures where charging begins. Even at low temperatures there is substantially no tendency to crystallize and cause separation of the sheets, despite the fact that the stearine pitch which has been disseminated through the fibers of the paper oxidizes to the point where it will not flow; nevertheless, it will soften under heat to an appreciable extent so that if the compound sheet is run through the hot rollers of a corrugating machine, the binder apparently softens to permit relative movement of the sheets which adjust themselves so that as soon as they cool, the sheets are held in the corrugated shape irrespective of the application of the liner sheets, though of course it is desirable to have the liner sheets affixed to give the structure mechanical strength. In this regard it may be noted that the usual steam treatment during corrugation is not necessary with my product.

While stearine pitch alone may be used for this purpose, this material in its usual form is somewhat too tacky to give the best results and I find it advantageous to compound it with bituminous material such as asphalt. The proportions of this compound may vary within a very wide range, but the best results I have obtained thus far have been where the asphalt and stearine pitch were mixed approximately equally; however, valuable benefits can be obtained if as little as 20% of stearine pitch is present, though I prefer to have in excess of 35% of this material.

I have also found that in order to get the results here set forth the stearine pitch should be blown prior to its use. It is preferable to mix the asphalt and pitch together and then blow the mixture. This results in a thorough commingling of the two materials and seems to render the mass particularly homogeneous. The blowing removes some of the volatile ingredients from the stearine pitch (as well as from the asphalt) reducing its tackiness and probably also inducing oxidation so that when the material is heated and spread out on the paper in use its film-forming characteristics are accentuated. However, the blowing (which ordinarily will follow the procedure usual in making blown asphalt) should not be continued to the point where the pitch loses all its tackiness and should be of about the same degree of intensity as that used for a medium blown asphalt; for example, the melting

point of a 50—50 mix of stearine pitch and asphalt prepared for use in my process may be in the order of about 210° F.

In applying the bituminous material to the paper, somewhat special procedure is advisable. The usual practice in applying asphalt to paper is to have a feed roll with fixed bearings which is about half submerged in the molten material. The paper is pressed against this roll by an upper roll and the amount of asphalt applied to the paper is controlled by the pressure of the upper roll. In this case the two rolls are rotated in the same direction as the movement of the paper and at the same speed as the paper is fed through. If one endeavors to use this same procedure with the stearine pitch compound it will be found that the compound tends to oxidize on the surface of the feed roll and gradually build up until there may no longer be any substantial transmission of heat from the roll, and then the apparatus becomes inoperative. To avoid this I have found it best to move the paper in the opposite direction to the rotation of the feed roll, with the paper pressed against the feed roll closely enough so that it keeps the surface of this roll polished. In this case a relatively large mass of compound will form against the surface of the paper and this should be scraped off by passing the paper over a doctor blade shortly after it leaves the feed roll. The amount of material left on the paper can be adjusted by the tension on the paper over the doctor roll as well as the sharpness of the doctor blade and the temperature of the compound. In usual operations using a compound that has a melt point of about 200° F. I find it advantageous to maintain this material at a temperature of about 400° F. during application. Shortly after the sheet of paper leaves the doctor roll a second sheet may be brought in contact with it and the two are run through a pair of squeeze rolls. However, I find it better practice to coat one surface of each of these two sheets and scrape the surface relatively clean with the doctor blade but leaving sufficient material on each face to give a smooth continuous surface. In this case there is a better permeation of the material into the paper (though ordinarily it will not go through even a very thin sheet of reasonably dense paper) and a very close bond is obtained free from air bubbles with less danger of bleeding or separation, and also there is a greater uniformity of application.

As soon as this paper is cooled it will be found that the two sheets are cemented together so closely that it is substantially impossible to separate them without tearing the sheets. However, if the material is heated as by passing it through a heated pair of corrugating rolls, the bonding material softens sufficiently so that apparently some readjustment between the sheets of paper may occur, which becomes substantially permanent on cooling, and accordingly it is possible to make a very fine grade of corrugated board from the paper made in accordance with my invention. As is usual practice, it is desirable to affix one or two liner sheets to the corrugated member. For this purpose, I may coat the inner faces of the liner sheets with a compound such as that described above or I may use other forms of adhesive such as the sodium silicate adhesives commonly used in the art. The latter form of adhesive is preferably used where the liner sheets are themselves compound sheets with waterproofing material between them. When a corrugated board is made up employing my paper, it

will withstand all temperature variations within the atmospheric range and will withstand substantial amounts of moisture without showing any tendency to disintegrate. It is thus readily adapted for making substantially waterproof boxes and cartons—a product which has been greatly sought for in the trade.

In some instances, as for example, in making a member to be corrugated I find it advantageous to use both sheets of paper of equal thickness. On the other hand, in some instances as for example in connection with the liner sheets it may be advantageous to use sheets of paper of unequal thickness so that one sheet supplies the necessary strength and the other sheet is simply a surface veneer which is available for printing or the like. In this case any moisture that attacks the product will be kept nearer the surface and there is less material tending to disintegrate if wet. It is of course advisable that the open ends of the corrugated board be closed as by taping or by compression.

While I have described my process as particularly useful in making corrugated board (which is probably its most important use) it also is valuable in other directions. Due to the fact that the stearine pitch compound will not bleed through, my process may be used for attaching delicate facing sheets (which may be of fine quality or selected colors) to one or both faces of a relatively coarse or low-grade underbody of paper or cardboard, so that in one operation there are obtained both the benefits of waterproofing and of veneering.

While I have found the use of the blown stearine pitch compound to be particularly useful in connection with the manufacture of laminated paper for use in the manufacture of corrugated board, it is also useful in some other particulars. Thus under some circumstances, I may simply apply the waterproofing material to one face of a sheet and allow it to harden so that the final product has the appearance of the paper on one side and is black on the other side. Again, I may use the stearine pitch compound as a medium for attaching other materials to paper. For example, I have found that if the paper is coated with a stearine pitch compound and then flaky metallic powder such as aluminum powder is applied, it is possible to get a sheet having a substantially metallized face and which has extraordinary qualities of imperviousness both to water and air. In such case the metallic powder may be in a very fine form or it may be in a coarse form of small flakes running up to a size in the order of 1/8-inch across or larger. In applying such metal, it is preferably brushed over the face of the paper after the paper has been given a very thin coating of the hot stearine pitch and finally the two products are rolled together in any desired manner to hold the metallic flakes in place after which any surplus should be brushed off. A particularly good product has been made using aluminum flake for this purpose. In a somewhat similar manner my process may be used for affixing foil to paper, as in this case the two can be squeezed tightly together (preferably between chilled rolls) without danger of excess adhesive oozing out on the rolls, and without the necessity of a long drying period.

It is understood that the term "stearine pitch" as used herein is intended to apply to the relatively high melting point residues resulting from the distillation of any fatty acid obtained from a natural glyceride, such for example as the ma-

terial obtained from the distillation of cottonseed fatty oil acids or fish oil fatty acids as well as fatty acids from other natural sources. It is also to be understood that the stearine pitch may be compounded with other materials of a pitchy nature in addition to asphalt, such for example as coal tar pitch. Minor proportions of various waxes may also be included if desired to give particular qualities to the compound, and both the stearine pitch alone or mixtures of this material with other such ingredients are intended to be embraced within the phrase "a compound pitch." Thus, if a small percentage of wax (say up to 5% of a wax such as paraffin or carnauba) is included, it will greatly reduce the tackiness of the surface so that the treated face of the paper can be exposed to prevent penetration of water into the surface. This product is of substantial value as it has a clean, non-tacky, odorless, tasteless and non-toxic surface which will remain substantially constant as regards physical characteristics, throughout the range of atmospheric temperatures but which can readily be rendered temporarily tacky to give it an adhesive surface by the use of a small amount of a volatile solvent such as naphtha.

In the foregoing description my invention has been described as applied to paper. This term is intended also to embrace cardboard or felt and the process may also be applied to other relatively dense, fibrous materials such as fabrics and particularly close woven materials. For example, binding tapes valuable for assembling articles made out of my waterproofed paper can be made up by combining paper with fabric by the use of a stearine pitch compound. Other forms and modifications of the structures described may also be employed without departing from the spirit of my invention.

What I claim is:

1. In the art of waterproofing paper, the steps of coating a surface of a sheet of paper with a melted compound pitch having a melting point above normal temperatures and comprising at least 20% of blown stearine pitch, and permitting such stearine pitch to cool and oxidize on the fibers of the paper.

2. A method as specified in claim 1, in which the compound pitch comprises at least about 50% of stearine pitch.

3. A method as specified in claim 1, which includes the further step of affixing a solid body to one face of the sheet of paper while the pitch is still hot, so that the sheet of paper is caused to adhere to such body.

4. The method of making corrugated paper which comprises coating a face of a sheet of paper with a compound pitch comprising a substantial percentage of blown stearine pitch, affixing to such surface while hot a second sheet of paper, permitting the pitch to oxidize so that it will not "bleed" when hot, passing the laminated sheet through hot corrugating rolls to readjust the sheets of paper and cooling in corrugated form.

5. In the art of waterproofing paper, the steps of coating one face of each of two sheets of paper with a compound pitch comprising at least 35% of stearine pitch, scraping off excess pitch, squeezing together such sheets while hot and permitting the pitch to cool and oxidize on the fibers of the paper.

6. A sheet of paper characterized by its impermeability having a face impregnated with a compound pitch comprising at least 20% of blown stearine pitch and having such face substantially coated with metal in the form of flakes.

7. Paper having a substantially unimpregnated surface and a surface impregnated with a compound pitch comprising at least 35% of blown stearine pitch, such compound being characterized by the fact that it will neither bleed through the paper nor become brittle at temperatures within the atmospheric range.

8. A corrugated paper consisting of two sheets of paper held together by a layer of compound pitch comprising at least 20% of blown stearine pitch with the exposed surfaces of such paper substantially free of such pitch and the two layers of paper held in relative position so as to maintain the paper in corrugated form.

9. A sheet of dense fibrous material having one face impregnated with a compound pitch comprising at least 20% of blown stearine pitch.

JAMES REID.