G. A. RICHTER, W. B. VAN ARSDEL AND D. H. WHITE.
WATERPROOF FIBROUS MATERIAL AND PROCESS OF MAKING THE SAME.
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WATER-REPELLANT COATING

PAPER TUBE IMPEMINATED WITH SULPHUR, AND WITH WATER-REPELLENT SUBSTANCE E.G. PARAFFIN.

Witness:

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By

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To all whom it may concern:

Be it known that we, GEORGE A. RICHTER, WALLACE B. VAN ARSDEL, and DONALD H. WHITE, all citizens of the United States, residing at Berlin, in the county of Coos and State of New Hampshire, have invented new and useful Improvements in Waterproof Fibrous Materials and Processes of Making the Same, of which the following is a specification.

In the manufacture of tubing from fibrous materials, and particularly of paper stock, it is the practice to conduct the web of paper stock from the Fourdrinier wire or other web-forming mechanism to a rotary mandrel where it is wound with the desired number of convolutions into a tube, subsequent to which the mandrel is withdrawn and the tube thus formed is dried. The paper stock, whether of ground wood, sulfate, sulfate, soda or rag pulp, is of such character and contains such an amount of water that the fibers felt or mat sufficiently to produce a substantially homogeneous fibrous tube of considerable strength. The tubing thus formed, however, is permeable to water and other fluids and various attempts have heretofore been made to treat the tube in such manner as to render them waterproof. Because of the character of the stock, the tubes thus formed, while porous, are not highly absorbent and it has been impossible to waterproof them by the use of such materials as are commonly employed in waterproofing felt or paper in the manufacture of prepared roofings or other manufactures. It is not only desirable that the tubes should be waterproofed but also that their tensile strength should be increased, so that they may be utilized as conduits for liquid under pressure. We have found, as a result of numerous experiments using many different kinds of materials, that it is possible to secure the desired results by first impregnating the tubes with a material which will add strength thereto, and then subjecting them to impregnation with a water-repellent material which will more or less fill the pores and interstices of the tubes.

Our process comprises two steps in the production of the finished tubes. The first step consists of impregnating the fibrous tubes, after they have been dried and the water removed, with a molten material of relatively high penetrability but which on setting increases the strength and rigidity of the tubes, and adds, to a degree, water-resistant properties. For this purpose, we preferably employ sulfur. The second step of our process consists in subjecting the tubes, which have been thus impregnated with sulfur, to impregnation with an amorphous waterproofing material which will become highly fluid at a temperature below the melting point of the sulfur. For this purpose, we may use any suitable material having the characteristics referred to, such for example as paraffin, carnauba or Montan wax, hydrogenized oil or other solid hydrocarbon, wax or fat.

Preferably both impregnating steps are carried out under pressure that the material thoroughly impregnates the fibrous foundation.

Proceeding to a more detailed description of one way of practising our method, we proceed as follows: The dried tubes are arranged in an upright position in a wire gauze or other basket which is then introduced into a bath of molten sulfur heated to a temperature ranging from 260° to 280° F. This bath is contained within a tank which is then closed, and, by means of compressed air, the pressure is elevated to 60 to 80 pounds for about 6 to 8 hours. The tank cover is then removed, the basket containing the impregnated tubes is lifted out, and the tubes are exposed to the open air so as to permit them to cool to ordinary atmospheric temperature or until the sulfur crystallizes within the interstices of the tubes. When the cooling has been accomplished, it is found that the fibrous tube is thoroughly impregnated with 50% to 100% by weight (according to the density of the tube) of definite minute sulfur crystals. The tube thus treated is dense and rigid, and its tensile strength is increased in the neighborhood of 50%, without however causing any perceptible increase in the thickness of the walls of the tube. The presence of the sulfur in the pores of the tube and between the fibers thereof increases the water-repellent property of the tube, leaving the tube, however, still pervious to water at high pressures. The basket of tubes is then introduced into a bath of paraffin or other suitable water-repellent material as stated.
This bath is contained in a tank which may be closed. Assuming that the bath consists of paraffin, it is heated to a temperature of 180° to 212° F. under a pressure of approximately 60 pounds for a period of 1 to 3 hours. Upon the expiration of this period, the bath is permitted to cool to a temperature somewhat higher than the solidifying point of paraffin in order that the highly fluid paraffin will become more viscous and not ooze from the pores of the tubes when the latter are removed. After this step of cooling, the basket of tubes is then removed from the tank, and, with the tubes in upright position, the tubes are permitted to cool in the atmosphere until the paraffin has hardened and set. Upon examination, it will be found that the paraffin has entirely permeated the tubes and has filled up all of the interstices between the minute sulfur crystals, and the crystals and the paper fibers of the tubes. The tubes are covered with a thin skin coating of paraffin interically and exteriorly.

The accompanying drawing shows a finished tube. Tubes as thus treated may be used as conduits for vegetable or animal oils, water and most acids, even at a fairly high pressure, without deterioration or permeation of the liquid.

In selecting the water-repellent material for the second step, it is necessary, as we have already stated, that such material be selected as will become highly fluid and have a high degree of penetration at a temperature below the melting point of sulfur. Various mixtures may be employed for this purpose, and, without attempting to enumerate all of the materials which may be successfully used, we may state that for example a mixture of gilsonite about 50 parts by weight, paraffin about 35 parts and linseed oil about 15 parts, solved by heat and thoroughly intermixed, produce results akin to those produced by the use of paraffin alone.

While we have described the process particularly in connection with the treatment of paper tubes, it is evident that other paper or fibrous articles may be subjected to the process for analogous purposes. Articles, such as molded or otherwise formed from paper pulp or other equivalent fiber, may be impregnated first with sulfur, and then with a water-repellent material, to increase the strength thereof and add to their waterproof properties without carbonizing or injuring the fibers.

What we claim is:

1. The herein described process of treating fibrous materials, which consists in impregnating the same with molten sulfur, permitting the sulfur to set and crystallize in the pores and interstices of said fibrous material, and then further impregnating said fibrous material with an amorphous water-repellent material whose melting point is lower than that of sulfur.

2. The herein described process of treating fibrous material, which consists in distributing sulfur throughout the body of said material, and then impregnating said material with a water-repellent compound which is solid at ordinary temperatures.

3. The herein described process of treating fibrous material, which consists in distributing sulfur throughout the body of said material, then impregnating said material under heat and pressure with a water-repellent material, solid at ordinary temperatures and having a melting point below that of sulfur.

4. The herein described process of treating paper tubes and the like, which consists in first impregnating such tubes with sulfur, and then impregnating said tubes with a water-repellent material which is solid at ordinary temperatures and having a melting point below that of sulfur.

5. The herein described process of treating paper tubes or the like, which consists in impregnating the same with molten sulfur while under pressure, permitting the same to cool and the sulfur to crystallize, then, without melting the sulfur, impregnating said articles with a molten water-repellent material, which is solid at ordinary temperatures, and then permitting said tubes to cool and said water-repellent material to set and harden.

6. A waterproof fibrous material consisting of a mass of paper fiber impregnated with sulfur, and further impregnated with a water-repellent material.

7. A waterproof paper tube impregnated with sulfur and having the pores and interstices filled with a water-repellent substance whose melting point is lower than that of said crystalline material.

8. A rigid waterproof paper tube having minute sulfur crystals distributed throughout the pores and interstices thereof, and impregnated and coated interically and exteriorly with a solid water-repellent compound.

9. A rigid waterproof paper tube having distributed throughout the pores and interstices thereof both free sulfur and a waterproofing compound comprising bitumen.

10. A rigid waterproof paper tube having distributed throughout the pores and interstices thereof both free sulfur and a waterproofing compound comprising bitumen tempered with oil.

In testimony whereof we have affixed our signatures.

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