

UNITED STATES PATENT OFFICE

2,648,615

METHOD OF FLAMEPROOFING CELLULOSIC WALLBOARD AND ARTICLE PRODUCED THEREBY

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No Drawing. Application May 24, 1949,
Serial No. 95,159

14 Claims. (Cl. 117—71)

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This invention relates to a method of treating cellulosic materials and more particularly to a method of flameproofing cellulosic wallboard. By the term "flameproofing" is meant the treating of the material so that it will not readily ignite and will not propagate flame under ordinary conditions.

Cellulosic wallboard has attained considerable commercial importance in the building and other industries where its structural and insulating qualities can be used to good advantage. However, wallboard, like all cellulosic materials is subject to destruction by fire and will propagate flame under ordinary conditions. In modern fireproof building construction, it is essential that the combustible character of such cellulosic wallboards be altered so that propagation of flame is difficult if not impossible.

Cellulosic materials have in the past been treated to flameproof them by impregnating them with materials such as chlorinated paraffin, chlorinated rubber or other chlorinated hydrocarbons, borates and certain other salts which decompose when heated. I have found however that these procedures do not constitute a satisfactory solution of the problem, and, moreover, that their use as heretofore proposed may be positively dangerous in that they give a false sense of security. An impregnating treatment ought to result in a permanent flameproofing of the material, and users will generally assume that it does so. My observations, however, show that the treatment may be relatively short-lived, in terms of the normal life of the impregnated material. My observations also show that many of the materials which have been proposed may have a destructive action on the cellulosic material itself.

My invention provides a flameproofing treatment which under all expected conditions of use will persist throughout the expected life of the impregnated material and hence will not become a deceptive fire trap, and which does not undesirably impair the structural strength and other physical properties of the impregnated material.

My treatment comprises two steps; first, impregnating the board with a mixture of substantially neutral flameproofing substances and then coating or covering the surface of the board with a vapor impervious and flame-resisting sealing preparation. It is feasible to treat wallboard by my method so that the impregnating salts will not leach out over an extended period of time, even in a relatively moist location, thus making wallboard available for use in locations where it was previously believed to be unsuitable.

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The primary impregnation solution which I have used is a substantially neutral aqueous solution of water soluble fire retarding agents. It is essential that this material have a high degree of penetration. This high degree of penetration may be brought about by the addition of a wetting agent.

As an example of a satisfactory impregnant, I have used an aqueous solution of ammonium sulfamate and sodium tetraborate and a wetting agent and treated the wallboard so as to incorporate about one-eighth pound of each of these substances per square foot of one-half inch cellulosic wallboard. Impregnation was effected by soaking the board in a hot aqueous solution (125° F. to 150° F.) containing approximately 7 parts of water and 1.175 parts each of ammonium sulfamate and sodium tetraborate and a suitable wetting agent which reduced the soaking time for complete impregnation. The board was allowed to remain in the solution until saturated. It was then heated to evaporate the water. The total weight of the resulting dried board was increased about 25% of dry solids.

After the impregnated board was dried the surface was painted with a coating preparation having flameproofing properties as well as providing a vapor seal. The material which was used for the coating was an organic sol of pyrobitumen. This material is resistant to flame and may have incorporated within it a pigment, such as finely divided metallic aluminum, to produce a more attractive surface as well as to increase the resistance of the coating to flame.

I have found that the wetting agents manufactured and sold by Carbide and Carbon Company under the names "Tergitol F G," which is a 25% aqueous solution of the sodium salt of 2-ethyl hexene 1-sulfonic acid, and "Tergitol #7," which is a 25% solution of the sodium salt of 3-9 diethyl di-decanol 6 sulfate, are most satisfactory for my process although to the best of my knowledge any wetting agent would be satisfactory.

The effectiveness of my flameproofing process appears to depend for its efficiency upon several different principles, all closely related to the physical and chemical properties of the flameproofing substances. In the impregnating mixture, the ammonium sulfamate, an organic preparation, liberates ammonia gas when heated apparently choking the flame by a smothering blanket of ammonia gas. Sodium tetraborate, on the other hand, fuses when heated and appears to form a protective incombustible molten flux coating the fibers of the board, thereby re-

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pellling the flames from the surface of the cellulosic fibers. The two materials ammonium sulfamate and sodium tetraborate also act to neutralize each other upon hydrolysis thus preventing injury to the wallboard by chemical action of the impregnating material when the wallboard becomes damp. The coating material, an organic sol of pyrobitumen, sold under the trade-name of "Roskote Resins," by Royston Laboratories, Inc., contains a major proportion of ultra divided solid highly polymerized and non-reactive asphaltene particles which are fairly saturated hydrocarbon materials primarily naphthanic in nature. The major portion of these colloidal particles are under .01 micron in diameter. This material is relatively free from inorganic contamination and from reactive organic constituents such as oil and low molecular weight fractions. Freedom from inorganic contaminants is especially important for the presence of such materials causes the coating film to be subject to attack by acids or alkalies. Such inorganic materials are also readily leached out of the coating by moisture causing permeation and reduction of the vapor sealing and insulating qualities of the film. Air dried films of "Roskote Resin" are resistant to strong inorganic acids such as sulphuric and hydrochloric; they are non-saponifiable by strong alkalies such as sodium hydroxide; and they resist weathering and oxidation and maintain their physical properties from sub-zero temperatures to above 500 degrees Fahrenheit. These coatings may be pigmented with metallic or metallic oxide pigments such as titanium dioxide, zinc oxide, cobalt oxide and oxides of iron to modify the physical properties. For example, aluminum pigmentation results in a film resistant to a temperature of 800 degrees Fahrenheit.

Insulating board or wallboard when treated according to the process of my invention will char but will not burn with a flame when subjected to intense heat such as the flame of a blowtorch. It is not affected by the presence of moisture. There is no deterioration of the flameproofing properties of the impregnating materials or the coating material over long periods of time. The wallboard, when treated according to my invention, retains its basic desirable physical properties plus the additional properties of flame and moisture resistance.

While I have described a present preferred application of my invention, it may be otherwise embodied or practiced within the scope of the following claims.

I claim:

1. A method of treating cellulosic materials comprising the steps of impregnating the cellulosic material with ammonium sulfamate and sodium tetraborate by immersing the wallboard until saturated in a hot aqueous solution of about 7 parts water and about 1.75 parts each of sodium tetraborate and ammonium sulfamate, substantially removing the water added by the impregnating solution and coating the surface of the dried material with an organic sol of pyrobitumen, the major portion of which has a particle size less than 0.01 micron in diameter.

2. A method of treating cellulosic materials comprising the steps of impregnating the cellulosic material with ammonium sulfamate and sodium tetraborate by immersing the wallboard until saturated in a hot aqueous solution of about 7 parts water and about 1.75 parts each of sodium tetraborate and ammonium sulfamate, substantially removing the water added by the impreg-

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nating solution and coating the surface of the dried material with an organic sol of pyrobitumen, substantially free of water-soluble inorganic contaminants.

3. A method of treating cellulosic materials comprising the steps of impregnating the cellulosic material with ammonium sulfamate and sodium tetraborate by immersing the wallboard until saturated in a hot aqueous solution of about 7 parts water and about 1.75 parts each of sodium tetraborate and ammonium sulfamate, substantially removing the water added by the impregnating solution and coating the surface of the dried material with a suspension of finely divided metallic aluminum in an organic sol of pyrobitumen, the major portion of which has a particle size less than 0.01 micron in diameter.

4. A method of treating cellulosic materials comprising the steps of impregnating the cellulosic material with a substantially neutral solution of ammonium sulfamate and sodium tetraborate, heating the impregnated material to substantially remove the diluent added by the impregnating solution, and coating the surface of the dried material with an organic sol of pyrobitumen substantially free of water-soluble inorganic contaminants.

5. A method of treating cellulosic wallboard comprising the steps of impregnating the cellulosic material with a substantially neutral solution of ammonium sulfamate and sodium tetraborate, heating the impregnated material to substantially remove the moisture added by the impregnating solution, and coating the surface of the dried material with a suspension of a finely divided metallic pigment in an organic sol of pyrobitumen substantially free of water-soluble inorganic contaminants.

6. A method of treating cellulosic wallboard comprising the steps of impregnating the cellulosic material with a substantially neutral solution of ammonium sulfamate and sodium tetraborate, heating the impregnated material to substantially remove the moisture added by the impregnating solution, and coating the surface of the dried material with a suspension of a finely divided metal in an organic sol of pyrobitumen substantially free of water-soluble inorganic contaminants.

7. A method of treating cellulosic materials comprising the steps of impregnating the cellulosic material with a substantially neutral aqueous solution of an ammonium compound which is solid at room temperatures but which liberates ammonia gas when heated to the combustion temperature of the cellulosic material and a borate which is fusible at the combustion temperature of the cellulosic material, substantially removing the moisture added by the aqueous impregnating solution and coating the surface of the dried material with an organic sol of pyrobitumen substantially free of water-soluble inorganic contaminants.

8. A flame-resistant wallboard comprising a sheet of cellulosic material impregnated with substantially equal parts of ammonium sulfamate and sodium tetraborate and coated with a vapor impervious and flame-resistant coating of pyrobitumen having an average particle size less than 0.01 micron in diameter.

9. A flame-resistant wallboard comprising a sheet of cellulosic material impregnated with ammonium sulfamate and sodium tetraborate and coated with a vapor impervious and flame-resist-

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ant coating of pyrobitumen substantially free of water-soluble inorganic contaminants.

10. A method of treating cellulosic wallboard comprising the steps of impregnating the wallboard with an aqueous solution of an ammonium compound which is solid at room temperature but which liberates ammonia gas when heated to the combustion temperature of the cellulosic material and a borate which is fusible at the combustion temperature of that material, the ammonium compound and the borate being in such proportions as to form a substantially neutral solution, substantially removing the water added with the impregnating solution and coating the surface of the dried material with an organic sol of pyrobitumen substantially free of water-soluble inorganic contaminants and having a major portion of its particles less than 0.01 micron in diameter.

11. A method of treating cellulosic wallboard as claimed in claim 5 wherein the metallic pigment is a metal oxide.

12. A method of treating cellulosic materials comprising the steps of impregnating the cellulosic material with a substantially neutral aqueous solution of an ammonium compound which is solid at room temperatures but which liberates ammonia gas when heated to the combustion temperature of the cellulosic material and a borate which is fusible at the combustion temperature of the cellulosic material, substantially removing the moisture added by the aqueous im-

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pregnating solution and coating the surface of the direct material with a suspension of a finely-divided metallic pigment in an organic sol of pyrobitumen substantially free of water-soluble inorganic contaminants.

13. A method of treating cellulosic wallboard as claimed in claim 12 wherein the metallic pigment is a metal oxide.

14. A method of treating cellulosic wallboard as claimed in claim 12 wherein the metallic pigment is powdered aluminum.

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