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FLAMEPROOF SHEET

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The present invention relates generally to a flameproof sheet, and more particularly, it relates to a flameproof sheet coated with bitumen, which sheet is to be used as a backing sheet for insulation, as a building paper to provide a vapor barrier, etc.

There are various ways of combining bitumen with paper sheets and boards, such as by impregnating the sheet or board with bitumen and by coating the sheet or board with bitumen. Impregnated sheets have a particular field of use, and such impregnation is usually accomplished by forming the bitumen into an emulsion and breaking the emulsion on the sheet or board, or by preparing an aqueous solution for impregnation. The present invention is not directed to or related to the manufacture of such sheet or board but, to the contrary, is directed to the manufacture of bitumen coated sheets or board, which are frequently used as backing sheets for insulation, such as rock wool, glass fibers and the like, and as vapor barrier sheets in building construction. In view of the use of such backing sheets and barrier sheets in building construction, it is important that a sheet be as flameproof as possible and, to this end, various attempts have been made to flameproof these sheets. In this connection, materials containing oxygen, such as fatty acid pitches and residual pitches have been used alone and in combination with bitumens. These materials are not flameproof but they char or cake upon heating and consequently do not melt or flow from the paper. In addition, the char tends to slow down the propagation of flame. A principal difficulty which arises from flameproofing a sheet in this manner is that the pitch tends to skin over so that combining with insulation material, such as rock wool and glass fibers or sheet material, is not feasible after a relatively short period of time.

Another way which has been used for making bitumen coated flameproof sheets is to mix flameproof materials with bitumen, or to mixtures thereof. Several difficulties arise through this method of preparing a flameproof sheet, one of these difficulties being that the flameproof materials used, such as ammonium salts, may decompose at the temperatures at which the bitumen is fluidized, causing the bitumen to foam and to be difficult for application to the paper sheet. Another difficulty is that these flameproofing materials tend to sludge so that uniform application of the material to the sheet is not feasible.

Furthermore, the previously known ways of flameproofing bitumen coated papers have not provided highest flameproof protection at low cost.

A principal object of the present invention is the provision of an improved flameproof sheet and a method for making such a sheet. Another object of the invention is the provision of improved insulation material. These and other objects of the invention, as will become more clear hereinafter, are accomplished by manufacturing a flameproof sheet, this being done by coating a paper sheet or board, which may be flameproofed, with a bitumen and then applying discrete particles of a flameproofing agent in such manner that the agent becomes embedded in the bitumen in dispersed relation and portions of the particles are not coated with bitumen. This sheet or board

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may then be combined with rock wool or glass fiber to provide improved insulation.

In accordance with the principles of the invention, a paper sheet or paper board is coated with bitumen, and while the bitumen is in a plastic condition, particles of a flameproofing agent are embedded in the bitumen in dispersed relation and in such manner that portions of the particles are not coated with the bitumen. It is important that the bitumen be dispersed so that the sheet may be combined with another sheet to make a duplex sheet or be combined with insulating material, such as rock wool or glass fibers.

It is quite important that portions of the particles not be coated with bitumen so that when flame is encountered by the sheet, the flameproofing agent may decompose or break down so as to form a gas which will more effectively flameproof the sheet. If the flameproofing agent is coated with bitumen, the agent does not as readily decompose and, consequently, the bitumen may melt or burn before the flameproofing agent becomes effective. It appears, that the greatly improved results of the invention result from the flameproofing agent being capable of being decomposed more readily than when coated with bitumen.

As pointed out above, the paper sheet or board may or may not be flameproofed. If the sheet is to be flameproofed, this may be done in any of several well-known ways, as for example by impregnating the sheet or board with a borax solution. This may also be done by impregnating the sheet or board with an emulsion which contains not only a fire-proofing material but also an asphalt.

The flameproofing agent, to accomplish the desirable results of the invention, should be in the form of discrete particles and may comprise any of the well-known agents. Well-known flameproofing agents include ammonium sulfate, chloride, phosphate, and bromide, monoammonium phosphate, etc.

As indicated in the American Chemical Society monograph on the art of flameproofing, entitled "Flameproofing Textile Fabrics," Robert W. Little, Reinhold Publishing Corporation, 1947, various methods of, and compositions for, flameproofing combustible organic materials are known. In order to obtain the results of this invention, it is essential to use one of the therein described flameproofing mechanisms which functions by presenting a physical barrier to the elements of combustion other than the product protected, that is, to flame heat, oxygen or both. Two flameproofing mechanisms function in this defined manner and employ compositions comprising in the one case inorganic compounds which fuse or foam (or both) at flame temperatures, and in the other compounds which decompose at elevated temperatures to give off gas, such as water vapor, carbon dioxide, sulfur dioxide, chlorine and ammonia.

The size of the discrete particles are an important feature of the invention. If the particles are too large they are unsightly and are readily removed upon handling. On the other hand, if the particles are too small they interfere with the adhesiveness of the bitumen and are unsatisfactory. In general, the particles should be of a size which will pass a 20 mesh screen but which will not pass a 150 mesh screen. Best results have been obtained with particles of a size of about 30 mesh.

As indicated above, the particles of flameproofing agent should be in dispersed relation and, in this connection, the amount of agent used should be between about 2 pounds per thousand square feet of sheet and about 20 pounds per thousand square feet of sheet. If larger

amounts are employed, the sheet is difficult to combine with insulating material and other sheets, and on the other hand if lesser amounts of flameproofing material are used, the sheet does not have sufficient flameproof characteristics.

The bitumen which is employed may be any one of several asphalts and pitches which are used for coating paper to impart moisture barrier characteristics. This may include the fatty acid pitches and residual pitches mentioned above, and the bitumen may comprise a mixture of asphalts, pitches, or both. Preferably, the bitumen is non-tacky at normal room temperatures but can be made tacky by heat for combining with insulating material or another sheet of paper or board. In order to facilitate such combination, the asphalt may be ribbed so as to provide lands and grooves in a well-known manner.

In the practice of the invention, a web of paper is coated with asphalt, which is in fluid condition, and while the asphalt is still tacky, a flameproofing agent is applied to the sheet in granular form. The asphalt may be cooled and formed into rolls for shipping to a converter, or in the alternative, the asphalt may be retained in a tacky condition and an insulating material applied to the sheet. As another alternative, the asphalt may be maintained in a tacky condition and a second web of paper or board applied to the coated sheet. When the latter alternative is carried out, it is important that the flameproofing agent not be completely coated with the asphalt.

As a specific example of the invention, a flameproofed paper is coated on a conventional coating machine with a layer of asphalt. While the asphalt is still tacky, ammonium sulfate having a size of 30 mesh and being in granular form is sifted onto the asphalt, about 3½ pounds per thousand square feet being employed. The asphalt was cooled to a non-tacky condition and the sheet formed into rolls.

As a second example of the invention, a sheet of paper is coated with a layer of asphalt and then a mixture of granules of ammonium sulfate and monoammonium phosphate, having a size of about 30 mesh, is also sifted onto the asphalt while still in a tacky condition. About 4 pounds per thousand square feet of sheet of the mixture is applied. The asphalt is maintained in a tacky condition and a second sheet of paper applied to the coated sheet. The laminated product is then treated so as to flameproof the paper components by impregnating the paper components with a flameproofing agent in a well-known manner.

The following is an example of a mineral wool batt formed in accordance with this invention and its general method of preparation. It is understood, of course, that the composition of, and method for, producing the product is exemplary and is not to be considered to limit the invention to the particular composition and operating conditions outlined.

A commercial flameproofed kraft paper weighing approximately 50 pounds per ream was coated with approximately 10 pounds/1000 square feet of an asphalt having a melting point of approximately 170° F. and a penetration within the limits of 20–35 at 77° F. The surface of the asphalt coating was then substantially uniformly dusted with approximately 10 pounds/1000 square feet of ammonium sulfate as a flameproofing compound. The thus-formed backing sheet was then laminated with tackifying heat and slight pressure to a mat of mineral fibers approximately 2 inches thick. The thus-formed mineral fiber batt was tested for fire-resistance in a simulated stud space formed of inorganic cementitious sheets and simulated studs, forming a space having an inside dimension of 3½ x 14¼ x 24" which duplicates a wall space formed by surfacing sheets and 2 x 4" wood studs on 16" centers. The batt was positioned with the non-vapor barrier sur-

face against one of the incombustible sheets, thereby forming a chimney effect between the vapor barrier backing and the other incombustible sheet. Three milliliters of non-leaded gasoline were burned in a trough 6 x 1 x ¼" deep, placed 1" below the edge of the vapor barrier backing sheet.

When so tested, the flameproofed mineral fiber batts, formed as above, exhibited a burned area of only approximately 13 percent, and passed standard tests for a good flameproof rating. As a comparison, the same flameproofing compound, ammonium sulfate, was mixed into the same 170° F. melting point asphalt in amount as great as possible while retaining the necessary spreading and adhesive characteristics of the asphalt (approximately 50 percent by weight of the asphalt). Mineral wool batts employing such an asphalt adhesive and a vapor barrier of the aforementioned type were tested in the foregoing manner. Such batts exhibited an average burn area approximately 180 percent the burn area of the batt formed in accordance with the above example. As this data indicates, it has not been found possible to duplicate the excellent flameproof characteristics of the batts formed in accordance with this invention, without the use of the type of flameproofing composition disclosed herein, applied in the specified method and amounts recited.

The products of the invention are economical to manufacture and have outstanding flameproofing characteristics. This is believed to be accomplished by the sifting on of the flameproofing agent in the manner set forth above so that the flameproofing agent is not completely coated with bitumen so that it has maximum utility and provides the greatest protection to the bitumen against flame.

The application is a continuation-in-part of my co-pending application, Serial Number 360,330, filed June 8, 1953, and entitled "Flameproof Sheet," now abandoned.

The various features which are believed to be new are set forth in the following claims.

I claim:

1. A mineral wool batt comprising a mat of mineral fibers, a paper backing sheet of sufficient strength to support said mat when adhesively united thereto, a coating of asphalt on said backing sheet in amount at least approximately 5 pounds per 1000 square feet of backing, said coating serving to adhesively unite said backing sheet to said mat, and only partially embedded in the surface of said asphalt adjacent said mat, at least 3 pounds per 1000 square feet of coated sheet of ammonium sulfate, particles dispersed so that portions of the asphalt are left exposed for said adhesive union, portions of the particles being uncoated with asphalt and protruding from the surface of the asphalt.

2. A mineral wool batt comprising a mat of mineral fibers, a paper backing sheet of sufficient strength to support said mat when adhesively united thereto, a coating of asphalt on said backing sheet in amount at least 5 pounds per 1000 square feet of backing, said coating serving to adhesively unite said backing sheet to said mat, and, only partially embedded in the surface of said asphalt adjacent said mat, approximately 75–125% by weight of said asphalt of ammonium sulfate in discrete particles dispersed, so that portions of the asphalt are left exposed for said adhesive union, portions of the particles being uncoated with asphalt and protruding from the surface of the asphalt.

3. A mineral wool batt comprising a mat of mineral fibers, a paper backing sheet of sufficient strength to support said mat when adhesively united thereto, a coating of asphalt on said backing sheet in amount approximately 10–15 pounds per 1000 square feet of backing, said coating serving to adhesively unite said backing sheet to said mat, and, only partially embedded in the surface of said asphalt adjacent said mat, approximately 75–125% by weight of said asphalt of ammonium sulfate in discrete particles dispersed so that portions of the asphalt are left exposed for said adhesive union, portions of the

particles being uncoated with asphalt and protruding from
the surface of the asphalt.

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