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METHOD OF MAKING THERMAL INSULATION

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2 Claims. (Cl. 154—28)

This invention relates to a method of making thermal insulation.

This application is a division of the applicant's copending application, Ser. No. 691,696, filed September 30, 1933, on Thermal insulation, now Patent No. 2,001,912, dated May 21, 1935.

It is an object of this invention to provide an improved method of making thermal insulation which is relatively simple and inexpensive in construction and efficient in use.

Thermal insulation in the form of metal foil carried by a frame, and thermal-insulating sheets having a metallic heat-reflective surface or coating are well-known in the prior art as represented by the following patents: U. S. Patents Nos. 1,757,479, 1,890,418, 10,375, 289,505, 294,780, 1,306,281, 1,383,680, 1,445,070, 1,667,691; British Patents Nos. 266,177 (1927), 310,572 (1929), 317,678 (1929); and German Patent No. 529,867 (1931). These patents pretty well represent the prior art in thermal insulation and they show the development of thermal insulation including the use of thermal insulating sheets having a metallic coating thereon and functioning as the active, heat-reflective constituent thereof. There are, however, serious objections to, and difficulties experienced in the use of thermal insulation in the form of metal foil as well as in form of sheets having a metallic coating or heat-reflective surface. Among these objectionable features are: The usual form of metal used for thermal insulation and coatings therefor is either a metal foil carried by a frame or a metal powder spread upon a base sheet. These materials, however, are costly, brittle, and very fragile. In order to make them available for use it is necessary to install them in rigid frames with the foil or coated sheet stretched and securely fastened in the frames. This construction is very impractical in building construction which requires a flexible, tough material which can be subjected, without damage, to rough handling, creasing, and abrasion.

Another objection to the prior art metal foils or metallized heat insulation sheets is that their metallic content upon exposure to acids, alkalis, and atmospheric conditions corrodes, tarnishes, and deteriorates generally, and thereby loses much of its heat-reflective power and efficiency. This is true whether the metallic insulation sheet be in the form of a metal foil or in the form of a foil-covered vegetable or cellulose base sheet or a base sheet having a metallic powder spread thereover.

Objects of this invention, therefore, are: to provide a thermal insulating sheet which in use overcomes the aforementioned and other difficulties experienced in the use of the prior heat insulators; to provide a thermal insulation sheet having a highly polished, silver-colored non-metallic coating or heat-reflective surface; and to provide a thermal insulation sheet that is relatively inexpensive to manufacture, which is flexible and tough, which can be subjected to rough handling and abrasion without damage; which is unaffected by weather conditions and the presence of acids and alkalis; which can be creased and folded without breaking or cracking its reflective surface; which is water proof and moisture-proof; and which is generally efficient as a heat insulator in all of the uses to which it may be put.

The aforementioned objects may be accomplished and the hereinbefore referred to and present non-metallic heat insulation sheet produced in many different ways and by using many different formulas, or constituents, some of which will be indicated hereinafter. However, a typical example of a satisfactory formula and method for making a typical specimen of the new thermal insulation sheet is as follows:

Formula and Example 1

A heat reflective coating or surface comprised of an intimate mixture of the following substances, the proportions indicated being by weight: 40 per cent finely divided silver sulphide (Ag_2S), 40 per cent casein, and 10 per cent wax, may be applied to a suitable vegetable base sheet which may be, for example, a sulphite or kraft paper or the like. This composition may be applied to the base sheet in any suitable manner as by hand, by means of an automatic brush, known as a brush-coater; or by the rolls of a coating machine; or the adhesive casein may be spread over the base sheet and the silver sulphide spread thereover as a dry powder as by dusting, sifting, or spraying. The base sheet thus coated may then be placed in a friction calender having its rolls heated to approximately from 300° to 400° F. and pressure then applied. This treatment changes the coating from either a black or dark gray color to a highly polished bright silver color and produces a thermal insulating sheet having a bright, highly polished surface that is highly reflective to heat and which sheet has the other desirable qualities hereinbefore mentioned, being tough, flexible, moisture proof, and weather-proof, resistant to acids and alkalis, generally non-corrosive, and capable of use in any type of building, wall, refrigerator or other con-

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struction where a thermal insulation sheet may be found useful.

In the foregoing example the silver sulphide is the active or heat-reflective constituent or pigment of the heat-insulating coating; the wax and casein act as a vehicle or carrier for the silver sulphide; the casein also serving as a binder between the silver sulphide and the base sheet.

As examples of bases, base sheets, or surfaces upon which the aforementioned heat-insulating coating may be spread the following may be named as illustrative: a sulphite or kraft paper; a combination sulphite and kraft paper; a combination of kraft paper, sulphite paper, and ground wood; a combination of kraft paper, sulphite paper, ground wood, and waste mixed papers; or any combination of the above; or any fibrous material including silks, cottons, rayons, woolens, linens, or wood; or metal, glass or other surface.

As examples of other heat-reflective pigments or active constituents that may be used in the finely divided state in place of silver sulphide in the manufacture of the aforementioned coating and heat-insulating sheet described in Example No. 1, as well as in the other coating compositions to be described hereinafter, are the following: litharge, aluminum oxide, stephanite, (a silver antimony sulphide, Ag_2SbS), pyrargycite (AgSbS); horn silver (silver chloride, AgCl), infusorial or diatomaceous earth, augite, a volcanic mineral of a black or greenish color, diallage, a mineral allied to augite having a brown, gray, or green color, laminated in structure, and having a metallic lustre when broken across; alunite, a boric sulphate of potassium and aluminum, or any other heat-reflective substance which is non-metallic and which can be finely divided and highly polished to give a silver sheen.

As examples of vehicles or carriers in which the silver sulphide in the above example, or any of the other heat-reflective constituents or pigments herein indicated may be used are: beeswax, paraffin wax, petroleum tailings, china wax, or any other wax whether it be soluble or insoluble in water, acid-resisting casein, or any casein in combination with formaldehyde; nitrocellulose; cellulose acetate; any phenol resin in combination with any asphalt derivative; any coal tar derivative; linseed oil or combinations thereof; starches; or any other vehicle that will act as an adhesive or binder and which will at the same time carry the aforementioned pigments or active heat-reflective constituents of the new heat-reflective coating composition and heat-insulating sheet.

The heat reflective coating formula recited in Example 1, above, may be replaced by any of the following formulas, all proportions indicated being by weight unless otherwise specified:

Formula 2.—20 percent silver sulphide, finely divided; 60 percent casein in combination with formaldehyde; and from 5 per cent to 10 per cent of a suitable wax, which may be any of those hereinbefore mentioned;

Formula 3.—8 oz. of 60 second cotton; one quart of ethyl acetate; one quart of toluol; ⅝ gal. of benzol or benzine mixed with castor oil, tricresyl phosphate and butyl acetate; and 2 lbs. of finely divided silver sulphide or any of the other heat-reflective constituents or pigments herein indicated;

Formula 4.—1 lb. of cumar; 10 per cent of soy bean oil; 20 per cent of naphtha; and 2 lbs. of finely divided silver sulphide or other pigment hereinbefore named;

Formula 5.—3 lbs. of feculose casafin; 9 parts of water; one part of inverted sugar; and 2 lbs. of finely divided silver sulphide or other heat-reflective pigment herein named;

Formula 6.—1 gal. of Chinawood oil; ½ lb. of litharge; 2 lbs. of resin; and 1 gal. of boiled linseed oil. This mixture is cooked to about 475° F. and the temperature allowed to drop to about 350° F. A suitable quantity of naphtha is then added to the mixture; and finally to that mixture is added 1¾ to 2 lbs. of finely divided silver sulphide or any of the other non-metallic or mineral heat-reflective pigments hereinbefore named.

Among the products that may be produced employing the thermal insulation sheet made as hereinbefore taught are the following:

Product "A".—This product is a heat insulation fabric particularly designed for use in building construction and may be made by applying any one of the aforementioned coating compositions to one side or surface of a sheet of sulphite paper. Two sheets of this sulphite paper thus coated are put through a duplexing machine with their uncoated surfaces back to back, and asphalt or other adhesive is applied to the untreated surfaces of the coated sulphite sheets; while simultaneously therewith a reenforcing fabric or web or jute, flax, cotton, or metal is introduced between the sheets and thoroughly covered with asphaltum or other adhesive; and finally the two sheets having the reenforcing web therebetween are united by passing them between two rolls while applying sufficient pressure to form all of these materials into a single, homogeneous heat insulation sheet having highly effective heat-reflecting non-metallic coatings or surfaces on both sides thereof.

Product "B".—This product is a heat insulation board particularly designed for use in building construction, and may be produced by coating one surface of a four or five ply pulpboard with any one of the above-named formulas. The process of manufacture is as follows: A heat-reflective surface coating is applied to chipboard, as above described, and this layer of chipboard, thus coated is then combined with three or four layers of the same material in the usual manner of combining or uniting pulpboard, or so-called wallboards, thereby leaving one heat-reflective surface exposed.

Product "C".—This product is an industrial insulation sheet particularly designed for use in the refrigeration industry and may be made by applying any one of the heat-reflective coating compositions above enumerated, and in the manner described, to one side of a suitable kraft paper, which may be paper of from 30 to 100 lbs. weight, approximately.

The aforementioned products and uses illustrate the wide application and the variety of uses to which the new heat-insulating sheet may be put but they are illustrative rather than limitative since the present heat-insulating sheet may also be used in many other ways and places, and among which are:

For use in automobile tops and in the refrigeration industry where tests of its use show considerable reductions in ice and electricity consumption when using this product; and as a heat-reflective surface behind or in back of radiators; while any one of the aforementioned coating compositions itself may be applied to sheet metal

in the manufacture of radiator cabinets. When so used the coating composition adds greatly to the efficiency of the radiator cabinet. These products may also be used for porch screens, sun-room screens, window screens, arranged behind plate glass to prevent frost accumulation; as window shades to reflect the sun's heat and to prevent it from entering a room or building; and in other ways.

Experimental data in the applicant's possession, and made upon test samples of certain of the products hereinbefore named, show that these products are efficient heat insulators; that their heat conductivity is less than, and consequently their heat insulating efficiency greater than, the usual vegetable board or sheet insulators, and metallic foil or metal-coated insulators now in use.

By way of recapitulation it may, therefore, be said that the present invention contemplates essentially a heat-insulating and reflective sheet consisting of a base having a highly polished, heat-reflective coating spread thereover and the heat-reflective coating consisting essentially of an adhesive vehicle or carrier having incorporated therein a finely divided, non-metallic substance which is capable of being highly polished to provide a bright, silver-colored heat-reflective surface.

By the term "non-metallic" as used hereinbefore, and as used hereinafter in the claims, is meant any substance other than a metal, that is, other than a simple elementary metal such, for example, as aluminum foil or powder, but including mineral, as well as non-mineral substances and vegetable and mineral substances, which is capable of being finely divided and spread upon and adhered to a base or base sheet, and which can be highly polished to provide a bright, silver-colored heat-reflective surface.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. The method of making thermal insulation which consists in securing a film of non-metallic, mineral material having relatively little or no lustre but including a binder to a supporting base sheet and then subjecting the said film to friction at an elevated temperature and pressure so as to convert the same into a highly polished, heat-reflective surface whose heat-reflective power approximates that of a relatively efficient heat-reflective polished metal.

2. The method of making thermal insulation which consists in securing a film of non-metallic mineral material having relatively little or no lustre to a supporting base sheet and then subjecting the said film to friction at an elevated temperature and pressure so as to convert the same into a highly polished, heat reflective surface.

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