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FIRE RETARDANT BUILT-UP ROOFING

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3 Claims. (Cl. 161—163)

This invention relates to an improved fire retardant built-up roofing and more particularly to a bituminous type built-up roofing which is light in weight as compared with the prior art fire retardant built-up roofing.

For many years bituminous type built-up roofs have been widely used. They usually consist of several overlapped layers of roofing felt adhered to the roof deck with nails and/or hot mopped bitumen such as asphalt or tar. Over the several layers of felt there is an additional mopping of hot tar or asphalt and then granules are applied over this base. The granules used are usually slag or gravel which may be slate, marble chips or various types of rock. If there are enough layers of felt and a substantial thickness of granules, such a roofing may pass a Class A fire test as prescribed by the Underwriters Laboratory. For example, a Class A built-up roof for a deck with a slope of 0" to ½" in 12" comprises four or more layers of #15 asphalt felt hot mopped with asphalt and then flooded with more hot asphalt to receive the granules. There may be a first application of slag, rock or the like of at least 175# per 100 sq. ft. of roofing, a second flood coat of asphalt, and a second application of granules of at least 225# per 100 sq. ft. of roofing. The total weight of this roofing is about 770# per 100 sq. ft. This roof has a Class A rating over a wood deck. For concrete or other decks the weight of the roofing may be somewhat less.

A bituminous emulsion has been used to prepare "cold" type built-up roofs. Vermiculite has been used in roofing products to aid in fire resistance. The present application relates to a new combination of known materials to yield a new result.

It is, therefore, an object of the present invention to provide a lightweight bituminous type built-up roof having substantial fire resistance.

It is a further object of the present invention to provide an improved bituminous type built-up roof which is lightweight and has substantial fire resistance.

It is a further object of the present invention to provide an improved fire resistant bituminous type built-up roof which insulates the roof deck from the sun's rays by means of reflective insulation.

These and other objects are attained by the present invention which relates to a built-up roof comprising a felt, a static bituminous emulsion and a top layer of vermiculite.

The vermiculite used for the roof surfacing may be either unexpanded or partially expanded, natural or colored vermiculite. Preferably in unexpanded form the vermiculite has a size in the range 5/16" to #20 mesh. The commercial grades which are preferred for this use are the coaresr grades, such as the African grades known in the trade as #3 or #4. The reason the coarser grades are preferred is for their lower bulk density and lower number of dustlike fines. The approximate grading and density of these preferred grades in the crude state are:

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Grade	Screen Size	Loose Density, lbs./ft.^{3}
#3	−6 +12 mesh	40
#4	−5/16 +12 mesh	37

"African vermiculite" is a common name applied to a variety of vermiculite which is an alteration of phlogopite mica; whereas "domestic vermiculite" is a common name applied to a vermiculite which is an alteration of biotite mica and which is generally found in Montana and South Carolina. The grade numbers mentioned in this application relate to particle size classification of the vermiculite granules and various particle size classifications are commonly used for the commercially produced varieties of vermiculite. For a more complete description of African vermiculite see "Micafil Vermiculite—Physical Properties"; Bulletin M–7; The Vermiculite Association, Inc., Rego Park, New York; March 7, 1961.

As is well known, vermiculite expands or exfoliates upon being subjected to elevated temperatures, such expansion generally commencing at about 300° F. with maximum expansion being attained at about 1400° F. When the vermiculite is heated at temperatures above 1400° F. up to about 2000° F., little or no additional expansion occurs as contrasted to heating at 1400° F., indicating that complete expansion occurs when the vermiculite is treated at temperatures of 1400° F. and above for the necessary period of time. (See United States Patent No. 2,868,735.) By the term "partial expansion," as used in this application, it is meant that the vermiculite is subjected to treatment at a temperature above the temperature at which expansion commences (about 300° F.) and below the temperature at which full expansion occurs (1400° F.). Another way of defining "partial expansion" is that degree of expansion of vermiculite granules which is more than ⅓ and less than ¾ of full expansion.

The base sheet may be any sheet used for roofing purposes and preferably a type known in the trade as cold process roofing felt which is an asphalt saturated sheet coated on both sides with asphalt and dusted with a parting agent such as mica. The felt is applied to the roof deck in any well known manner including the use of nails if the deck is nailable and/or by the use of an adhesive such as an asbestos fibrated asphalt cutback adhesive. There should be at least one ply of felt and preferably two plies. The coating is a static emulsion and preferably a clay-type asphalt emulsion wherein the clay is the emulsifying agent. This type of emulsion is well known and is characterized by its static properties (i.e. its resistance to flow under heat).

This type of emulsion is well known in the art and is exemplified by the emulsions disclosed in a number of patents to Lester Kirschbraun including U.S. Patents Nos. 1,302,810; 1,398,201; 1,479,042; 1,495,260; 1,506,371 and 1,734,437, among others. This type of emulsion is made by first preparing a dispersion wherein colloidal clay is suspended in water; the dispersion being heated to a temperature about equal to the melting point of the bitumen to be used after which the molten bitumen is gradually added to the dispersion while the mixture is rapidly agitated to insure the production of a stable emulsion. As a specific example of the manner of producing such an emulsion, 250 parts by weight of ben-

tonite clay are added to 500 parts by weight of water at 90° F. and the mixture is agitated until a smooth homogeneous dispersion is obtained. This dispersion is then heated to about 200° F. and is added, together with molten asphalt (having a melting point of about 105° F. and a penetration of about 100 at 77° F.) to a vortex mixer. The dispersion and asphalt are mixed in the vortex mixer until an emulsion is formed, after which it is removed from the mixer for storage and subsequent use.

The following is an example of a preferred embodiment of the invention but it will be understood that variations and substitutions may be made within the scope of the claims. To a wood deck there was applied a cold process felt. The felt was applied with nails and an asbestos fibrated cutback adhesive in two plies having 19" laps. The felt was coated with bentonite clay-type asphalt emulsion at the rate of 10 gallons per 100 sq. ft. An unexpanded African vermiculite of a screen grade size #3 was hand broadcast over the wet surface at the rate of 13–15# per 100 sq. ft. After drying, the roofs are subjected to the standard Underwriters fire test with the following result:

Test	Test Result (Typical)	Requirement Class "A"
Spread of flame	2½'	6' maximum.
Burning Brand (A)	Pass.	Pass.
Intermittent	do.	Do.

In order to obtain a Class A rating the usual hot asphalt built-up roof depends upon the use of a very large amount of gravel or other surfacing as well as four layers of felt. These roofs, however, are limited in the slope to which they may be applied and usually may not exceed 3" in 12" since otherwise the gravel will move off the surface and there is not then enough fire protection. In the example above, the test was made on a slope of 5" in 12" and since there is so little of the vermiculite coating which is mostly embedded in the coating emulsion, there is no movement of the vermiculite off the roof surface. Furthermore, the static type asphalt emulsion itself stands a much greater sloping than hot asphalt without flowing off when heat is applied. In the above example one ply of felt lapped 4" has been found satisfactory for yielding a Class A fire test. Thus, the Class A roof is not only lighter, less costly, easier to apply (no hot asphalt kettles) but it may be applied to slopes where no other type of Class A built-up roof is available.

The least costly vermiculite is the domestic Montana or South Carolina vermiculite, however, this product is of darker color and becomes still darker after exposure for a length of time on a roof. The African vermiculite is initially lighter in color but may be translucent to actinic rays unexpanded. If this vermiculite is fully expanded it does not have as much fire resistance as if unexpanded or partially expanded. Thus, the most preferable material is partially expanded African vermiculite. This may be obtained by passing the ore through a 700° F. kiln in about ten minutes which gives an average expansion of about ⅓ of full expansion. The African vermiculite then is a reflective light colored material having a silver or gold sheen. This mateiral has substantial light reflectivity and insulates the roof from the sun's rays. Thus, this preferable material yields not only all of the advantages cited for this vermiculite type roof but in addition adds insulation from the sun's rays.

In the above example a preferred method of coating the cold process felt with the emulsion is by means of a spray gun. A preferable type of spray gun is one having a row of three nozzles, the nozzle in the center being adapted to deliver chopped fiber glass and the outer two nozzles delivering a spray of the emulsion. By this means it is possible to apply a greater amount of emulsion than may be applied by other single coating methods. A major function of the fiber glass is to prevent any surface cracking due to the drying process.

When the language "capable of being installed on a steep slope" is used in the claims herein, it is intended to include all degrees from level to a steep slope.

We claim:

1. A lightweight fire retardant built-up roof capable of being installed on a steep slope, which comprises a web of fibrous material attached to the roof decks, a continuous coating of the dried residue of a static bituminous emulsion over the web and a substantially continuous coating of vermiculite granules over said coating and exposed to the weather, said vermiculite being selected from the group consisting of unexpanded vermiculite granules and vermiculite granules which have been partially expanded to at least ⅓ of their fully expanded size.

2. A lightweight fire retardant built-up roof according to claim **1** wherein said emulsion is an asphalt emulsion utilizing clay as the emulsifying agent.

3. A lightweight fire retardant built-up roof according to claim **1** wherein said vermiculite granules are of the African variety having a particle size of from 5/16" to #20 mesh and being partially expanded by heating to a temperature of about 700° F.

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