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MINERAL ROOFING FELT WITH ASPHALT BINDER

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This application is a continuation-in-part of pending application, Serial No. 704, filed January 6, 1960, now abandoned.

The present invention relates to an improved roofing felt and to roofing products made therefrom, and more particularly to a roofing felt containing substantial quantities of mineral wool, such as rock wool, slag wool and fiber glass of the type ordinarily used for insulation material.

Roofing felt is conventionally used as the base for roll roofing products, such as saturated felt and coated roll roofing, with and without granules embedded in the upper surface, and for asphalt roofing shingles. Customarily, the felt is made of wood fiber, either alone or with paper pulp, repulped paper and/or rags, on a paper making machine. The felt contains little or no asphalt as it comes from this machine, so it is then placed in a saturator where it is impregnated with molten saturating asphalt. The saturated felt may be sold as such or it may be further processed by the application of a coating asphalt to produce roll roofing which may have granules embedded in the asphalt coating. Alternatively, the asphalt coated felt with granules may be cut into shingles, such as strip shingles. The products made from such conventional roofing felt have been widely used for over a half century and have proven generally satisfactory as roof coverings.

Such roofing products using conventional felts have certain disadvantages however, including a tendency to shrink and expand during use caused by the alternate wetting and drying out of the substantial quantity of organic fibers present, the requirement that substantial amounts of asphalt be used in order to properly coat the organic fibers, the requirement that the felt first be made in a generally unsaturated form on a paper machine after which it must be transferred to a separate saturating machine, and the difficulty of manufacturing shingles or other roofing products using such conventional felts which pass the prescribed Underwriters Laboratories test for a Class A rating.

Roofing felts using mineral fibers, such as asbestos fibers or woven textile quality glass fibers, to form the base are known, however they are much more expensive than the more conventional roofing felts discussed above and for this reason have found only limited and specialized markets.

It is an object of this invention to provide an improved roofing felt, and roofiing products made therefrom, which avoids the problems of conventional organic fiber felts without any material increase in cost.

It is a further object of this invention to provide a roofing felt which is substantially fire resistant and which is resistant to expansion, contraction and rotting.

It is a further object of the present invention to provide a roofing felt containing mineral wool as the major fibrous ingredient which has the requisite flexibility and tensile strength for manufacture on a paper making machine.

All ingredient proportions set forth herein for the product of the present invention are by weight and are based on the dry weight of the finished product.

These and other objects are attained by the present invention which relates to a roofing felt containing as the principal fiber ingredient mineral wool, such as rock wool or fiberglass of the insulation type, wherein apshalt emulsion and pulverized asphalt are jointly utilized as a binder and wherein there is present as the minor fiber ingredient a lesser proportion of a cellulosic fiber. Specifically, the present invention is directed to a new roofing felt using substantial amounts of mineral wool as the major fiber constituent, such as rock wool, slag wool or the insulation type of fiberglass, which has a very limited tensile strength and has not previously been considered a practical base for roofing felt when used in relatively large quantities. The advantages hereof are attained by the use of mineral wool as the major fiber constituent and organic fibers as the minor fiber constituent, together with both pulverized asphalt and an asphalt emulsion. It has been found that to best attain the desired objectives according to the present invention, the ingredients should be present in following proportions by weight based on the dry weight of the finished saturated felt: mineral wool—30% to 60%; organic fiber—10% to 35%; and asphalt—25% to 35%. Additionally, it has been found that, even where these proportions are observed, it is essential that the asphalt be present as a mixture of asphalt emulsion and pulverized asphalt in a ratio of between 5:1 to 2:1.

The invention may be best described by reference to a specific formulation of the felt and a method for its preparation, however it should be understood that variations and substitutions may be made within the scope of the appended claims.

Example

Newspaper stock was beaten in a hydropulper for about one hour and the pulped stock was transferred to a beater where Dixie clay and then asphalt emulsion A, pulverized asphalt and rock wool were added.

The mixture was then agitated in the beater for 15 minutes and transferred to a stock chest where it was gently stirred while being fed to a conventional single cylinder felt machine operating at 50 feet per minute where it was made into the felt product of the present invention. Since the shrinkage which normally occurs with ordinary organic cellulosic felt did not occur with this new product, the drying rolls on the felt machine had to be specially adjusted. The amounts of the various ingredients were selected to provide the following proportions based on the dry weight of the finished felt product: 17.8% newspaper stock, 10.3% Dixie clay, 21.4% asphalt emulsion, 8.8% pulverized asphalt and 41.7% rock wool. This was done since the water present in the various ingredients, such as that in the asphalt emulsion and that required to make a paste of the pulverized asphalt, evaporates from the final product and can be varied as desired to meet different processing conditions required. The product weighed 17 lbs. per 100 sq. ft., and the Scott tensile for a one inch wide strip of the product was 35 lbs. per inch in the machine direction and 22 lbs. per inch across the machine direction, for an average tensile strength of 28.5 lbs. per inch.

Emulsion A in the above example was made with an asphalt having a softening point in the range 105–120° F., by the ring and ball ASTM Method of Test D–36 and a penetration in the range 100/10 mm. to 120/10 mm. at 77° F., 100 g., 5 sec., by ASTM Method of Test D–5. About 12 parts of bentonite clay were used for each 100 parts of asphalt as an emulsifying agent and the emulsion was stabilized with about 0.5 part each of potassium dichromate and chromate acid for each 100 parts of asphalt. The emulsion as added in the process had a 50% water content. The pulverized asphalt used was a very finely pulversized material and was mixed with sufficient water

to form a paste. Its softening point (R.&B.) should be above 200° F. and preferably from 220° F. to 230° F.

The process may be described as a beaterless process in that the mineral fiber merely requires mixing in a slow moving paddle mixer. If a beater is used, beating of the stock should not continue for more than 15 minutes after the addition of the mineral fiber, and preferably should last for about 5 minutes; as compared to the usual requirement that stocks be beaten for several hours.

It has been found that both the total amount of asphalt used and the ratio of asphalt emulsion to pulverized asphalt must fall within the hereinafter defined ranges in order to obtain the advantageous results of the present invention. Thus, it has been found that the total asphalt used must be between 20% to 35% by weight and the ratio of asphalt emulsion to pulverized asphalt in the dry felt product must be between 5:1 to 2:1. If the total asphalt used exceeds the above recited upper limit, the asphalt retention properties of the final product have been found to be unacceptably poor, whereas use of a quantity of asphalt below the above recited lower limit has resulted in water resistance and dry tensile strength below acceptable minimums. The specified range for the asphalt emulsion-powdered asphalt ratio has been found to provide the requisite degree of flexibility on the one hand (increased by the asphalt emulsion) and the requisite tensile strength on the other hand (increased by the pulverized asphalt). It has previously been establishd that in order to properly manufacture saturated felt felt on commercial equipment, the minimum tensile strength required as determined by laboratory tests is about 50 lbs. per 2 inch width and the minimum flexibility should be that which permits bending the saturated felt over a ¼ inch radius and must at least be sufficient to permit bending the saturated felt over a ⅜ inch radius. In order to point out the criticality of the asphalt emulsion-powdered asphalt ratio in practicing the present invention, reference is made to the following table showing the results of laboratory tests which indicate the effect of variations in this ratio. The products tested were made in accordance with the procedure outlined in the example above and all proportions and conditions, other than the asphalt emulsion to pulverized asphalt ratio, were identical to those set forth in the example. For convenience in presentation and analysis, the following table assumes a total asphalt content of 30% rather than 30.2% as in the above example.

Sample	A	B	C	D	E	F
1	30	0	00:0	5	5	34.0
2	25	5	5:1	5	5	48.0
3	20	10	2:1	4	5	55.3
4	18	12	3:2	0	0	71.0
5	10	20	1:2	0	0	*60.3
6	0	30	0:00	0	0	*51.3

*Broke due to brittleness.

Column A indicates the percentage of asphalt emulsion present in the final product; column B indicates the percentage of powdered asphalt present in the final product; column C indicates the asphalt emulsion to powdered asphalt ratio; column D indicates the number of samples passing over a ¼ inch radius (5 samples tested); column E indicates the number of samples passing over a ⅜ inch radius (5 samples tested); and column F indicates the average tensile strength in pounds per two inch width of saturated felt (5 samples tested).

As can readily be seen from the above table, the 5:1 ratio of asphalt emulsion to pulverized asphalt (Sample 2) has the requisite flexibility although its tensile strength is marginally satisfactory, clearly proving that any lesser amount of pulverized asphalt would not achieve a satisfactory product. On the other hand, the marked difference in flexibility where the ratio of asphalt emulsion to pulverized asphalt is decreased from 2:1 (Sample 3) to 3:2 (Sample 4) shows the criticality of the claimed lower limit of no less than 2 parts asphalt emulsion for each part of pulverized asphalt. Thus, the test results set forth above are proof of the criticality of the defined asphalt emulsion-powdered asphalt ratio in the present invention.

As indicated above, mineral wool must constitute the major proportion of the fiber constituent of the felt in accordance with the present invention, and preferably the mineral wool content is from 30% to 60% by weight. Mineral wool as used herein is intended to include rock wool, slag wool and even the blown type of fiberglass which is woolly in nature and which is ordinarily used for insulation. This type of fiberglass is to be distinguished from the much more expensive extruded type commonly used for textile or related purposes. Furthermore, the term "mineral wool" distinguishes from asbestos which is of a completely different nature.

The above example utilized newspaper fiber but other types of organic fiber having web-forming properties may be substituted to provide the minor proportions of the fiber constituent; as for example, wood fiber (preferably chemical or semi-chemical pulp, or ground fiber), rags or other cellulosic fibers or combinations of such organic fibers. The organic fiber must be present in an amount sufficient to permit the formation of a web and is preferably present in the range of from 10% to 35% by weight.

Clay or other filler material is not essential to the composition of the invention although it may be used in amounts up to 20% by weight, if desired, to increase the fire resistance and flexibility of the sheet as well as to reduce cost. Various mineral fillers such as slate dust, mica and the like, may be used as filler materials instead of clay.

It may also be desirable in certain cases to adjust the pH of the stock with alum or the like to between 4.5 and 7.0, since higher pH values might not ensure precipitation of the emulsion, and lower pH values might permit an attack on impurities in the mineral wool; if such are present.

A roll roofing suitable for cold process roof application was made with the felt of the above example by applying, in the conventional manner, a top coating of a coating type asphalt containing sand and a back coating of a coating asphalt and talc.

In another application, conventional strip shingles were made from the felt of the example by applying a common coating mastic to one surface and subsequently pressing in granules to form a finished shingle weighing about 215 lbs. per square. Shingles so produced pass Underwriters Laboratories prescribed test for Class A asphalt shingles.

Felt made in accordance with the present invention exhibits many desirable and unexpected properties. It is very light and fluffy and has surprisingly good strength and flexibility properties considering the relative brittleness of mineral wool. The felt of the present invention also has improved sound absorption properties, when compared to felts utilizing wood or paper fiber, and its fire resistance properties are so good that it can be used to make a Class A shingle without requiring any modifications in conventional shingle making procedures and equipment or in application techniques. Its processing properties are such that it can readily be made on conventional felt making equipment, as for example due to the freeness of the felt on the paper machine, the white water contains little or no asphalt, and the asphalt does not adhere either to the felts or the drying rolls. Of particular importance with regard to roofing products made from the felt of the present invention is the surprising discovery that the felt does not require further saturation because of the minimal amount of shrinkage of the felt which occurs.

What is claimed is:

1. A roofing felt comprising mineral wool as the major fiber constituent, a cellulosic fiber having web forming properties as the minor fiber constituent, said cellulosic

fiber being present in an amount sufficient to permit the formation of a web, and from 25% to 35% by weight of asphalt, said asphalt constituent comprising the dried residue of an asphalt emulsion having a softening point of from 105° F. to 120° F. as measured by the ring and ball ASTM Method of Test D–36 and pulverized asphalt having a softening point above 200° F. as measured by the ring and ball ASTM Method of Test D–36 present in a ratio of from 2:1 to 5:1.

2. A roofing felt according to claim 1 wherein said mineral wool is present in an amount of from 30% to 60% by weight and said cellulosic fiber is present in an amount from 10% to 35% by weight.

3. A roofing felt in accordance with claim 1, and further including 10% to 20% of a pulverized inorganic filler.

4. A roofing felt in accordance with claim 1 wherein said mineral wool is rock wool.

5. A roofing felt in accordance with claim 1 wherein said mineral wool is slag wool.

6. A roofing felt in accordance with claim 1 wherein said mineral wool is fiberglass of the insulation type.

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