Sept. 20, 1955 L. A. BIERLY 2,718,479

ASPHALT COATED SHEET

Filed Nov. 16, 1948

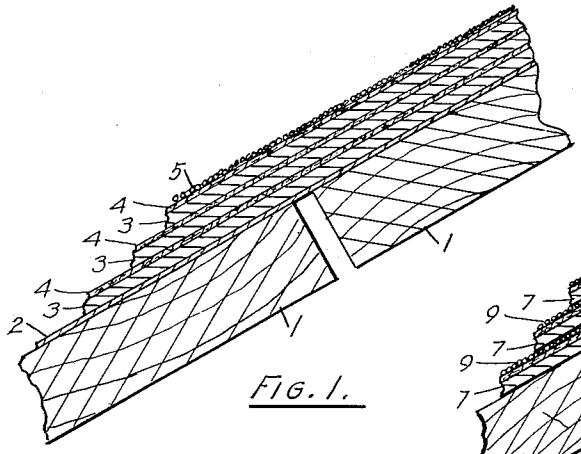


FIG. 1.

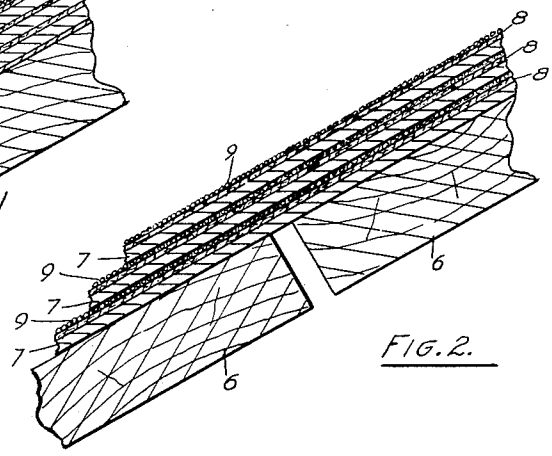


FIG. 2.

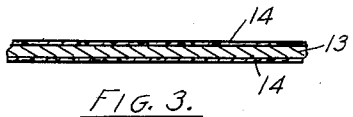


FIG. 3.

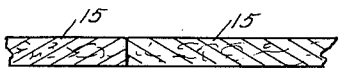


FIG. 4.

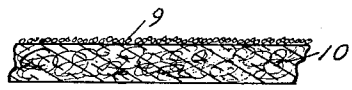


FIG. 5.

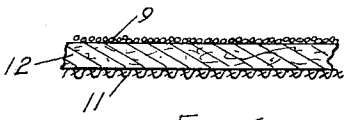


FIG. 6.

INVENTOR.

BY Lester A Bierly

Ralph Hammar

Attorney

United States Patent Office 2,718,479
Patented Sept. 20, 1955

2,718,479

ASPHALT COATED SHEET

Lester A. Bierly, Chautauqua, N. Y., assignor to Presque Isles Laboratories & Manufacturing, Inc., Erie, Pa., a corporation of Pennsylvania

Application November 16, 1948, Serial No. 60,273

2 Claims. (Cl. 117—168)

This application is a continuation in part of my application, S. N. 6,017, filed February 3, 1948, and now abandoned.

This invention is intended to increase the fire resistance of asphalt compositions or of articles containing, or coated with, asphalt compositions. One use is in asphalt shingles or roofing where it is possible to so increase the fire resistance as to obtain a class "A" rating as described in Patents 2,326,723, Fasold et al.; 2,326,724, Fasold et al.; and 2,424,234, Greider et al. Another use is in asphalt coated paper where it is possible to make a paper which is self-extinguishing in the sense that it will burn only in the immediate presence of an externally created flame. The fire resistance is obtained from materials which, in the presence of flame, react with the burning or heated asphalt to produce a foamy porous mass having a blister-like crust serving as a thermal insulator and as a mechanical stabilizer holding the asphalt in place. Materials having this property in various degrees of effectiveness are glass wool, rock wool, asbestos, hydrated lime, mixtures of hydrated lime and mineral fillers, and chlorinated paraffin. Chlorinated paraffin, in addition, has the property of releasing chlorides which have a snuffing action on the flame. Further objects and advantages appear in the specification and claims.

In the drawing, Figs. 1 and 2 are sections through a built up and shingle roofs having felt impregnated or coated with an asphalt composition embodying my invention; Fig. 3 is a section through an asphalt coated paper; Fig. 4 is a section through an asphalt tile, and Figs. 5 and 6 are sections through a glass fiber base shingle.

In Fig. 1 is shown a typical type of built up roof in which 1 indicates the roofing boards; 2 indicates a layer of building paper suitably fastened to the roofing boards; 3 indicates layers of asphalt impregnated roofing felt; 4 indicates layers of mopping asphalt, and 5 indicates the surfacing mineral granules, e. g., slate or ceramic granules. Except for the layers of mopping asphalt, which will be hereinafter described, the roofing is, or may be, of common construction.

In Fig. 2 is shown a typical asphalt shingle roof in which 6 indicates the roofing boards to which are applied asphalt shingles having a layer 7 of asphalt impregnated felt, a layer 8 of flexible asphalt coating composition, and a surfacing layer 9 of mineral or ceramic granules. Except for the flexible asphalt coating composition the roof is, or may be, of common construction.

As explained in the Fasold et al. and Greider et al. patents, the common constructions of asphalt built up or shingled roofs satisfactorily pass the tests of the Underwriters' Laboratories, Inc. for a class "C" rating and fail to pass the more severe class "A" and class "B" tests which are reserved for highly fire resistant roofs such as slat or asbestos cement shingles, or for built up roofs having a very heavy mineral surface coating. These patents describe particular asphalt coating compositions which enables the built up and shingled roofs to pass the class "A" or class "B" tests.

The present invention uses an improved mopping asphalt or flexible asphalt coating composition which likewise has sufficient fire resistance to enable the roofing to pass the class "A" and class "B" tests. The asphalt composition (usable as a mopping asphalt in the built up roofing and as a flexible asphalt coating or impregnating composition in the shingle roofing) comprises any of the commercially used "flexible coating" asphalts which ordinarily have a softening temperature in the region of 225° F. but may have a wide range of softening points, e. g., 125–300° F. to which has been added dried sludge resulting from the manufacture of soda ash by the Solvay Process. This sludge has the following chemical composition:

	Per cent
$CaCO_3$	60.0
$Ca(OH)_2$	29.3
$CaSO_4$	2.21
$CaCl_2$	1.16
$Mg(OH)_2$	1.9
Fe_2O_3 plus Al_2O_3	1.1
SiO_2	1.9
NaCl	0.64

It is believed that the active ingredients in this sludge which impart the fire resisting properties are derived from the hydrated lime ($Ca(OH)_2$ and $Mg(OH)_2$). The hydrated lime is a material which is substantially increased in volume (from 1.7 to 3.3 times) by the water of composition added during hydration. The water of composition of the calcium hydroxide is rapidly released at the temperature of 1076° F. The water of composition of magnesium hydroxide is rapidly released at a temperature of 662° F. Both of these temperatures are below flame temperatures used in the Underwriters' tests. The portion of the asphalt coating in contact with the flame breaks down the hydrated calcium and magnesium oxides. The release of the water of composition produces a foaming action on the heated or burning asphalt, resulting in a cellular structure which serves as a heat insulator for the layers of asphalt composition not in contact with the flame. The cellular or porous structure is further increased by the expulsion of the water of composition caused by decomposition at flame temperatures from the molecules of hydrated oxides of calcium and magnesium. Both of these oxides have the property of substantially increasing in physical volume upon hydration so that upon de-hydration a porous structure results.

Another important property of the hydrated oxides of calcium and magnesium is the reduction in viscosity of the asphalt coating composition. For example, the substitution in the preferred flexible asphalt shingle coating composition, based upon the disclosure of the Fasold et al. and Greider et al. patents, of 50% (by weight) dried sludge for 50% (by weight) of the fibrous asbestos dust results in a lowering of the Wagner-Bowen plasticity value, as disclosed in Greider et al. patent, No. 2,424,234, from approximately 300 grams to approximately 150 grams. This reduction in viscosity may permit pumping of the asphalt composition since the Fasold et al. and Greider et al. compositions are too stiff for pumping and must be spread. This reduction in viscosity does not affect the fire resisting properties, although the teachings of the Fasold et al. and Greider et al. patents would indicate that a reduction in viscosity would decrease the fire resistance.

The other ingredients in the sludge are not believed to have a controlling effect upon fire resistance. The calcium carbonate or limestone alone does not have sufficient fire resisting effect. Possibly this is due to the high

temperature at which the calcium carbonate breaks down, and to the slowness of break down at this elevated temperature. Furthermore, the carbon dioxide released upon break down is less effective in producing or causing foaming of the asphalt. The calcium chloride in the dried sludge does not contain any water, and if it did contain any water, the water would be released at the application of temperatures of 400–500° F. The calcium sulphate likewise has its water of composition released prior to the application of the coating to the roofing. The silicon dioxide, sodium chloride, iron oxide and aluminum oxide are not believed to have any substantial effect in increasing the fire resistance, either due to the properties of the material or to the small amounts present.

The fire resisting properties of roofing having an asphalt coating composition containing hydrated lime (hydrated calcium oxide and magnesium oxide) has been demonstrated in a comparative test run between asphalt shingles constructed in accordance with the preferred teachings of the Fasold et al. and Greider et al. patents in which the flexible asphalt coating composition applied to the asphalt impregnated felt consisted of blown asphalt having a softening temperature in the range of 220–240° F., in which is mixed from 35–50% by weight of fibrous asbestos dust. In the first test an equal weight of dried sludge was substituted for one half of the preferred Fasold and Greider asbestos dust. In the second test all of the Fasold and Greider asbestos dust was omitted and an equal weight of dried sludge substituted in its place. These shingles were subjected to a torch test, determined to be equivalent to the Underwriters' class "A" test. In the torch test the shingle (with or without surface granules) is placed at an angle of 30 degrees to the horizontal and an oxyacetylene flame, having a temperature of approximately 2000° F. is positioned at right angles to the shingle so that the tip of the blue-white cone of the flame touches, or is in contact with, the shingle. If the flame does not burn through the shingle in two minutes, the shingle will successfully pass the Underwriters' class "A" tests described in the Fasold and Greider patents. The torch test is, in effect, an accelerated class "A" test. Asphalt shingles of five well-known manufacturers failed in the torch test in from 30 to 55 seconds. Both of the shingles containing the dried sludge passed the test. The shingle containing half sludge was indistinguishable from the Fasold and Greider shingle. The shingle containing no asbestos dust exhibited a tendency for the asphalt coating composition to run off the shingle, indicating that a small amount of anchoring effect obtained from the asbestos, glass wool, rock wool or any other incombustible fibers are desirable. The shingle containing 100% of sludge however did pass the test although there was a tendency for the asphalt to slide. The sludge containing asphalt coating composition had a substantially lower viscosity at the application temperature of 400–500° F., which made the coating easier to apply.

The behavior of the sludge or hydrated lime containing asphalt coating composition in the presence of a flame is such as to protect the roof boards from combustion. The asphalt composition in immediate contact with the flame burns and produces a fluffy or foamy mass which serves as a thermal insulator, protecting the lower layers and roofing boards from the flame. After removal of the flame the asphalt burns for from one half to two minutes and then dies out. The burning of the asphalt is sufficiently confined to the immediate region of the flame so that the shingles satisfy the class "A" Underwriters' test. The burning of the asphalt composition in the presence of the flame results in the formation of an outer crust which, although it may become red hot, is sufficiently separated or spaced from the lower layers of the roofing as to prevent or retard the transmission of the flame.

The following are examples of flexible asphalt coating compositions all using commercial asphalt having a softening point of 225° F. (all percentages by weight) which

produce roll or shingle roofing passing the Underwriters' class "A" tests:

	Per cent
1. Asphalt	80
Glass fibers	20
2. Asphalt	70
Sludge (impregnating Owens-Corning glass fiber cyclone mat)	30
3. Asphalt	70
Glass fibers	30
4. Asphalt	70
Sludge	10
Sand	15
Glass fibers	5
5. Asphalt	70
Rock wool	30
6. Asphalt	65
Sludge	15
Sand	15
Glass fibers	5
7. Asphalt	65
Sand	15
Hydrated lime	15
Glass fibers	5
8. Asphalt	60
Sludge	25.7
Rock wool	14.3
9. Asphalt	60
Sludge	15
Sand	20
Glass fibers	5
10. Asphalt	58.8
Sludge	11.8
Glass fibers	29.4
11. Asphalt	58.8
Sludge	11.8
Asbestos (fine fibers)	29.4
12. Asphalt	57
Sludge	28.75
Asbestos fibers	14.25
13. Asphalt	55
Glass fibers	16.6
Limestone dust	28.4
14. Asphalt	55
Sludge	40
Rock wool	5
15. Asphalt	53.4
Sludge	40
Glass fibers	6.6
16. Asphalt	53.4
Glass fibers	6.6
Limestone dust	40
17. Asphalt	53.4
Sludge	40
Asbestos (long fibers)	6.6
18. Asphalt	50
Sludge	50
19. Asphalt	50
Sludge	30
Glass fibers (base, glass fiber pipe wrap)	20
20. Asphalt	50
Sludge	40
Rock wool	10
21. Asphalt	50
Sludge	20
Sand	25
Rock wool	5
22. Asphalt	50
Glass fibers	10
Limestone dust	40
23. Asphalt	47
Sludge	23.5
Sand	24.8
Asbestos fiber	4.7

	Per cent
24. Asphalt	44.5
Sand	27.7
Asbestos fiber	5.5
Hydrated lime	22.3
25. Asphalt	44.5
Sludge	22.3
Sand	27.7
Asbestos fiber	5.5
26. Asphalt	44.5
Sand	27.7
Asbestos fiber	5.5
Limestone dust	22.3
27. Asphalt	43.5
Sand	43.5
Glass fiber	2.2
70% chlorinated paraffin	10.8

In all of the examples using asbestos fiber the length of fiber was immaterial. The minimum amount of asbestos fiber was substantially as effective as greater amounts, and apparently had only a physical anchoring effect. Fibers which fuse together at flame temperatures (glass or rock wool) are more effective than asbestos fibers. The fused matted fibers form a harder crust having greater physical strength and superior heat resistance. The glass or rock wool fibers should be long enough to have a felting effect. For flat or slightly pitched roofs, no fiber is necessary.

The examples are subject to modification due to differences in the softening point of the asphalt, the term used in this application to designate asphalt derived from petroleum, natural asphalt, pitch, coal tar, and other similar bituminous material. The asphalt having lower softening points require a greater percentage of fire resistant material while the asphalt having higher softening points require less fire resistant material.

The fire resisting properties appear to be due to:

1. A physical anchoring effect which prevents running of the asphalt and thereby limits the spreading of the flame.

2. The interspersing of non-combustible mineral matter throughout the asphalt which reduces the volume of combustible material in contact with the flame and also serves as a barrier between particles of asphalt.

3. The formation by the fire resistant material of a porous mass having a blister-like coating which serves as a thermal insulator.

The physical anchoring effect is imparted by the fibers such as asbestos, glass wool, rock wool, etc. The greater effectiveness of the glass and rock wool is due to the fact that these fibers fuse in the presence of flame and produce a mechanically stronger crust or blister which more effectively prevents penetration of the flame. Because of the increased physical strength of the blister, the brand or source of the flame is better supported or held away from, or above, the underlying shingles and roofing boards. The asbestos fibers do not fuse, but merely lose mechanical strength under the effect of flame. All of the ingredients of the composition, being inorganic or mineral matter, are incombustible and serve to reduce the amount of asphalt which can burn in the presence of flame. This property alone is insufficient to impart sufficient fire resistance to pass the class "A" Underwriters' test. For example, sand and limestone dust, two of the commonly used fillers for asphalt shingles and roofing, have little fire resistance when used alone. The porosity of the blister-like mass in contact with the flame is due in part to the fusing of the glass or rock wool fibers, in part to the breaking down of the hydrated lime, releasing its water of composition by decomposition, and in part to the breaking down of the asbestos fibers (if the fibers have water of constitution). The porous blister-like mass formed by the hydrated lime also has an anchoring effect on the asphalt in addition to the heat insulating or shielding effect. Chlorinated paraffin in the presence of flame reacts with the asphalt to produce a foamy mass which has a pronounced heat shielding effect and at the same time there is a release of chlorides which have a snuffing action on the flame so the asphalt is self-extinguishing in the sense that it will burn only in the presence of an externally created flame. This reaction of chlorinated paraffin takes place at temperatures of from 350–450° F. and even at these temperatures there is a permanent chemical and physical change in the asphalt which prevents the return of the foamy mass to the liquid or solid state upon cooling. The reaction of chlorinated paraffin is different from the reaction of other chlorinated hydrocarbons such as chlorinated naphthalene. In the presence of flame, an asphalt-chlorinated naphthalene mixture becomes very liquid, has little or no bubble formation, and apparently has no reaction with the asphalt even though the chlorides released by the naphthalene do have a snuffing action on the flame. The heat shielding effect is a property peculiar to chlorinated paraffin.

In Example 2, the asphalt with 30% sludge filler impregnates a glass fiber felt base 10 producing the shingle illustrated in Fig. 5. In the manufacture of this shingle a sheet of glass wool (or asbestos or rock wool) felt having a thickness about 50% greater than the finished shingle thickness and a weight of 10–20% of the finished shingle is dipped in asphalt composition and then passed through rolls which squeeze out the excess asphalt. Because the felt is loose or open the asphalt and mineral filler penetrates uniformly and after passing through the squeezing rolls, the fibers are uniformly dispersed throughout the shingle. This method of making shingles avoids the stiffening effect of fibers on the asphalt. The addition of sand, sludge, limestone dust and other mineral fillers within the ranges disclosed does not materially increase the viscosity of the asphalt. However after the mineral filler has been added, the glass, rock wool, or abestos fibers rapidly stiffen the composition even at temperatures in the range of 450–500° F. By flowing the hot asphalt composition into a glass, rock wool, or asbestos felt, the fluid asphalt composition readily penetrates the felt. An asphalt composition containing the same percent fiber as the impregnated felt would be much stiffer and harder to handle. Flowing the asphalt composition into felt is an easier way of producing a fiber containing fire resistant coating. The asphalt content of the impregnated felt may be in the range of 10–70% by weight of the impregnated felt.

The glass wool felt impregnated shingle has greatly superior mechanical strength and toughness, has a gripping or sealing action on nails, and has by far the greatest heat resistance of any of the examples. The porous blister formed in the presence of the flame is very uniform and free from cracks and the asphalt around the blister is substantially unaffected. While two minutes under the torch test is sufficient for class "A," this shingle withstood 10 minutes and gave no indication that the torch could not have been held much longer without failure. The use of mineral fillers in the asphalt, while not necessary for heat resistance, may be desirable to reduce costs, to improve weather resistance, or for any of the reasons the roofing industry considers fillers desirable.

In Example 19, glass fiber pipe wrap **11**, a thin foraminous glass cloth, is substituted for the conventional asphalt impregnated paper roofing felt producing the shingle illustrated in Fig. 6 in which the coating is indicated at **12**. The pipe wrap results in a shingle having greater strength and lighter weight.

In Example 27, the shingles are self-extinguishing in the sense that the asphalt will not support combustion except in the immediate presence of flame. The self-extinguishing properties come from the chlorinated paraffin. The chlorinated paraffin also contributes to class "A" fire resistance by causing a violent foaming of the asphalt which serves as a thermal insulator if it is me-

chanically stabilized or anchored by the incombustible fibers. The mineral filler (which may be any of the inert mineral fillers used in the shingle industry such as sand, slate flour, limestone dust, or active mineral fillers having heat resistant properties, such as sludge, hydrated lime, asbestos dust) gives some body to the foaming asphalt so that it is better able to support the weight of the brand used in the class "A" Underwriters' test. It is not necessary that the mineral filler be of the sort capable of imparting fire resistance. The inert mineral fillers are equally satisfactory and usually cheaper. If the mineral fillers are of the sort producing fire resistance, such as sludge, hydrated lime, chrysotile asbestos dust, the amount of chlorinated paraffin may be decreased. The heat resistant mineral fillers produce a foaming action and an excess of foaming action produces no beneficial result.

The fire resisting effect of the mineral filler is affected by the particle size in the sense that smaller particles have a greater surface than larger particles. Another factor is the adhesion between particles of filler. This effect is more pronounced in the case of fibrous particles having felting properties such as asbestos, and is still more pronounced in the case of particles which fuse together such as glass or rock wool fiber. The porosity of the particle at flame temperature is important both from the point of view of the interlocking action on the asphalt coating, and from the point of view of thermal insulation. Hydrated lime appears to be particularly effective in this respect. Hydrated lime, although soluble in water, does not tend to pick up moisture and develops its porosity at flame temperature. Any hydrated lime which becomes exposed during the weathering of the asphalt coating will tend to react with the carbon dioxide in the air and produce a protective skin of calcium carbonate.

The particle size of the dried sludge used in Examples 2, 4, 6, 8, 9, 10, 11, 12, 14, 15, 17, 18, 19, 20, 21, 22, and 25, is such that 99% passes a 50 mesh sieve, 95% passes a 100 mesh sieve, and 80% passes a 140 mesh sieve. It is very difficult to get the dried sludge to go through a 200 mesh sieve as the sludge is light and fluffy and the particles tend to ball up and adhere to each other. Under transmitted light the sludge particles appear to be round and very uniform in size. The particles at room temperature are slippery and have the feel of hydrated lime.

The sand used in Examples 4, 6, 7, 9, 21, 23, 24, 26, and 27 was the sand such as that used in mixing cement. The sand alone did not impart the class "A" heat resistant properties, since some commercial shingles having from 40% to 50% sand filler in the asphalt coating only have class "C" fire resistance.

The limestone dust used in Examples 13, 16, 22, and 26 is a waste limestone material used in road building. This limestone dust contains a number of larger particles. Pulverized agricultural limestone, which has an average particle size finer than the limestone dust, is superior but neither form of limestone alone produces the class "A" heat resistant properties.

The chlorinated paraffin used in Example 27 preferably has a stabilizer which raises the break down temperature of the chlorinated paraffin above 350° F. It is desirable that the break down temperature of the chlorinated paraffin be at least 450° F. so that the chlorinated paraffin will not break down when the asphalt coating is heated for application to the roofing. Without stabilizers the chlorinated paraffin breaks down at about 300° F. to 350° F. and causes a foaming of the asphalt. Apparently this results in a permanent physical and chemical change, since the asphalt foam does not return to the solid or liquid state upon cooling and is substantially impossible to reheat as local hot spots set off the breakdown of the chlorinated paraffin into a progressive foam producing reaction. The action of the chlorinated paraffin is improved by the addition of antimony oxide which serves as a catalyst accelerating the breakdown and also as a flame retardant preventing after-glow due to the formation of antimony chloride, a heavy gas. Stabilizers for chlorinated paraffin are well known. Sludge or powdered limestone act as stabilizers. Some other stabilizers are derivatives of ethylene oxide, propylene oxide, butylene oxide, phenyl ethylene oxide, tolyl ethylene oxide, diphenyl ethylene oxide, phenoxy propylene oxide, diethyl ethylene oxide, benzyl ethylene oxide, epichlorhydrin, glycide or its ethers, such as methyl-, ethyl-, propyl-, tolyl-, alpha or beta naphthyl-, also cyclopentene oxide, cyclohexene oxide; alkaline earth metal salts of aliphatic acids having from five to ten carbon atoms, of which strontium caprylate is an example; tetra aryl and alkyl substituted compounds of tin in which the alkyl or aryl groups have from four to twelve carbon atoms and of which tetra butyl tin, tetra phenyl tin, dibutyl diphenyl tin, and dibutyl tin dilaurate are examples.

As disclosed in Fasold et al. Patents 2,326,723 and 2,326,724, it has been considered that the granule surface coating for shingles or roll roofing should be made from a flexible coating asphalt which is the term applied by the roofing industry to asphalts having a softening point in the range of over 160° F., and most commonly having a softening point in the region of 225° F. The flexible coating asphalt is not necessary. By increasing the mineral filler content class "A" fire resistance can be obtained when the shingle coating is made from lower softening point asphalts, known in the roofing industry as penetrating asphalt. These penetrating asphalts have softening points in the range of 80–160° F., and commonly have a softening point in the region of 125° F. By mixing higher percentages of asbestos dust and the other mineral fillers disclosed in the Fasold and Greider patents, or the mineral fillers disclosed in this application, class "A" asphalt shingle coating can be made which have, in addition to the class "A" fire resistance, superior toughness and flexibility.

Examples of asphalt coating all using asphalt having a softening point of 125° F. are as follows:

	Per cent
28. Asphalt	41.2
Sludge	52.9
Glass fibers	5.9
29. Asphalt	38.4
Sludge	54
Glass fibers	7.6
30. Asphalt (half 225° F. softening point asphalt, and half 125° F. softening point asphalt)	70
Sludge (impregnating Owens-Corning glass fiber cyclone mat)	30
31. Asphalt	70
Sludge (impregnating Owens-Corning glass fiber cyclone mat)	30
32. Asphalt (125°)	66⅔
Asbestos fiber (Passed "A" test—did not run at 212° F. on 30° incline (2 hours).)	33⅓
33. Asphalt	57
Sludge	14
Asbestos	28

All of these shingles passed the class "A" torch test. In Examples 28, 29, 32, and 33 the coating was applied to the ordinary asphalt impregnated paper roofing felt commonly used in the roofing industry as a shingle base. In Examples 30 and 31 the glass fiber cyclone mat, a glass felt having a thickness somewhat greater than the finished shingle thickness, served both as the base and as the body of the shingle. It is apparent from these examples that the use of high softening point asphalt for shingle coatings is unnecessary. The lower softening point asphalts which have not been oxidized by blowing and which have lower viscosity and greater flexi-

bility and are accordingly easier to handle, are equally adaptable as shingle coating asphalt. The superior flexibility of the lower softening point or penetrating asphalt is a desirable property since the shingles are easier to handle and less likely to crack when laid during cold weather.

The behavior of the shingles in Examples 28–33 under the torch test was substantially the same as in the other shingles which passed the class "A" torch test. The asphalt in contact with the torch flame burned and a crust was produced which served as a thermal insulator. The shingle in Example 31 which contained a high percentage of penetrating asphalt exhibited the tendency for the asphalt to run, but the class "A" fire resistance was not impaired. Unexpectedly the penetrating asphalt did not prove to be sufficiently more inflammable than the coating asphalt to destroy the class "A" fire resistance. The size of the blister in the region of the torch flame was not appreciably greater than the size of the blister in the shingle using coating asphalt. The penetrating asphalt, due to its lower viscosity, was appreciably easier to handle which is an important manufacturing advantage. Another unexpected property of the penetrating asphalt coating was its stability at roof temperatures. The shingle of Example 32, when subjected to 212° F. for two hours, showed no tendency to run. This means that the shingles having a penetrating asphalt coating will be satisfactory since roof temperatures never reach 212° F.

While Fasold and Greider teach the use of "coating asphalt," it has not been heretofore appreciated that a shingle coating could be made with a "penetrating asphalt" having a softening point well below summer roof temperatures. With the mineral fillers disclosed in this application and the mineral fillers disclosed in Fasold et al. Patent 2,326,723, a class "A" fire resistant shingle coating can be made from "penetrating asphalt" if the percentage of mineral filler is slightly increased. In the trade, the line of division between "coating asphalt" and "penetrating asphalt" is 160° F. Asphalts having a softening point above 160° F. are known as "coating asphalts." Asphalts having a softening point below 160° F. are known as "penetrating asphalts." Most commonly the "coating asphalts" will have a softening point of 225° F. and the "penetrating asphalts" will have a softening point of 125° F.

In all of the examples, 1 through 33 inclusive, the shingles were tested inclined 30° to the horizontal as in the Underwriters' class "A" test requirements. The asphalt coating was accordingly subjected to a gravity force tending to slide the coating from beneath the torch flame and to expose the base. In order to demonstrate the fire resisting effect of hydrated lime and sludge, the following tests were run with the shingles level so that there was no gravity force tending to slide the coating. These tests demonstrate the fire resistance of sludge and hydrated lime and eliminate the need for mechanical anchoring effect. These tests were not run on the glass wool or fiber containing coatings because the fibers had sufficient mechanical anchoring effect to hold the coatings in place upon the inclined shingle, and so long as the coating was held in place its fire resistance would be the same on the incline as on the horizontal.

	Per cent
34. Asphalt	90
Hydrated lime	10
35. Asphalt	40
Sand	50
Sludge	10
36. Asphalt	80
Sludge	20

In examples 34, 35, and 36, the coating was applied to standard asphalt impregnated paper felt used as a shingle base by the roofing industry. The asphalt was "flexible coating" asphalt having a softening point of about 225° F. The thickness of the coating was substantially the same as the standard commercial shingle. In carrying out the tests the samples were supported level and an oxyacetylene torch having a tip temperature of 2000° F. was directed down against the coating with the blue-white tip of the flame contacting the coating. At the end of two minutes none of the shingle samples had burned through, indicating that the sludge and hydrated lime had sufficient fire resistance to give class "A" fire resistance, although the presence of some other materials to mechanically anchor the coating in place is required. In Example 36 the hydrated lime content is approximately 6%, indicating that one gram of hydrated lime plus two grams of limestone is capable of imparting class "A" fire resistance to twelve grams of asphalt. Example 34 indicates that one gram of hydrated lime is capable of imparting class "A" fire resistance to nine grams of asphalt. Ordinary commercial shingles containing from 50–60% asphalt and from 40–50% mineral filler such as sand, powdered limestone, when subjected to the same test as Examples 34, 35, and 36 failed in three fourths to one and one half minutes. It is concluded from these examples that an asphalt coating mechanically anchored, for example, by any sort of fiber, will have class "A" fire resistance by the addition of a small amount of hydrated lime. Sludge is a cheap source of hydrated lime which, in addition, contains powdered limestone, one of the fillers commonly used in the roofing industry. The problem of mechanically anchoring an asphalt coating composition under the heat of flame temperatures is well understood in the art and many different expedients are available.

As a guide in formulating asphalt shingle coating compositions, it can be concluded that class "A" fire resistance will be imparted to asphalt in the following proportions: 1 part hydrated lime to 9 parts asphalt; 1 part sludge to 4 parts asphalt; 1 part glass or rock wool to 4 parts asphalt. The glass or rock wool also serves to mechanically anchor the coating. The sludge and hydrated lime, while having some anchoring effect, should for best results be supplemented by some fibrous or other material which will prevent sliding of the coating. For asphalt coating compositions having 80–30% asphalt and 20–70% mineral filler, fire resistance will be imparted by 3–22.3% hydrated lime and 4.7–29.4% mineral fiber, all percentages being by weight of the coating composition.

In Fig. 3 is shown a self-extinguishing asphalt coated paper which, for example, may be used to enclose mineral wool insulating bats. The paper **13** may be ordinary kraft paper, or kraft paper which has been fireproofed by the addition of common fireproofing agents, such as a bath in a mild solution of sodium silicate followed by a bath in a mild solution of ammonium sulphate or ammonium phosphate, or a bath in a mild solution of ammonium phosphate alone without the preceding bath in a sodium silicate solution. The fireproofing of the kraft paper is insufficient to prevent the spread of flame through the asphalt coating **14**. The asphalt coated paper (with or without preliminary fireproofing of the paper) is made self-extinguishing by the addition of from 5 to 25% 70% chlorinated paraffin and from 5 to 25% antimony oxide. Higher percentages of chlorinated paraffin and antimony oxide may be used, but are not necessary. The asphalt is the ordinary "coating asphalt" used in coating roofing.

In Fig. 4 is shown a commercial asphalt tile **15** which has been made self-extinguishing by the addition of chlorinated paraffin. The commercial asphalt tile consists of asphalt heavily loaded with mineral fillers. Due to the presence of asphalt the tile ordinarily will burn completely once combustion has started. Upon the addition of 5% to 25% of chlorinated paraffin and 5% to 25% antimony oxide the tile becomes self-extinguishing

in the sense that it will burn only in the immediate presence of flame. As in the case of the other applications of chlorinated paraffin, suitable stabilizers are added.

The paraffin is preferably chlorinated sufficiently to be a solid at room temperatures. 70% chlorinated paraffin is a readily available solid.

Chlorinated paraffin is also usable for fireproofing asphalt emulsions and paint. The asphalt emulsions usually have either a soap or clay base and have the consistency of soft butter. The emulsions may be thinned with water. Upon adding from 5–25% of 70% chlorinated paraffin and from 5–25% antimony oxide, a fireproof emulsion is obtained. No stabilizer is necessary for this application as the chlorinated paraffin may be mixed with the emulsion without heat. Mineral fillers may be added, such as sludge or hydrated lime.

Asphalt paints consist of asphalt thinned with a solvent, usually a petroleum oil. Since the solvents for asphalt are also solvents for chlorinated paraffin, asphalt paints may be fireproofed by the addition of from 5–25% of 70% chlorinated paraffin and from 5–25% of antimony oxide.

In the emulsions and paints the fireproofing properties of the chlorinated paraffin result from foaming of the asphalt in the presence of the flame, producing a thermal insulating product which protects the coated material, and from the breakdown of the chlorinated paraffin, releasing chlorides which have a snuffing action on the flame and producing antimony chloride, a heavy gas. While the emulsions and paints will burn in the presence of an externally created flame as soon as the flame is removed the combustion of the asphalt emulsions or paint is immediately extinguished.

What I claim as new is:

1. A roof covering having a high resistance to fire comprising a base sheet carrying an asphalt coating flexible when cool and heat plasticizable to a flowable consistency having uniformly distributed therein 20–70% mineral filler containing 3–22.3% of hydrated lime and 4.7–29.4% mineral fiber, all percentages by weight of the asphalt coating.

2. A prepared sheet roofing having high resistance to fire comprising a base sheet carrying a weather surface coating of asphalt flexible when cool and heat plasticizable to a flowable consistency having uniformly dispersed therein 3–22.3% hydrated lime and 4.7–29.4% mineral fiber fusible under roof flame temperatures, all percentages by weight of the asphalt coating.

References Cited in the file of this patent

UNITED STATES PATENTS

929,813	Aimes	Aug. 3, 1909
1,885,870	Snyder	Nov. 1, 1932
2,248,749	Engelhardt et al.	July 8, 1941
2,299,612	Clayton et al.	Oct. 20, 1942
2,332,260	Roediger	Oct. 19, 1943
2,326,723	Fasold et al.	Aug. 10, 1943
2,326,724	Fasold et al.	Aug. 10, 1943
2,384,671	Fratis	Sept. 11, 1945
2,420,644	Athy et al.	May 20, 1947
2,424,234	Greider et al.	July 22, 1947
2,458,143	Burns et al.	Jan. 4, 1949
2,463,983	Leatherman	Mar. 8, 1949