Dec. 6, 1949 H. W. GREIDER ET AL 2,490,430

COMPOSITION ROOFING

Filed Aug. 7, 1943 2 Sheets-Sheet 1

Fig. 1.

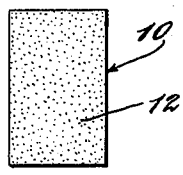


Fig. 2.

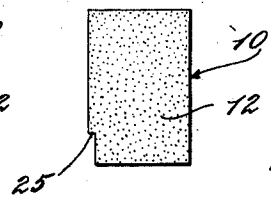


Fig. 3.

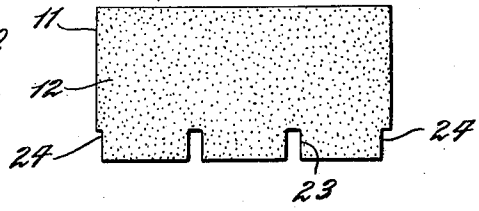


Fig. 4.

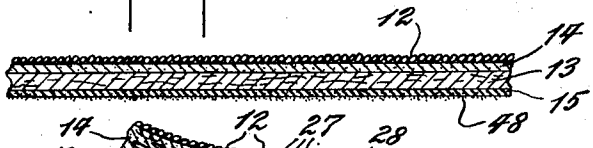


Fig. 5.

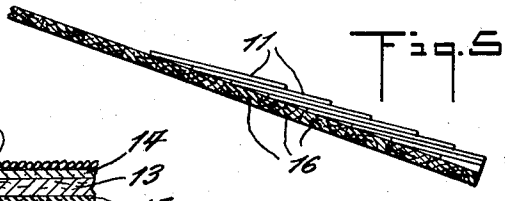


Fig. 7.

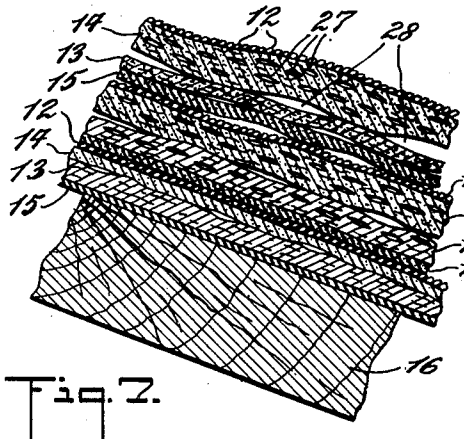


Fig. 6.

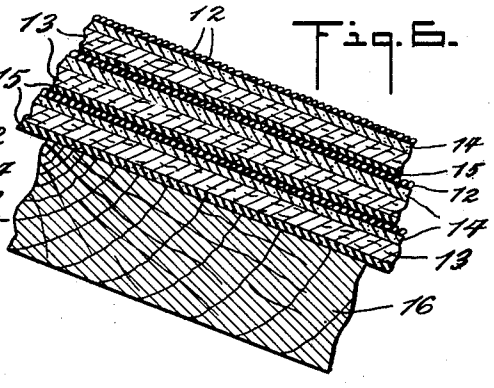


Fig. 8.

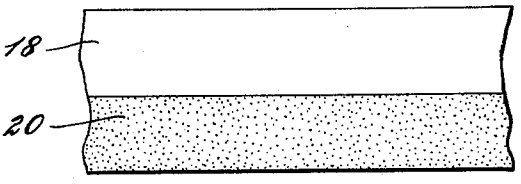
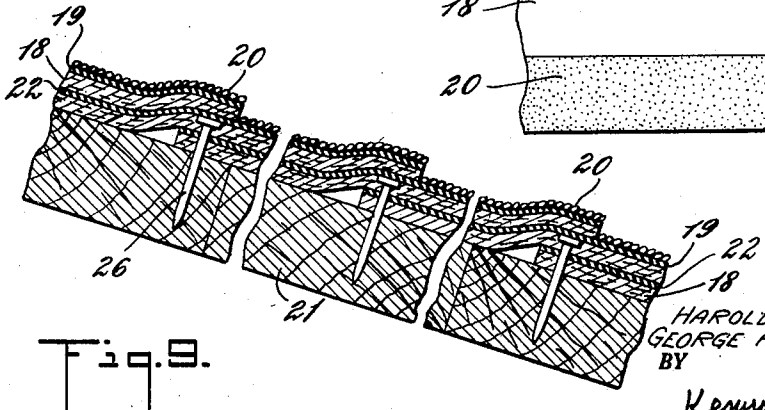


Fig. 9.



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COMPOSITION ROOFING

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Fig. 10.

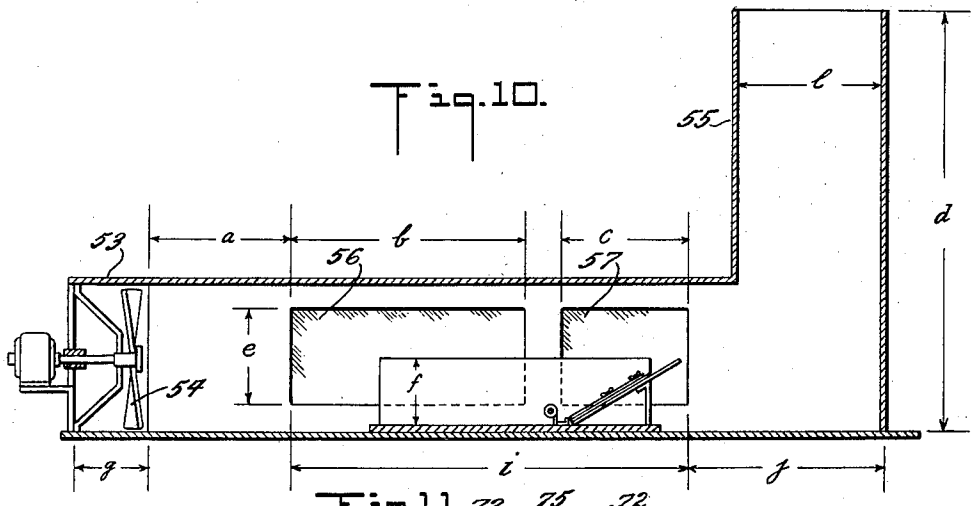


Fig. 11.

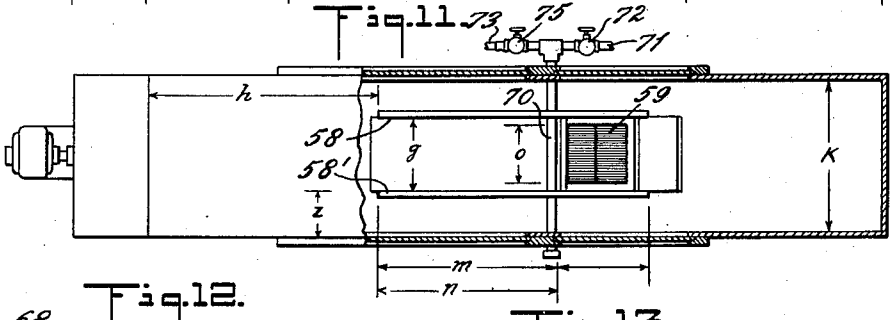


Fig. 12.

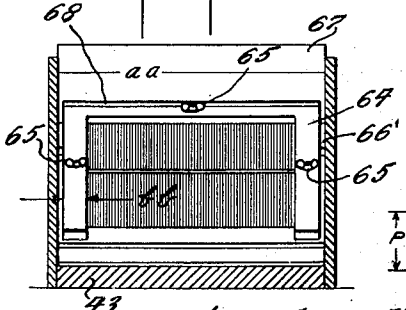


Fig. 13.

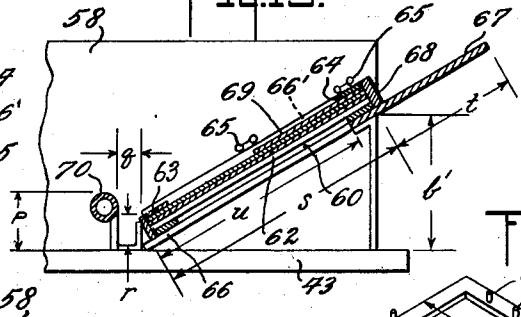
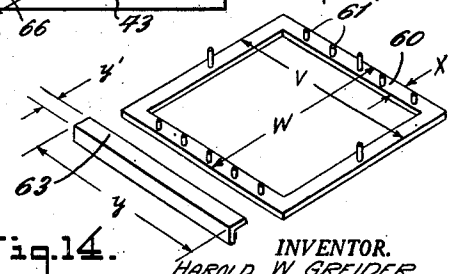


Fig. 15.



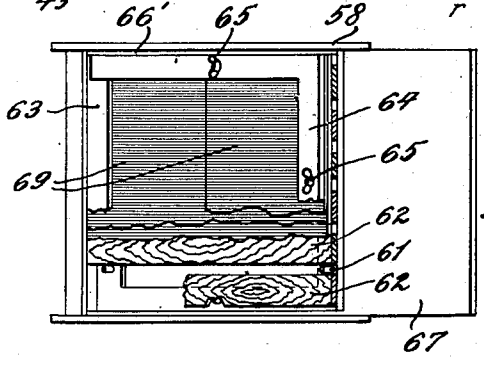


Fig. 14.

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UNITED STATES PATENT OFFICE

2,490,430

COMPOSITION ROOFING

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Application August 7, 1943, Serial No. 497,806

14 Claims. (Cl. 117—30)

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This invention relates to roofing. It relates particularly to roofing embodying bituminous material as waterproofing.

Heretofore bituminous prepared roofing has been very extensively manufactured using as a base a fibrous web such as roofing felt, impregnating the fibrous web with a bituminous material, and coating the impregnated web with a weather-resistant bituminous coating composition. The bituminous coating composition usually contains a mineral filler such as slate flour or powdered limestone in amounts less than about 40% by weight of the bituminous coating composition. Usually there is applied to the bituminous coating on the surface intended to be exposed to the weather a suitable granular material such as slate granules or more finely-divided mineral surfacing material such as talc or mica. Finely-divided materials such as mica flakes, talc, silica dust or the like may be made adherent to the non-weather exposed surface of the roofing to prevent sticking of adjacent layers of the roofing material in the package.

The term "roofing" is used herein in the broad sense as referring to water- and weather-resistant coverings such as shingles (individual or strip shingles), roofing tiles, cap sheets, base sheets, sidings, roof deck coverings made from such preformed materials, built-up roofings, and the like.

The bituminous roofings of the character aforesaid that have been manufactured and sold heretofore have relatively low fire resistance. The most widely accepted tests for determining the fire-resistant properties of roofing are those prescribed by Underwriters' Laboratories, Inc., of Chicago, Illinois. According to the tests prescribed by Underwriters' Laboratories, Inc., fire-retardant roofings are placed in three classifications, depending upon their ability to pass the tests required for such classification; these classifications being class "A," class "B" and class "C." The class "C" rating is the lowest fire-retardant rating and serves to distinguish roofings having appreciable fire-retardant properties from roofings having little or no fire-retardant properties such as untreated wood shingles which, of course, are readily ignited and tend to burn freely. So far as we are aware, prepared bituminous roofings of the type heretofore on the market made on a felt base of organic fiber have not been able to attain, regardless of the thickness thereof or the number of thicknesses, a rating of Underwriters' Laboratories, Inc. higher than a class "C" rating. The class "A" rating is the highest rating

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awarded by Underwriters' Laboratories, Inc., and is reserved for such highly fire-retardant roofings as asbestos-cement shingles of the double coverage type. Class "B" is an intermediate rating and is, for example, awarded to roofings such as single coverage asbestos-cement shingles. A brief description of the class "A," class "B" and class "C" fire-retardant tests of Underwriters' Laboratories, Inc. is contained in our pending applications for Roofing, Ser. No. 370,636, filed December 18, 1940 (Patent No. 2,326,723) and Ser. No. 399,024, filed June 20, 1941 (Patent No. 2,326,724).

It is a purpose of this invention to improve the fire resistance of roofings comprising a layer of thermoplastic material such as bituminous material. Thus, for example, we have found that a roofing material which comprises an organic fiber felt base and a bituminous waterproofing coating can be made according to this invention, at the cost of ordinary bituminous roofing material, that is so highly fire-retardant that a three-layer covering on a combustible roof deck will satisfactorily withstand exposure to the class "A" fire-retardant tests prescribed by Underwriters' Laboratories, Inc. We have found further that such roofing material embodying our invention, when applied so as to provide two layers, will satisfactorily pass the class "B" fire-retardant tests prescribed by Underwriters' Laboratories, Inc.

The importance of fire-resistant properties for roofing is self-evident. Certain roofings such as asbestos-cement shingles, tile and the like have high fire resistance but such roofings are very costly as compared with asphalt-felt roofings, and for this reason asphalt-felt roofings are very extensively used on all kinds of structures notwithstanding the limited fire protection that is afforded by this type of roofing. According to this invention, asphalt felt roofings can be made without substantial increase in cost which are comparable in fire-retardant properties to relatively much more costly roofing constructions such as asbestos-cement, tile and the like.

Substantially all bituminous roofings comprise a strain-resisting base or foundation sheet such as roofing felt which is coated with a bituminous coating that provides waterproofing and weather resistance. This invention has to do with the coating material rather than the base sheet. While the base sheet might be made of non-combustible material, the non-combustibility of the base sheet does not solve the problem if the bituminous coating itself burns or tends to flow so as to spread the flame. According to the pres-

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ent invention, the waterproofing coating is rendered highly fire-resistant so that, even when applied to a base sheet of combustible organic fibers, roofing can be made which has the high degree of fire resistance mentioned above.

The highly fire resistant bituminous coating composition of this invention is particularly well suited for the manufacture of roofings such as bituminous shingles (individual or strip shingles), cap sheets, base sheets and the like, and, likewise can be used in the manufacture of such products as roll roofing, siding, and in the construction of built-up roofing and the like and generally wherever it is desired to provide roofing comprising a highly fire-resistant bituminous layer.

In our aforesaid application Ser. No. 370,636, we have described and claimed bituminous roofing comprising a waterproofing layer of bituminous composition which contains intimately commingled with the bitumen component of the composition a filler material of the range 35% to 55% by weight of the bituminous composition that is in the form of finely-divided solid water-insoluble heat-resistant mineral material which passes a 14 mesh testing sieve and over 50% by weight of which is retained on a 200 mesh testing sieve and which has the special flow resistance characteristics that are described, illustrated and defined in said application.

The special fire-resistant bituminous compositions which are described in our aforesaid application Ser. No. 370,636, instead of burning with melting and flowing of the bitumen in the bituminous coating composition, are characterized by the fact that the filler material contained therein constitutes a skeletal mat that is flow-resistant and that when exposed to flame remains in place and keeps the bitumen from bleeding out and by the fact that the bitumen, in becoming carbonized, forms a carbonaceous binder which binds the particles comprising the skeletal mat into a coherent layer that possesses very high heat insulating properties.

The roofings of the present invention when exposed to fire afford the type of fire-retardant protection that is afforded by the special fire-resistant bituminous compositions that are described in our aforesaid application Ser. No. 370,636, but afford this extremely high fire resistance as a result of different formulation that will be described in detail hereinbelow.

The invention herein set forth is based upon our discovery that certain fibers, namely asbestos fibers and cotton fibers of the screen grading defined below, have the capacity when used in minute quantities relative to the other ingredients of the bituminous composition, of greatly increasing the fire resistance of the bituminous waterproofing coating layer or layers of bituminous roofings, provided the bituminous composition of such layer or layers contains sufficient additional filler material so that the total weight of the finely-divided solid water-insoluble filler material constitutes at least 35% by weight of the bituminous composition. The quantity of such special fiber may be very small, e. g. 0.1% by weight of the bituminous composition and even less and unless combined with other filler as aforesaid does not by itself have the capacity to appreciably affect the fire resistance of a bitumen with which it is mixed.

The fiber that we have found to have such remarkable effect upon the fire resistance of bituminous compositions containing over 35% by weight of finely-divided filler are asbestos fibers and cotton fibers that are of the size range passing a .742 inch testing sieve and retained on a No. 6 testing sieve. The asbestos fiber referred to is asbestos fiber that has been prepared by milling asbestos-bearing rock and separating those fibers which have been completely and thoroughly opened as in the commercial production of asbestos fibers for textile fabrication purposes. Such fibers are derivable from asbestiform minerals such as chrysotile, actinolite, amosite and crocidolite.

In determining the screen fractions or gradings of fibrous or other mineral filler that are referred to herein, 8 inch diameter testing sieves of the W. S. Tyler Company sieve series meeting American Society for Testing Materials Standard E11—39 for Sieves for Testing Purposes have been used. A quantity of filler to be screened ranging from 200 to 300 grams is placed in the uppermost of a series of testing sieves and subjected to suitable agitation as in a standard W. S. Tyler Company Ro-Tap sieve shaking machine for a period of five minutes in order to separate the original filler roughly into fractions retained on the different testing sieves. This operation is repeated if necessary in order to obtain about 100 to 200 grams of the desired screen fraction, which fraction is then individually rescreened for 15 minutes using the Ro-Tap sieve shaking machine or its equivalent in order to remove any fines contained therein. The resulting sieve fraction is material that has passed the coarser screen and is retained on the finer screen. As aforesaid, the fiber herein considered passes a testing sieve which has an opening .742 inch and is retained on a No. 6 testing sieve. The intermediate testing sieves in this range are .525 inch; .371 inch; No. 3 testing sieve, and No. 4 testing sieve.

The highly fire resistant bituminous compositions of this invention are formulated so that the waterproofing bitumen in the composition is of the range 20% to 65% by weight of the composition and so that the filler material is of the range 35% to 80% by weight of the composition. Within this range a wide variety of diluent filler materials may be employed in combination with the special fiber above defined. Such diluent filler may be mineral filler or organic filler provided the filler material is of finely-divided solid water-insoluble particulate form and the filler is composed of material that has a softening point above about 500° F. According to this invention such compositions are rendered highly fire-resistant by the employment of the asbestos fibers or cotton fibers passing a .742 inch sieve and retained on a No. 6 sieve in an amount that does not exceed about 5% by weight of the composition and that may be as low as 0.1% or less by weight of the composition. While fibers of the character above mentioned are relatively high in price as compared with the other ingredients of bituminous roofings, the fact that they are suitable when employed in relatively small amounts makes the employment of such mineral fibers commercially feasible. Thus, for example, one can, according to this invention, modify a four ton batch of bituminous coating material which has low fire resistance so that the bituminous composition will afford roofing having very high fire resistance merely by incorporating in the batch of bituminous coating composition only about 5 to 10 pounds of the special fiber above referred to.

In order to afford a better understanding of this invention, it will be described for purposes of exemplification in connection with a typical embodiment. The roofing material of this embodiment is composed of a base of strain-resisting roofing felt, a weather surface coating of special bituminous coating composition, a surface layer of mineral granules partially embedded in the surface coating, a thinner layer of the special coating composition on the back of the felt base sheet, and finely-divided dusting material adherent to the back layer of the special bituminous coating composition.

In the exemplary embodiment, the base or foundation sheet is ordinary roofing felt made of vegetable and animal fibers, e. g. a roofing felt made from organic fiber stock weighing about 6 pounds per 100 square feet. The felt is impregnated with a suitable impregnating material, e. g. a conventional bituminous roofing saturant having a softening point of about 100° F. to about 170° F. The base sheet as thus composed has little fire resistance and, when exposed to fire, is consumed quite readily.

A typical example of the special coating composition is given below:

	Per cent
Asphalt (softening point 230° F.)	45.0
Slate flour (85% passing a 200 mesh testing sieve)	54.1
Asbestos fiber (passing a .525 inch sieve and retained on a .371 inch testing sieve)	.9

It is to be noted that the special fiber only constitutes .9% by weight of the composition. However, notwithstanding the presence in the composition of 54.1% by weight of slate flour, the coating composition without the very small amount of special fiber tends to flow and burn when exposed to flame temperature and is devoid of those characteristics which we have found to afford high fire resistance. But by the incorporation of the very small quantity of the special fiber, the character of the composition upon exposure to flame is greatly modified and high fire resistance is afforded. This effect produced by the small amount of special fiber while seemingly incredible, has been verified by repeated experimental determinations.

In preparing the special bituminous composition, the asphalt is heated to a heat liquefied condition and the above described mineral filler materials are mixed therewith. It is important that the bitumen and finely-divided mineral filler be thoroughly mixed and intimately commingled so that the composition of the coating with respect to the distribution of the filler therein is uniform throughout. The composition should be applied to the base sheet while in a thoroughly mixed condition so that the resulting layer is substantially uniform in consistency and thickness. In this typical embodiment herein described, the coating is applied to the felt base sheet at the rate of about 45 pounds per 100 square feet. Before the coating cools to atmospheric temperature, a conventional surfacing material such as slate granules can be applied to the surface for weather exposure and these granules are partially embedded in the layer of special bituminous composition. The granular surfacing material is preferably non-combustile and, while employed, is not relied upon to impart fire resistance to the roofing. On the opposite side of the roofing material, there may be employed a thin coating of bituminous coating material, e. g.

an asphalt having a softening point of about 200° F. to 240° F., so as to weigh about 5 pounds per 100 square feet, and finely-divided dusting material such as talc or mica dust or similar material may be applied and partially embedded in the back coating. Preferably, for maximum fire resistance, the back coating should be special coating composition embodying our invention.

The roofing thus prepared may be packaged in sheet form, or, alternatively may be cut into sections suitable for individual or strip shingles. The roofing weighs about 95 pounds per 100 square feet. Of this weight, about 30% by weight is in the form of mineral granules adherent to the weather surface and finely-divided dusting material adherent to the other surface, the balance of the roofing being the felt, the bituminous impregnating material and the bituminous coating composition.

The special bituminous coating composition may advantageously be mixed and applied in the manner mentioned in our said application Ser. No. 370,636 (Patent No. 2,326,723). As stated in said application, the coating composition may, if desired, in order to increase the resistance of the applied coating to blistering, be applied using the method and apparatus of our Patent No. 2,105,531 and 2,159,587, but this is not essential.

The roofing material above described can be made up into suitable roofings and roofing structures, description of typical and exemplary roofings and roofing structures being facilitated by reference to the accompanying drawings, wherein

Fig. 1 is a plan view of a prepared roofing embodying this invention in the form of an individual shingle of simple rectangular shape;

Fig. 2 is a plan view of prepared roofing embodying our invention in the form of an individual shingle of a preferred shape;

Fig. 3 is a plan view of prepared roofing embodying our invention in the form of a shingle strip;

Fig. 4 is a fragmentary cross sectional view on an enlarged scale of prepared roofing embodying our invention;

Fig. 5 is a sectional elevation of an inclined shingle roof embodying our invention without showing the component layers of individual shingles;

Fig. 6 is an enlarged sectional elevation view of a portion of the roof covering shown in Fig. 5, as installed;

Fig. 7 is similar to Fig. 6 except that the roofing is illustrated as it appears after exposure to flame temperature;

Fig. 8 is a plan view of one form of prepared sheet roofing embodying our invention adapted to be installed in roll form;

Fig. 9 is a sectional elevation of a portion of an inclined roof deck with the roofing material of Fig. 8 installed thereon, the roofing material being shown with exaggerated thickness for clarity;

Fig. 10 is a side elevation partly in section of the testing device for determining the flow resistance value of the filler contained in the special bituminous composition;

Fig. 11 is a plan view partly in section of the fire testing device;

Fig. 12 is a front elevation of the test panel assembly used in the testing device;

Fig. 13 is a side sectional elevation of the fire test panel assembly;

Fig. 14 is a plan view of the test panel assembly with parts thereof broken away; and

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Fig. 15 is a perspective view of the frame and guard plate used in the test panel assembly.

The prepared roofing material may be cut into individual shingles 10 shown in Fig. 1. Preferably the roofing material is cut into individual shingles 10 having the shape shown in Fig. 2 or into strip shingles of the type shown in Fig. 3. Of course, shingles or the like of other shapes may be used in the practice of this invention. In cross section the prepared roofing material appears as in Fig. 4 and comprises a base or foundation sheet 13 of bitumen impregnated roofing felt. Overlying this roofing felt is a coating 14 of special coating composition having adherent to the surface thereof and partially embedded therein the slate granules 12. Adherent to the back of the roofing material is a layer 15 of the special bituminous coating material in which is embedded finely-divided dusting material 48. Ordinarily some bituminous coating material and dusting material are employed on the back of the roofing material, but these materials are not essential and are sometimes omitted particularly when the roofing material is to be used in built-up roofing.

In Fig. 5 is shown a typical roofing structure in place on a roof deck comprising boards 16 which serve as a support for the shingles, e. g. strip shingles 11 or individual shingles 10. The individual shingles may be 16 inches long overall and laid with a 5 inch exposure thereby affording triple coverage over all parts of the roof deck except for a portion of the spaces between adjacent shingles in each course. The component parts of the individual shingles appear in detail in the enlarged fragmentary view shown in Fig. 6.

In the installation of a fire-resistant roof covering, the employment of strip shingles of the type shown in Fig. 3 is preferred since the recesses or slots 23 only extend partially into the body of the shingle and since the notches 24 provide recesses of similar depth between abutting pieces of strip shingle, thereby preventing penetration of flame into the body of the roof covering. Individual shingles 10 provided with a notch 25 are preferred for similar reasons.

The preformed roofing can of course be laid with a greater proportion thereof exposed and so that the roof covering will be composed of two layers instead of three. Such a roofing is illustrated in Figs. 8 and 9. In Fig. 9 the roofing material is shown as installed on a roof deck with the thickness of the courses exaggerated for clarity. The preformed roofing material consists of a foundation sheet 18 of bituminized roofing material, coated over a part of its width with a coating 19 of the special coating coposition. This material may be made up in rolls about 36 inches wide for example with slightly less than half of the width of the asphalt saturated foundation sheet 18, e. g. 17 inches of the width, coated with the special coating 19 and covered with the mineral granules 20, e. g. slate granules. This type of roofing may be laid on boards 21 of a roof deck using suitable securing means such as nails 26, the slate covered portion being exposed and the balance underlying an adjoining sheet as shown in Fig. 9. Where the preformed sheets overlap they are caused to adhere to each other by a bituminous adhesive material 22 which, preferably, has the high fire resistance of the special coating compositions embodying our invention.

Referring to the above described special fire resistant bituminous compositions and to the roofing and roofing structures shown in the accompanying drawings, such roofing has been found to possess extremely high resistance to fire. Thus a roofing structure such as that shown in Fig. 5, namely, comprising three thicknesses of the preformed roofing will withstand the class "A" fire retardant tests prescribed by Underwriters' Laboratories, Inc., in their published instructions. As stated in our aforesaid application Ser. No. 370,636, we do not know of any prepared bituminous roofing commercially made on a felt base of organic fibers which, irrespective of the weight of the roofing material or the number of layers or plies that are applied to the roof deck, will successfully pass the class "A" fire retardant tests, or will even pass the class "B" fire retardant tests of Underwriters' Laboratories, Inc.

When ordinary bituminous prepared roofing, e. g. asphalt shingles applied so as to provide triple layer coverage of the deck, is subjected to the class "A" burning brand test, for example, the coating material when exposed to the brand melts and as a mass starts running down the surface of the roof. The melted asphalt also starts to burn and the burning asphalt in running down the roof spreads the fire. The coating material that runs down the roof leaves the bituminous organic felt base exposed which, being readily combustible, starts burning so that the fire goes through the roofing quite readily and ignites the combustible roof deck in a relatively short time.

By way of contrast our improved roofing which contains the special fire-resistant bituminous coating layer behaves very differently when subjected to fire as in the burning brand test. The behavior of the roofing material as applied in three layers to a roof deck, e. g. as shown in Figs. 5 and 6, is indicated roughly in Fig. 7. During exposure to the flame the special bituminous composition instead of flowing and running, remains in place due to the stabilizing action of the filler materials contained in the bituminous composition. As aforesaid, the fine filler such as slate flour has little or no stabilizing action, but we have found that when such filler material is combined with the selected screen gradings of the special fiber the composition becomes stabilized and highly resistant to flowing and to combustion. Moreover, during the exposure to flame small bubbles 27 are formed which tend to expand the coating composition and augment its effectiveness as a heat insulating layer.

In the roof covering as a whole as illustrated in Fig. 7 the upper layer of special bituminous composition has become expanded somewhat and has become somewhat irregular, but the coherent porous mat-like mass has remained and acts as a protective barrier against the flame. The uppermost layer 13 of felt may be carbonized and to a considerable degree may have disappeared leaving air pockets 28 together with some residual carbonized material. The intermediate layer 14 of special bituminous composition is also expanded, but remains in place as a protective heat insulating layer. The intermediate layer of felt is charred, but is better preserved than the uppermost layer of felt. The bottom layer of the special bituminous composition is less severely carbonized than the upper layer and likewise is considerably expanded. The bottom layer of felt is fairly well preserved and the upderlying board 16, if charred at all, has not become ignited. The backing layers 15, when composed of the

special bituminous composition, likewise augment the heat insulating effect of the roof deck covering, but it is not essential that these layers 15 be composed of the special bituminous composition of this invention in order for the roof covering to pass the class "A" fire retardant test of Underwriters' Laboratories, Inc. In making the class "A" burning brand test of Underwriters' Laboratories, Inc., it usually takes the burning brand about 30 to 45 minutes to burn out. During this time the upper surface of the uppermost layer 14 may become red hot, but the heat insulation effect of the carbonized residues of the layer 14 is so great that the board 16 does not become ignited and may not even appear scorched.

When the special bituminous composition of this invention is exposed to flame, the effect of the flame is confined to the area immediately beneath and closely adjacent to the area of direct exposure to flame and when the flame becomes extinguished all charring of the roofing soon ceases and the roofing cools down.

A roofing such as that shown in Figs. 8 and 9 which provides double coverage will successfully pass the class "B" fire retardant tests of Underwriters' Laboratories, Inc., when the special bituminous composition is made according to this invention.

The high fire resistance of the special bituminous coating composition is due to a combination of factors. The effect of the relatively small amount of special fiber in stabilizing the entire bituminous mass when it is exposed to flame has been mentioned above. However, the presence of the slate flour as diluent filler is essential, for if the diluent filler were omitted the small amount of special fiber by itself would have no appreciable effect in stabilizing the bitumen. On the other hand the slate flour in the amount used has virtually no effect in stabilizing the bitumen. However, when these filler materials are employed in combination, the very small amount of the special fiber coacts with the balance of filler in the composition so that the total fiber in the composition becomes converted to a stable skeletal mat within the waterproofing bitumen. The bitumen that is present in the bituminous composition likewise cooperates with the skeletal mat of fiber and other filler for upon exposure of the composition to flame it tends to carbonize without excessive combustion to form a cementitious binder for the skeletal mat of filler material so that the filler is held in place as a coherent layer or mat that not only resists combustion but also has extremely high heat insulating effectiveness.

As stated in our aforesaid application Ser. No. 370,636, the property of a filler or filler mixture of imparting flow resistance to a bituminous composition, when the bituminous composition containing it is exposed to flame temperature is a definite property and is a property that is capable of accurate measurement. However, since this property of filler materials and its use in imparting fire resistance to bituminous compositions were not known prior to our invention as described in our said application Ser. No. 370,636, we found it necessary to devise a test apparatus and procedure whereby this property can be accurately measured. The test consists in directing a flame against an inclined specimen of roofing that carries a coating composition consisting of bitumen and the filler or filler mixture under precisely controlled conditions determined by the construction and operation of the testing apparatus. This test and test procedure are described below, reference being made to Figs. 10 to 15 of the accompanying drawings.

Samples of material to be tested are made by applying bituminous coating material to an asphalt saturated organic fiber felt base sheet so that the coating weighs 25 pounds ±2 pounds per 100 square feet. No granular material or the like is applied to the surface of the coating. The asphalt saturated felt base sheet weighs about 30 pounds per 100 square feet and is saturated to the extent of about 175% by weight with asphalt having a softening point of about 150° F. The bituminous coating material is applied by coating the felt in the machine direction of the sheet and the felt is applied to the test deck so that the machine direction of the sheet is parallel to the direction of flame travel.

The test is made in the wind tunnel 53 having a fan 54 at one end and a stack 55 at the other end. The tunnel is made of ¼ inch thickness asbestos-cement lumber and has two windows 56 and 57 therein which can be opened and closed by any suitable means (not shown).

Within the tunnel are the burner and testing deck which are located between two shields 58 and 58' of the asbestos-cement lumber spaced 12¼ inches apart, and which are rigidly mounted on an asbestos-cement slab 43. The inclined test deck is indicated generally by the reference character 59 and comprises a lower iron-frame-like member 60 having ¼ inch pegs 61 projecting from the face adjacent the upper and lower margins. Between the pegs strips 62 of combustible material 1¾ x 12 x ¼ inches are placed. This combustible material is what is known as Masonite Quarterboard and is selected instead of wood because it can be obtained with greater uniformity than can wood. Masonite Quarterboard is made from wood fiber by compression of the fiber of a fiberized mass in the presence of a binder until it has a density of about 36 pounds per cubic foot. The four center boards are dried at 180° F. in a steam oven for at least 7 days. Two full plies 12 x 12 inches of the roofing 69 to be tested and one half-ply 12 x 6 inches are placed on the combustible deck followed by an L-shaped guard plate 63 which guards the bottom edge of the roofing and of the Masonite. The assembly is held down by an iron frame 64 open at the bottom and held in place by thumb screws 65.

After the test deck has been assembled it is placed on the inclined support 66 which has an opening in the back underneath the combustible material 62 and which has side flanges 66' to protect each side of the test panel. The support 66 comprises a baffle 67 to prevent the flame from licking around behind the test deck. The support which is made of iron is mounted on the asbestos-cement slab 43 which measures 12 x 40 x 1 inches. The parts for carrying the test deck are also made of iron. An iron bar 68, 12 x 1 x ¼ inches, is placed across the top edge of the deck to protect the combustible material at this point.

In front of the test deck is the burner 70 comprising an iron pipe having an inside diameter of .472 inch and an outside diameter of .675 inch, with 17 holes 0.078 inch in diameter and ½ inch apart disposed at an angle that is parallel with the plane of the test deck. The burner has one inlet 71 controlled by a valve 72 and another inlet 73 controlled by a valve 75.

The dimensions of different parts of the testing

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apparatus shown on the drawings as used by us are as follows:

	Inches		Inches
a	24	*o*	8
b	38	*p*	2
b'	6	*q*	¾
c	18½	*r*	1
d	72	*s*	12
e	16½	*t*	7
f	10	*u*	10½
g	12¼	*v*	12
h	38	*w*	12
i	64	*x*	1
j	32	*y*	12
k	24	*y'*	1
l	24	*z*	6
m	40	*aa*	12
n	27	*bb*	1

In carrying out the test the apparatus is first assembled and the burner is lighted, the valve **72** being open and adjusted until a pilot flame is produced that is about ½ inch in length when the fan is operating. The windows **56** and **57** are then closed and the room in which the apparatus is placed is arranged so that there will be relative constant conditions during the test. The temperature and relative humidity of the room should be approximately 80° F. and 40%, respectively. The fan should generate a wind velocity of about 150–155 feet per minute at the portion of the deck exposed to the flame. The valve **75** is then opened until a flame about 8 to 9 inches long is produced having a temperature of about 1325–1370° F. When the valve **75** is opened to increase the flame a timing device is started.

During the test the upper surface of the test deck can be observed as well as the back composed of combustible Masonite strips. During the test the behavior of the coating material can be noted including possible exposure and combustion of the felt base sheet, the flowing of coating material down the roof deck, etc. When one or more of the Masonite strips of the test deck catch fire and begin to burn the test is concluded. If the Masonite merely carbonizes without breaking into flame the end point has not yet been reached.

During the progress of the above described test the heat of the flame tends to soften the bitumen in the bituminous composition and, in the case of ordinary bituminous coating composition, the composition melts and to large extent flows off leaving the felt exposed so that it catches fire and burns through with the result that the Masonite boards soon become ignited. When, however, the bituminous composition of this invention is employed, the mineral filler forms a stable skeletal mat within the bitumen and the bitumen tends to remain in place, and the residual material to the extent that it does remain in place protects the felt and retards the ignition of the Masonite boards. The time in minutes required to ignite the Masonite boards is the "flow resistance value" of the filler or filler mixture being tested, and in our aforesaid application Ser. No. 370,636 we stated that the filler material to be suitable should have a flow resistance value of at least 40 minutes when subjected to the above described test. This is to be contrasted with 18 minutes for the felt without any coating at all applied thereto and with 13 minutes for the felt coating with the asphalt unmixed with any filler, and with a period of 17 minutes for the asphalt containing 35% of slate flour and no other filler. When a filler material, or a particular grade of filler material is stated herein and in the claims to have a "flow resistance value" of 40 minutes or greater than, or less than, 40 minutes, the "flow resistance value" as measured by the above described testing apparatus and procedure is intended.

In our aforesaid application Ser. No. 370,636 the flow resistance test is described as carried out with the filler consituting 35% by weight of the bituminous composition, the balance of the bituminous composition consisting of roofing asphalt having a softening point of about 230° F. However, for the purpose of defining the fire resistant roofings of the present invention, the flow resistance value, unless otherwise specified is the flow resistance value of the filler mixture in whatever amount it is used in the bituminous composition and as incorporated with whatever the bitumen component of the composition may be. Referring to the above mentioned example of the practice of this invention, if slate flour is substituted for the .5% of special asbestos fiber, so that the composition consists of 55% by weight of slate flour and 45% by weight of asphalt having a softening point of 230% F., the flow resistance value of the slate flour is only about 32 minutes and the roofing is incapable of attaining any rating according to the fire retardant tests of Underwriters' Laboratories, Inc., higher than a class "C" rating, which is the rating that is assigned to ordinary commercial bituminous roofings. However, when the .9% of special fiber is incorporated in the bituminous composition the flow resistance value is raised to 58 minutes, and the roofings carrying such coating will meet the requirements of the higher ratings under the tests prescribed by Underwriters' Laboratories, Inc., as has been mentioned hereinabove.

Within the range passing a .742 inch testing sieve and retained on a No. 6 testing sieve, the different intermediate screen gradings differ somewhat from each other in their effectiveness. This may be illustrated in the following table which shows the effectiveness of the different screen gradings of chrysotile asbestos fiber in composition consisting of asphalt having a softening point of 230° F., slate flour, 85% of which passes a 200 mesh testing sieve, and the screen fractions of the special chrysotile asbestos fiber, for bituminous compositions containing 35% by weight of total filler and 55% by weight of total filler. The table indicates the percent by weight of the different screen gradings required to afford a flow resistance value of about 40 minutes. The screen grading passing a .742 inch testing sieve and retained on a .525 inch testing sieve is indicated as (—.742 inch+.525 inch). The screen grading passing a No. 3 testing sieve and retained on a No. 4 testing sieve is indicated as (—3+4). Other gradings are indicated similarly.

Screen Grading	Total Filler	
	55% by weight of composition	35% by weight of composition
(—.742 inch+.525 inch)	.05	.3
(—.525 inch+.371 inch)	.1	.8
(—.371 inch+3)	.2	1.0
(—3+4)	.25	1.2
(—4+6)	.3	1.5

The foregoing is illustrative of the varying effectiveness of the different screen gradings of the special asbestos fiber when a typical thoroughly-

opened grade of chrysotile asbestos fiber is used.

The other fiber that is mentioned hereinabove is cotton fiber of the screen gradings above mentioned. The different screen gradings of cotton fiber are slightly less effective than the corresponding screen gradings of asbestos fiber. One can of course utilize a mixture of the asbestos fiber and cotton fiber of the screen gradings mentioned.

While the special asbestos and cotton fibers have the remarkable stabilizing action that has been pointed out above, it is important that these fibers be employed in the very small quantities that have been mentioned. If attempt is made to incorporate in the fire resistant bituminous composition more than about 5% by weight of the composition of these special fibers, the fibers tend to form into clots or clumps that are undesirable. These clots or clumps during application of the coating tend to be dragged along leaving areas or zones that are virtually unprotected both from the point of view of resistance to weather and from the point of view of resistance to fire. Moreover, the presence of more than a small amount of special fiber tends to impair the adhesion of the coating to the underlying felt when the coating is subjected to the heat of a flame. However, when these special fibers are employed in the very small quantities above mentioned ranging from an amount that is merely a fractional percent of the composition up to about 5% by weight of the composition, the special fibers can be successfully incorporated in a bituminous composition that when heat plasticized is spreadable to form a layer of uniform consistency and uniform thickness, and that has very high fire resistance. In this connection any slightly pebbled appearance of the surface of the coating is not detrimental provided the bituminous coating affords a layer of substantial thickness extending continuously over the surface of the base sheet so as to afford a weather resistant coating.

With regard to the diluent filler material that is employed in the bituminous composition there is a wide selection. There are a number of heat resistant mineral fillers which are suitable other than slate flour, e. g. limestone dust, silica flour, clay, talc, fly ash, hydrated Portland cement, dead-burned calcium sulphate, precipitated calcium silicate hydrate and the like. Most fillers of such character are of such state of subdivision that about 90% by weight thereof will pass a 100 mesh testing sieve.

Fillers such as asbestiform mineral fiber which is of the type referred to as dust and which is discarded in enormous quantities on the dumps as a waste by-product of the milling of the commercial grades of asbestos fiber may be used. Such asbestos dust, as well as other finely-divided fibrous minerals such as disintegrated asbestos-cement scrap, disintegrated fiber-bearing serpentine rock, finely-divided mineral wool and finely-divided glass fibers have been disclosed in our application Ser. No. 370,636 as providing highly fire resistant bituminous coatings if used in the quantities and state of subdivision therein specified. One can advantageously, according to the present invention, employ the special fibers passing a .742 inch testing sieve and retained on a No. 6 testing sieve in conjunction with the more finely-divided fibrous minerals and with or without non-fibrous mineral fillers for by so doing the fire resistance of the bituminous composition is increased, but it is apparent that the quantity of the special fiber which is employed in the practice of the invention can be reduced still further to extremely minute quantities as compared with the bituminous composition as a whole in comparison with the amount required to achieve a flow resistance value of 40 minutes when a filler such as slate flour is employed that by itself has little effectiveness.

In addition to mineral fillers, organic filler material may be employed although it is usually advantageous to employ a heat-resistant mineral filler in an amount such that the ratio of the percent by weight of heat-resistant mineral filler in the bituminous composition to the percent by weight of waterproofing bitumen in the bituminous composition is at least 1 to 3 and even more desirably at least 1 to 2. By "heat resistant" any material that retains structural integrity when a coating composition containing it is exposed to flame temperature is intended and any material such as chrysotile asbestos, kaolin clay or the like that contains water of constitution liberatable at or below flame temperature is regarded as heat resistant.

Among the organic fillers are fibrous fillers which may be animal, vegetable or synthetic, e. g. fibrous fillers such as grades of cotton fiber that are shorter than the special grades of cotton above mentioned, wool, sawdust, defibrated wood, paper fibers (sulphite or kraft), regenerated cellulose (rayon), cellulose acetate and the like. Such fibers in themselves have a stabilizing action on the bitumen of a bituminous composition, but the employment of the special fibers of this invention serves to improve upon the fire resistance of the bituminous composition as a whole.

Non-fibrous organic filler materials may likewise be employed such as finely-divided cork, coal, coke, ground hard rubber, ground synthetic resins (such as phenol-aldehyde resins, lignin resins and the like), pyrobitumens, and the like.

More generally any finely-divided water-insoluble filler or filler mixture may be employed provided the filler material has a softening point above about 500° F. and preferably above about 700° F. and provided the filler or filler mixtures can be incorporated in a bituminous composition that is spreadable in a heat plasticized condition when the diluent filler plus the special fiber that is employed according to this invention provides a total filler content constituting 35% or more by weight of the bituminous composition. In determining the softening point of the filler material the standard cube-in-air softening point test is referred to.

In formulating the bituminous composition it is desirable, however, that at least about half by weight of the filler material be sufficiently finely divided to pass a 100 mesh testing sieve and when the total filler content is of the range 55% to 80% by weight of the bituminous composition it is desirable that at least two-thirds by weight of the filler material pass a 100 mesh testing sieve. It is also desirable to avoid the presence of non-fibrous filler material retained on a 14 mesh testing sieve and any excessive amount of fibers retained on a 14 mesh testing sieve is undesirable due to the fact that such filler material detracts from the spreadability of the composition. Accordingly it is usually desirable that the amount of filler material retained on a 14 mesh testing sieve be less than about 10% by weight of the total filler material in the bituminous composition.

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With regard to the waterproofing bitumen that is employed in the fire resistant bituminous composition, it is usually preferable in the manufacture of shingles or the like to employ an asphalt having a softening point of about 200° F. to 250° F., although a somewhat broader range is permissible, namely, asphalts having a softening point of about 160° F. to about 275° F. For more flexible products such as roll roofing, an asphalt having a softening point of below 160° F. may be used, and roofings of satisfactory fire resistance can be produced utilizing asphalt having a softening point above 80° F., although it is usually preferable, even in the case of roll roofings and the like, to utilize an asphalt having a softening point above 120° F. The softening point of the waterproofing bitumen is determined by the standard ball and ring test. In addition to asphalts derived from Mid-Continent crudes, other asphalts are suitable such as asphalts derived from Mexican, Venezuelan and Colombian crudes. Other bitumens such as pitches, coal tar and the like may be used in the practice of this invention. Moreover, any modifier, e. g. of a resinous or oily character, that may be mixed and blended with the bitumen is to be regarded as part of the bitumen content of the composition.

When reference is made herein to "waterproofing bitumen" this term is used in reference to asphalt, tar, pitch and the like having a softening point of the range 80° F. to 275° F. and unmixed with filler. If any bituminous material comprising bitumen having a softening point above 500° F. such as pyrobitumens, e. g. grahamite, wurtzilite and the like, is employed or if a very highly oxidized asphalt is employed in a powdered state, such bituminous material is regarded as part of the filler and not part of the waterproofing bitumen. When reference is made herein to a bituminous material, or a bituminous coating or a bituminous layer, reference is made to a material, composition, coating or layer comprising bitumen either with or without filler.

In the foregoing example of the practice of this invention the special bituminous coating composition was applied in layer form at the rate of 45 pounds per 100 square feet of the roofing. It is usually desirable to apply the special bituminous coating material to the weather exposed side of the base sheet so that the layer will weigh at least 20 pounds per 100 square feet, the range ordinarily being from about 25 to about 60 pounds per 100 square feet, although about 30 to about 50 pounds per 100 square feet is usually preferable. In the foregoing example wherein the special bituminous coating material contained substantially 50% by weight of filler and the coating was applied at the rate of 45 pounds per 100 square feet, the amount of filler in the coating composition constituted about 22.5 pounds per 100 square feet of the roofing material. For prepared roofing materials it is usually desirable that the roofing material contain in one or more layers such as a surface layer or backing layer, sufficient of the special bituminous composition so that the roofing material will contain at least 7 and preferably about 14 pounds per 100 square feet of the filler material. By varying the number and thickness of the layers of special bituminous coating composition of this invention, varying degrees of fire-retardant effectiveness can be attained. The special bituminous composition of this invention is especially effective when it is disposed in a roofing so as to occur in a plurality of layers separated by felt or other sheet material, for example, as shown in Figs. 5, 6 and 9. In such plural layer construction it is desirable that the total filler constitute at least about 15 pounds per 100 square feet of the roof covering and preferably about 42 pounds per 100 square feet of the roof covering. It is also desirable that each of at least two layers of the special bituminous composition contain at least 7 pounds per 100 square feet and preferably at least about 14 pounds per 100 square feet of the roof covering of the finely-divided solid water-insoluble filler.

While embodiments of this invention have been shown in the form of preformed roofing materials such as shingles and roll roofing, it is apparent that the special bituminous composition of this invention may be employed in the manufacture of roof coverings installed on the job, such as built-up roofings, certain types of which are exemplified in our aforesaid application Ser. No. 370,636.

It is one of the advantages of this invention that the new roofing herein defined possesses high fire resistance without sacrifice of other properties required for a roofing and without substantial increase in cost compared with conventional roofings heretofore manufactured. The new roofing of this invention has very good weathering characteristics and is rough and pliable. Thus a typical preformed roofing material such as a shingle can be bent 180° of arc in two seconds around a 4 centimeter mandrel with the fire-resistant special coating composition on the outside without cracking the coating through to the felt base, the test being made at 77° F. It is desirable that a roofing having a bituminous waterproofing coating be sufficiently pliable to bent bent 180° of arc in two seconds about a mandrel 10 centimeters in diameter at 77° F. with the coating on the outside without cracking the coating through to the base on which it is applied, and any such coating or layer is referred to herein as "pliable" at ordinary temperatures.

While felt sheet material has been mentioned hereinabove as the strain resisting sheet-like element of roofings and roof coverings embodying this invention, it is apparent that any other suitable sheet-like base material, either fibrous or non-fibrous, either foraminous or non-foraminous, and either deformed or non-deformed that is adapted to afford the desired strength characteristics may be employed. Thus fabrics other than felt may be employed such as woven fabrics or fabrics of unspun bonded fibers. The base sheet may, if desired, be saturated with a bituminous or other waterproofing material or may be dry. Sheet material such as a composition board or insulation material may be employed. Plain or corrugated or indented sheet metal may be employed as the base sheet. Ordinary roofing felt made of organic fibers is, however, the most inexpensive sheet material, and, notwithstanding the combustibility of such sheet material, roofings comprising it can, according to this invention, be made highly fire resistant. If desired, non-combustible fibers can be incorporated in the felt or other fibrous base sheet to augment the fire resistance of the roofing.

It is apparent that one can by the employment of this invention provide highly fire resistant bituminous compositions that have a flow resistance value of at least 40 minutes and preferably a flow resistance value of at least 80 minutes, by the expedient of incorporating in a bituminous composition containing finely-divided solid water-

insoluble mineral filler which has a softening point above 500° F. and which is of the range 35% to 80% by weight of the composition, a small amount of the special asbestos fiber or cotton fiber or any mixture thereof in amounts which are not greater than 5% by weight of the bituminous composition and which may be below a tenth of one percent by weight of the bituminous composition. The amount that is used will vary somewhat depending upon the percent by weight of bitumen in the composition, and the presence or absence of other fibrous mineral in the composition.

While this invention has been described in connection with certain typical examples of the practice thereof, it is to be understood that this has been done for purposes of exemplification. Accordingly the scope of this invention is to be governed by the language of the following claims construed in the light of the foregoing description of our invention.

We claim:

1. A roofing having high resistance to fire comprising sheet-like base material and a layer of thermoplastic bituminous composition carried by said sheet-like base material, said bituminous composition containing waterproofing bitumen having a softening point above 80° F. and not above 275° F. and of the range 20% to 65% by weight of said bituminous composition, and said bituminous composition containing intimately commingled and distributed uniformly throughout finely-divided solid water-insoluble filler having a softening point above 500° F. and of the range 35% to 80% by weight of said bituminous composition, said filler consisting in major proportion by weight of particles passing a 100 mesh testing sieve and comprising less than 10% by weight of the total filler of particles retained on a 14 mesh testing sieve, said filler comprising fiber which is selected from the group consisting of asbestos fiber and cotton fiber and mixtures of said fibers, which passes a .742 inch testing sieve and is retained on a No. 6 testing sieve and which is present in appreciable amounts constituting less than 5% by weight of said bituminous composition, and said bituminous composition when heat plasticized being spreadable to form a layer of uniform thickness and uniform consistency and providing a pliable weather resistant layer of the hot-spread coating type integrally bonded with said sheet-like base material.

2. A roofing according to claim 1 wherein said filler passing a .742 inch testing sieve and retained on a No. 6 testing sieve consists predominantly of asbestos fiber.

3. A roofing having high resistance to fire comprising sheet-like base material and carried by said sheet-like base material a layer of thermoplastic bituminous composition, said bituminous composition containing waterproofing bitumen having a softening point above 80° F. and not above 275° F. and of the range 45% to 65% by weight of said composition, said bituminous composition containing intimately commingled and distributed uniformly throughout finely-divided solid water-insoluble filler having a softening point above 500° F. and of the range 35% to 55% by weight of said bituminous composition, said filler consisting in major proportion by weight of particles passing a 100 mesh testing sieve and comprising less than 10% by weight of the total filler of particles retained on a 14 mesh testing sieve, said filler comprising fiber which is selected from the group consisting of asbestos fiber and cotton fiber and mixtures of said fibers, which passes a .742 inch testing sieve and is retained on a No. 6 testing sieve and which is present in appreciable amounts constituting less than 5% by weight of said bituminous composition, said filler including said fiber contained in said bituminous composition as applied to said sheet-like base material having a flow resistance value of at least 40 minutes, and said bituminous composition when heat plasticized being spreadable to form a layer of uniform thickness and uniform consistency and providing a pliable weather resistant layer of the hot-spread coating type integrally bonded with said sheet-like base material.

4. A roofing according to claim 3 wherein said finely-divided solid water-insoluble filler comprises heat resistant mineral filler the ratio of the percent by weight of which to the percent by weight of waterproofing bitumen in said bituminous composition is at least 1 to 3.

5. A roofing according to claim 3 wherein said fiber consists essentially of asbestor fiber and said finely-divided solid water-insoluble filler consists essentially of heat resistant mineral filler.

6. A roofing having high fire resistance comprising sheet-like base material and carried by said sheet-like base material, a layer of thermoplastic bituminous composition, said bituminous composition containing waterproofing bitumen having a softening point above 80° F. and not above 275° F. and of the range 20% to 45% by weight of said composition, said bituminous composition containing intimately commingled and distributed uniformly throughout finely-divided solid water-insoluble filler having a softening point above 500° F. and of the range 55% to 80% by weight of said bituminous composition, at least about two-thirds by weight of said filler passing a 100 mesh testing sieve and less than 10% by weight of said filler being retained on a 14 mesh testing sieve, said filler comprising fiber which is selected from the group consisting of asbestos fiber and cotton fiber and mixtures of said fibers, which passes a .742 inch testing sieve and is retained on a No. 6 testing sieve and which is present in appreciable amount constituting less than 5% by weight of said bituminous composition, said bituminous composition when heat plasticized being spreadable to form a layer of uniform thickness and uniform consistency, said filler including said fiber contained in said bituminous composition as applied to said sheet-like base material having a flow resistance value of at least 40 minutes, and said bituminous composition providing a pliable weather resistant layer of the hot-spread coating type integrally bonded with said sheet-like base material.

7. A highly fire resistant prepared roofing material comprising sheet-like base material and a layer of thermoplastic bituminous composition carried by said sheet-like base material, said bituminous composition containing waterproofing bitumen having a softening point above 120° F. and not above 275° F. and of the range 20% to 65% by weight of said composition, said composition containing intimately commingled and distributed uniformly throughout finely-divided solid water-insoluble filler having a softening point above 500° F. and of the range 35% to 80% by weight of said bituminous composition, said filler consisting in major proportion by weight of particles passing a 100 mesh testing sieve and comprising less than 10% by weight of the total filler of particles retained on a 14 mesh testing sieve, said filler comprising fiber which is se-

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lected from the group consisting of asbestos fiber and cotton fiber and mixtures of said fibers, which passes a .742 inch testing sieve and is retained on a No. 6 testing sieve and which is present in appreciable amount constituting less than 5% by weight of said bituminous composition, said filler including said fiber contained in said bituminous composition as applied to said sheet-like base material having a flow resistance value of at least 40 minutes, said composition being spreadable in a heat plasticized state to form a layer of uniform thickness and consistency, said layer being a weather resistant layer of the hot-spread coating type integrally bonded with said sheet-like base material and being applied at the rate of about 20 pounds to about 60 pounds per 100 square feet of said roofing material, and said roofing material being pliable at 77° F.

8. A highly fire resistant prepared roofing according to claim 7 wherein said filler comprises heat resistant mineral filler the ratio of the percent by weight of which to the percent by weight of waterproofing bitumen in said bituminous composition is at least 1 to 3.

9. A highly fire resistant prepared roofing material according to claim 7 wherein said waterproofing bitumen is of the range 20% to 45% by weight of said bituminous composition, said finely-divided solid water-insoluble filler is of the range 55% to 80% by weight of said bituminous composition and at least two-thirds by weight of said finely-divided solid water-insoluble filler passes a 100 mesh testing sieve, and wherein said filler comprises heat resistant mineral filler the ratio of the percent by weight of which to the percent by weight of waterproofing bitumen in said bituminous composition is at least 1 to 2.

10. A highly fire resistant prepared roofing material according to claim 7 wherein said fiber consists essentially of asbestos fiber.

11. A roof covering having high resistance to fire, comprising sheet-like base material and a plurality of layers of thermoplastic bituminous composition carried by said sheet-like base material, said bituminous composition containing waterproofing bitumen having a softening point above 120° F. and not above 275° F. and of the range 20% to 65% by weight of said composition, and said bituminous composition containing intimately commingled and distributed uniformly throughout finely-divided solid water-insoluble filler of the range 35% to 80% by weight of said bituminous composition and having a softening point above 500° F., said filler consisting in major proportion by weight of particles passing a 100 mesh testing sieve and comprising less than 10% by weight of the total filler of particles retained on a 14 mesh testing sieve, said filler comprising fiber which is selected from the group consisting of asbestos fiber and cotton fiber and mixtures of said fibers, which passes a .742 inch testing sieve and is retained on a No. 6 testing sieve and which

is present in an appreciable amount constituting less than 5% by weight of said bituminous composition, said filler including said fiber contained in said bituminous composition as applied to said sheet-like base material having a flow resistance value of at least 40 minutes, said filler including said fiber constituting at least 15 pounds per 100 square feet of said roof covering with at least 7 pounds per 100 square feet contained in each of at least two layers of said coating composition, and said bituminous composition when heat plasticized being spreadable to form a layer of uniform thickness and uniform consistency and providing pliable weather resistant layers of the hot-spread coating type integrally bonded with said sheet-like base material.

12. A roof covering according to claim 11 wherein one of said layers of said bituminous composition is on the weather side of said roof covering and is applied at the rate of at least 30 pounds per 100 square feet, and wherein said finely-divided solid water-insoluble filler constitutes at least 42 pounds per 100 square feet of said roof covering with at least about 14 pounds per 100 square feet contained in each of at least two of said layers.

13. A roofing having high resistance to fire according to claim 1 wherein said sheet-like base material is in the form of fibrous sheet material.

14. A highly fire resistant prepared roofing material according to claim 7 wherein said sheet-like base material consists essentially of felted fiber sheet material impregnated with a bituminous waterproofing material and wherein surfacing granules are embedded in the normally weather exposed surface of said layer of thermoplastic bituminous composition that is integrally bonded with said sheet-like base material.

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GEORGE ARTHUR FASOLD.

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