Patented Jan. 8, 1952 2,581,640

# UNITED STATES PATENT OFFICE

2,581,640

## BITUMINOUS COMPOSITION

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No Drawing. Application August 23, 1945, Serial No. 612,284

3 Claims. (Cl. 106—282)

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This invention relates to solvent thinned bituminous composition adapted to be applied in a fluid or semifluid state, the solvent being volatile so that, after application of the composition, the composition becomes stiffened due to loss of the solvent therefrom by evaporation. This invention relates particularly to solvent thinned bituminous composition adapted for "cold process" built-up roofing construction. In "cold process" built-up roofing construction the bituminous composition is thinned by means of a volatile solvent so that the composition is sufficiently workable at atmospheric temperatures, or when only mildly warmed, to permit manual application of the composition for the purpose of bonding sheets of felt or the like together and provide layers of waterproofing adhesive between such sheets of felt or the like in a build-up type of bituminous roofing.

It is an object of the invention to afford a solvent thinned bituminous composition suitable for application to provide a waterproofing layer for adhesively uniting the plies of a built-up roofing, which bituminous composition as disposed in the fabricated built-up roofing will have high fire resistance and will impart high fire resistance properties to the built-up roofing as a whole. While the special bituminous composition of this invention is especially designed for use between plies of built-up roofing, the special composition of this invention can, if desired, be used to provide a highly fire resistant surface coating of built-up roofing or to provide a highly fire-resistant, water-resistant adhesive for various sheet materials.

In the construction of built-up roofing, the plies of felt or the like are generally bonded together by so-called "mopping-asphalt," namely roofing grade asphalt having a softening point of about 140° F. to 200° F. and which can readily be heat liquefied on the job and spread with a mop or similar implement. Occasionally the mopping asphalt contains a mineral filler such as limestone dust or slate flour in an amount such as 20% to 30% by weight of the composition, but in common practice is used without any filler.

Built-up roofings, if made of a sufficient number of plies of sheet material, and particularly if made up using asbestos felt sheet material for the several plies of the roofing, or if surfaced with a large amount of coarse granular slag or gravel, have fairly satisfactory resistance to becoming burned through from the outermost layers to an underlying roof deck when the roofing is exposed to flame. However, built-up roofings heretofore

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made have relatively low resistance to spread of flame along the surface thereof particularly under the influence of wind. This poor resistance to spread of flame is due largely to the combustibility of the mopping asphalt. Even when the sheet material is composed of asbestos felt and even when the mopping asphalt is used only in layers beneath the top layer of felt, the roofing has poor resistance to spread of flame due to the combustible mopping asphalt and saturant asphalt bleeding out to the surface, and melting and flowing out from between the plies, thus forming areas which burn readily and carry the flame along the surface of the roofing. Moreover, since the mopping asphalt becomes heat liquefied and very thin and non-adhesive upon exposure of the roofing to flame, any wind is apt to raise up the plies of sheet material, and when this happens the air is taken into the body of the roofing, the mopping asphalt is burned rapidly, and the entire roofing burns very actively and soon ignites the underlying roof deck.

The use of solvent-thinned asphalt to adhesively bond the plies of a built-up roofing so that the asphalt may be applied as a cold composition instead of in a heat liquefied condition, has been very limited due to the fact that the solvent tends to become entrapped between the plies of the roofing. It may be added, that when a volatile solvent is employed the presence of the solvent that is retained in the finished roofing aggravates the combustibility of the roofing. For this reason, the provision of a highly fire resistant cold process built-up roofing using a solvent-thinned bituminous composition presents special problems.

According to this invention, a bituminous composition is provided which is thinned with a volatile solvent for the bitumen in the composition so that the composition can be applied cold, or, if desired, in a slightly warmed condition, to adhesively bond the plies of a bituminous built-up roofing, and which, in the finished roofing, not only provides a good bond between the plies, but also possesses remarkably high fire resistive properties and imparts a very high degree of fire resistiveness to the built-up roofing as a whole.

In our co-pending application Ser. No. 497,805, filed August 7, 1943, for Built-up Roofing and Compositions Therefor which has resulted in Patent No. 2,424,234 for Compositions for Built-up Roofing, we have disclosed bituminous compositions, and built-up roofing construction containing such compositions, having high fire resistive properties. The bituminous compositions dis-

closed in our Patent No. 2,424,234 are of the "mopping-asphalt" type, namely, adapted for spreading when heated on the job, the bituminous composition being applied hot (usually at a temperature of the order of 350° F. to 425° F.) and the layers of felt being bonded thereto and together while the bituminous composition is still in a heat plasticized condition. As distinguished from our Patent No. 2,424,234, the invention of the present application is concerned with a bituminous composition which is suitable for "cold process" application, the bitumen being reduced to a fluid or semi-fluid consistency by the presence of the volatile solvent and the tendency of some of the volatile solvent to remain in the bituminous composition for long periods of time presents special problems which have to be overcome if the composition as used in the built-up roofing is to have high fire resistance. These special problems are due primarily to the effect of the solvent in inducing the running and flowing of the bitumen so as to be in a free burning condition regardless of the inflammability or non-inflammability of the volatile solvent. We have found that for cold process application a different formulation of the non-volatile constituents should be employed as compared with mopping asphalt composition disclosed in our Patent No. 2,424,234 as will be apparent from the disclosure of our present invention set forth hereinbelow.

The fire resistive bituminous composition of this invention results from a combination of a number of factors which are explained and more fully defined hereinbelow. These factors include the amount and softening point of the bitumen that is used, the amounts and kinds of different filler ingredients, the formulation of the composition as a whole, as well as the non-volatile base, within certain limits of consistency. In general the bitumen has a softening point of the range 80° F. to 150° F. and constitutes about 30% to about 55% by weight of the non-volatile constituents, namely, the non-volatile bitumen and filler materials which are referred to hereinafter and in the claims as the "non-volatile base" of the compositions. The filler material constitutes about 45% to about 70% by weight of the non-volatile base. The filler comprises what is referred to herein and is defined more in detail below as planar-extended filler. Such filler has special properties which differ quite widely depending upon the particle size, and such properties are defined hereinbelow in terms of the "grading index" of the planar extended filler. The "grading index" of the planar-extended filler must be within certain limits in relation to the per cent. by weight of the bitumen in the non-volatile base. Finely particulate filler passing a 100 mesh testing sieve must also be present within certain limits in relation to the per cent. by weight of bitumen in the non-volatile base. The non-volatile base must be within certain limits of consistency as measured by the "Wagner-Bowen plasticity value" at 400° F. which is defined hereinbelow and likewise the composition as a whole, including the solvent, must be within certain limits of Wagner-Bowen plasticity value at 77° F. which is defined hereinbelow. For preferred embodiments, solvents which are capable of affording low viscosity characteristics are employed and which, as a result, have a special effect in reducing flame spread after the composition is incorporated in a built-up roofing.

It is seen from the foregoing that the special fire resistive properties are obtained in accordance with this invention within narrow and critical limits of formulation, and the chief features of our present invention are based upon our discovering that by formulation within the defined limitations of composition a solvent-thinned bituminous composition is provided which can be used in cold-process production of built-up roofings and which in the installed built-up roofing affords extraordinarily high resistance to fire.



In order to facilitate an understanding of this invention a typical embodiment thereof will first be described for purposes of exemplification. The composition of the example meets all of the requirements mentioned hereinabove, and after the formulation of the typical embodiment has been described, the critical factors essential to this invention will be explained and defined in detail and applied to the described typical embodiment.

In the following example, and elsewhere herein, the percentages given are percentages by weight. One of the ingredients of the composition is asbestos dust. Asbestos dust which passes a 6 mesh standard testing sieve and is retained on an 8 mesh standard testing sieve is indicated for purposes of brevity as (−6+8). Other screen gradings are indicated similarly. The non-volatile base of the composition of the typical example contains the following constituents:

*Non-volatile base*

| | Per cent |
|---|---|
| Asphalt (130° F. softening point) | 40 |
| Asbestos dust gradings— | |
| (−6+8) | .01 |
| (−8+10) | .04 |
| (−10+14) | .1 |
| (−14+20) | .3 |
| (−20+28) | 1.0 |
| (−28+35) | 2.5 |
| (−35+48) | 2.0 |
| (−48+65) | 1.25 |
| (−65+100) | 1.0 |
| (−100+150) | 1.0 |
| (−150+200) | 1.3 |
| (−200) | 4.5 |
| Total asbestos dust | 15 |
| Kaolinitic clay (mostly −200) | 45 |

The non-volatile base above stated is combined with a volatile solvent, the proportions for the purpose of this specific example being 15% by weight (on the composition as a whole) of solvent and 85% by weight of the non-volatile base so that the solvent thinned composition has the following formulation:

| | Per cent |
|---|---|
| Asphalt (130° F. softening point) | 34 |
| Asbestos dust | 13 |
| Kaolinitic clay | 38 |
| Solvent | 15 |

The particular solvent employed in the foregoing example consists of petroleum naphtha having a boiling range between 295° F. and 360° F.

The composition of the formulation above described may be prepared in any suitable way as by thinning the asphalt with the solvent and incorporating the filler ingredients so that they become thoroughly and uniformly distributed.

The above described composition is easily workable at normal atmospheric temperatures and can be easily spread at such temperatures by use of a suitable implement so as to bond together the plies of felt material of built-up roofing. In the installation of built-up roofing the

composition is spread out as a layer of desired thickness whereupon the volatile solvent begins to escape making the surface tacky and sticky and well suited for bonding in place the next succeeding layer of felt or the like, and the operation can be repeated until the desired number of layers of bituminous waterproofing adhesive and of sheet material have been installed.

The fire retardant tests of Underwriters' Laboratories, Inc. for the Class "A," Class "B," and Class "C" ratings are described briefly in our aforesaid Patents Nos. 2,326,723 and 2,326,724, which tests are carried out in testing built-up roofings installed in the manner aforesaid. Of these ratings 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. The Class "A" rating is the highest rating 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 single coverage asbestos-cement shingles. So far as we are aware there is no built-up roofing of the smooth surface type other than that disclosed in our aforesaid Patent No. 2,424,234, that carries, or is entitled to, either the Class "A" or Class "B" rating whether the plies of sheet material are composed of asbestos fiber and whether the bituminous waterproofing is applied hot without a volatile solvent or is thinned with a volatile solvent so as to be capable of cold application. However, built-up roofings of the cold process type wherein the bitumen is thinned with a volatile solvent have been, prior to the present invention, particularly deficient in fire resistive properties. There are built-up roofings which carry a higher fire retardant rating, which higher rating is achieved by placing over the top of the built-up roofing a very large amount, such as 400 pounds or more per 100 square feet, of some material such as crushed rock or slag that protects the roofings from flame, but use of such large quantities of crushed rock or slag is undesirable and, frequently, as when an inclined roof deck is to be covered with built-up roofing, can not be used at all.

Built-up roofings of the general construction shown in our aforesaid Patent No. 2,424,234 which have been installed using the special cold process bituminous composition of this invention that have been described above by way of example will successfully pass all of the tests prescribed by Underwriters' Laboratories, Inc. for the Class "A" rating. Moreover, for different numbers and arrangements of plies and using possible variations in the formulation of the special bituminous composition, other built-up roofings within the scope of this invention will successfully pass the Class "A" and Class "B" fire retardant tests prescribed by Underwriters' Laboratories, Inc. In typical construction of a built-up roofing using the special bituminous composition of this invention, the composition is applied at normal temperature as to a layer of roofing felt already put in place, the volatile solvent is permitted to partially evaporate therefrom causing the bituminous composition to become tacky and adhesive, and, while the bituminous composition is in this condition, another layer of felt is made adherent thereto, these operations being repeated



until the desired number of plies have been installed.

When ordinarily solvent thinned bituminous compositions are used in the construction of built-up roofings, and even when ordinary mopping asphalt applied in a heat liquefied condition is used in the construction of built-up roofing, the bituminous material, when the built-up roofing is subjected to the fire retardant tests prescribed by Underwriters' Laboratories, Inc., tends to flow out from between the plies of felt onto the surface exposed to the flame and burns with considerable vigor. Moreover, the wind playing over the test deck tends to life up the ends of the felt sheets so that the fire gets into the body of the roofing quite rapidly. Such roofings are particularly vulnerable to the flame spread test. This is the case even though the upper surface of the built-up roofing does not carry a waterproofing layer of the asphalt.

By way of contrast, built-up roofing made with the special bituminous composition of this invention behaves very differently when exposed to fire. During exposure to the flame the bitumen and filler in the special bituminous composition remain in place due to the fact that the filler provides a stable skeletal mat in the bitumen, so that the bitumen instead of running out and burning carbonizes and forms with the filler a protecting mat-like layer that not only is highly resistant to combustion, but also has high heat insulating effectiveness. Moreover, when a mineral filler such as asbestos dust is present that contains water of constitution liberatable at or adjacent flame temperature small bubbles form in the residual mat-like mass that augment its heat insulating effectiveness.

Hereinabove it has been pointed out that the special bituminous composition of this invention must be formulated within very close limits which are critical to obtaining the desired high fire resistance when the bituminous composition is incorporated in a built-up roofing and that the desired high fire resistance is due to a combination of factors. One of these factors is the grading index of the planar-extended filler component of the bituminous composition. The planar-extended filler material is exemplified by fibrous filler such as asbestos fibers, cotton fibers, etc., and by plate like material such as mica, the particles of which are thin relative to their lateral extent. Such fibrous fillers and plate-like fillers are characterized by the fact that at least one dimension is very small relative to another more extended dimension, and such fibrous and plate-like fillers are referred to generally herein as "planar-extended" filler materials thereby indicating that the particles are in the form of fibers or are in the form of plates having an extended dimension that is confined essentially to only one of the three dimensional planes.

The grading index of a planar-extended filler is an index which is indicative of the effectiveness of a particular screen grading or mixture of screen gradings of planar-extended filler material in promoting flow resistance of a bituminous composition when exposed to flame temperature. We have found that one of the factors contributing to the fire resistance of a bituminous layer in a roofing is that of being resistant to flow when the roofing is exposed to flame temperature. Fillers as a class have very little effect on such flow when used in amounts such as those used in conventional roofings and ordinary filler materials have very little effect in counteracting flow even

when used in relatively large amounts. We have found, however, that there is a point whereat further additions of filler material, even very small additions, result in a very great increase in flow resistance of the bituminous material and that there is a limited zone wherein the bituminous composition, when highly heated, will be stabilized against flowing, even though soft and highly plastic, due to the occurrence of a skeletal mat within the composition which stabilizes the composition and has the further effect of forming with the bitumen a protective heat insulating mat-like mass that carbonizes in situ as a coherent, continuous protective layer that is highly resistant to flame and transmission of heat.

The property of a filler material whereby a bitumen heated to adjacent flame temperature becomes stabilized and resistant to flow is a definite physical property of the filler material that is similar to such properties as solubility, effect of dissolved salts on boiling point, etc. Moreover, the property is capable of accurate measurement, according to a test procedure which we have devised in order to accurately define the invention which is the result of our research and discoveries. This test procedure enables us to measure the flow resistance of a particular filler or filler mixture under conditions of actual exposure to fire. For determining the flow resistance coefficient of a filler contained in the bituminous composition of this invention the bituminous composition is applied in a solvent thinned condition and the solvent is permitted to evaporate until less than 1% by weight of the solvent remains, the test being made on the essentially non-volatile base of the composition. The resulting bituminous layer, as disposed on an inclined test deck, is exposed directly to flame under precisely controlled conditions determined by the construction and operation of the testing apparatus. The test employed is the test for measuring the flow resistance coefficient of a filler which, as regards both apparatus and test procedure, is described in our aforesaid Patent No. 2,424,234 except that in the preparation of the sample to be tested the solvent-thinned bituminous composition is placed between the plies of the sample by initially applying it in the solvent thinned condition to one or the other of the plies, permitting the solvent to evaporate until the bituminous composition becomes tacky and adhesive, applying the other ply to the tacky surface thereof, and placing the sample in a drying oven at about 170° F. until the solvent has been driven off and less than 1% by weight of the solvent remains. The thickness and weight of the resulting layer should be the same as that mentioned in our Patent No. 2,424,234 as prescribed for the test.

The coefficient of flow resistance is computed according to the following expression:

$$100-\frac{\text{Weight of total collected bituminous composition}\times 100}{\text{Weight of bituminous composition in exposed area}}$$

For example, if the weight of the bituminous coating in the exposed area of the sample was 1000 grams prior to testing and the total collected bituminous composition was 50 grams, the flow resistance coefficient would be

$$100-\frac{50\times 100}{1000}=95$$

If none of the coating of bituminous composition flows into the pan or onto the exposed portion of ply 73*a*, then the flow resistance coefficient is 100, which is the maximum attainable.

The non-volatile base of the bituminous composition of the invention should be such that the filler has a flow resistance coefficient of 75 or greater, although in preferred embodiments of the present invention the filler has a flow resistant coefficient between 90 and 100. The filler employed in the non-volatile base of the example of the present invention that has been described hereinabove, has a flow resistance coefficient of substantially 95.

As stated above, we have found that it is essential that the bituminous composition of this invention contains a planar-extended filler material. We have likewise found that the amount of planar-extended filler material that is required depends to a large extent upon the screen analysis of the different screen fractions contained therein, for the different screen fractions are widely different in their effectiveness in imparting flow resistance. This can be illustrated in the case of asbestos dust which is the planar-extended filler material that is employed in the above-described typical embodiment of this invention. In the case of chrysotile asbestos dust, we have found that when the screen grading (−28+35) is used and the non-volatile base of the composition contains 6.5% by weight of such specially graded fibers, 53.5% by weight of kaolinitic clay (mostly −200), (total filler 60%) and 40% by weight of asphalt having a softening point of about 135° F., the non-volatile base has a flow resistance coefficient of about 75. The screen grading (−8+10) is considerably more effective since a flow resistance coefficient of 75 can be achieved when the non-volatile base contains only about .66% by weight of such mineral fiber together with 59.34% of the kaolinitic clay (total filler 60%) and 40% of the same asphalt. In other words, using the same total amount of filler consisting of asbestos fiber plus diluent filler that has little flow resistance effectiveness in amounts less than 60% by weight, the coarse fraction (−8+10) is much more effective than the fraction (−28+35) in affording a given degree of flow resistance for the non-volatile base. On the other hand, if asbestos fiber (−200) is used, it requires about 25% by weight of such fiber to achieve a flow resistance coefficient of about 75. The effectiveness of the fibrous filler in the composition just mentioned, and the surprising effect of only .66% of the (−8+10) fraction, is evidenced by the fact that a non-volatile base consisting of 60% by weight of the same kaolinitic clay and 40% by weight of the same asphalt, has a flow resistance coefficient of only about 33.

In view of the differences in effectiveness of the different screen gradings of a planar-extended filler, such as asbestos dust, we have, in order to accurately define the planar-extended filler component of the non-volatile base of the bituminous composition of this invention, assigned to the different screen gradings of planar-extended fillers what we have called a "screen factor" for each of the different gradings. The screen grading of (−28+35) of chrysotile asbestos fiber has been taken as having a value of unity. Therefore any screen grading that requires only half the amount to achieve the same flow resistance coefficient as compared with the amount of the grading (−28+35) will be twice as

effective and will have a screen factor of 2. On the other hand, a screen grading which requires twice the amount as compared with the amount of the grading (−28+35) will only have half the effectiveness and will have a screen factor of 0.5. In like manner screen factors can be assigned to the other screen gradings.

The above-described test for determining the flow resistance coefficient of a filler in the non-volatile base of a bituminous composition affords a convenient basis for setting up the screen factors of the screen gradings of the planar-extended fillers on a definite scale, and when the screen factor of a planar-extended filler is referred to herein, the screen factor as determined in the following manner, is intended. The test for determining the flow resistance coefficient is carried out using the test apparatus and procedure above-described. The total filler in all cases is 60% by weight of the non-volatile base and the asphalt in all cases is an oxidized straight run asphalt having a softening point of about 135° F. Kaolinitic clay, substantially all of which passes a 200-mesh testing sieve, is used in all cases as the standard diluent filler, and the amount by weight of a particular screen grading of planar-extended filler to achieve a flow resistance coefficient of 75, is determined. Each sample is prepared using the materials and construction of the test sample as described hereinabove.

By way of concrete example, it has been mentioned above that chrysotile asbestos fiber of the screen grading (−28+35) is taken as having a screen factor of unity. It being the case that 6.5% by weight of the non-volatile base of chrystolite asbestos dust of the screen grading (−28+35)—the total filler being 60% as aforesaid—is required to afford a flow resistance coefficient of 75, and it also being the case that about 66% by weight of the non-volatile base of the screen grading (−8+10), (the total filler being 60%), also affords a flow resistance coefficient of about 75, the screen factor of chrysotile asbestos dust of the screen grading (−8+10) is seen to be about 10. By way of further illustration, the "screen factors" of the different screen gradings of a typical chrysotile asbestos dust on the bases above-mentioned, are as follows:

| Screen Grading | Screen Factor |
|---|---|
| (−6+8) | 30.0 |
| (−8+10) | 10.0 |
| (−10+14) | 4.0 |
| (−14+20) | 2.5 |
| (−20+28) | 1.5 |
| (−28+35) | 1.0 |
| (−35+48) | .8 |
| (−48+65) | .6 |
| (−65+100) | .5 |
| (−100+150) | .4 |
| (−150+200) | .35 |
| (−200) | .25 |

It is to be noted that in the case of the asbestos fiber of the screen grading (−200), it required about 25% of the non-volatile base to achieve a flow resistance coefficient of 75 and that the screen factor .25 has been assigned to this particular grading. Similarly, any grading of a different type of planar-extended filler which requires more than 25% by weight of the non-volatile base of the bituminous composition to afford a flow resistance coefficient of about 75, is to be considered as having a screen factor of .2.

The foregoing affords a convenient way of ascertaining the flow resistance effectiveness of a



planar-extended filler, e. g., asbestos fiber. Given the percentage by weight of the screen gradings of the asbestos fiber contained in the non-volatile base of the bituminous composition, the percentage by weight of each multiplied by the screen factor of each of the screen gradings, gives what we term the "grading index" for each screen grading, and, by adding the grading indices of each screen grading together, the grading index of the total asbestos fiber is readily determined. By way of illustration, the grading index of the mineral fiber component of the non-volatile base of the above-mentioned typical embodiment of the bituminous composition of this invention is as follows:

| Screen Grading | Percentage by Weight of Composition | Screen Factor | Grading Index |
|---|---|---|---|
| (−6+8) | .01 | 30 | .30 |
| (−8+10) | .04 | 10 | .40 |
| (−10+14) | .1 | 4 | .40 |
| (−14+20) | .3 | 2.5 | .75 |
| (−20+28) | 1.0 | 1.5 | 1.50 |
| (−28+35) | 2.5 | 1 | 2.50 |
| (−35+48) | 2.0 | .8 | 1.60 |
| (−48+65) | 1.25 | .6 | .75 |
| (−65+100) | 1.0 | .5 | .50 |
| (−100+150) | 1.0 | .4 | .40 |
| (−150+200) | 1.3 | .35 | .45 |
| (−200) | 4.5 | .25 | 1.10 |

Total grading index of asbestos fiber 10.65

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 A. S. T. M. 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 in 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 re-screened for 15 minutes using the Ro-Tap sieve shaking machine or its equivalent in order to remove any fines contained therein. The resulting screen fraction is material that has passed the coarser screen and is retained on the finer screen.

When reference is made herein to "screen factor" and "grading index," the reference is made to those values when determined under the specific conditions above-specified. When, however, reference is made to the flow resistance coefficient of the filler material in the non-volatile base of a bituminous composition, the reference is to the flow resistance coefficient of the entire filler content of the composition whatever the amount may be and whatever the character of the bitumen used in the composition may be, the non-volatile base being tested, however, on a sample that is of the construction and asphalt-saturated felt material, above-specified.

The planar-extended filler that is preferred in the practice of this invention is asbestiform mineral fiber, chrysotile asbestos dust being especially desirable. Other asbestiform mineral fibers of the particle size mentioned may likewise be employed, such as Canadian picrolite, amosite, anthophyllite, tremolite, and actinolite.

Another suitable fibrous mineral is a comminuted mixture of hydrated Portland cement

and asbestos fiber, the hydrated Portland cement having become set with the asbestos fiber distributed therethrough. A convenient source of such material is asbestos-cement roofing scrap which usually contains about 20% to 35% by weight of asbestos fiber and about 65% to 80% of hydrated Portland cement. Heretofore such scrap has been regarded as an unavoidable waste of no commercial value. However, by subjecting the scrap to a disintegrator, such as a hammer mill, the resulting mass contains a multiplicity of short asbestos fibers to which the hydrated Portland cement adheres as nodules and for this reason this material is fibrous and is to be included in the term fibrous mineral.

Another material which is somewhat similar to asbestos-cement in that the material contains mineral fibers together with some non-fibrous material, is disintegrated fiber-bearing serpentine rock. Since disintegrated fiber-bearing serpentine rock contains fibrous particles, such disintegrated serpentine rock is regarded as one form of fibrous mineral which is suitable for use in practicing this invention. However, depending upon the physical structure and fibrous mineral content of the particular serpentine rock that is used, the proportion of fiber contained therein is subject to some variation, but, as pointed out below, this merely has the effect of varying somewhat the screen factors of the various screen gradings of the disintegrated serpentine rock as calculated to chrysotile asbestos dust of the screen grading (−28+35) which has a screen factor of unity. Moreover, disintegrated fiber-bearing serpentine rock is of such character that in order to liberate the fibrous material contained therein, it should pass a 20-mesh testing sieve, and, when reference is made herein to disintegrated fiber-bearing serpentine rock, only that serpentine rock which has been disintegrated so that it passes a 20-mesh testing sieve is intended, since individual particles of coarser gradings are not fibrous in character but granular (are not fibrous mineral as this term is used herein) and since such coarser gradings are ineffective in producing highly fire-resistant roofings.

While fibrous mineral fillers selected from the group consisting of asbestiform mineral fibers, disintegrated asbestos-cement and disintegrated fiber-bearing serpentine rock are preferred, other mineral fibers may likewise be employed, such as mineral wool and glass fibers. The term "mineral wool" includes various products obtained by attenuating into fibrous form suitable fused materials, such as rock or slag.

In addition to fibrous minerals, other fibrous fillers may be employed as the planar-extended filler component of the bituminous composition of this invention although the mineral fibers are preferable for use in the practice of this invention and it is desirable that a major proportion by weight of the planar-extended filler consist of asbestiform mineral fibers. Thus, any of a wide selection of animal, vegetable and synthetic fibers may be used. Cotton is suitable and, in the very short grades is inexpensive and, in fact, has little commercial value.

In addition to cotton, one may employ wood fibers, such as fine sawdust, or defibrated wood and paper and paper fibers, such as ground wood, sulphite, and kraft paper pulps. Finely divided wool fiber is also suitable but is much more costly. Synthetic fibers, such as regenerated cellulose (rayon) and cellulose acetate also may be used.

In addition to fibrous fillers, another filler that is similar to fibrous fillers in that it is effective in varying degrees depending upon the screen grading or mixture of screen gradings that is employed, is mica. Mica is characterized by its occurrence in the form of small plates which are thin relative to their lateral extent. Mica and fibrous materials are characterized by the fact that at least one dimension is very small relative to another more extended dimension, and, as stated above, are referred to herein under the generic term "planar-extended filler material." In the case of the filler, such as mica that exists in the form of thin plates, particles which are retained on a 14-mesh testing sieve are undesirable in the composition.

With regard to fibrous fillers other than asbestiform mineral fibers, it is not usually the case that a particular screen grading of, for example, asbestos-cement, cotton, wood fiber, etc., will have the same screen factor as that of chrysotile asbestos fiber. In fact, even as many different types of asbestiform mineral fiber there are some variations in this regard. However, utilizing chrysotile asbestos dust as the standard, chrysotile asbestos dust of the screen grading (−28+35) having a value of unity, the screen factor of the screen grading of other fibrous fillers is determinable in the same way that the screen factor of the different screen gradings of chrysotile asbestos fiber is determinable as has been described hereinabove. However, fibrous fillers, particularly in the case of wood fibers, cotton and the like, are subject to considerable variation, and for this reason the screen factor and grading index has been calculated to chrysotile asbestos fiber, which is more uniform in its physical characteristics, as the standard. The foregoing, with respect to the screen factors of other fibrous fillers, also applies to planar-extended fillers of the plate type. For example, the screen factor of mica of the screen grading (−28+35) is about 0.9. The foregoing also applies to the screen factors of mixtures of planar-extended fillers, calculated to chrysotile asbestos dust of the screen grading (−28+35) as the standard.

In ascertaining the grading index of a filler of the planar-extended type for use in a bituminous composition for cold process application in the construction of built-up roofing, the grading index required will vary with the amount of bitumen in the bituminous composition, the amount of bitumen being, of course, an inverse function of the total filler. When the amount of waterproofing bitumen in the non-volatile base of the composition is about 30% by weight, the grading index of the planar extended filler is desirably at least about 4, while for a total bitumen content of the non-volatile base of about 55% by weight, the grading index for obtaining similar stabilization of the bitumen will be at least about 8. For bitumen contents of the non-volatile base ranging from 30% by weight to 55% by weight, the minimum required grading index varies proportionally from about 4 to about 8 respectively. More generally, in the practice of this invention, it is desirable to employ filler of the planar-extended particle type having a grading index the ratio of which to the percent by weight of waterproofing bitumen in the non-volatile base is at least about 1 to 8, and preferably is at least about 1 to 5.

When a filler of the planar-extended type is used, such filler should be used in the finely-divided dust-like form as distinguished from long

cotton, wood, or asbestos fibers. Fibrous fillers that are retained on a 6 mesh testing sieve are undesirable in the coating composition. It has been mentioned above that mica retained on a 14 mesh testing sieve is undesirable. Accordingly, and somewhat more generally, it is desirable that the filler material of the planar-extended type be confined to that which passes a 6 mesh testing sieve and which does not have more than one dimension greater than about .046 inch, which is the width of the opening in a 14 mesh testing sieve. When a filler of the planar-extended type is used that is coarser than has been mentioned above, such filler material tends to form into clumps or clots which render the solvent-thinned bituminous composition unspreadable with desired uniformity and also impairs the fire resistance of the applied coating due to occurrence of zones of insufficient protection and due to uneven and poor adhesion to the plies of felt or the like contained in the built-up roofing. For this reason, it is highly desirable to limit the quantity of coarser planar-extended filler to that which can be incorporated in a bituminous composition that, when thinned with a volatile solvent to the consistency defined below, is spreadable to form a layer of substantially uniform thickness and uniform consistency which does not present clumps of filler and streaks wherein little or no filler occurs. In this connection, some irregularity of surface due to the action of the applying implement is permissible provided there is good distribution of bitumen and filler over the entire surface to which the bituminous composition is applied. It is usually desirable that less than 10% by weight of the total non-volatile base of the bituminous composition consist of a filler of the planar-extended type which is retained on a 14 mesh testing sieve, although in the case of mineral wool a substantially greater proportion of such coarse material can be incorporated in a spreadable composition. While the presence of any fiber retained on a 6 mesh testing sieve is regarded as undesirable and while the presence of any mica retained on a 14 mesh testing sieve is regarded as undesirable, any small quantity of such excessively coarse planar-extended filler that may be present while still retaining spreadability is to be regarded as having a screen factor of 40. Usually it is desirable that the ratio of grading index of the filler of the planar-extended type to the per cent. by weight of the bitumen in the composition to be less than about 1 to 1.7, and preferably less than about 1 to 2.5, so as to avoid the inclusion of an excessive quantity of the coarser screen fractions.

As stated hereinabove, the total filler contained in the non-volatile base of bituminous composition of this invention is of the order of 45% to 70% by weight of the non-volatile base. Preferably, the filler constitutes from 55% to 65% by weight of the non-volatile base. While the filler may consist entirely of filler particles of the planar-extended type, provided such filler is used within the aforesaid limits of grading index in relation to the bitumen content of the non-volatile base, it is preferable, and constitutes normal practice of this invention, to include a diluent filler that is not of the planar-extended type. In addition to kaolinitic clay, there are a number of other heat-resistant mineral fillers which may be employed, e. g., slate flour, limestone dust, silica flour, other clays, talc, fly ash, hydrated Portland cement, dead burned calcium sulphate, and precipitated calcium silicate hydrate. Most fillers of this character are of such state of subdivision that about 90% by weight thereof will pass a 100 mesh testing sieve.

In addition to mineral fillers, organic filler materials may be employed, although it is usually advantageous to employ a heat-resistant mineral in an amount such that the ratio of the per cent. by weight of heat-resistant mineral filler in the non-volatile base of the bituminous composition to the per cent. 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 bituminous composition containing it is exposed to flame temperatures is intended and any material such as chrysotile asbestos, kaolin clay, hydrated Portland cement or the like that contains water of constitution liberatable at or below flame temperature is regarded as heat-resistant. The foregoing respecting the proportion of heat-resistant mineral filler in the non-volatile base applies to the total filler including the planar-extended type filler and any diluent filler used in conjunction therewith.

Among the organic fillers, examples of such fillers of the planar-extended type have been given hereinabove. Examples of non-planar-extended organic filler materials which may be employed are finely-divided cork, coal, coke, ground hard rubber, ground synthetic resins (such as phenol-aldehyde resins), pyrobitumens, and the like.

More generally, any finely-divided solid 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. 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 of this invention, we have found it essential that the filler include particles which are sufficiently finely-divided to pass a 100 mesh testing sieve. The particles passing a 100 mesh testing sieve may be any of the constituent particles passing a 100 mesh testing sieve that are contained in the bituminous composition, namely, may be either of the planar-extended type, or diluent filler not of the planar-extended type, or a mixture of both. We have found that for total filler contents of the non-volatile base ranging from 45% to 70% by weight, the filler particles passing a 100 mesh testing sieve should vary from at least about 20% to at least about 40% by weight, and preferably from at least about 30% to at least about 50% by weight, proportionally. The presence of such finely-divided filler assists in preventing migration of the bitumen upon exposure of the bituminous composition to flame temperature and reduces combustibility and flame spread. Such finely-divided filler also improves the application consistency of the bituminous composition when in solvent-thinned condition suitable for cold process application.

For the preferred range of total filler content, namely, 55% to 65% by weight of the non-volatile base, the filler particles passing a 100 mesh testing sieve should vary from at least about 28% to at least about 35%, and preferably from at least about 35% to at least about 45% by weight, proportionally.

The presence of excessively coarse planar-extended filler materials has been commented upon above. The presence of excessively coarse non-planar-extended filler is also undesirable.

For this reason, it is desirable that the amount of non-planar-extended filler retained on a 14 mesh testing sieve constitute less than 5% by weight of the non-volatile base of the bituminous composition.

Of the fillers other than planar-extended type filler, we prefer to employ kaolinitic type clay, since we have found that the special bituminous compositions of this invention that contain kaolinitic type clay are particularly effective in preventing the separation of the plies of built-up roofing when the roofing is exposed to flame temperature. It is desirable, therefore, that the non-volatile base of the special bituminous composition of this invention contain at least 15% and preferably at least 25% by weight of kaolinitic clay.

Of the filler materials above-mentioned, chrysotile asbestos fiber and Canadian picrolite usually contain about 12% to 15% of water of constitution liberatable at temperatures approaching flame temperature. Other asbestiform mineral fibers are low in water of constitution. Some of the non-fibrous filler materials contain water of constitution that is liberatable at or adjacent flame temperature. Thus kaolinitic type clays, powdered serpentine rock, calcium silicate hydrate and hydrated Portland cement contain 10% or more of water of constitution that is liberatable at or below flame temperatures. When the filler material contains water of constitution liberatable at or below flame temperature, the liberation of moisture causes the bituminous composition as disposed in a built-up roofing to develop pores to a greater extent than otherwise when the bituminous composition is exposed to flame temperature and this is desirable since the pores tend to augment the heat insulating efficiency of the matlike residue that is formed upon exposure of the bituminous composition to flame temperature. It is desirable that the bituminous composition of this invention have incorporated therein a filler material containing water of constitution, which water of constitution is liberatable at or below flame temperature, that amounts to at leas about 5% by weigh of the non-volatile base of the bituminous composition.

In order that there may be a proper overall proportioning of any particular filler or filler mixture to the bitumen, we have found that it is also essential that the non-volatile base of the bituminous composition be formulated within certain limits of plasticity value which has been determined by us, using a Wagner-Bowen mixing bowl plasticimeter, manufactured by E. E. W. Bowen, Bethesda, Maryland, in the modified form illustrated and described in our aforesaid Patent No. 2,424,234.

In the formulation of the bituminous composition of this invention the Wagner-Bowen plasticity value at 400° F. of the non-volatile base of the bituminous composition should be greater than 250 grams but should be less than 1000 grams. Preferably the Wagner-Bowen plasticity value at 400° F. of the non-volatile base should be between 275 and 700 grams. The Wagner-Bowen plasticity value at 400° F. of the non-volatile base of the above described specific example of the invention is about 315 grams. The foregoing Wagner-Bowen plasticity values are determined using the Wagner-Bowen plasticimeter and the test procedure with reference thereto that are fully disclosed in our aforesaid Patent No. 2,424,234 and reference herein or in the claims to the Wagner-Bowen plasticity value at 400° F. of the non-volatile base of the bituminous composition of this invention is to such pasticity value as so determined.

It is also important that the bituminous composition as formulated in solvent-thinned condition for cold process application in the construction of built-up roofings be formulated within predetermined limits of Wagner-Bowen plasticity value at 77° F. The Wagner-Bowen plasticimeter that is used for making this determination is identical with that referred to hereinabove and described and illustrated in our aforesaid Patent No. 2,424,234 except that a different type of drag tool is employed. Thus instead of using the drag tool shown in Figs. 19 and 20 and in detail in Figs. 21A and 21B of the drawing of our said patent, the drag tool used is in the form of a simple rod $\frac{3}{16}$ inch in diameter which extends horizontally from the collar **128** fixed to the vertical shaft **127** and which has a shorter end portion bent downwardly so as to be 90° to the horizontal portion for penetrating below the surface of the bituminous material in the mixing bowl of the plasticimeter. The foregoing reference characters are those appearing in the drawing of our Patent No. 2,424,234 and the direction of the emanation of the horizontal portion of the rod from the shaft **127** is the same as that of the rod **146** comprised in the drag tool shown in Patent No. 2,424,234. The length of the horizontal portion of the rod measured from the axis of the shaft **127** to the axis of the turned down end portion of the rod is $4\frac{1}{8}$ inches. The distance from the axis of the horizontal portion of the rod to the tip of the turned down end portion is $1\frac{1}{32}$ inches. The distance between the tip of the turned down end portion of the rod and the upper surface of the bottom of the bowl of the plasticimeter is $\frac{3}{4}$ inch. The turned down end portion of the rod is directed downwardly at an angle of 33° to the vertical in the clockwise direction as regards rotation of the bowl of the plasticimeter about its axis. In carrying out the test for determining the Wagner-Bowen plasticity value at 77° the depth of the composition in the mixing bowl as it passes the drag tool is one inch, and the lower end of the measuring rod which acts as an indicator respecting the proper depth of the composition in the bowl as shown in our Patent No. 2,424,234 is adjusted so as to be one inch from the bottom of the bowl. Except for the difference in the nature of the drag tool and for the difference in the depth of the composition in the plasticimeter bowl as it passes the drag tool and for the difference in the temperature maintained in the test, the measurement of the Wagner-Bowen plasticity value at 77° F. of a solvent-thinned composition is as described and illustrated in our Patent No. 2,424,234 and reference herein or in the claims to such value is to such value as so determined with the changes described.

In formulating the bituminous composition in solvent-thinned condition we have found that the Wagner-Bowen plasticity value at 77° F. should be between 15 and 125 grams and preferably is between 25 and 75 grams. The Wagner-Bowen plasticity value at 77° F. of the solvent-thinned composition of the above described example of this invention is about 52 grams.

With regard to the bitumen that is employed, it has been pointed out above that the softening point of the bitumen may be between 80° F. and 150° F. and that the per cent. by weight thereof on the non-volatile base may be between 30%

and 55%. However, in preferred practice, the bitumen used has a softening point between 115° F. and 135° F. and constitutes from about 35% to about 45% by weight of the non-volatile base of the bituminous composition. The softening points referred to are determined by the standard ring and ball softening point test. Asphalts from Mid-Continent crudes are desirable although other asphalts are suitable, such as those obtained from Mexican, Venezuelan, and Colombian crudes. Moreover, other bitumens, such as pitches, coal tar and the like may also be used in the practice of this invention. We have found that the flow resistance coefficient of a given amount of filler is usually somewhat higher in the case of a cracked asphalt as compared with other types of asphalt, and for this reason may be advantageously employed especially in substrata of a built-up roofing where there is to be little direct exposure to the weather. When, however, the special bituminous composition of this invention is to be used for direct exposure to the weather, it is usually preferably to employ some bituminous or asphaltic material other than cracked asphalt as all, or as the major proportion of, the bitumen content of the non-volatile base of the special bituminous composition.

When reference is made herein to "bitumen," this term is used in reference to asphalt, pitch, tar or the like by itself and unmixed with filler. When, on the other hand, reference is made herein to bituminous composition or a bituminous material or a bituminous layer, reference is made to a composition, material or layer comprising bitumen either with or without filler. Any modifier, e. g., of a resinous or oily character that may be mixed with the bitumen is to be regarded as part of the bitumen content of the composition.

The bituminous composition as made up for "cold process" application in the construction of built-up roofing has, of course, a solvent for the bitumen in the composition so that the solvent that is present, by dissolving the bitumen, will reduce the bituminous composition to the desired condition of workability and spreadability. The solvent that is employed should likewise be of such volatility that after the solvent-thinned composition of this invention has been applied as a layer, the solvent will evaporate therefrom within a reasonable time and cause the layer of bituminous composition to set up because of loss of solvent therefrom. By "volatile" solvent, as this term is used herein and in the claims, the reference is to a solvent which is adapted to dissolve the bitumen in the bituminous composition and which, in a bituminous composition such as that hereinabove described as a typical example of the practice of this invention, exhibits fugacity of the order of, or greater than, carbon tetrachloride. In the case of inflammable solvents, it is ordinarily desirable that the solvent not have a flash point below about 80° F.

Any of the solvents for bitumen may be employed, examples being petroleum fractions of suitable volatility and flash point, those supplied in the naphtha class being preferable. Turpentine is also suitable.

In addition to the foregoing non-inflammable solvents, solvents such as carbon tetrachloride and tetrachlorethylene may be used. With regard to the employment of non-inflammable solvents, we have found as a result of our research that use of non-inflammable solvents contributes only slightly to the fire resistive properties of the special bituminous composition of this invention.

While any volatile solvent for the bitumen in the bituminous composition may be employed in the practice of this invention, we have found that the fire resistive properties of the composition are very markedly improved by employment of a solvent having a high solvent power for the bitumen in the bituminous composition, namely, one which reduces the solvent-thinned composition to within the limits of Wagner-Bowen plasticity value at 77° F. that have been set forth above (15 to 125 grams) when employed in relatively small proportion in the bituminous composition. Ordinarily it is preferable to employ a solvent which reduces the bituminous composition to within the aforesaid limits of Wagner-Bowen plasticity value at 77° F. when the solvent constitutes 35% or less of the bituminous composition, and for obtaining optimum results the solvent constitutes not more than 20% by weight of the bituminous composition. In ordinary practice we have found that the best results from the point of view of fire resistance are obtained when the solvent is present within the aforesaid limits while maintaining the Wagner-Bowen plasticity value at 77° F. within the preferred limits above stated for the value, namely, 25 to 75 grams. It is also desirable to employ in preferred embodiments a solvent of high fugacity, namely, a solvent which, in a bituminous composition such as that of the above described typical example of the practice of this invention, exhibits a fugacity of the order of, or greater than, petroleum naphtha of the boiling range 300° F. to 400° F., and any such solvent is referred to herein and in the claims as a "highly fugitive solvent" for the bitumen.

The foregoing regarding the fugacity and solvent power of the solvent is of importance in attaining high fire resistive properties when the bituminous composition is employed as a substratum in the body of a built-up roofing (namely, under an overlying layer of felt or the like), since we have found that the fire resistiveness of the roofing is adversely affected by the retention of volatile solvent, whether the solvent is inflammable or non-inflammable, due to the tendency of retained solvent to induce flow of bitumen which in turn induces flammability and combustibility. In the construction of built-up roofing by cold process application of bituminous composition, sheet material that overlies a layer of the special bituminous composition is necessarily put in place while the layer of bituminous composition is still somewhat tacky and adhesive due to presence of some retained solvent. This retained solvent thereafter becomes entrapped and many months may elapse before the amount of retained solvent becomes materially reduced as a result of gradual permeation to and escape from an outer surface of the roofing. We have found that the retention of solvent in built-up roofing made from solvent-thinned bituminous composition constitutes the chief reason why this type of built-up roofing has presented a particularly great fire hazard and why the problem of affording high fire resistance in the case of this type of built-up roofing is especially difficult. The problem of attaining high fire resistance in connection with this type of built-up roofing has been largely attained by the special formulation of the non-volatile base of the bituminous composition. However, it is important in attaining very high

fire resistance according to this invention that the solvent used be of the type and amount hereinabove defined.

While the composition of this invention is ordinarily made up so as to be suitable for application at ordinary atmospheric temperatures, it is not without the scope of this invention to subject the composition to mild heating, e. g., in cold weather, to increase the fluidity of the composition for application and such mild heating is not inconsistent with "cold-process" application as distinguished from the hot application of ordinary mopping asphalt at temperatures of the order of 300° F. to 350° F.

It is apparent that compositions other than the specific example hereinabove given of a typical embodiment of this invention will meet the requirements of the definition hereinabove stated for those bituminous compositions which are adapted for cold process production of built-up roofings having high fire resistance although the narrowness and criticality of the limitations imposed by the definition of this invention confine the possible variations within close limits of formulation.

While reference has been made hereinabove to the employment of felt consisting of organic fibers or asbestos fibers, and to the impregnation of felt with a bituminous waterproofing material, it is apparent that any other sheet-like strain-resisting material can be employed in the fabrication of built-up roofings employing the special fire resistant bituminous composition of this invention. Thus sheets of woven fabric such as canvas or duck may be employed, or sheets of unspun fibrous material and generally any type of fibrous sheet-like base material, either foraminous or non-foraminous, and impregnated or unimpregnated, may be employed. Moreover, the impregnating material for the fibrous sheet may be bituminous or some other type of binder or waterproofing material.

The bituminous composition of this invention may be used for other purposes than the construction of built-up roofing and is suitable generally as a cementing composition for application to surfaces and for binding plies of sheet material together with a waterproofing bituminous layer. While the composition as applied contains the volatile solvent, the volatile solvent gradually evaporates during and after application. The non-volatile constituents of the composition of this invention afford the high fire resistive properties that have been referred to hereinabove after the volatile solvent has been evaporated and this invention relates both to the cementing composition in its solvent thinned condition and to the cementing composition in its wholly or partially dried condition as characterized by the formulaton of the non-volatile constituents.

While this invention has been described in connection with certain illustrative embodiments thereof, it is to be understood that this has been done for the purpose 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 solvent-thinned bituminous cementing composition adapted for application to provide a waterproofing layer in the construction of built-up roofing which consists essentially of non-volatile constituents constituting the non-volatile base of the bituminous composition, and a volatile solvent for the bitumen in said non-volatile base, said non-volatile base comprising about 35% to about 45% by weight of bitumen having a softening point of the range 115° F. to 135° F. and about 55% to about 65% by weight of finely-divided solid water-insoluble filler having a melting point above 500° F., said filler comprising planar-extended filler consisting of particles which pass a 6 mesh testing sieve and which do not have more than one dimension greater than .046 inch and the grading index of which has a ratio to the percent by weight of the bitumen in said non-volatile base of at least 1 to 5, the ratio of the grading index of said planar-extended filler to the percent by weight of the bitumen in said non-volatile base being not greater than about 1 to 2.5, said finely-divided solid water-insoluble filler comprising material passing a 100-mesh testing sieve which is any constituent particles passing a 100 mesh testing sieve comprised in the total filler and which constitutes in said non-volatile base at least about 35% to at least about 45% by weight of said non-volatile base proportionally for total filler contents ranging from 55% to 65% by weight of said non-volatile base, said filler comprising heat-resistant mineral filler the ratio of the percent by weight of which in said non-volatile base to the percent by weight of bitumen in said non-volatile base is at least 1 to 2, said non-volatile base having a Wagner-Bowen plasticity value at 400° F. greater than 275 grams and less than 700 grams, said volatile solvent constituting not greater than 20% by weight of said bituminous composition and having fungacity in said composition at least as great as carbon tetrachloride, and said bituminous composition as thinned by said solvent having a Wagner-Bowen plasticity value at 77° F. between 25 and 75 grams.

2. A solvent-thinned bituminous cementing composition according to claim 1 wherein said volatile solvent is a highly fugitive solvent.

3. A solvent-thinned bituminous cementing composition according to claim 1 wherein said planar-extended mineral filler consists in major proportion by weight of asbestiform mineral fibers.

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HAROLD W. GREIDER.


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