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PROCESS OF PROTECTING UNDERGROUND METALLIC SURFACES

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This invention relates to a method of protecting metal surfaces adapted to be placed underground so that corrosion of the surface is inhibited, the method involving application of the mica pitch composition disclosed in my co-pending application Serial No. 475,839 filed August 16, 1930, and in application Serial No. 334,608 filed January 23, 1929, the latter application having issued as Patent No. 1,773,131 on August 19, 1930.

As disclosed in my co-pending application, one object of my invention is to provide a toughened pitch composition which will not bleed or run at the highest temperatures encountered in use and, on the other hand, will not break or shatter at low temperatures which may be encountered at times. Coal tar and oil tar pitches have heretofore been used for coating and surfacing but present the difficulty that if the melting point of the pitch is made sufficiently high to overcome flow when exposed to maximum summer temperatures, the pitch will be excessively brittle when exposed to low temperatures, i. e., winter temperatures. According to the Manhayfer Patent No. 1,112,817 of October 6, 1914, the surfacing and coating properties of pitch are improved by intermingling infusorial earth of kieselguhr therewith in such quantities and proportions as to render the finished product plastic. Infusorial earth, it has been found, clings together in lumps and it is difficult to homogeneously disperse it in the pitch. When dispersed it readily settles out of the pitch upon melting of the pitch-infusorial earth mixture. Due to the physical structure of the infusorial earth, it serves merely as a filler and does not substantially increase the tensile strength of the coating resulting from the application of infusorial earth-pitch mixtures to the surface to be protected. In other words, the effect of the infusorial earth on the pitch is comparable to the effect of a stone aggregate incorporated in concrete on the concrete, i. e., it increases the compressive strength but does not materially increase the tensile strength of the concrete.

According to my invention, mica is mixed with pitch to produce a toughened-pitch composition. Mica is less expensive than infusorial earth, does not cause foaming when mixed with pitch, remains in suspension without an appreciable tendency to settle out, is flaky in structure and has great tensile strength so that when admixed with pitch it imparts binding strength to the mixture and thus prevents breaking and shattering thereof at low temperatures. Due to the leaf-like structure of mica it greatly increases the

tensile strength of the resultant coating. The effect that mica has of increasing the tensile strength of the coating may be considered analogous to the effect of reinforcing steel incorporated in concrete on the concrete. Per unit of mica in the mica pitch composition, as compared with "spheroidal" fillers such as infusorial earth in earth pitch compositions, the surface of mica contacting with the pitch is far greater and hence far greater reinforcement is obtained by incorporating mica in pitch. Due to the increased reinforcement obtained by the use of mica less mica than infusorial earth is required to produce a composition resulting in a coating of desired strength. Hence, for a given strength coating the mica pitch composition contains less mica filler than the infusorial earth filler, and the mica pitch is correspondingly more fluid at any temperature above its melting point than an earth filled composition. It follows, therefore, that the mica-pitch composition can be applied satisfactorily at lower temperatures. Hence, less evaporation of volatile content from the composition takes place. Furthermore the pitch content of the coating is the important protective agent. With mica pitch compositions more pitch is present for each pound of composition or unit of thickness of coating produced thereby and, hence, the surface covered with the coating is more effectively protected as compared with coatings made by applying other filled compositions such as infusorial earth-pitch compositions.

A commercial mica readily obtainable on the market as such may be used and preferably ground mica of from 60 to 100 mesh is admixed with pitch to form this improved composition. I have found that satisfactory and improved results may be obtained with a ground white mica having the following mesh composition:

	Per cent
Retained on 28 mesh.....	0.1
Passing 28 mesh retained on 48 mesh.....	13.8
Passing 48 mesh retained on 60 mesh.....	11.2
Passing 60 mesh retained on 80 mesh.....	11.7
Passing 80 mesh retained on 100 mesh.....	13.0
Passing 100 mesh retained on 150 mesh.....	10.9
Passing 150 mesh retained on 200 mesh.....	6.5
Passing 200 mesh.....	31.8
Loss.....	1.0
Total.....	100.0

The mica of the above mesh composition is known as No. 80 mica.

The term "pitch" as used herein is intended to include equivalent bitumens and residues obtained from the distillation of tars and oils, such as coal tar pitch and pitches obtained from coke oven gas and water gas tar, oil tar, pine tar, cannell tar, asphalt, and petroleum residuums, petroleum pressure still tars, pressure still pitches or mixtures of the aforementioned materials.

The mixture of pitch and mica is preferably prepared by first melting the pitch and then adding from 10 to 30 per cent mica thereto, agitating the pitch while adding the mica and agitating the mixture of pitch and mica preferably by a suitable mechanical agitator or stirrer until a substantially homogeneous mixture of pitch and mica is formed. It will be noted that the resultant mixture is made by admixing a major proportion of pitch with a minor proportion of mica, in the particular embodiment disclosed, 10 to 30 per cent mica. A pitch of sufficiently high initial melting point to give a mixture of the desired melting point is of course used as the starting pitch. A pitch of lower melting point may be distilled in the usual manner to remove distillate oils until the resultant pitch is of the desired melting point and then the resultant pitch may be mixed with mica of from 60 to 100 mesh to form the desired mica-pitch mixture. I have found that a part of the mica may be replaced by asbestos without deleteriously affecting the surfacing and coating properties of the mixture. Preferably, however, mica is used as the sole filler for the pitch.

The following tabulated properties of mica-pitch compositions and infusorial earth pitch compositions involving the same starting pitch will serve to indicate the greater efficiency of mica in raising the melting point of pitch:

Example No.	Composition		Melting point pitch mixture
	Pitch		° F.
1	75%	25% mica	198
2	72%	28% mica	189
3	75%	25% infusorial earth	163
4	71.5%	28.5% infusorial earth	167

The following tabulated properties of mica-pitch compositions serve to emphasize the differences between mica-pitch compositions and corresponding untreated pitches:

Example No.	Composition	Melting point pitch (untreated)	Melting point mica-pitch mixture	Slide in 7 hours at 70° C.
5	21.4% mica	125° F. (known as paving pitch).	187° F.	1/4"
6	78.6% pitch	125° F. (known as paving pitch).	146° F.	1 3/4"
7	18% mica	143° F. (known as roofing pitch).	167° F.	1 1/4"
8	82% pitch	143° F. (known as roofing pitch).	187° F.	5/16"
9	21% mica	165° F. (known as water gas tar pitch).	180° F.	3/4"
10	79% pitch			
11	20% mica			
12	80% pitch			

It is evident from the foregoing that mica incorporated in pitch raises the melting point a considerable extent, to wit, 62° in the case of example 5 involving a paving pitch having a melting point of 125° F.; 21° in the case of Example 6 involving a paving pitch; 24° in the case of Example 7 involving a roofing pitch of the melting point of 143° F. and having 18% mica incorporat-

ed therein; 44° in the case of Example 8 involving a roofing pitch of 143° F. melting point and having 21% mica incorporated therein and 15° in the case of Example 9 involving a water gas tar pitch having a melting point of 165° F. and having 20% mica admixed therewith. It will be noted that the physical characteristics of the mica-pitch composition are dependent upon the particular pitch used and the amount of mica admixed therewith. Further, the preferred composition disclosed herein consists only of two ingredients, to wit, pitch and mica.

As disclosed in my co-pending application, the mica-pitch mixtures described herein have been found particularly valuable as a coating medium for pipe lines and metals generally to prevent corrosion. Pipe lines are particularly subject to corrosion underground because of the electrolytic action of ground currents which cause rapid deterioration of the pipe line in the field of the electric current, particularly where the ground is moist or contains ground water, as is frequently the case over long sections of pipe lines used for transporting oil and gas, and in the case of pipe lines in cities which are necessarily adjacent sewers and water lines. The mica-pitch composition described herein, when applied as hereinbelow described to form a smooth, uniform coating, acts to inhibit to a remarkable degree the corrosive action of ground currents on the metal surfaces to which it is applied. I attribute this property of the composition to the insulating quality of the pitch and of the flat flakes of mica homogeneously distributed therein which form insulating laminae throughout the composition. Further, since the mica enhances the tensile strength and non-permeability to water of the coating composition, the tendency of ground currents to follow lines of moisture penetrating the composition is greatly reduced. This non-permeability of the mica-pitch composition to moisture and ground currents with resulting corrosive action on the pipe line, is further minimized by reason of the smooth, glossy outer surface which is a characteristic of my mica-pitch composition, which smooth outer surface does not present irregularities and rough spots constituting points of attack for seepage water and corrosion due to soil movements. Thus corrosion of underground surfaces is inhibited to a surprising degree by applying to such surfaces a substantially uniform coating of the mica-pitch composition of my invention. This composition may be applied to pipes or metals by dipping the pipes or metals after priming into a bath containing the mica-pitch mixture or by wiping or pouring the mica-pitch composition onto the material or article to be coated or by any other suitable means such as spraying and the like.

The property of the mica-pitch mixture to become freely fluid at elevated temperatures, i. e., at temperatures somewhat above the melting point of the mica-pitch mixture, renders the mixture as hereinabove indicated particularly suitable for application to pipes or metals by dipping, wiping, pouring, or spraying processes. The mica-pitch composition at temperatures below the melting point is substantially solid but upon being heated to somewhat above the melting point becomes freely fluid, forming a liquid which is substantially homogeneous throughout and which I have found is admirably suited for purposes of coating or enameling metal.

As above indicated, in order to adequately

protect the metal surface it is important that a smooth, substantially uniform coating, i. e., free from pits and openings and of substantially uniform thickness, be formed on the metal surface so that no portion thereof is exposed to soil conditions upon burial. I have found that the mica-pitch composition of my invention forms such coating when applied at a temperature somewhat above its melting point and such that the composition is freely fluid. The temperature of application of the mica-pitch enamel should not be greater than 200° F. above its melting point. Thus, for the mica-pitch composition disclosed herein having a melting point, in round numbers, of from about 150° F. to 200° F., the maximum temperature at which the enamel is maintained during application should not be greater than about 350° F. to about 400° F. By keeping the enamel within this temperature range its composition will not be radically changed, i. e., substantial evaporation of the oil content of the pitch and substantial decomposition of the pitch content with free carbon formation will not take place. With other than mica fillers for pitch in order to produce a composition which can be applied to pipe to form a uniform coating thereon, it was found necessary to heat the composition to such high temperatures that degradation of the pitch took place.

To form a satisfactory coating, the enamel must wet the surface to be coated and bond with the primer usually employed, and a certain degree of flow of the enamel must take place before it sets in order to permit the formation of a smooth even surface. To meet these conditions, the enamel must be above a certain minimum temperature hereinabove pointed out when applied, so that premature setting of the enamel is avoided. As the primer for the pipe a bituminous paint free of fillers, free flowing and containing a volatile solvent which evaporates upon application of the primer to the pipe may be employed. Pitch dissolved in a solvent, which upon application, forms a thin coating with which the mica pitch composition bonds has been found a satisfactory primer.

I have found that an eminently satisfactory coating can be produced by applying the mica-pitch enamel at a temperature at least about 125° F. above its melting point. Thus, for mica-pitch enamels herein disclosed having a melting point of from about 150° F. to about 200° F., the minimum temperature of the enamel during application should be from about 275° F. to about 325° F. respectively. While the enamel might be applied at a lower temperature than that herein indicated, for the best results the temperature should be at least about 125° F. above its melting point.

One possible theory which may provide an additional reason why optimum results follow from applying the enamel at the minimum temperature indicated is as follows: In order to obtain an effective coating it is important that the mica particles therein be coordinated with respect to the surface of the coating, e. g., the mica flakes be arranged parallel to the surface forming laminae which reinforce the coating and improve the non-conducting qualities thereof. A sufficient time interval must be allowed between the time of application of the enamel and the time of setting for the mica particles to become properly coordinated with respect to the surface. If the temperature of application is below the opti-

mum minimum temperature specified the enamel will set before an opportunity is afforded the mica particles to become properly coordinated. By applying the enamel within the range specified, i. e., for enamels having a melting point of from about 150 to about 200° F. at a temperature of from about 325 to about 400° F., an opportunity is afforded the mica particles to become properly coordinated with respect to the surface of the coating and a smooth, uniform, glossy coating results.

Whether the coating is applied by dipping, draining or spraying, it is important, as noted above, that the temperature of the mica-pitch composition be maintained not lower than that at which it will flow readily to produce a smooth, uniform coating. If the pipe to be protected is to be dipped into a bath of the enamel and then removed, the desired smooth, uniform, glossy coating in accordance with this invention is produced by the excess enamel draining from the dipped pipe. If the temperature of the enamel is such that it is not freely fluid the enamel will not drain uniformly from the pipe but the excess enamel will set and harden on the pipe, resulting in a coating of different thicknesses in which weak spots appear. Likewise if the enamel is applied to the pipe by pouring it on while rotating the pipe and the temperature of the enamel is below the optimum minimum temperature hereinabove pointed out, the enamel may not wet the pipe nor bond with the primer usually employed and will not flow over and uniformly coat the pipe but will set on the pipe during its rotation without covering the complete surface thereof.

I have found that mica-pitch compositions, applied to pipe, while maintained at a temperature falling within the range hereinabove specified, result in a smooth, glossy, uniform coating through which the mica particles are substantially uniformly distributed in the form of laminae. The thickness of the coating will depend upon the particular temperature of application of the enamel. For example, with an enamel having a melting point of about 200° F. and applied at a temperature of about 395° F., a coating approximately $\frac{1}{8}$ inch thick resulted. When the temperature of application of this enamel was lowered to 335° F. a coating approximately $\frac{1}{4}$ inch thick resulted.

The melting point of the mica-pitch mixture herein given is determined by the Ring and Ball Method, A. S. T. M. Standard Method D-36-26.

While preferred embodiments of this invention have been described, it will be understood that this invention is not to be limited by the disclosure herein but only by the scope of the appended claims.

I claim:

1. The method of coating metallic pipes which comprises applying in heat liquefied condition a composition constituted of a major proportion of pitch and a minor proportion of finely divided mica, said composition having a melting point of from about 150° F. to about 200° F., to the pipe while the said composition is in heat liquefied condition at a temperature of from about 325° F. to about 400° F., causing the said composition in said heat liquefied condition to completely cover the pipe and then set thereon to produce a smooth, uniform coating covering the exterior of the pipe.

2. The method of coating metallic pipes which comprises applying a pitch primer to the pipe, 75

applying in heat liquefied condition a composition constituted of from 70 to 90 per cent coal tar pitch and from 10 to 30 per cent finely divided mica, said composition having a melting point of from about 150° F. to about 200° F., to the primed pipe while the said composition is in heat liquefied condition at a temperature of from about

325° F. to about 400° F., causing the said composition in said heat liquefied condition to completely cover the pipe and then set thereon to produce a smooth, uniform coating covering the exterior of the pipe.

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