

UNITED STATES PATENT OFFICE.

JAMES A. W. PINE, OF NEW YORK, N. Y.

METHOD OF REJUVENATING ASPHALT.

938,698.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, JAMES A. W. PINE, a citizen of the United States, and resident of the city of New York, in the county of New York and State of New York, have invented new and useful Improvements in Methods of Rejuvenating Asphalt, of which the following is a specification.

This invention or discovery relates to a method of rejuvenating or revitalizing asphalt, and particularly "lake" asphalt, so-called, or asphalt of the type of Trinidad Lake asphalt, wherein the cementitious properties of the bitumen have become exhausted or devitalized or deteriorated through chemical action, or by causes other than injury due to wear and abrasion.

Although this invention or discovery relates to the treatment of the asphalt itself, I believe that its most useful application, and perhaps its best expression, is found in the treatment of such asphalt contained in artificial mixtures used for asphalt pavement, and I will therefore address my description to the treatment as applied to such asphalt pavement. It is to be clearly understood however that my invention or discovery is applicable to the treatment of asphalt of said type in and of itself, whether commingled or compounded with other material or not.

In this country the greater part of the asphalt pavement used, approximately 90% thereof, is composed of a concrete mixture in which Trinidad asphalt or asphalt of that type, as distinguished from the rock asphalt commonly used in Europe, constitutes the cementitious material. In making asphalt pavements of this character, which are artificial mixtures, it has been the custom to fuse together refined Trinidad asphalt, or asphalt of that type, with a heavy petroleum residuum in the proportion of about 100 pounds of asphalt to 20 pounds of petroleum residuum. The fusion of these two materials makes an asphaltic cement which is the cementing material that holds together the non-bituminous mineral matter, such as sand or stone dust, in the form of bituminous concrete. It is designed to have about 10% of soluble bitumen in the pavement mixture and the quantity of asphalt cement used depends upon its purity. Asphalt cement composed of Trinidad asphalt and petroleum residuum usually contains about 33 $\frac{1}{3}$ % of earthy matter which was originally present in the crude asphalt. The method of manufacturing this artificial as-

phalt concrete is to heat the sand to about 400° F., and to heat the asphalt separately in kettles, adding the fluxing material, such as petroleum residuum, and agitating until a thorough fusion is obtained; then the hot sand is dumped into a mechanical mixing machine and the asphaltic cement afterward poured over it while at a temperature of about 300° or 350° F., and by means of agitation each grain of sand becomes coated with the asphaltic cement. The mixture so made is taken to the street and spread while hot upon the foundation to the desired thickness and rolled with heavy rollers to a smooth and satisfactory surface, and when cold it is ready for traffic.

It has been found that a pavement made in the aforesaid manner is subject to deterioration by rotting or by disintegration or by reason of chemical changes or other causes resulting in the exhaustion or deterioration of the cementitious properties of the bitumen, as distinguished from injury due to stress of traffic, wear, improper mixing of the asphaltic mixture, or similar causes which do not affect the inherent cementitious properties of the bitumen. The precise internal character of the exhaustion or deterioration of the asphalt contained within the mass is difficult to determine. It is believed that water plays a part in the destructive process; that uric acid plays a part; that illuminating gas escaping from gas pipes below the pavement acts to some extent as a solvent to destroy the cementitious properties of the bitumen; it is probable that the presence of salt in the crude asphalt has some effect in the deteriorating process, and that the use of improper fluxes such as petroleum residues having a paraffin base, also has a deteriorating effect.

Whatever may be the cause or causes of the deterioration, disintegration, or exhaustion, and whatever the precise unascertained chemical change in the structure, the result of the deterioration or exhaustion or devitalization of the cementitious properties of the bitumen, is that the asphalt pavement becomes lifeless, crumbly and easily friable. The appearance of the exhausted or devitalized asphalt in such deteriorated pavement is that of an inelastic and easily friable mass; its color is dull brown as contrasted with the brilliant black of fresh asphalt; and such deterioration of the asphalt pavements usually first exhibits itself in brown

patches which quickly go to pieces under the stress of traffic. Heretofore it has been the practice to remove this rotted or deteriorated part of the asphalt pavement and to patch the hole thus produced with fresh made asphalt concrete in a manner well known, the exhausted or devitalized asphalt pavement, which is removed, being thrown away and regarded as a wholly useless waste product. It is estimated that some sixty millions of square yards of this artificial asphalt pavement containing approximately one million tons of asphalt, have been laid in the cities of the United States during the past thirty years, and that the average life of such pavement is about ten years.

The quantity of the exhausted or devitalized asphalt pavement which is annually thrown away as a waste product as above described has been and is enormous, and it is estimated that not less than one million square yards of said exhausted pavement is thrown away annually. Several attempts have been made and processes patented for using old asphalt paving material over again by mixing it with fresh material containing sufficient new bitumen to furnish the proper cementitious properties for the whole mass, but these attempts have never been practically successful and have never been carried beyond an experimental stage, and, so far as I am aware, it has never been proposed before my discovery to revitalize or rejuvenate the exhausted asphalt contained within said old asphalt paving material, so as to restore its cementitious properties, as distinguished from adding to such material fresh asphalt, and so in effect making a new mixture, and using the old material simply as the non-bituminous mineral ingredient in place of new sand or the like.

The almost universal practice, prior to my invention or discovery, has been to send the exhausted pavement, which has been taken up in the course of repairs, to the dump, thus wasting it entirely. By the use of my invention or discovery all this exhausted and devitalized pavement, which is now thrown away, may be rejuvenated and revitalized without the addition of fresh bitumen or other cementitious material, and restored as often as it becomes exhausted, to a condition equal to or better than fresh prepared material for pavement construction.

In practicing the invention I subject the mass of pavement containing such deteriorated or exhausted asphalt, to a temperature of between 300° and 400° F. using preferably a temperature of approximately 360° F. under conditions which allow the heat to penetrate uniformly throughout the mass. Any suitable apparatus may be employed for thus heating the material, and preferably the mass of material is agitated during the process of heating, or immediately there-

after while hot. As a result of this treatment the appearance and quality of the exhausted or devitalized asphalt changes. It is restored to a bright black color and becomes elastic and tenacious, and the bitumen recovers its original cementitious properties. The mass becomes homogeneous and granular as the heated mass is mechanically worked, and in short, the mixture is restored to a condition equal to or better than that of the original fresh asphalt mixture, and its substance is indistinguishable either superficially or by analysis from the original mixture prepared from fresh material for pavement construction. Thus, out of a new raw material consisting of exhausted, crumbly and devitalized asphalt pavement which has heretofore been treated as a waste product having no value whatever, an asphalt mixture is produced which is in all respects equal to the original mixture, and is probably superior thereto owing to the fact that the soluble salt, which existed in the original crude asphalt and which has a deleterious effect upon the cementitious properties of the bitumen, has probably become more or less dissolved in use, and also owing to the fact that any improper fusion between the asphalt and the fluxes used in the original manufacture of the mixture may be corrected in my process.

It is believed that this process is applicable solely to asphalt known as "lake" bitumen, of which Trinidad asphalt is a type, and to mixtures compounded thereof, and that such asphalt as rock asphalt, which is not subject to internal deterioration or devitalization from the above mentioned causes, and pavements composed thereof, would not require, if indeed they were susceptible to, a revitalizing or restorative treatment such as described. However, inasmuch as the internal character of the chemical changes which bring about the deterioration or devitalization of the bitumen is obscure, I do not desire to limit my claim to the treatment of asphalt of the Trinidad type, or of pavements containing the same, although my process is peculiarly, if not exclusively, applicable thereto.

My invention is applicable to any asphalt which does rot or deteriorate by chemical action or from such causes as are above set forth.

I claim:

1. The method of rejuvenating asphalt, wherein the cementitious properties of the bitumen have become exhausted or devitalized in whole or in part through chemical action or by causes other than injury due to wear or abrasion, consisting in heating a mass of said asphalt to a temperature of between 300° and 400° F. under conditions which allow the heat to penetrate uniformly throughout the mass, whereby the asphalt is

restored to an elastic and tenacious consistency equal or superior to that of fresh asphalt.

2. The method of rejuvenating asphalt pavement, wherein the cementitious properties of the bitumen have become exhausted or devitalized in whole or in part through chemical action or by causes other than injury due to wear or abrasion, consisting in heating the mass containing the deteriorated cementitious material to a temperature of between 300° and 400° F. under conditions which allow the heat to penetrate uniformly throughout the mass, whereby said material is restored to an elastic and tenacious consistency equal or superior to that of fresh asphalt pavement.

3. The method of rejuvenating asphalt pavement, wherein the cementitious properties of the bitumen have become exhausted or devitalized in whole or in part through chemical action or by causes other than injury due to wear or abrasion, consisting in heating the mass containing the deteriorated cementitious material to a temperature of between 300° and 400° F. under conditions which allow the heat to penetrate uniformly throughout the mass, and mechanically agitating the mass while hot, whereby said material is restored to an elastic and tenacious consistency equal or superior to that of fresh asphalt pavement.

4. The method of rejuvenating asphalt pavement, wherein the cementitious proper-

ties of the bitumen have become exhausted or devitalized in whole or in part through chemical action or by causes other than injury due to wear or abrasion, consisting in heating the mass containing the deteriorated cementitious material to a temperature of between 300° and 400° F. under conditions which allow the heat to penetrate uniformly throughout the mass, and mechanically agitating the mass during said heating process, whereby said material is restored to an elastic and tenacious consistency equal or superior to that of fresh asphalt pavement.

5. The method of rejuvenating artificial asphalt pavement compounded from "lake" asphalt wherein the cementitious properties of the bitumen have become exhausted or devitalized in whole or in part through chemical action or by causes other than injury due to wear or abrasion, consisting in heating the mass containing said deteriorated asphalt to a temperature of between 300° and 400° F. under conditions which allow the heat to penetrate uniformly throughout the mass, whereby said "lake" asphalt contained within the mass is restored to an elastic and tenacious consistency equal or superior to that of fresh asphalt.

Signed at New York city this 28th day of August 1908.

JAMES A. W. PINE.

Witnesses:

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ERNEST STAUFFEN, Jr.