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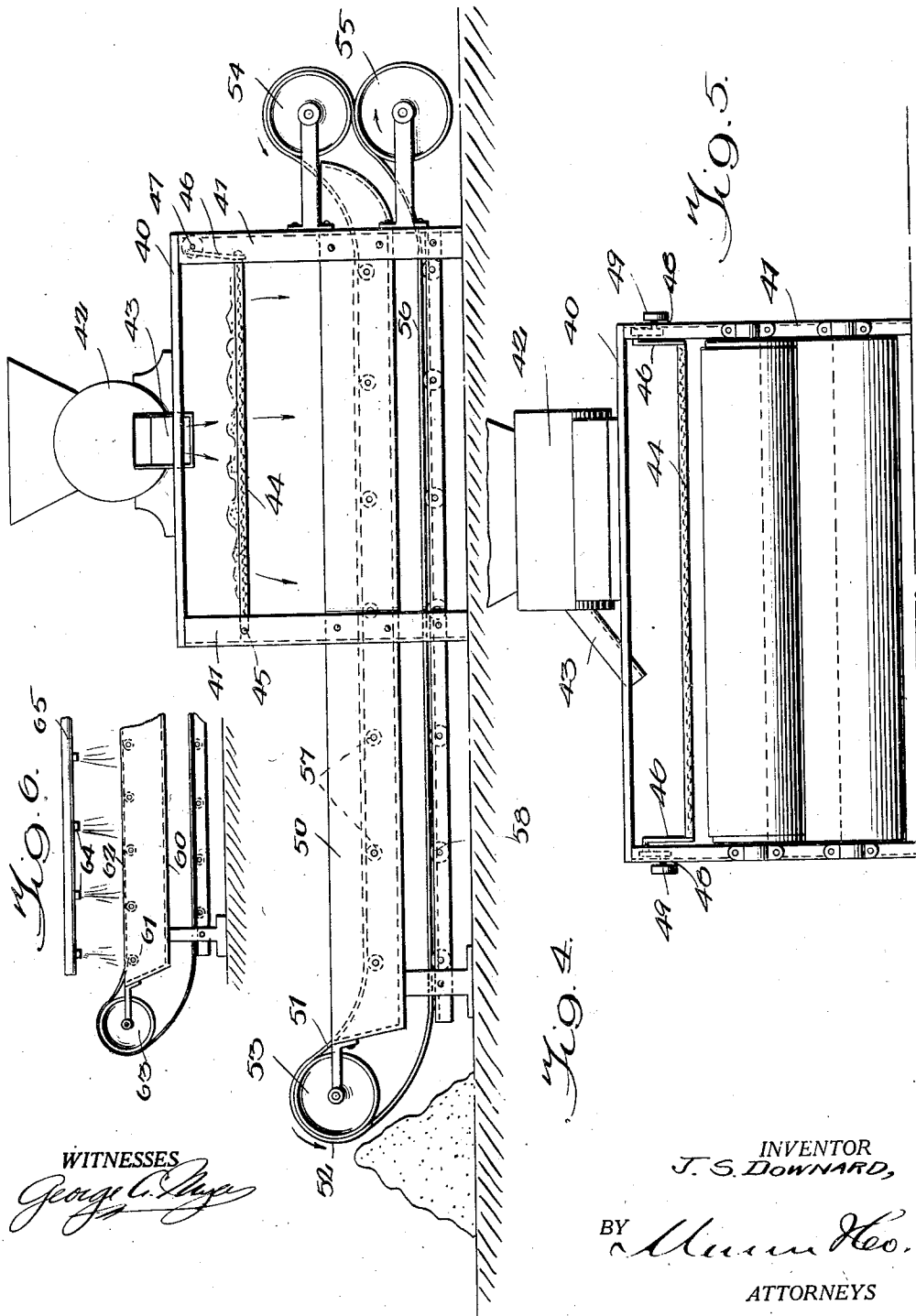
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PROCESS FOR PRODUCING ASPHALT PAVING MIXTURES

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PROCESS FOR PRODUCING ASPHALT PAVING MIXTURES.

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This invention relates to the manufacture and use or application of asphalt products such as asphalt paving mixtures or the like.

Heretofore in this art the preparation and laying of asphalt paving has been rendered highly expensive because of the fact that it has been virtually necessary to provide an elaborate plant and elaborate facilities for the manufacture and production of the asphalt near the point of use. The necessity of providing such plants and facilities near the point of use follows largely from the fact that the asphalt mixture in order to be susceptible of handling and proper application to the roadway must not be allowed to cool after it is once prepared but must be kept hot and in practice it is hauled from the nearby plant in covered and insulated wagons and is raked hot to the desired depth on the previously prepared base or roadway and is then tamped or rolled. The high initial cost and the cost of upkeep of the plant and facilities with such practice is aggravated by the fact that such plants rapidly deteriorate and that their removal from place to place involves enormous expense. It has long been recognized that these difficulties and disadvantages could be avoided if some means or mode could be devised which would enable the asphalt paving mixture to be prepared at a central point and permit of shipment of the same to the point of use in such condition and state as to be susceptible of practical handling and of laying or application to the roadway without the necessity of elaborate treatment. The use of various chemical compositions has been proposed for these expedients, however, involving as they do, the use of chemicals, increase the cost of production, and to some extent supply an inferior product departing from the standard specifications which have been found by long test and experiment to be most satisfactory. Another mode heretofore proposed is known as the inverted penetration method, and consists in flooding asphalt on the base of the roadway and covering it with stone chips or sand and depending upon the traffic on the roadway to mix it but this has been found unsatisfactory because the ingredients are necessarily combined in a haphazard manner and are not properly and accurately weighed, proportioned and mixed. In fact, it is becoming to be recognized by engineers and others skilled in the art that, at this time, the use

of a nearby plant and other facilities which enable the ingredients to be weighed, proportioned and properly mixed and then applied while hot is necessary to the production of satisfactory results although such procedure involves enormous expense and many practical difficulties as above set out.

The object of the present invention is to provide for the production of an asphalt paving mixture of standard specifications at a central plant in such condition and state that it may be shipped while cold from the central plant to the point of use, and yet remain so constituted as to be susceptible of ready and easy handling and adapted to be applied or laid on the roadway as soon as it has been subjected to a simple and comparatively inexpensive treatment.

Accordingly, the invention consists, in its broader aspects, of manufacturing at a central plant an asphalt paving mixture having an asphalt and mineral content conforming to standard specifications as to proportions and ultimate character but in which the asphalt content is so associated with the mineral matter and is preserved in such a physical state that the mixture remains in a granular condition susceptible of ready handling and not liable to become adhesive or to solidify at ordinary conditions of temperature and pressure, although the paving mixture may be changed from a non-adhesive, granular mixture to an adhesive and solidifying mass by a simple and inexpensive heat treatment to which it is subjected at the point of use and immediately prior to laying or application to the roadway. To this end the asphalt content of the paving mixture, up to the time the paving mixture is subjected to the heat treatment, comprises in part asphalt of high melting point which is hard and non-adhesive at ordinary temperatures and in part asphalt of low melting point which is soft and adhesive at ordinary temperature, the two different kinds of asphalts being precluded from blending and tempering one another at ordinary temperatures by separately combining, in a novel and peculiar manner, either or both with the mineral matter and then mingling the same while cold so that the combined mineral matter and asphalts exist in a granular state with both asphalts in effect comminuted or finely divided and with the hard asphalt intermingled throughout the mixture to prevent solidification or consolidation of the

mass at ordinary temperatures. The product produced as a result of these steps is granular, non-solidifying and non-adhesive at ordinary temperatures and may be readily handled and shipped without difficulty and will not mass or bond even when exposed to the heat of the sun and to any conditions which ordinarily exist during handling or shipping, for the high melting asphalt being thoroughly distributed and incorporated in the mixture prevents the particles of the mass from adhering and bonding. At the point of use it is only necessary to heat or warm the mixture so as to mingle the hard and soft asphalt or temper the asphalt content of mixture and thereby produce a paving mixture of standard specifications in that it comprises proper proportions of mineral matter and asphalt of standard and required properties.

In preparing the paving mixture constituting the present invention asphaltum is selected which is not adhesive at ordinary temperatures such as are produced by the sun or air and it can be assumed for all practical purposes that 130° F. is such a temperature. Thus the asphalt as selected must have a melting point above 130° F. and is usually approximately 132° although it may vary somewhat without seriously affecting the results. This melting point is secured by blowing the melted asphalt or by adding tempering agents, such as gilsonite, grahamite or glance pitch or it may be secured in any other known or approved manner. Such asphalt is then melted and is mixed with sand or other mineral matter which has been previously heated and the sand and melted asphalt are thoroughly incorporated in a mixer of any conventional type. From this point on the process consists in so treating the mixture as to cool the same while obtaining and preserving the same in a granular state and the details of the method are set out in the description of the apparatus hereinafter included. There is produced a granulated mixture or mass consisting of grains of sand or particles of mineral matter coated with asphalt at high melting point and not adhesive at ordinary temperatures, such mass constituting 90% of the bulk of the final paving mixture.

Similarly 10% of the bulk of the final paving mixture is separately prepared in precisely the same manner as the 90% above described, the only difference in the two processes residing in the fact that the one which is above described involves the use of an asphalt of a high melting point, and that the other involves the use of a soft asphalt of a low melting point. In both instances however the agitation or other expedients resorted to during, before or after cooling as above described produces a granulated un-solidified mixture of asphalt and sand.

These two mixtures separately prepared as above are then mixed cold so that particles of one are uniformly and thoroughly mingled throughout the other. After such mixture however the resulting product is still of granular form and is non-adhesive and non-solidifying at all times at ordinary temperatures by virtue of the presence of the high melting point asphalt which is distributed throughout the mixture and which precludes the relatively small per cent of soft asphalt from bringing about the adhesion or solidifying of the mass. In this condition the mixture may be shipped from the plant to the point of use and at all stages and when it arrives at its destination it is granular and susceptible of ready and easy handling. When the mixture is to be laid on the road it must be first heated to such an extent that the soft and hard asphalts are blended and tempered, and when this has been done asphalt paving mixture of standard specifications is produced. The only treatment necessary at the point of use is the heat treatment. It is to be understood of course that the heat treatment involves a stirring, circulation or agitation of the asphalt, as some circulation of the comminuted or granulated mixture is essential to effective heating. This treatment is however extremely simple as will be appreciated when it is borne in mind that it does not require the power necessary to incorporate the materials as in the primary mixing nor does it require any means for weighing or proportioning the materials or for drying or heating the sand or melting the asphalt or the like. Indeed in some instances, as where the mixture contains an excess of soft asphalt of low melting point, the material may be laid without heating since the sun provides the necessary heat to blend the materials after the mixture has been transported and placed "in situ," this being accomplished by raking the mixture into a sheet and of course exposing it to the sun thereafter. Ordinarily however, it will be desirable to select the asphalts used in the mixture of such melting point and properties that they will not blend until subject to the action of artificial heat. But if the hard asphalt selected had a softening point of 115 deg. F., and the soft asphalt a softening point of 100 deg. these two would not blend and would stay granular if they were kept in a cool place in the shade, but if exposed to a summer sun in a southern climate, they would bond and blend immediately, especially if exposed in a thin sheet.

In standard paving mixtures the asphalt content varies from 7% of the entire bulk to 10% thereof and the mineral matter varies from 93% to 90%. The mineral matter may be sand, stone, stone dust, chatts, broken slag or any combination of such substances or any hard mineral aggregate reduced to

approximate size, it being preferred that the mineral matter be of a size standard in sheet asphalt, rock asphalt, or asphaltic concrete specification. As the present invention aims to produce a paving mixture which when laid will conform to standard specifications as well as to have the other advantages herein set forth, regard is had to these proportions in determining the proportion of hard asphalt and soft asphalt utilized in carrying out the present invention. Obviously, the proportions of hard asphalt and soft asphalt utilized may be varied to suit conditions and to the character and quality of the materials used. For the sake of illustration the proportions which may be utilized in preparing certain mixtures are set out in examples as follows:

Example No. 1.

(A) Take of hot sand, 90 parts by weight, and mix this with melted asphalt of 96 penetration until the asphalt is thoroughly incorporated, amount of asphalt used being 10 parts by weight. Cool and granulate.

(B) Take of hot sand, 90 parts by weight, and of asphalt, 10 parts by weight, the asphalt to be of 9 penetration, properly melted and incorporate the sand and asphalt by mixing, then cool and granulate the mixture.

Take of A, 85% by weight, and of B, 15% by weight, mix thoroughly, and the mixture is ready for shipment. At the point of use heat the mixture and it will produce a pavement having a cementing asphalt of a penetration of 58 degrees.

Example No. 2.

(A) Take of hot sand, 90 parts by weight, and of melted asphalt, 10 parts by weight, said asphalt to be of 96 penetration, mix, cool and granulate.

To this add 10% of powdered asphalt, the composition of which is two-thirds of 45 penetration asphalt and one-third gilsonite melted, cooled and ground to a powder. Mingle this powdered asphalt with the cooled and granulated mixture A, and it is ready for shipment.

On re-heating the final penetration of the cementing medium will be 67 degrees.

Example No. 3.

(A) Take of hot sand, 90 parts by weight, and of melted asphalt a penetration of 90, 10 parts by weight, mix, granulate and cool.

(B) Take of hot sand, 90 parts by weight, and of melted asphalt, 225 degrees penetration, 10% by weight, heat, mix and granulate, combine them by weight in the proportion of 75% of A to 25% of B. Thoroughly intermingle after cooling and the mixture is ready for shipment. When heated at the point of use and the two mixtures flux one

another a penetration of the cementing medium will be approximately 26 degrees.

Example No. 4.

(A) Take of hot sand, by weight 90 parts, and of melted asphalt, 10 parts by weight, said asphalt being of 45 degrees penetration, heat, mix and granulate, and then cool to granular form.

(B) Take of 96 penetration asphalt, 10 parts by weight, and of hot sand, 90 parts by weight, mix, granulate and cool.

Of A take 90 parts by weight, and of B 10 parts by weight, intermingle and ship to the point of use. When heated the cementing medium will have a penetration of from 35 to 40 degrees.

Of course it is to be understood that the various steps in the process may be carried out by many different types of apparatus many of which are well known and widely used by those skilled in the art but for the sake of illustration there are shown several types of apparatus involving novel features and which are well adapted to carry out the process herein described and especially certain steps thereof.

In the drawings which accompany this application and which form a part of this specification:

Figure 1 is a diagrammatic view in elevation, showing one form of apparatus;

Figure 2 is a view in end elevation of the discharge end of the mixer;

Figure 3 is a view in end elevation of the revolving drum;

Figure 4 is a diagrammatic view in elevation, showing a slightly modified form of apparatus;

Figure 5 is a view thereof in end elevation; and

Figure 6 is a fragmentary view in elevation, showing a slightly modified form or variations of the type of apparatus illustrated in Figures 4 and 5.

Referring to the drawings, and more especially to Figures 1, 2 and 3, the numeral 10 designates the mixer in which heated asphalt and sand are first mingled and thoroughly incorporated. Two parallel shafts 11 extend through the mixer and carry paddles or mixing blades 12. Suitable means is provided for treating the mixture with a spray of water and subjecting the same to a blast of cold air while it is being agitated for the purpose of cooling the mixture while preserving the same in a granular state. For the sake of illustration the means is shown as comprising pipes 13 having spray nozzles 14 for spraying the mixture with water at the proper time and there is also provided a blower pipe 15 having suitable nozzles or blowers 16 associated therewith. The sand or mineral matter is thoroughly coated with asphalt before it is cooled by spraying with

water and by the blowing with air. Just enough water is sprayed on the mixture to carry off the heat, the object of having water being merely to accelerate the cooling action and the water by instantly converting it into steam which absorbs the heat and is carried off. From the mixer the material is transferred by a conveyor 18 to the revolving drum 19 having baffles 20 on the inner periphery thereof which bring about a continuous agitating and cascading of the material therein. The revolving drum 19 is also equipped with a water distributing pipe 25 and with an air blower pipe 26 having suitable nozzles associated therewith to accelerate the cooling action. The delivery end of the revolving drum deposits the material onto the vibrating screens 28 either directly or by means of suitable conveyors. A number of screens 28 are provided and are preferably disposed one above the other. They may be vibrated in any manner known to those skilled in the art and may be of any construction suitable to the requirements of their present use. For the sake of illustration one means is shown for vibrating the screen, and includes a motor 30 connected to driving gear wheels 31 having eccentric or crank pins 32 connected to the screen 38 by links or connecting rods 33 whereby the screens are vibrated. In order to force particles of the material through the screens revolving endless scrapers 35 mounted on sprockets 36 may be provided to coat with the screen for this purpose. In the pit or hopper below the lowermost screen the granulated asphalt and sand are collected and from this pit an elevator carries the material to a conventional mixer (not shown). In the mixer cold granulated mineral matter and hard asphalt is mingled with the cold granulated mineral matter and soft asphalt to produce the final paving mixture.

In Figures 4 and 5 a modified form of apparatus is shown and as illustrated includes a platform 40 supported by uprights 41. A mixer 42 is mounted on the platform 40 and serves to thoroughly incorporate the sand or other mineral matter in the heated asphalt. A discharge chute 43 leads from the delivery end of the mixer 42 and extends through the opening provided therefor in the platform 40, the chute delivering the mixture of sand and asphalt onto a vibrating screen 44. One end of the vibrating screen 44 is pivotally mounted, as at 45, on the uprights 41 and the opposite end of said screen is connected by links 46 with crank disks or eccentrics 47, the crank disk 47 being fixed to short shafts 48 rotatably mounted in the uprights and having pulleys 49 driven from a suitable source of power. When the shafts 48 are rotated the eccentrics or crank disks 47 serve to vibrate the screen 44 through the links 46, the links being pivoted to the screen and to the crank disk. Any suitable means may be employed for vibrating the screen and for mounting the same, the means shown being illustrated merely for the sake of illustration. It is also to be understood that scrapers or brush wheels such as shown in Figure 1 may also be employed if found desirable. The vibrating screen 44 is disposed above an elongated tank 50 which contains water. The finely comminuted mixture of asphalt and sand which drops into the water from the screen 44 settles onto the upper run 51 of an endless belt 52. The belt 52 which is preferably of canvas or other suitable material is supported by rollers 53 and 54 and is driven from the roller 55 which coacts with the roller 54 for this purpose. The upper run of the belt, designated at 51, passes down into the tank 50 and through the water contained in the tank and the lower run 56 passes below the tank. As shown in Figure 4 the upper run 51 travels over rollers 57 provided therefor within the tank 50 and the lower run 56 passes through the rollers 57 provided therefor below the tank 50. With this form of apparatus the mixture is not subjected to a spray of water or blast of air while in the mixer 42 but is passed directly onto the vibrating screen 44. After passing through the vibrating screen 44 the mixture of asphalt and sand is finely divided and while in such condition it drops into the water in tank 50 and is carried through the water by the belt 52. The water cools the asphalt while the same is finely divided and thus produces a granular condition.

The variation of the form or type of apparatus shown in Figures 4 and 5 is illustrated in Figure 6. The form shown in Figure 6 is in all respects like that shown in Figure 5 except the tank which is designated at 60 is shallow and the rollers 61 on which the upper run 62 of the belt 63 is supported are arranged at the water level in the tank whereby the upper run of the belt while being soaked or wetted with water is not covered thereby. With this form of apparatus the mixture of asphalt and sand drops onto the water soaked belt from the vibrating screen with the mixture in a finely divided condition as before and the water soaked belt in the tank with a light spray of water delivered from the nozzle 64 of the spraying pipe 65 cools the finely divided asphalt while preserving its granular condition so as to prevent solidification and producing granulation of the mixture.

While there is herein shown and described various modes and various types of apparatus for carrying out the present invention it will be seen that in its broad aspects the invention consists in dividing the cementing

medium into two parts or elements, a hard element of high melting point, and second, a soft element of low melting point whereby the material is kept in granular form until it is desired to make it adhere and solidify.

This may be accomplished by circulating the mass or by applying artificial heat by mixing thoroughly previous to use and using the sun's heat and disposing the same in situ in a manner where the heat of the sun will effect it, and then under pressure, as by rolling or the like, the two classes of asphalt will amend each other and the materials may be bonded and formed under pressure. In this connection it is to be understood that after having been placed on the roadways all of the mixtures embodying the present invention are spread or distributed and rolled or otherwise subjected to the action of pressure.

I claim:

1. A process for preparing adhesive and cementitious asphalt paving mixtures which consists in separately preparing a granulated mixture of mineral matter and blown asphalt of high melting point, and a granulated mixture of mineral matter and asphalt of low melting point, and mixing the separately prepared mixtures while cold and in heating the final mixture at the point of use whereby the two mixtures commingle and temper each other to produce in the final paving mixture a pre-determined compound of standard asphalt content.

2. A process for preparing adhesive asphalt paving mixtures which consists in separately preparing a granulated mixture of finely divided mineral matter and asphalt of high melting point secured by previously blowing the asphalt, and a granulated mixture of finely divided mineral matter and asphalt of low melting point, and mixing the separately prepared mixtures while cold.

3. An adhesive asphalt paving composition in granular form required to be heated prior to use to provide a plastic mass of standard asphalt content and comprising a granulated mixture of finely divided mineral matter and asphalt of high melting point

and of low penetration secured by previously blowing the asphalt, and a granulated mixture of asphalt of low melting point distributed throughout said first-mentioned mixture.

4. An adhesive asphalt paving composition in granular form required to be heated prior to use to provide a plastic mass of standard asphalt content and comprising finely divided mineral matter and two distinct and separate asphalt ingredients distributed throughout the finely divided mineral matter, one of the asphalt ingredients having a melting point higher than the maximum temperature induced by the heat of the sun, the other asphalt ingredient having a relatively low melting point, the asphalt ingredient of high melting point operating to maintain the mixture in a granular condition and to prevent consolidation under natural conditions of temperature and pressure.

5. A process of preparing asphalt paving mixtures which comprises intimately incorporating a finely divided mineral matter with an asphalt of high melting point in molten condition, cooling the resulting mixture to granular form, thereby producing a non-flowing plastic mass, incorporating a finely divided mineral material with an adhesive asphalt of low melting point, intermingling the two thus formed, the non-flowing plastic mass of granular form being adapted to maintain the second mentioned finely divided mineral matter and the asphalt of low melting point in a state of division so that the asphalt paving mixture may be shipped without said mixture forming a compact mass.

6. An adhesive asphalt paving composition in granular form required to be heated prior to use to provide a plastic mass of standard asphalt content and comprising a granular mixture of finely divided mineral matter, and asphalt of a high melting point and of low penetration, and a granulated mixture of asphalt of low melting point and finely divided mineral matter distributed throughout said first mentioned mixture.

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