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PRODUCTION OF ASPHALT PAVING MIXTURES

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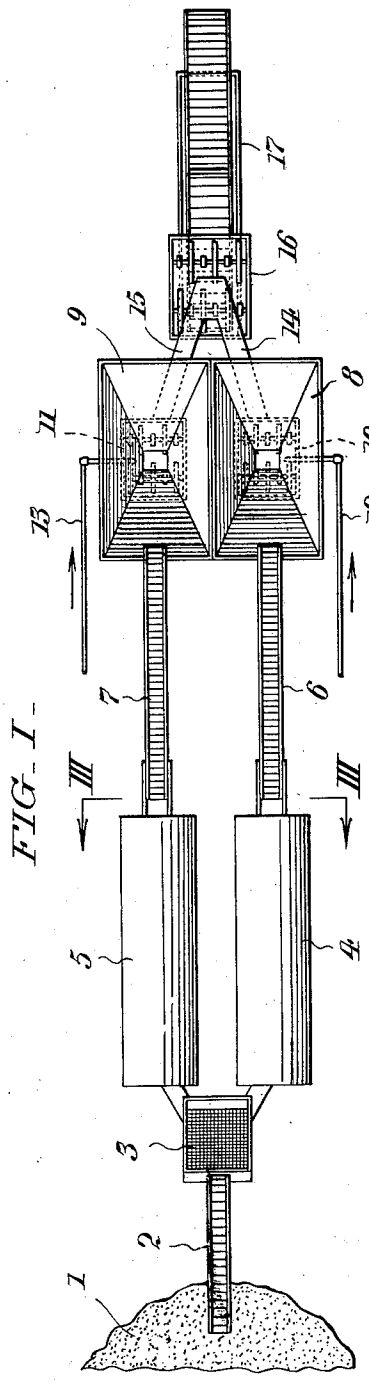


FIG. I.

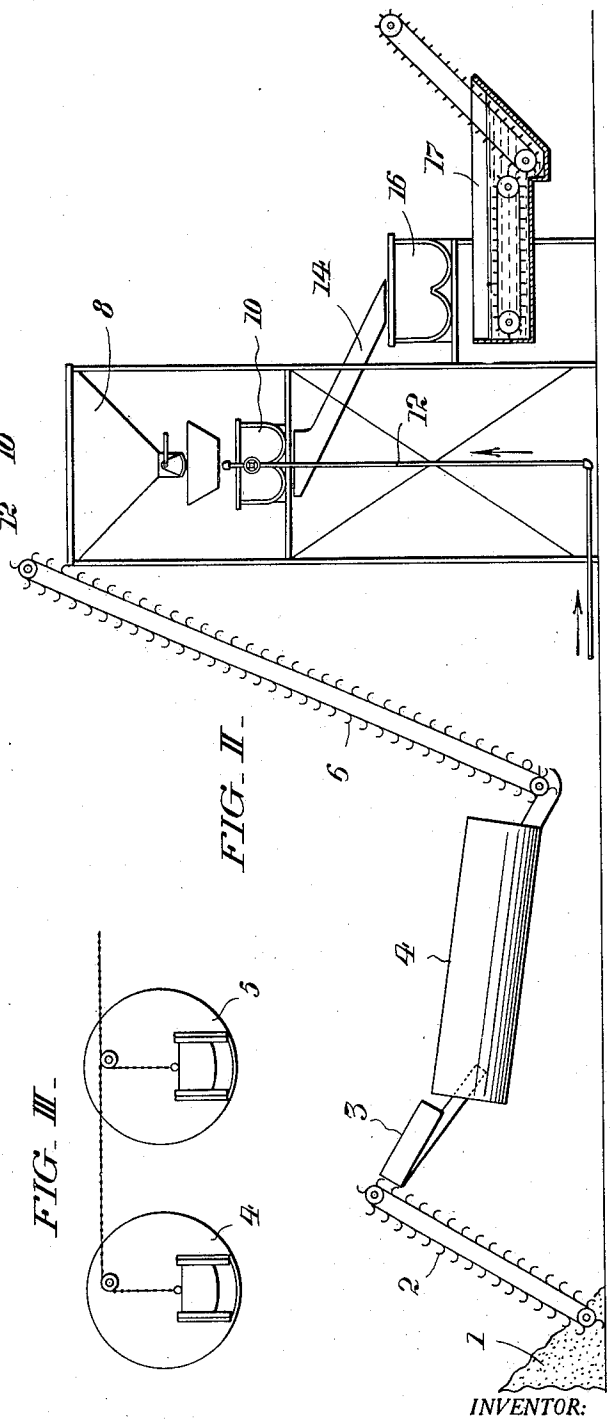


FIG. II.

FIG. III.

WITNESSES

Hubert Fuchs

William Bell, Jr.

INVENTOR:

Alfred S. Hirzel,

BY Fraser & Paul

ATTORNEYS.

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PRODUCTION OF ASPHALT PAVING MIXTURES

Alfred S. Hirzel, Wilmington, Del.

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4 Claims. (Cl. 106—31)

My invention relates to an asphalt paving mixture capable of being transported and laid cold. Asphalt mixtures which are sufficiently granular to endure transportation and placement without preliminary coalescence may be produced by subdivision of the required mineral aggregate and the combination with each of a suitable asphalt, one of the subdivisions being combined with a hard asphalt of high melting point and the other with a softer asphalt. The subdivisions thus coated are recombined after they have cooled and are then thoroughly intermixed and the dissemination through the mass of the cool particles coated with the hard asphalt suffices to maintain it as a granular structure and prevent coalescence until the mixture has been transported and laid, after which compaction and coalescence takes place as a result of rolling and traffic, the two grades of asphalt ultimately becoming so intermingled as to form one asphaltic binder having properties suitable for the desired pavement.

But in producing these granular mixtures by the use of a subdivided aggregate no attention has heretofore been paid to the advantages which may be secured by varying the character of each subdivision and varying the treatment to which it is subjected. Heretofore these subdivisions (except for the penetration of the asphalt) have been alike in character and treatment. As a result of my plan for varying the subdivisions and their treatment I am able to get more satisfactory results and yet use a lesser proportion of hard asphalt than would otherwise be possible, and consequently I am enabled to produce a pavement in which the cementing medium has a better consistency and longer life than would otherwise be the case.

According to my invention I dry and heat to the required temperature each subdivision of the aggregate separately, the temperatures being different and being regulated by the character of the asphalt with which each subdivision is to be coated. In this way I am able to reduce the proportion of aggregate in the subdivision which is coated by the hard asphalt to any desired percentage; and am also enabled to recombine the subdivisions without cooling, for the difference in temperature thus produced is itself sufficient to prevent such coalescence of the subdivisions as would result in objectionable solidification of the mass. Furthermore, by thus combining the subdivisions at different temperatures but without cooling, I avoid a tendency which otherwise exists of the hard asphalt in one subdivision to strip the soft asphalt from the stone in the other subdivision.

In the previous practice of the prior art process above described the particles covered with hard asphalt have usually been in quantity as large as those covered with the soft asphalt, but by applying the hard asphalt to that subdivision of the aggregate which contains the larger particles and which therefore have less surface to be coated I am able to produce a mixture in which the greater part of the aggregate has been coated with the softer asphalt, and in this way I am able to better regulate the consistency of the resulting paving mixture.

My invention avoids the possibility of heating a part of the stone to a temperature high enough to injure the asphalt with which it comes in contact. According to my plan of operation, each subdivision of the stone is heated to a temperature determined by the melting point of the asphalt with which that subdivision is to be combined.

In the accompanying drawing, Fig. I is a conventionalized plan view of a suitable apparatus arranged to carry out my invention.

Fig. II is an elevational view of the same; and

Fig. III is an enlarged sectional view along the line III—III in Fig. I showing the simultaneous control of the driers.

In the accompanying drawing, 1 is a pile of material from which the aggregate is to be formed. It may be crushed stone, gravel, or sand or other suitable material. By the elevator 2 this material is advanced to a separating screen 3, which is of a size to separate the original material into two nearly equal subdivisions one of which is composed of small particles and the other of larger particles. For example, if the pile consists of crushed screenings runnings from 3/8 of an inch down to fine dust, I may employ a ten mesh screen to effect the subdivision of the material so that one subdivision will consist of material ranging from 3/8 of an inch to the smallest held on a ten mesh screen, and the remainder consisting of the finer material which passes the screen will constitute the other subdivision.

The coarse material is passed into the drier 4 while the finer material is passed into the drier 5. The employment of these separate driers enables me to heat each subdivision to differing temperatures dependent upon the melting point or characteristics of the asphalt with which they are to be subsequently combined, and the driers are operated in such a way as to accurately accomplish this. From these driers the material heat-

ed to the proper temperature is conveyed, as by the elevators 6 and 7, to hoppers 8 and 9, each overlying a mixer of the usual pug-mill type, a weigh-box being interposed to accomplish definite regulation of the amount of material delivered to each mixer. By means of this arrangement the proper quantity of the coarser part of the aggregate heated to its proper temperature is delivered to the mixer 10 while at the same time the proper quantity of the finer part of the aggregate heated to its proper temperature is delivered to the mixer 11. Simultaneous delivery is facilitated by the common control of the discharge openings of the driers as sufficiently illustrated in Fig. III.

By properly selecting the screen diameter of the screen 3, the material constituting the pile 1 can be divided in two nearly equal parts, (an advantage from a manufacturing standpoint) one part containing particles of larger diameter and one particles of smaller diameter. The difference in amount of superficial area of the particles in these two divisions allows the use of varying proportions of asphalt applied to each, and allows considerable freedom in the percentage of hard asphalt to soft in the final mix. It also permits the employment of material in the pile 1 which constitutes a properly graded aggregate, and allows this properly graded aggregate to be subdivided and recombined without intermission in the feeding of material to either hopper 8 or hopper 9, thus avoiding any delay in the continuity of the process such as would be caused should the supply of material from either of these hoppers fail.

A melted asphalt is delivered to the mixer 10 by the pipe 12 and another melted asphalt is delivered to the mixer 11 by the pipe 13. According to my invention I prefer to thus combine a comparatively hard asphalt, say of 185 degrees melting point, with the coarser subdivision of the aggregate, and a softer asphalt say of 100 degrees melting point with the finer subdivision of the aggregate. To accord with this plan the coarser part of the aggregate is raised in its drier to a temperature approximating 185 degrees F. while the finer subdivision of the drier to a temperature approximating 100 degrees F. In this way, there is delivered substantially at the same time to each mixer a proper quantity of aggregate and asphalt, the aggregate in each case having a regulated temperature depending upon the asphalt with which it is to be combined. While I have instanced as the harder asphalt one which has 185 degrees melting point, yet I may employ an asphalt melting at 135 degrees F. and having a penetration of 45 at 77 degrees F., or I may employ an asphalt melting at 225 degrees F. and having a penetration of 13 at 77 degrees F. It is desirable that the temperature of the stone be within four or five degrees plus or minus of the melting point of the asphalt with which it is to be combined. The same is true of the softer asphalt to be mixed with the finer materials. This asphalt may range from very soft material having a melting point of say 60 degrees to a harder asphalt melting at 135 degrees F. and having a penetration of 45 at 77 degrees. These melting points are determined by the ball and ring method.

The temperatures which I have instanced are only illustrative and may vary, and must be understood as expressed temperatures at the time of mixing the stone with the asphalt. In order to properly dry stone if it is wet it may be necessary to first raise it to a higher temperature than those I have mentioned and then cool it down to the required point. This may be accomplished by using a dryer-cooler, or in any other convenient way.

When each mixture is complete, the contents of the two separate mixers are simultaneously emptied and conveyed without cooling by the chutes 14 and 15 to a common mixer 16 of larger size wherein the two streams of the material are thoroughly incorporated and mixed together. By reason of their difference in temperature the materials do not coalesce and solidify but remain sufficiently separate and in a granulated state during the mixing in the common mixer. When this has been accomplished, the material is discharged into a cold water bath 17 from which it is removed by belt conveyors 18 and 19. The material is now ready for use and may be stored in stock piles indefinitely. As a result of the treatment which I have described, the mixture does not consolidate or coalesce but remains under all ordinary circumstances in granular condition, and in this condition it may be shipped long distances by truck or by railroad and thereupon spread on the road, after which it is compressed and consolidated by rolling and traffic.

While I have expressed a considerable range of proportionment for the aggregate, and a variety of melting points for the asphalt, yet it must be understood that the two asphalts must have such melting points and characteristics that when combined in the proportions chosen the resultant asphaltic mixture will constitute a satisfactory asphalt cement to accomplish the proper bonding of the total aggregate employed.

I have found that satisfactory results are obtained by using 4% (of the total mix) or thereabouts, of an asphalt having a melting point of 185° and 6% of an asphalt having a melting point of 100°, that is, a ton of finished material contains about 80 lbs. of an asphalt having a melting point of 185°, and 120 lbs. of an asphalt having a melting point of 100°, making a total asphaltic content of 10%, or 200 lbs. per ton.

This means that after the original aggregate has been properly separated into the portion containing the larger size particles and the portion containing the smaller size particles, that I use 12% by weight, or 120 lbs. of an asphalt having a melting point of 100° on the material which passes the 10 mesh screen and which has been heated to about 100°, and that I use 8% or 80 lbs. of an asphalt having a melting point of 185° on the larger material, which has been heated to about 185°.

A given quantity of fine material has a larger surface area and therefore requires more asphalt to coat it than a similar weight of coarser material. By adding the softer asphalt to the fine material I am able to get into the mixture a greater quantity of the softer asphalt than would otherwise be the case.

As previously explained the differing temperature of the two streams of material which are fed to the common mixer 16 maintains sufficient resistance to coalesence in that mixer, whereas in previous processes of this general character the water cooling of one or both of these streams prior to the mixing in the common mixer has been required. This is objectionable in that any water passing into the receptacle where the streams are mixed tends to produce stripping of the softer asphalt from the stone to which it has been

applied, a difficulty which my process entirely overcomes.

It will be understood that my invention is not limited to the use of materials for the aggregate subdivided at any particular point or to the use of asphalts having any particular melting point. The character of the aggregate and of the asphalt are determined by the necessity of producing the desired ultimate paving mixture for the use intended. My invention relates to the plan for the separate and different heating of the subdivisions of the aggregate calculated according to the asphalts with which each subdivision is to be combined, and to the separate addition to each of these subdivisions of asphalts having differing melting points, whereby I secure the desired granular mixture, and avoid any overheating of any part of the asphalt, and regulate the proportion of soft asphalt used in such a way as to facilitate the proper laying and compression of the mixture after it has been placed.

Having thus described my invention, I claim:

1. The method of producing a granular asphalt paving mixture which consists in heating two aggregate subdivisions in separate driers, then adding to and mixing with each subdivision two different asphalts and then while still at different temperatures recombining and thoroughly intermixing the same.

2. The method of producing a granular asphalt paving mixture which consists in subdividing the aggregate, drying and heating each subdivision to differing temperatures, adding to each subdivision asphalts of differing melting points and then while they are still at different temperatures recombining and thoroughly intermixing the same.

3. The method of preparing a granular and transportable asphalt paving mixture which consists in subdividing an aggregate into a coarser and a finer subdivision, conducting the coarser subdivision of the aggregate to a mixer where it is combined with a hotter asphalt of a higher melting point and conducting the finer subdivision of the aggregate to a mixer where it is combined with a less hot asphalt having a lower melting point, and after each subdivision has been thoroughly mixed with its asphalt, recombining and thoroughly intermixing the subdivisions of the aggregate along with the asphalts with which they are coated while still at different temperatures.

4. The method of producing a granular asphalt mixture in which asphalts of different hardness are combined in a desired proportion which consists in subdividing and proportioning an aggregate according to the size of the particles, combining the proper proportion of hard asphalt with the coarser subdivision and combining the proper proportion of a softer asphalt with the finer subdivision and then recombining the subdivisions.

ALFRED S. HIRZEL.