Sept. 17, 1963 H. E. PIQUETTE 3,103,860

METHOD OF CONSTRUCTING BITUMINOUS AGGREGATE SURFACES

Filed Aug. 30, 1961

Fig. 1

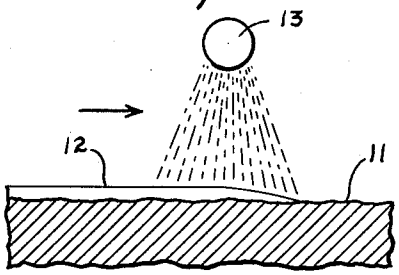


Fig. 2

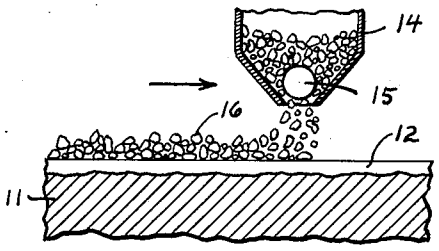


Fig. 3

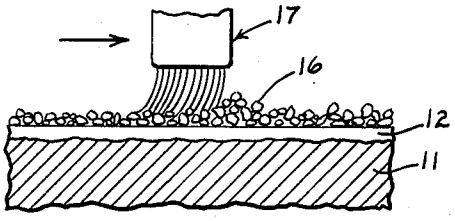


Fig. 4

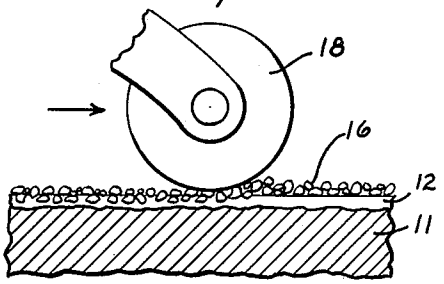


Fig. 5

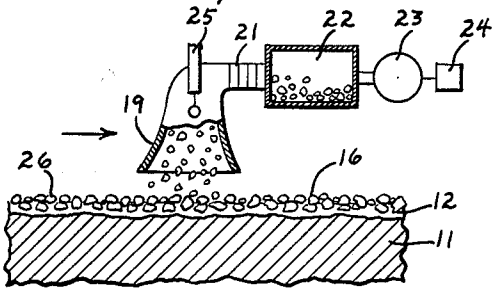


Fig. 6

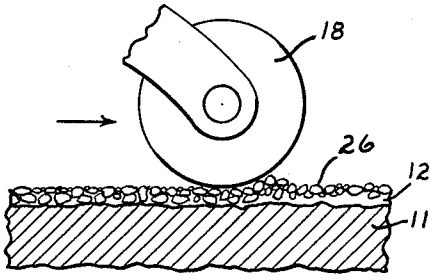
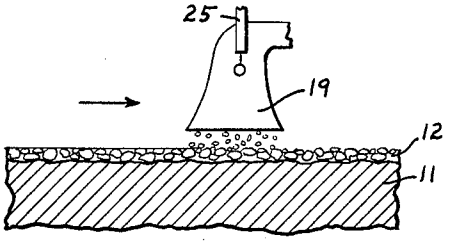


Fig. 7



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METHOD OF CONSTRUCTING BITUMINOUS AGGREGATE SURFACES

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The primary object of this invention is the provision of a novel and improved method for seal coating a pavement which provides a coated surface of improved and more durable construction, which avoids the waste of aggregate, which avoids the necessity for extensive clean up of aggregate after the coating has cured, and which avoids numerous other objectionable characteristics of seal coating operations carried out by prior methods.

The various steps of the improved method are diagrammatically illustrated in the accompanying drawings in which:

FIG. 1 shows in fragmentary section a part of a surface which has been prepared for seal coating together with the step of applying the bituminous material to the prepared surface.

FIG. 2 illustrates the step of spreading the aggregate over the bituminous layer,

FIG. 3 illustrates the step of drag brooming an aggregate prior and during the rolling thereof,

FIG. 4 shows the rolling step,

FIG. 5 illustrates the step of withdrawing the bulk of the excess aggregate from the surface,

FIG. 6 shows the final rolling step, and

FIG. 7 shows an optional step of withdrawing the balance of the loose aggregate from the coated surface.

The term "seal coat" is herein used in its commonly accepted sense and signifies a final or top coating layer of a bituminous pavement of the type produced by distributing bituminous binding material while in liquid state and thereafter imbedding a mineral aggregate in the bitumen prior to setting or curing of the bitumen and the term "seal coating" refers to the method for producing such a coating.

The method of preparing or repairing pavements by seal coating has long been practiced. It is commonly used for surfacing pavements which do not carry heavy traffic such as lightly traveled rural highways, parking lots, driveways, sidewalks and the like, and is a relatively inexpensive method of producing dust free pavements which do not require high strength. The method is also commonly employed to repair or preserve previously constructed pavements. In either case, it is usually necessary to prepare the surface to be seal coated. In the case of new construction, the preparation may consist in applying to the highway or roadway, a layer of gravel, sand, crushed rock or the like which is graded and rolled to provide a suitable base. Where the treatment is for repair or maintenance, the base may only require sweeping and the filling of holes. In some instances, a thin layer of aggregate may be first spread over the base before spraying with bitumen.

After the surface has been prepared, a bitumen is distributed over the base in sufficient volume to coat the surface particles of the base or aggregate. The bitumen may be applied in a number of ways, the most common being to spray the heated material from a distributor. The bitumen must be in such physical state that it will coat the surface and aggregate and thus must be relatively fluid when applied. It must also have the capacity to set or cure to a firm adherent, non-fluid state after being applied. To this end, it commonly contains a suitable proportion of volatile solvent which will slowly evaporate to delay the setting and it is applied hot to obtain maximum fluidity during application. In some instances, the bitumen may be applied cold but this requires a higher percentage of volatile solvent and consequently a lower percentage of bonding material remaining on the highway. In some instances, the material is prepared in the form of an aqueous emulsion of the bitumen. In conventional practice, a layer of aggregate is then spread over the bitumen and the pavement is rolled to imbed the aggregate into the bitumen, whereupon the pavement is usually opened to traffic.

This method of construction, while probably the least expensive of all methods, has certain serious disadvantages such that highway authorities are being compelled to resort to other more expensive methods. In this method, after the application of the bitumen, it is essential that aggregate be applied in substantial excess of that which will ultimately become imbedded in the bitumen to insure complete cover for the bitumen so that "bleeding" of the bitumen will not occur during rolling or so-called "compaction," or subsequently, under the influence of traffic. Should bleeding occur after the bitumen has set or cured, subsequent applications of aggregate are seldom effective to remedy the trouble and a slick or tacky pavement results.

This necessity for applying a substantial excess of aggregate over the bitumen has, in the past, resulted in a number of serious objections to this method. First, though not necessarily the most important, is the fact that during the rolling and compaction to achieve maximum imbedment of the aggregate in the bitumen, some of the aggregate particles are coated only to a minor degree insufficient to maintain them as an integral part of the pavement, but sufficient to render them adherent to the shoes of pedestrians or the tires of vehicles passing over the pavement with the result that a certain part of the aggregate and the adhering bitumen is carried off the pavement onto walkways and into buildings or disfigures the surface of the vehicles passing thereover.

Secondly, and of particular importance on urban pavements, is that much of the excess aggregate eventually works out to the shoulders of the highways and to the gutters, sidewalks and lawns of city streets, by movement of vehicles over the pavement. This necessitates costly cleanup operations in cities to prevent the aggregate from being carried into sewers by drainage water and to prevent property damage and personal injury.

Thirdly, the pavements must usually be open to traffic shortly after completion and before thorough curing. Traffic passing over and through the excess aggregate causes the particles to move over each other under the pressure of the vehicle tires and to thus grind and pulverize the excess aggregate. This traffic also acts to grind out a part of the aggregate already imbedded. In addition, large amounts of pulverized aggregate in highly divided form creates a highly objectionable dust problem as vehicles pass over and through the loose aggregate.

According to the method of the present invention, the early steps are essentially the same as those heretofore employed. FIG. 1 illustrates in highly diagrammatic form the first step normally employed in seal coating, namely, the preparation of the surface. The precise nature of this step depends largely upon conditions. In constructing a built up pavement this step may include the formation and grading of the subgrade and the spreading and grading of one or several layers of crushed rock or other suitable aggregate. In other cases, such as in the repair of old or damaged pavements may consist of little more than a sweeping or minor patching of holes to provide a suitable surface such as indicated at 11 in FIG. 1.

After the preparation of the surface there is applied thereto a coating of a bituminous material indicated at 12, as illustrated in FIG. 1, which material may be applied by a conventional motor driven distributor (not shown) through the usual spray bars 13. This is the commonly

used and preferred manner of distributing the bitumen, but any suitable apparatus may be employed for the purpose.

After the bitumen has been distributed a layer of aggregate, as illustrated in FIG. 2, is spread over the surface. While this may be done by hand, a suitable spreader is best employed which usually comprises a truck (not shown) to which is mounted a device such as a hopper **14** for the reception of aggregate from the truck and having a feed mechanism such as a roller or rollers **15** for spreading the aggregate as indicated at **16**.

After the aggregate is spread, it is necessary or at least desirable for the best results, to smoothen out the layer, in as much as this layer may not be uniform and for this purpose a drag broom **17** is passed lightly over the aggregate layer as indicated in FIG. 3. This also serves to provide a somewhat thicker layer of aggregate in the low spots of the bitumen coating where a thicker layer of bitumen may have accumulated by flow thereto after distribution.

Thereafter the surface is rolled, as illustrated in FIG. 4, by means of a conventional road roller **18** to imbed the particles **16** of aggregate into the bitumen layer as shown in FIG. 4, as thoroughly as possible without excessive breaking and degradation of the aggregate. It is common practice to alternately broom and roll the surface which is an aid in determining how long the rolling should continue. The amount of rolling which can be tolerated at this point will, of course, depend also on the character of the aggregate. If the aggregate is a hard nonfrangible material, more extensive rolling may be tolerated than the case of a more frangible material, before objectionable degradation occurs.

According to the improvement of this invention, following the first rolling step mentioned above most of the excess aggregate is removed from the surface. Ideally this step should consist of removing all of the unimbedded aggregate except those particles which are partially coated with bitumen but insufficiently for compaction into the bitumen during the previous rolling operation, plus just those additional particles which can be forced into the bitumen layer between the particles already present by a subsequent rolling operation, so that there remains no excess of bitumen over that required to retain and seal the particles of aggregate and likewise no excess of aggregate. Such perfection probably cannot be attained in practice but a practical approximation can be effected by the use of a vacuum type pickup and conveyor analogous to a household vacuum cleaner. Any suitable vacuum unit may be employed, one such unit is diagrammatically indicated in FIG. 5 wherein the numeral **19** indicates the inlet nozzle of such a cleaner, which may be connected through a flexible connection **21** to a receiver **22** for receiving the aggregate picked up from the surface, a vacuum pump, blower or the like **23** acting to move the air through the nozzle. Suitable control means **24** may be provided to control the rate of air movement into the nozzle and means such as an hydraulic cylinder or cylinders **25** act to control the elevation of the inlet to the nozzle. These various instrumentalities are carried on a vehicle (not shown) movable over the surface under construction. In this step as previously mentioned, the collecting vehicle is so adjusted that little or none of the partially coated particles are drawn up into the nozzle, since they are imbedded in the bitumen to at least some extent and thus resist lifting. The adjustment is also set to leave a relatively thin layer of particles over the surface as indicated at **26**. This is an essential and very important step in the method. The surface at this stage is soft and susceptible to lateral displacement so that the loose aggregate cannot be successfully rolled off the soft surface as with a grader or similar blade without damaging the particles beneath.

Following the removal of most of the excess of aggregate, the surface should again be rolled as indicated in FIG. 6, from which it will be noted that the particles of aggregate which are partly coated and imbedded are pressed into the surface and the bitumen is squeezed around these particles as well as around the slight excess of particles which have been retained upon the surface, in accordance with the preceding step.

A further optional step may be employed as indicated in FIG. 7 wherein the suction cleaner heretofore described is again passed over the surface with the nozzle in close proximity to the surface whereby to pick up any residue of aggregate which may be left on the surface after the final rolling operation.

It will be observed that through the use of the improved method herein described, the entire seal coating operation is completed at one time and when the final step has been taken and the surface allowed to cure or set for a reasonable period of time, the pavement may be open to travel without the objectionable after effects described above. Furthermore, the method results in an improved surface since better compaction is obtained, sufficient aggregate is incorporated in the coating to prevent subsequent bleeding and traffic does not act to grind out aggregate which has already been incorporated in the coating. In addition, the method results in the more economical utilization of aggregate since the excess aggregate removed by the suction cleaning may be reused and is not wasted as in prior practice.

While I have thus described and illustrated a specific and preferred embodiment of the invention, numerous changes and combinations are contemplated within the scope of the appended claims in which I claim:

1. The method of constructing bituminous aggregate pavement surface layers which comprises the steps of preparing the pavement base, including grading and contouring thereof, applying a layer of bituminous paving material over the top of said base, and thereafter performing the following steps prior to setting or curing of the bitumen layer, spreading a layer of mineral aggregate onto the bituminous layer, rolling the layer of aggregate to force the particles of the aggregate into the bituminous layer and to squeeze the bituminous material upward around the aggregate particles to coat and retain the same, and thereafter withdrawing most but not all of the loose aggregate from the surface to a storage receptacle by means of vacuum withdrawal.

2. The method of constructing bituminous aggregate pavement surface layers which comprises the steps of preparing the pavement base, including grading and contouring therof, applying a layer of bituminous paving material over the top of said base, and thereafter performing the following steps prior to setting or curing of the bitumen layer, spreading a layer of mineral aggregate onto the bituminous layer, drag brooming the aggregate layer to level the aggregate particles and fill small depressions due to irregularities in the pavement base which tend to accumulate an excess of bituminous material, rolling the layer of aggregate to force the particles of the aggregate into the bituminous layer and to squeeze the bituminous material upward around the aggregate particles to coat and retain the same, and thereafter withdrawing most but not all of the excess aggregate from the surface to a storage receptacle by means of vacuum withdrawal.

3. The method of constructing bituminous aggregate pavement surface layers which comprises the steps of preparing the pavement base, including grading and contouring thereof, applying a layer of bituminous paving material over the top of said base, and thereafter performing the following steps prior to setting or curing of the bitumen layer, spreading a layer of mineral aggregate onto the bituminous layer, rolling the layer of aggregate to force the particles of the aggregate into the bituminous layer and to squeeze the bituminous material upward around the aggregate particles to coat and retain the same, thereafter withdrawing most but not all of the excess aggregate from the surface to a storage receptacle

by means of vacuum withdrawal, and thereafter rolling the surface to further impress the remaining aggregate and compact the pavement surface.

4. The method of claim 3 including the further step of removing the balance of the excess aggregate remaining after the last rolling by vacuum withdrawal from the pavement surface.

5. In the method of seal coating a pavement wherein an excess of aggregate is spread over a layer of bitumen and thereafter compacted by rolling, the steps which comprise lifting susbtantially but not quite all of the excess aggregate from above the bitumen layer by vacuum withdrawal prior to setting or curing of the bitumen layer and immediately thereafter again rolling the surface to imbed the remaining excess of aggregate.

6. The method of claim 4 including the further step of removing the balance of the excess aggregate remaining after the last rolling, by vacuum withdrawal from the pavement surface.

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