

Nov. 5, 1940.

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METHOD OF CONSTRUCTING BITUMINOUS-BOUND WEARING
SURFACES FOR ROADWAYS AND STREETS
Filed Oct. 14, 1937

2,220,149

Fig. 1

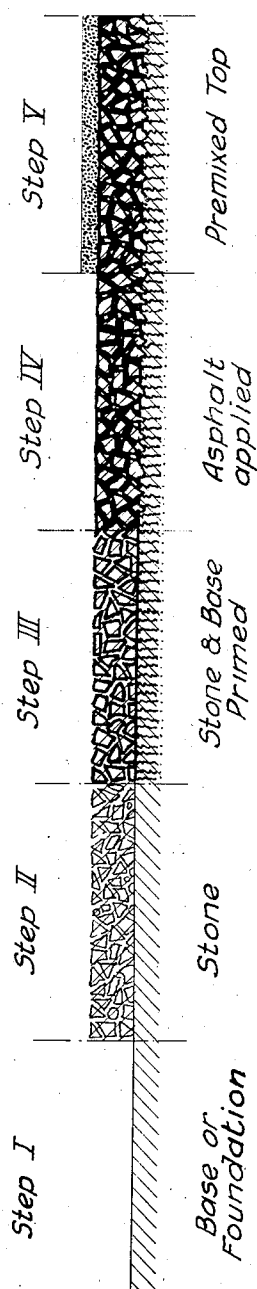
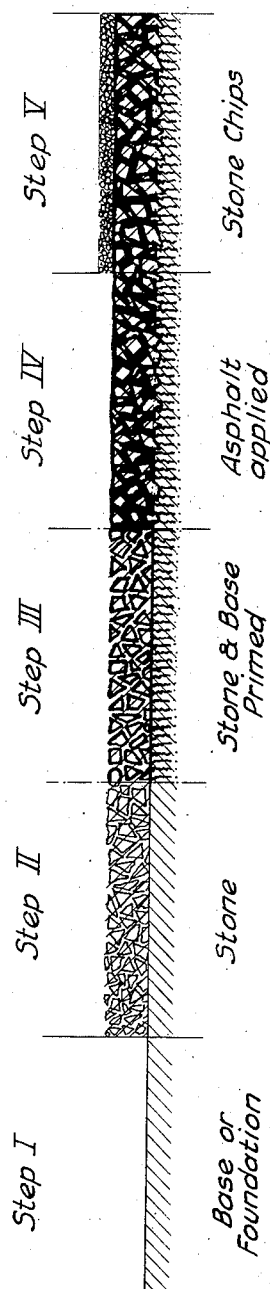


Fig. 2

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2,220,149

METHOD OF CONSTRUCTING BITUMINOUS-
BOUND WEARING SURFACES FOR ROAD-
WAYS AND STREETS

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Application October 14, 1937, Serial No. 168,852

4 Claims. (Cl. 94—23)

This invention relates to a method for constructing bituminous-bound wearing surfaces for roadways and streets. More particularly it relates to the use of liquid bitumens as a prime coat in building thin bituminous-bound roadway surfaces of the type generally called "surface treatments," "double surface treatments," "inverted penetration" and the like. According to this invention liquid priming bitumen is for the first time poured, or applied by pressure, over uncoated aggregates previously spread on the foundation, whereby the priming bitumen serves simultaneously to prime both the said uncoated aggregates and the foundation under the aggregates, and whereby heavy bitumen, later applied to the primed aggregates, is conveyed entirely around each particle of such aggregates and over and into the surface under the aggregates.

It is old to the art to prime foundations upon which thin or relatively thin bituminous surfaces are constructed, and the value of such priming of road or street foundations has throughout the world proved its value. It is new to apply a priming bitumen in such a manner that it will currently prime both the foundation and the layer of uncoated aggregates spread on that foundation, and to later use such priming coat as a means or agent to facilitate the subsequent coating of such mineral aggregates with a heavy bitumen by conveying said heavy bitumen around said aggregates, to the end that said aggregates will be firmly bonded together. This novel use of the priming bitumen constitutes the present invention, and roadways and streets so constructed have proven that it is not only equally important, if not much more so, to prime the aggregates as it is to prime the foundation, and roads and streets so constructed have in like manner proven that the heavier or subsequent application of bituminous cement over the pre-coated aggregates, not only uniformly coats such aggregates themselves, but the heavier bituminous cement is drawn down and into the foundation itself. In accordance with the prior art, there was no thorough coating of the uncoated mineral aggregates, and the subsequent layers of bituminous cement applied, laid over the immediate surface and did not coat, even in double surface treatment, more than the surface of said aggregates.

In the preferred manner of carrying out my invention, I proceed as follows:

On any suitable foundation that is in proper shape, or that has been properly shaped and bonded, I spread a layer of uncoated aggregates,

constituting the major part of the wearing surface that is to be built, which wearing surface may be of any desired thickness. Over this layer of uncoated particles I apply sufficient priming bitumen to not only coat the surface of all aggregate particles, but to flow between such particles to the foundation below, where the bitumen spreads out to cover and to prime the foundation. I thus simultaneously prime both the aggregate particles and the foundation upon which the layer of aggregate has been spread. I thereafter complete the construction of the surface in any standard manner, that is, I may apply alternate layers of bituminous cement and aggregate until the desired thickness is constructed, or I may apply a single layer of the bituminous cement, using a pre-mix with a stable bituminous binder and a volatile solvent, as disclosed in my United States Letters Patent No. 1,750,096, or sufficient plant mix, either hot or cold type, using the primed base and aggregates as a binder course, to bring the total thickness to the required amount.

Priming bitumens as used in road building have similar functions to priming paints used in covering wood, that is, the priming bitumen is sufficiently fluid to penetrate and flow into all surface openings in the material primed, so that water cannot later penetrate that surface. Also, the priming bitumen spreads out over the surface primed and forms a very thin adhesive layer to which the heavy bitumen will cohere perfectly and with maximum strength not developed when the heavy binding bitumen is applied directly to an unprimed surface. The knowledge of what constitutes a suitable priming bitumen is common to the art, and may be found in current specifications and texts.

According to prior practice, the thin bituminous-bound surfaces herein mentioned are ordinarily constructed in stages or layers of alternate applications of bitumen and aggregate. The lowest or first layer is usually a prime coat of bitumen applied to the foundation and given time to cure. Over this cured prime there is next applied a layer of bituminous cement, followed with alternate layers of mineral aggregate and bituminous cement to make up the total required thickness of the finished surface. The lowest layer of the mineral aggregate is the largest in amount and in size of particles. In fact, this first layer of aggregate generally constitutes more than half the total thickness of the entire bituminous-bound surface and much more than half of its structural strength. If this layer fails, the entire

structure immediately fails. The prior practice is to place this layer of aggregate in an uncoated condition on the layer of heavy bituminous cement, and to apply over it another layer of bituminous cement. The bituminous cement is expected to adhere to the uncoated stone without benefit of a prime coat, much as heavy paint might be expected to adhere to rough porous wood without benefit of a priming paint. A heavy paint so applied would of course soon peel off because it is not sufficiently fluid and penetrating to serve as a prime coat. If it were made thus fluid and penetrating it would lack the required stability to serve as a binding cement. As a result of this application of heavy bituminous cement direct to the major part of the structural aggregate, without benefit of a prime coat, there have been many failures from lack of coating, from lack of adhesion, and from water attack between coating and stone. To prevent this type of failure, I prime the aggregate before adding the heavy bitumen, and I thus provide for a complete cover of heavy bitumen; for a perfect protection against water damage; and for a maximum adhesion between heavy bitumen and primed aggregate. To prevent waste and other types of failure, I prime the major course of aggregates simultaneously with priming the foundation under that aggregate.

Prior practice in building the type of thin bituminous surfaces herein considered requires that the initial layer, that is, the prime coat, be dried out or cured before spreading another layer upon it. This process generally requires from ten days to three weeks and the roadway is generally closed to traffic and the public denied the use thereof, because during this curing process the surface of the roadway may be sticky and slippery, and therefore very difficult for traffic, which would pick up areas of the prime coat, leaving bare uncoated areas that must be repaired before construction is continued. In instances where the wet prime is covered with a blotting coat of fine or dusty material to help ameliorate the stickiness, this dust is a nuisance to traffic and must be swept off before another layer of the surface is added, again adding to the cost, both in labor and cost of covering with blotting material. Furthermore, most prime coats, after drying out, become brittle and are easily cracked by the pressure from the sharp corners and edges of the coarse aggregate spread upon it and pressed into it by rollers and by traffic. These cracks permit the passage of water and are largely responsible for the many pot-holes and disintegrated areas appearing so frequently in thin bituminous-bound surfaces, and causing endless repair and maintenance. With the use of my invention, all of these defects are removed. There is no pick-up of the prime from the foundation because the foundation is protected from contact with traffic by the coarse aggregate. There is no long wait for the drying-out process because I prime the materials and within twenty-four hours add the required top, thus saving a great part of the cost of construction. This permits me to lay the prime coat one day and to complete the entire surface, ready for traffic, the next day. I thus reduce the cost and save immensely on traffic-use.

Under my invention, on types of highways and streets that are bonded with water, such as water-bound macadam, clay gravel, sand clay and the like, the coarse aggregates are rolled before the wet prime cures, and therefore the particles

are seated before any brittleness can occur and there is no further driving of the particles of the coarse aggregate into the primed surface to crack it. I thus prevent the type of failure known as "pot-holes" and the following disintegration. Water, the worst enemy of pavements, cannot, with my invention, pass through any of my primed foundation, or between that primed foundation and the primed aggregate of the lower aggregate layer, or between the prime coat on that aggregate and the surface of the particle, whereas under the prior art water could and did do all of these things detrimental to the pavement. A further important time saving factor is that my invention may be practised and roadways surfaced under this method at any season of the year where the road foundation is dry, or relatively dry, and the temperature not below 42° F., whereas even in the Southern States, such as North Carolina, South Carolina and Georgia, no priming material is permitted to be applied, under the old art, after October 15 or November 1.

On other than the water-bound type, such as concrete, the resurfacing of sheet asphalt or asphaltic concrete, the primed bitumen acts as a tack or adhesive coat for the bottom of the coating of mineral aggregates spread over such a foundation, and with the same resultant surface coating of heavy bitumen, as above described.

As a definite example of the method of carrying out my invention, suppose it is desired to build a bituminous-bound surface one and one-half inches in thickness on any well-shaped and compacted base or foundation of the type that unusually requires about 0.3 of a gallon of cut-back asphalt prime per square yard, I would proceed as follows:

Over the foundation I first spread a layer of stone passing a one and one-quarter inch mesh, and retained on a one-half inch mesh, placing the particles in the desired relation to each other, making a uniform layer of the desired thickness. Over this layer of aggregate I then apply between 0.35 and 0.45 of a gallon of cut-back asphalt of the type specified below. Within twenty-four hours I roll this primed material and the water-bound types of foundations to seat the aggregate before the prime has set. I then complete the surface treatment either by adding sufficient plant-mixed material to bring the thickness up to the required one and one-half inches, or I complete the surface in any other standard method, such as by successive layers of bituminous cement and aggregate.

The cut-back asphalt used in the above example shall substantially meet the following requirements when tested in accordance with standard practice:

Flash point.....150° to 250° F.
Distillate to 600° F.....25 plus
Viscosity, Saybolt @ 180° F.....150° to 250° F.
Solubility residue of distillation...99% in CS₂.

It will be understood that the above specified priming material is one of the several types that may be used. I could, of course, use cut-back tar. In fact, any standard priming bitumen may be used. Also, in the above example, I have named a thickness of 1.5 inches. Any thickness of such surface now being constructed may be constructed under my invention, and any type of foundation now being used may also be used under my method. Modifications in procedure, relative to thickness, bitumen, quality and quan-

tity of materials, amount of compression, etc., will be apparent, in the light of this disclosure, to those skilled in the art.

5 If a coal tar priming product is used, one substantially meeting the following requirements when tested in accordance with standard practice would serve:

Specific viscosity, Engler @ 104° F. 18 to 25
 10 Distillate to 455° F., not over 40%
 Soft point residue R & B., not over 140° F.
 Bitumen soluble in CS₂, at least 90%
 Specific gravity @ 60° F. 1.1 to 1.22

Or, if the wearing surface is to be completed by successive layers of bituminous cement, one substantially conforming to the following requirements, when tested in accordance with standard practice:

Specific gravity @ 60° F., at least 1.02
 20 Penetration at 77° F., 100 gr., 5 sec. 90 to 120
 Open flash point, not less than 390° F.
 Loss, 5 hrs. @ 325° F., not over 1%
 Ductility at 77° F., at least 100 cms.
 25 Bitumen soluble in CS₂, at least 99%

The novelty of this invention lies in the novel employment of priming bitumens to simultaneously serve several stages of construction, instead of the one stage formerly served, and wherein the structural and water-proofing features are vastly improved, with a marked saving in time and cost.

In the accompanying drawing I have diagrammatically shown different ways of practicing the present invention, but the showing therein made is to be understood as illustrative, only, and not as defining the limits of the invention.

In said drawing:

Figure 1 diagrammatically shows consecutive steps in producing a chipped stone wearing surface.

Figure 2 diagrammatically shows consecutive steps in producing a pre-mixed top wearing surface.

In the method of Figure 1, step I consists in the preparation of the suitable base or foundation which may be of any appropriate kind and may be an old pavement which it is desired to resurface. This is followed by step II which consists in spreading upon said base a layer of unprimed aggregate. Step III consists in applying the primer to the aggregate in such quantity that it will thoroughly wet such aggregate, flow downwardly therethrough, and spread over, wet and soak into the underlying base, after which the aggregate is compacted. Step IV consists in applying the heavy bituminous binder to envelop and bond the aggregates to one another throughout the mass. And step V consists in the addition of stone chips to the bituminous-bound surface of step IV to complete the job.

According to the procedure of Figure 2, steps I to IV, inclusive, are the same as in Figure 1, but step V of Figure 2 consists in the addition to step IV of a pre-mixed top layer in lieu of the stone chips of Figure 1.

The foregoing detailed description sets forth the invention in its preferred practical forms of making or resurfacing pavements, as the case may be, but the invention is to be understood as fully commensurate with the appended claims.

In the appended claims I have referred to "a cutback bituminous primer" as including both asphalt and tar.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In the art of constructing bituminous-bound wearing surfaces for roadways and streets, the method which comprises preparing a suitable foundation, thereafter spreading upon said foundation, prior to priming the latter, a layer of unprimed coarse aggregates, and thereafter applying to the resulting assembly a fluid cutback bituminous primer in sufficient quantity to flow downwardly over and between the aggregates and to spread over the foundation to simultaneously prime both of the theretofore unprimed aggregates and foundation.

2. In the art of constructing bituminous-bound wearing surfaces for roadways and streets, the method which comprises preparing a suitable foundation, thereafter spreading upon said foundation, prior to priming the latter, a layer of unprimed coarse aggregates, thereafter applying to the resulting assembly a fluid cutback bituminous primer in sufficient quantity to flow downwardly over and between the aggregates and to spread over the foundation to simultaneously prime both of the theretofore unprimed aggregates and foundation, and thereafter applying a bituminous binder to the thus primed aggregates and foundation.

3. In the art of constructing bituminous-bound wearing surfaces for roadways and streets, the method which comprises preparing a suitable foundation, thereafter spreading upon said foundation, prior to priming the latter, a layer of unprimed coarse aggregates, thereafter applying to the resulting assembly a fluid cutback asphalt primer in sufficient quantity to flow downwardly over and between the aggregates and to spread over the foundation to simultaneously prime both of the theretofore unprimed aggregates and foundation, and thereafter applying a bituminous binder to the thus primed aggregates and foundation before said bituminous primer has cured.

4. In the art of constructing bituminous-bound wearing surfaces for roadways and streets, the method which comprises preparing a suitable foundation, thereafter spreading upon said foundation, prior to priming the latter, a layer of unprimed coarse aggregates, thereafter applying to the resulting assembly a fluid cutback tar primer in sufficient quantity to flow downwardly over and between the aggregates and to spread over the foundation to simultaneously prime both of the theretofore unprimed aggregates and foundation, and thereafter applying a bituminous binder to the thus primed aggregates and foundation before said bituminous primer has cured.

SAM EVERETT FINLEY.