

May 4, 1943.

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MIXING AND SURFACING METHOD
Filed March 25, 1940

2,318,339

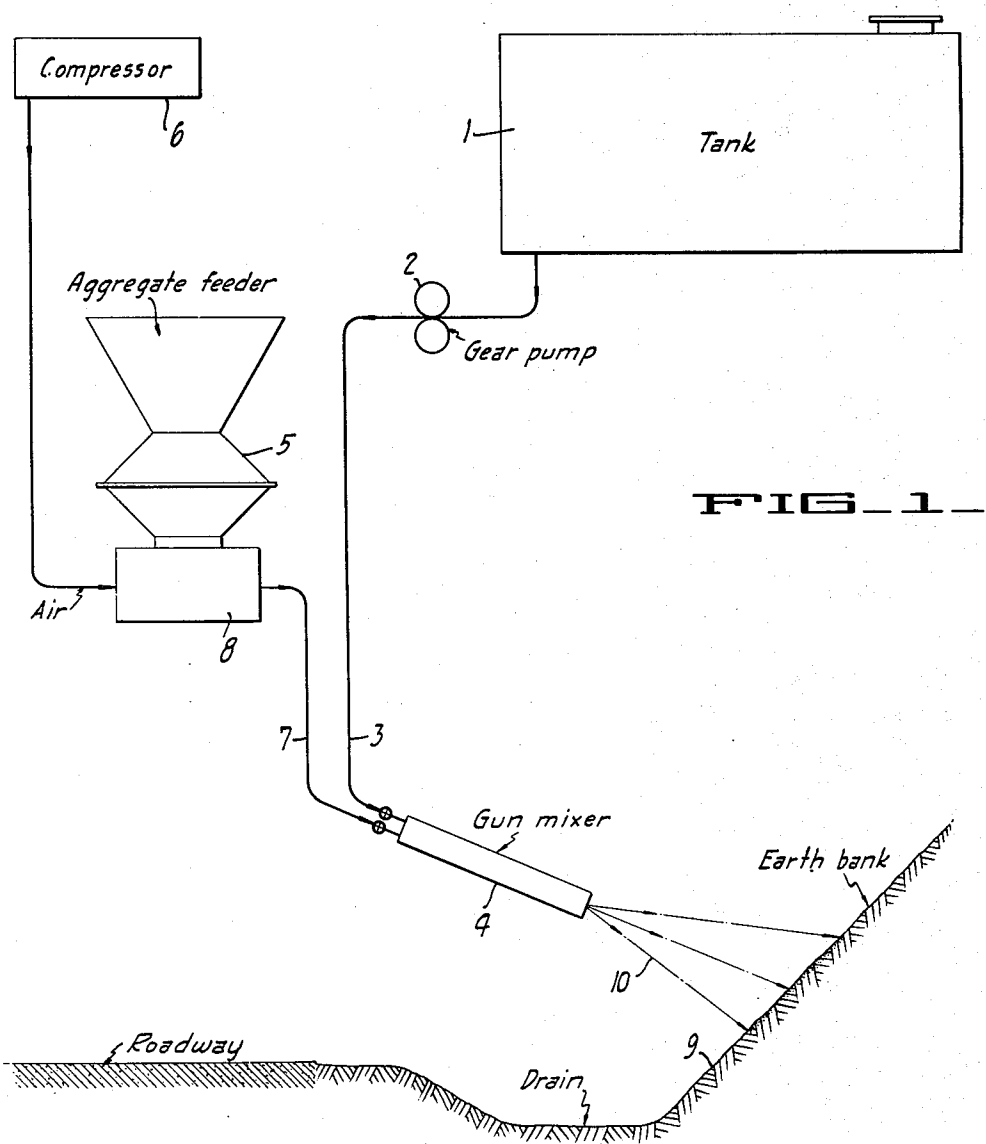


FIG. 1

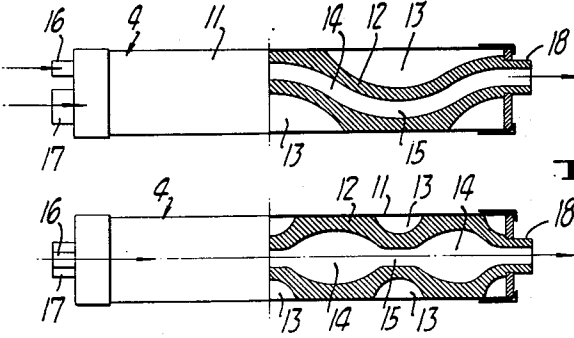


FIG. 2

FIG. 3

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2,318,339

MIXING AND SURFACING METHOD

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Application March 25, 1940, Serial No. 325,753

5 Claims. (Cl. 94—23)

This invention relates generally to a method of applying an erosion-resistant coating to surfaces subject to the erosion of wind and water, and is concerned more particularly with a method whereby the natural soil which is available can be employed with an emulsified asphalt to make the surface coating.

This application is a continuation in part of my copending application, Serial No. 203,077, filed April 20, 1938, for Plastic mixing device, now Patent No. 2,213,640.

At the present time considerable repair work is necessitated along highways, particularly in hilly or mountainous sections because of the erosion effects of both water and wind. It is quite common after a severe rain storm, to have sections of the paved roadway undermined and thereby necessitate building back the grade of the road and then resurfacing at a cost of several hundred or several thousands of dollars depending upon the character of country in which the work must be done. These undesirable results are usually occasioned by the fact that the rain water washes away the soil along the gutters and shoulders of the road until it has eaten into and underneath the road surface itself to render it unsafe for travel.

Also along highway cuts, rain storms frequently cause slides which are not only dangerous to traffic but also require considerable expense in keeping the roads open. Similar conditions exist along river banks subject to the erosive action of flood water, and also along the ocean front where sea walls are subjected to the constant wear from the waves.

Attempts have been made to provide a satisfactory coating for surfaces of this character where the erosion of wind and water must be presented in order to maintain the surface in proper condition, for example, by the use of concrete surfaces, walls and spillways. This construction is not only expensive, but is also unsatisfactory because of the rigid, non-yielding character of the concrete which is worn away rapidly and is subject to cracking. Some treatment of the gutters and shoulders of highways have also been made by the application of oil which is mixed with the dirt, which to some extent resists the erosion of wind but is ineffective in so far as water erosion is concerned.

The present invention is designed to obviate the foregoing disadvantageous characteristics of surfaces of the character referred to and is concerned with the provision of a tough, resilient coating which can be applied economically and

which will effectively resist both wind and water erosion.

It is a general object of the invention, therefore, to provide an improved method of processing surfaces which are subject to the erosive effects of wind and water.

Another object of the invention lies in the provision of a method of mixing bituminous material such as emulsified asphalt with the natural soil available to provide a hard, resilient asphalt coating as an erosion-resistant surface.

Other objects and advantages of the invention will be apparent from the following description of a preferred method of carrying out the invention, as illustrated in the accompanying drawing, in which:

Figure 1 represents schematically apparatus capable of carrying out the method of applicant's invention.

Figure 2 is a diagrammatic view of the mixing device employed in carrying out the method.

Figure 3 is also a diagrammatic view of the mixing device.

Generally the method of my invention contemplates the preparation of a natural soil aggregate of the character available in the vicinity of the surface to be treated and the mixing of such aggregate with an emulsified viscous material of a bituminous nature such as emulsified asphalt or emulsified coal tar.

Various types of natural soil are available in different locations such as decomposed granite, river wash, clay, sandy loam, volcanic ash, and sedimentary deposits. Each of these soil aggregates presents different problems in accordance with the character of material, its moisture content, and the fineness of the particles which are available for use. Preliminary to the actual mixing operations, the soil available must be tested for its moisture content and size.

Generally it may be said that sand, sandy loam, river wash, volcanic ash, and the sedimentary deposits are the easiest to mix and apply, while the decomposed granite and soil with a high clay content offer the greatest difficulties.

Usually a mixture of material will be prepared from the natural soil available using approximately 15% by volume of material which will pass through a 200 mesh screen, 25% of material which will pass through a 10 mesh screen, and 60% of the material too coarse to pass through a 10 mesh screen and up to one-half or three-quarters of an inch in diameter.

In accordance with the character of the soil aggregate available the emulsified asphalt may

be diluted with water. For example, for use with a soil aggregate having approximately 4% native moisture and emulsified asphalt having 56% asphalt by volume in the emulsion will be diluted by using three gallons of water to one gallon of asphalt emulsion. If the soil aggregate to be used has 8% native moisture, the asphalt is diluted by using two gallons of water to one gallon of asphalt. The general control for determining the proportion of liquid in the asphalt to the soil is to have 1½ gallons of liquid to one cubic foot of soil in the final mixture as applied. The mixture should provide approximately 2% of pure asphalt per cubic foot of the material when mixed and applied.

It has been found that these proportions are critical in that an improper balance between the asphalt and the aggregate will result in cracking of the surface coating when applied because of poor binding characteristics.

After the proper balance has been determined between the soil aggregate and the emulsified asphalt, the two ingredients may be mixed and applied in an apparatus of the character shown in Figure 1, wherein tank 1 provides a source of emulsified asphalt, from which asphalt is fed by metering pump 2 through a valved conduit 3 to a mixing device 4. A conventional type of aggregate feeder is shown at 5 whereby a proportionate amount of aggregate may be fed into an air stream from the compressor 6 to the conduit 7 which leads through a valved connection 8 to the mixing device 4. The mixing device 4 is of the type disclosed in said application, Serial No. 203,077. The conduits 3 and 7 are preferably flexible hose while the mixing device 4 is of a size adapted to be carried by an operator to enable manipulation with respect to the surface to be coated. The material is discharged from the mixing device in the form of a conical spray 10 under considerable pressure as will be later described.

Referring to Figure 2, a mixing device of the character shown in the above application is illustrated diagrammatically. The mixing device 4 may include a casing 11 having a resilient body 12 mounted therein with a plurality of spaces 13 provided between the body and the casing to provide for relative movement therebetween. The resilient body 12 is provided with a tortuous or zigzag passage made up of a series of mixing chambers 14 separated by restrictions 15. At the feed end of the mixing passage, feed devices in the forms of tubes 16 and 17 are provided for connection to the conduits 3 and 7, while the discharge end of the passage is formed as a tube 18.

The metering pump 2 and the aggregate feeder 5 are driven by suitable means to provide the proper proportion of aggregate and binder to be supplied to the mixing device 4. Generally the pump 2 will operate at a higher pressure than that supplied by the compressor 6. For example the pressure of the emulsified asphalt at the mixing chamber 4 may be in the neighborhood of 90 lbs./sq. inch while the aggregate in the air stream may be introduced from the conduit at approximately 60 pounds.

The mixing device 4 is of a character which provides a thorough mixing and intermingling of the emulsified asphalt and the aggregate so that each particle of the aggregate is coated with pure asphalt before it leaves the mixing device. The mixing action should not be such as to break down the emulsion in the mixing device

itself. The air stream and aggregate from the conduit 7 and the stream of binder, such as emulsified asphalt, from the conduit 3 are introduced into the feed end of the mixing passage where a swirling and rebounding action takes place with the rapid expansion of the materials in entering the enlarged feed end of the passage from their restrictions in the feed conduits. This is followed by a change of direction as the material approaches the first restriction 15 which serves to recompress the mixture. Another change of direction is afforded in passing from the first mixing chamber 14 to the second mixing chamber 14. Because of successive build-up and release of material at each restriction 15 a characteristic pulsation is set up in the walls of the mixing passage to further enhance the mixing action.

This action is sequential throughout the mixing device, so that the alternate expansion and compression afforded by the mixing chambers and the restrictions, together with successive directional changes, controls the material as it flows through the tortuous passage to thoroughly and completely mix the binder and the aggregate. As a result all pieces of aggregate are thoroughly coated. The mixing action is such that the emulsified character of the binder, such as emulsified asphalt for example, is not broken down. In this way the stream of material 10, which is being discharged at a considerable pressure, is made up of a plurality of independent particles of aggregate, each one of which is coated with a binder so that the impact of the pressure application causes immediate adherence of the particles in a very dense form.

Because the emulsion is spread over the surfaces of the aggregate without breaking down its emulsified form, a surface of material applied by the above method is still in a condition where it can be formed or shaped as by rolling or with a trowel or like instrument. After the material is placed in the surface, natural atmospheric evaporation of the contained moisture is slowly accomplished while the emulsion particles are being freed of their water encasement, so that the asphalt particles can coalesce and bind themselves to each other and to the aggregate particles as well as to the surface to which the coating is applied.

The rate of discharge from the mixing device 4 is uniform, so that a coating of substantially uniform depth to a desired thickness can be built up upon the surface. The impact application assures that the coating will penetrate the cracks and crevices of more or less hard surfaces such as concrete, rock and the like. In soft, dusty surfaces an actual penetration of the particles of from ½ to ¾ of an inch is found to take place.

The pressure at the outlet of the mixing device is controlled in accordance with the distance the material must travel before application, but should not be less than 30 lbs. per square inch for close application, i. e., from 2 to 6 feet. Higher pressures are used where the material must be projected farther or where deep cracks or the like must be filled.

It is desired to point out that one of the important features of applicant's invention lies in the coating of the particles of aggregate in the mixing device with the binder before application by impact. In this way rebound is reduced to a minimum and a good dense coating is obtained with minimum porosity so that a hard "con-

crete-like" surface of asphalt is provided after setting of the material.

Along roadways in applying an erosion-resistant surface to gutters and shoulders, it is desirable immediately after coating a surface with the asphalt aggregate coating to proceed over the same surface and project a fine natural soil aggregate into the top portion thereof by air blast application with apparatus of the character shown. If this is done before the erosion-resistant surface has set, the natural soil aggregate will adhere to the surface so that the natural coloring of the roadway is obtained. Only the smoothness and uniformity of the surface indicates that it is other than the natural soil along the road. This is desirable, particularly to aid in night driving by providing a contrasting color between the road surface and the gutter therealong as well as to retain the natural coloring of the roadway for its scenic effect.

The above method can also be used to advantage in repairing asphalt or concrete road surfaces per se because of the ease of application and the quick setting characteristics of the mixture as made and applied in accordance with the method outlined. Complete setting will take place in approximately two hours after application and a dense hard surface is obtained which compares favorably with the common road surface of asphalt formed by pre-mix of the materials and rolling after application. Such conventional road surface usually has a density in the order of 135 lbs. per cubic foot, whereas a surface prepared by the method disclosed herein provides a density in the order of 150 lbs. per cubic foot.

It will be evident that the described method has numerous applications such as the building of flood control surfaces along rivers and of erosion resistant surfaces along seawalls, and for water-proofing roofs, exposed walls, and the like.

For use in lining canals a softer, more resilient character of surface is desired, and such may be obtained by using a straight petroleum base asphalt wherein the ordinary commercial asphalt is thinned by the use of kerosene, gasoline, or cheap petroleum distillates. Otherwise the method of mixing and application is the same as that outlined above.

I claim:

1. The method of mixing and applying an erosion-resistant coating to roadway surfaces which comprises continuously supplying measured

amounts of aggregate to an air stream, continuously supplying measured amounts of a binder, such as emulsified asphalt, to impinge against the aggregate and air stream in a mixing passage, repeatedly subjecting such materials in such passage to changing pressures and to changes of direction, continuously ejecting the mixed material for impact application to a surface to be coated, and thereafter effecting an impact application of natural road surface soil to the coating before it has set.

2. The method of mixing and applying an erosion-resistant coating to roadway surfaces which comprises continuously supplying measured amounts of a natural soil aggregate and a binder to a confined air stream to effect a substantially complete coating of the particles of aggregate with the binder, and continuously ejecting the mixed material for impact application to the roadway surface to be coated.

3. The method of mixing and applying an erosion-resistant coating to roadway surfaces which comprises continuously supplying measured amounts of a natural soil aggregate and a binder to a confined air stream to effect a substantially complete coating of the particles of aggregate with the binder, continuously ejecting the mixed material for impact application to the roadway surface to be coated, and thereafter effecting an impact application of natural soil aggregate to the coating before it has set.

4. The method of mixing and applying an erosion-resistant coating to roadway surfaces which comprises continuously supplying measured amounts of a natural soil aggregate and emulsified asphalt to a confined air stream, whereby to effect the substantially complete coating of the aggregate particles with the asphalt, and then effecting an impact application of the mixed material to the surface to be coated.

5. The method of mixing and applying an erosion-resistant coating to roadway and the like surfaces which comprises continuously supplying measured amounts of a natural soil aggregate and emulsified asphalt to a confined air stream, repeatedly subjecting such materials while confined and traveling in said air stream to changing pressures and to changes of direction of travel, and then immediately effecting an impact application of the mixed material to the surface to be coated.

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