

UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN CONCRETE PAVEMENTS.

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We, GABRIEL LEVERICH and ALBERT H. EMERY, of the city, county, and State of New York, have invented a new and Improved Pavement, of which the following is a specification:

A perfect pavement should be hard, firm, and somewhat elastic under tread, neither smooth nor rough, and not affected by frost, wear, or moisture. Practically, such a pavement may be approximated by laying over a deep, stable, and well-drained road-bed a covering impervious to wet, and therefore not separated by frost, which temporarily yields somewhat under percussion without fracture, and which, by slight abrasion under wear, maintains a roughened surface.

The object of this invention is to fulfill these conditions by the construction of a compound pavement in which the resisting material, held in close though elastic union by the cement, receives and transmits jar and pressure to the road-bed, applied thereto in a plastic state. The compound should rapidly form a hard, coherent, semi-elastic mass, with all the characteristics of the best paving-stone. The materials therefor must be selected for their resisting or cementing qualities. Sharp sand, coarse gravel, or broken angular stone, and a simple cement substance are best, without any of the other ingredients usually added, which, either alone or together, but imperfectly possess the requisite qualities, and therefore are foreign to the compound.

For such a pavement the sand, gravel, or broken stone, should be sharp, clean, and hard, and vary in coarseness, as laid at or below the surface. The cement should be uniform, fluid, and adherent during admixture. The compound should condense and harden rapidly under manipulation, and contain the greatest amount of rock and the least of cement which will form a mass most resembling stone itself.

The several tar and pitch like compounds, singly or together, form cement, with or without heat. These are mechanical mixtures, made up chiefly of liquids varying in density. Some are volatile at ordinary temperature; others rapidly vaporize when heated.

Common tar, mineral or vegetable, is too fluid for a suitable cementing material. When used

it hardens, from the evaporation of its lighter elements, slowly and imperfectly, and, the change taking place first at the surface, retards the process beneath. To stimulate this change and thicken the cement, mineral or vegetable pitch, or similar bodies, are sometimes added to the tar. The parts, however, mix irregularly and imperfectly, and though these bodies resist pressure when gradually applied, they abruptly fracture under percussion, and carry this defect with them into the cement.

A stable compound is best; hence, in this invention, commercial tar is used, the distilled mineral product, as gas or coal tar, being preferred to the other. This alone in time and under favorable circumstances may form a strong and elastic cement. Herein the same result is obtained in the beginning by a proper application of heat to the tar, whereby the lighter parts are separated before use, which otherwise would slowly evaporate afterward.

We will now proceed to fully describe our invention.

Tar, from its structure and composition, is a poor conductor of heat; therefore, it must be carefully heated, or a part may be injured before the remainder is affected. By this invention a large quantity may be treated uniformly and successfully. Steam under pressure is employed. Two methods are distinguished, in the one of which furnace heat and steam are used together, and in the other steam alone. A plain cylindrical still set upright over the furnace, containing coils of steam-pipe placed near its bottom, (a part being perforated with small holes,) a condenser, and a steam-boiler comprise the apparatus required for both methods. For the second a steam-jacket may also be put around the still. In the first method the tar in the still is heated outside from the furnace, and inside from steam let in the perforated pipes, which, escaping in minute jets, mingles with it and passes upward to its surface, causing a rapid and uniform ebullition. The elements of the tar, vaporizing at a lower temperature, pass off with the steam, and may be condensed and separated in the usual manner. In the second

method steam circulates through the closed and perforated coils, and within the jacket surrounding the still, the furnace being dispensed with.

Of these two methods the first is simpler and cheaper; the second yields the most uniform product. In each, by causing an efficient circulation within the still, the contents may be raised to the required temperature without overheating at any point, and distillation continued until the tar is concentrated to the proper consistency. At what point this will take place is a matter of experience. Ebullition and evaporation are under complete control, being determined by the quantity and pressure of the steam admitted. This should be so regulated that while circulation is kept up no water is condensed within the still during the process, which is continued until the product is as thick as can be used properly.

The resisting material used is sand alone for the road-surface, sand mixed with broken stone for the middle layers, and larger broken stone for the bottom ones. Gravel may be used with the broken stone or alone. The other is preferred, shapes and sizes being chosen which best form a compact structure, smooth on top and strong throughout. It is not necessary that the fragments be uniformly small. Several sizes are mixed to form a close mass without cavities, the larger pieces being put in the lower layers. This material should be carefully selected, free from dirt and other foreign matter. If needful, it should be screened, washed, and then dried by exposure and heat. It is heated and mixed with hot cement in a suitable apparatus. This may be a hollow cylinder, rotating over a furnace about a stationary axis slightly inclined, and bearing fixed arms for stirring, with hoppers and feed arrangement at the upper end for the sand and stones, and a pipe to admit the cement.

Fire being in the furnace, and the apparatus put in motion, the sand and stones are shoveled in the different hoppers and pass separately into the revolving cylinder, where, meeting the cement, the whole is tumbled over and against the heated interior surface, stirred by the fixed arms, and slowly moved downward to the lower end of the cylinder, where it passes out fully intermixed.

The furnace may be dispensed with for heating by inclosing the cylinder within another larger and concentric thereto, and admitting steam into the space between. The resisting material may be dried, heated, and mingled in one cylinder, and discharged to meet the cement into another, where the several parts are incorporated together, the cylinders working at the same time over one furnace.

The operation is continuous, and the mixing temperature and proportions may be controlled at will by regulating the fire, the feed of sand and stones, the flow of cement, and the opening through which the mixture is discharged.

Thus far the process is conducted at a central point, where heat and power are economically applied. From thence the mixture is conveyed to the road-bed in vehicles arranged to discharge it in a thin layer over a narrow connected space, or upon the roller, to be delivered in like manner therefrom, the object being to quickly and evenly spread it for rolling, in thickness varying with the coarseness of the material.

The work is done without handling the product or its components in regular order. The hot cement from the still and the heated sand and stone from the drying apparatus pass to the mixing apparatus, and the resulting compound is discharged into the wagons without intermission and consequent loss of heat.

The temperature at which the several operations are conducted is determined by experience. The cement is reduced in the still until as thick as it can readily be worked afterward without loss of strength or adhesion; and as sand and stones receive heat without injury, and retain it well, they may be made as hot as the cement before mixing, which, promptly following, will require but little additional heat, and the mixture will remain hot for a considerable time.

A roller is used to level and pack first the road-bed, and then the several layers of paving material spread thereon. It should condense the surface more than any passing vehicle in use, and so closely press the materials into contact throughout their whole depth that with but little cement they will firmly cohere together. For this purpose the steam road-roller excels any other in cheapness and quality of work. For use upon cement pavements its surface should be heated.

The road-bed having been made ready, the paving is laid upon it in sections in successive layers, each in narrow strips, parallel with the line of road, as fast only as it can be thoroughly compressed by the roller, which is driven back and forth over it in the same direction, and also gradually worked from one side of the road-bed to the other. When one layer is finished another is put down in like manner, and the operation continued section by section until complete.

The firmness and solidity of the pavement depend upon the nature of the material used, the thickness of the layers, the speed and weight of the roller, and the amount of rolling.

In preparing and laying the new and improved pavement, the volatile compounds of staple value distilled from the tar and otherwise lost are saved, the quantity of cement used is essentially lessened, and the resisting material is brought into closer contact. The strength and endurance of the pavement are thereby increased. It is ready for immediate use when laid, and consequently the cost is greatly reduced.

What we claim as our invention is—

1. The process herein described for preparing tar for use in the manufacture of pavements—that is to say, distilling off the water and the greater portion of the oils contained in the crude tar by means of steam introduced into the mass in small jets, whether used alone or in combination with external heat, as set forth.

2. The pavement composed of sand mixed with gravel or broken stone, combined with tar residuum, prepared as set forth.

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