UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN COMPOSITION PAVEMENTS.

Specification forming part of Letters Patent No. **204,763**, dated June 11, 1878; application filed May 2, 1878; patented in England, January 15, 1878.

To all whom it may concern:

Be it known that I, JOHN COLLINS RUSSELL, of Kensington, in the county of Middlesex, England, have invented a new and improved preparation of certain materials for paving roads, applicable also for the manufacture of drain-pipes and other articles; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention relates to the treatment of peat and spent tan for the manufacture of an improved product or material suitable for paving roads and other places, and for roofing and other purposes; and it also relates to the application of the said material for making drain-pipes, moldings, cornices, and other parts of the internal decoration of houses and other articles.

In carrying out my invention the peat or spent tan, (as the case may be,) while in a moist condition, is first bruised, so as to thoroughly disintegrate the peat or tear the spent tan and loosen its fibers. The peat or tan is then, while still moist, spread out, preferably in thin layers, on shelves in a chamber heated by means of an open fire of gas-coke placed within the chamber. The heat of the chamber in the case of peat should not exceed 180° Fahrenheit, and in the case of spent tan 220° Fahrenheit. The peat or tan, if not spread out in thin layers, should be occasionally moved or stirred about, and should be allowed to remain in the said chamber until it is thoroughly dry. This chamber resembles in its construction the drying-chamber in foundries, in which the sand-cores are dried, being provided with a pit beneath opening into the chamber for supplying fresh air, and apertures near the roof for the escape of vapor. Other means may be used to dry the peat or tan; but I consider the mode that I have described the most suitable one.

The dried peat or tan or a mixture of both, in any proportions, is then placed in a boiler or other closed vessel, so constructed that the air may be exhausted from it by means of an air-pump or otherwise, and that it may be heated externally, so as to raise its contents to a temperature of about 150° Fahrenheit, but not exceeding 180° Fahrenheit. Care should be taken to prevent the peat or tan or mixture thereof from being carbonized at this stage.

The boiler or other vessel is provided with a man-hole furnished with a tight-fitting cover, which is closed when the peat or tan has been placed therein. The air is then exhausted from the boiler, and consequently from the peat and tan or mixture, and thereby the fibers of the peat or tan are opened, and it is rendered much more porous and better suited for the further processes.

A small proportion of powdered sulphur, say, about from two to three per cent. of the tar employed, as hereinafter described, is mixed with the peat and tan. The sulphur may be added either to the peat or tan in the closed vessel, or mixed with the tar in the tar-caldron hereinafter mentioned.

The boiler used by me is provided with a horizontal shaft, to which blades or spoons are attached, and which, when put in motion, will act as stirrers, or the boiler can be made to revolve on its longitudinal axis, and have blades fixed to its sides internally, which will act as stirrers when the boiler is put in motion.

The journals of the boiler are tubular, and air is exhausted through the one and tar introduced through the other, as more fully described hereinafter.

The boiler is steam-jacketed or heated by a sand-bath set above a furnace, or in any other suitable manner; but care must be taken that flames are not allowed to come into contact with it or to cause the contents to become carbonized.

In close proximity to the boiler I employ a caldron for containing tar, which is provided with the necessary heating apparatus, and is connected by a pipe provided with a stop-cock to one journal of the boiler. In the caldron I place about nine hundred pounds of gas-tar for every one thousand pounds of peat or tan or peat and tan treated in the boiler. Care should be taken that no more gas-tar is used than will suffice for the saturation of the mixture made with carbonate of lime, as hereinafter mentioned. In cases where powdered sulphur has not been added to the peat or tan in the boiler, as hereinafter mentioned, crude sulphur is now added to the

tar in the tar-caldron in the proportion of from two to three per cent. by weight of sulphur to tar, and the whole is raised to a temperature of about 250° Fahrenheit. The use of sulphur, whether when mixed with the peat or tan in the vacuum-boiler or introduced with the tar, I find very beneficial in the manufacture of my improved product, as it renders the tar thin and fluid and greatly aids in effecting the complete mixture of the materials while being treated in the vacuum-boiler, and facilitates the removal of the cooked mixture. It will sometimes be found advantageous to add two per cent. of starch or glucose or one of the similar hydrocarbons at the same time as the sulphur, in order to give additional facility for the extraction of the mixture when molded, as hereinafter mentioned. After the tar or the tar and the starch shall have been added to the vacuum-boiler, its horizontal shaft with its stirrers is set in motion, or rotary motion is given to the boiler itself, and continued for about thirty minutes. The temperature of the tar is lowered in flowing from the tar-caldron into the vacuum-boiler and coming into contact with the peat and tan therein, and it becomes necessary to again raise the heat until the contents of the boiler are raised to a temperature of at least 200° Fahrenheit, care being taken that the mixture of tar and tan or peat is not allowed to become too dry. The man-hole is then opened and the heated mixture of peat or tan and tar is next transferred to an open kneading-trough, which is steam-jacketed or similarly heated, and is provided with a longitudinal shaft furnished with blades so set as to knead the ingredients as they are successively placed in the trough, and gradually move the whole mass from one end of the trough to the other, and back again when the motion of the shaft is reversed, or the mixture made as hereinafter mentioned may be expelled from the trough at one end and again placed in at the other. The kneading operation is continued until the whole mass is rendered thoroughly homogeneous. Above this trough is placed a vibrating sieve, in which carbonate of lime and slag are placed successively, and from which they are distributed gradually and evenly over the mass in the trough. In some cases sand is added.

When it is intended to manufacture a paving material the ingredients are added in the following order and proportions for the above-named quantity of peat or tan and tar—that is to say, I add carbonate of lime in fine powder, dry and warm, about five hundred and thirty pounds. This is kneaded with the peat or tan and tar for about fifteen minutes. Then I add granulated blast-furnace or puddle slag, about fifteen hundred pounds, dry and heated to about 100° Fahrenheit, and the kneading is continued for about fifteen minutes. Then twenty pounds of linseed-oil, which has been previously gently boiled for two hours with two per cent., by weight, of quicklime, should be added, and further kneading continued for fifteen minutes. I then add about six hundred pounds of clean coarse sand, dry and heated to about 100° Fahrenheit, and continue the kneading by the action of the stirring-shaft for about twenty minutes. The kneaded mass is then taken from the trough and passed between rollers or through a grinding-mill. It is afterward again placed in the kneading-trough and about one hundred and twenty-five pounds of gas-pitch melted with twenty-five pounds of stearine-pitch, with about three pounds of gas-tar, are added in a fluid state, and then an additional quantity of about two hundred pounds of carbonate of lime should be well kneaded with the other ingredients. Then an additional quantity of about three hundred pounds of granulated slag and three hundred pounds of coarse sand should be added, and the whole mixture is thoroughly kneaded for at least thirty minutes, or until it is rendered thoroughly homogeneous. The temperature should, meanwhile, be gradually raised to 270° Fahrenheit, or to a sufficient heat to cause the pitch and tar to run freely and permeate the mass.

The mixture of the gas-tar (or an equivalent liquefying agent) with the gas-pitch and stearine-pitch is necessary in order that the necessary fluidity may be obtained without raising the temperature of the pitch too high.

This composition, treated as above, which I call "No. 1," is, when ready to be taken from the kneading-trough, filled into molds of any shape, which must be hot. It should then be subjected to hydraulic pressure equal to, say, two tons on the square inch, or it may be spread upon the surface intended to be paved or covered, and rammed with hot rammers.

In molding blocks for paving I find it advisable to protect the blocks in the following manner: Tarred felt, cut the shape and size of the mold, is laid on the bottom thereof. The mold is then filled with the above-described composition, and another piece of felt is laid on the top, and the whole subjected to pressure, the felt, when the block is cold and hard, remaining adhering to the sides of the block, and serving, when laid with the felt-covered sides vertical, as a protection against the chipping of the edges of the block. Instead of felt thin sheets of wood may be used for the same purpose. The blocks after remaining some seconds under pressure are raised out of the molds and are either stacked and allowed to cool and harden, or before being stacked they may, in order to give them antiseptic qualities, be caused to absorb a quantity of sulphurous anhydride by being exposed to the fumes of burning sulphur; or, when the blocks are pressed without the tarred felt or sheets of wood, they are, while hot, placed in a solution of five hundred pounds sea-salt, three hundred pounds slaked lime, and three hundred pounds of a salt of magnesia in three hundred

gallons of boiling water. The temperature of this solution when used should not exceed that of the blocks to be immersed in it.

When a more elastic or tough material is required for paving purposes, I vary the ingredients and their relative proportions as follows, the process being otherwise the same as above described: For one thousand pounds peat or tan, (the latter ground finer than in the former case,) treated in the drying-chamber, as before, I use one thousand pounds of gas-tar, with the addition of the same percentage of sulphur, as before described, and also, if desired, of starch or other similar hydrocarbon. The mixture is treated or cooked in the vacuum-boiler and then removed to the kneading-trough, where I add about five hundred pounds carbonate of lime in fine powder and about five hundred pounds fine-screened granulated slag, and afterward ten pounds of linseed-oil, with from two to three per cent., by weight, of quicklime, which has been previously gently boiled two hours, the kneading of the mass being effected as above described. The mass is then taken from the trough and ground as before, and afterward placed in the trough with about two hundred pounds of gas-pitch melted with fifty pounds of stearine-pitch, with the addition of a little—say, five pounds—gas-tar added in this order and heated as before. Then an additional quantity of about three hundred and seventy-five pounds of carbonate of lime should be well kneaded with the other ingredients. Then an additional quantity of about two hundred and fifty pounds of granulated slag should be added, and the whole mixture is kneaded for about thirty minutes, the temperature being raised to 270° Fahrenheit, as before. No sand is used in this case. This I call my "improved composition No. 2."

To make a composition suitable for the foundation or substratum of roads or other surfaces to be paved, as a substitute for concrete, I use for one thousand pounds of peat or tan (or peat and tan) dried as before, twelve hundred pounds of gas-tar, which are treated, as above described, in a vacuum-boiler and tar-caldron, respectively, and mixed with two thousand pounds carbonate of lime, ground fine, and two thousand pounds of clean coarse sand. The mass is removed from the trough ground and replaced as before, and four hundred pounds gas-pitch, melted with one hundred pounds of stearine-pitch and ten pounds of gas-tar, are added in this order, kneaded, and heated for two hours to a temperature not exceeding 200° Fahrenheit.

This composition, which I call "No. 3," is spread on the ground and rammed with hot rammers to form a substratum of the requisite thickness, (in ordinary cases four inches being sufficient,) and upon it may be laid the composition, prepared as previously described, or blocks made of such composition.

To make a tough elastic material suitable for roofing purposes, drain-pipes, moldings, cornices, and other ornaments for the interior of houses, which I call "composition No. 4," the ingredients and proportions are as follows: One thousand pounds of peat or tan (the latter being ground finer than when the material is to be used for paving purposes) treated in the drying-chamber as before, two hundred and fifty pounds of gas-tar, three per cent. of crude sulphur, and, if preferred, two per cent. of starch or other similar hydrocarbon, three hundred pounds of carbonate of lime in fine powder, one hundred pounds of any cheap kind of marine glue, and ten pounds of linseed-oil which has been previously gently boiled with three per cent. of quicklime. The whole mass is kneaded as before, removed from the trough, ground, replaced in the trough as before, and then three hundred and seventy-five pounds of gas-pitch, melted with one hundred and twenty-five pounds stearine-pitch, with five pounds gas-tar, are added, and then an additional quantity of about two hundred pounds of carbonate of lime should be well kneaded with the other ingredients, then an additional one hundred pounds of marine glue, the whole to be kneaded for at least four hours, the temperature not exceeding 270° Fahrenheit.

Another proportion of ingredients to produce a material which I call "composition No. 5," suitable for the same purposes as the last, is as follows: One thousand pounds peat, prepared and treated in the drying-chamber as in the previous cases, one thousand pounds gas-tar with the addition of the same percentage of sulphur, and, if desired, of starch or other similar hydrocarbon, six hundred pounds carbonate of lime, twenty pounds of linseed-oil which has been previously gently boiled with two to three per cent. of quicklime, eight hundred pounds of fine screened slag. The whole mass is kneaded as before, removed from the trough, ground, replaced in the trough as before, and then one hundred and seventy-five pounds of gas-pitch, melted with twenty-five pounds of stearine-pitch, with the addition of three pounds of gas-tar. Then an additional two hundred pounds of carbonate of lime should be well kneaded with the other ingredients, then an additional four hundred pounds of fine screened slag, the whole to be kneaded for at least one hour at a temperature not exceeding 200° Fahrenheit.

I am aware that various attempts have been made to employ peat and tan and combinations of peat and tan with various other substances for the manufacture of compositions proposed to be used for paving and other purposes; but, so far as I am aware, all such attempts have failed, owing to the want of properly mixing proper proportions and properly treating the ingredients at the various stages.

I make no claim generally to the use of the separate ingredients; but

What I claim as my invention is—

1. The process of producing a material for

use in paving or construction of road-beds, &c., whose most important steps consist in drying bruised or finely-ground peat or spent tan, heating the same *in vacuo* to degree of 150° Fahrenheit, and adding sulphur and gas-tar, gas-pitch, and stearine-pitch in the proportions specified, then kneading the mixture while heated and adding carbonate of lime and furnace-slag, substantially as described.

2. In molding the material hereinbefore described, the process of applying pieces of felt in the bottom and sides of the mold, as set forth.

3. As an article of manufacture, the paving material, formed of peat or spent-tan, gas-tar, gas-pitch, stearine-pitch, sulphur, carbonate of lime, and furnace-slag, as specified.

The above specification of my invention signed by me this 6th day of November, 1877.

JOHN COLLINS RUSSELL.

Witnesses:
WM. CLARK,
T. W. KENNARD.