UNITED STATES PATENT OFFICE.

JOSHUA R. HAYES, OF NEW YORK, N. Y.

IMPROVEMENT IN THE PREPARATION OF COMPOSITION FOR PAVEMENTS.

Specification forming part of Letters Patent No. **107,490**, dated September 20, 1870.

To all whom it may concern:

Be it known that I, JOSHUA R. HAYES, M. D., of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Making Asphalt Pavements; and do hereby declare that the following is a full, clear, and exact description thereof.

In making my improved asphaltic compound for paving streets, sidewalks, &c., I keep in view the chemical affinity that exists between bitumen and calcareous matter—a combination found in nature and known under the name of "mineral asphalt." This natural substance is not found in sufficient quantities over the surface of the earth to make it a practicable thing for paving purposes in all localities, when brought into competition, as to cost, with stone and wood. Hence, asphalt pavements are used only in France, Switzerland, and a few other countries contiguous to the natural deposits of mineral asphalt. Chemically, this native mineral asphalt is bitumen or pitch in combination with earthy material. Of the latter material, calcareous earth, by reason of its natural affinity for bitumen, if not in excess, gives to the asphalt mineral its valuable and durable characteristics for paving purposes. For this reason the Val de Travers asphalt, found near Paris, in France, is superior to that found elsewhere, as in Trinidad, &c.

Bitumen combined with earthy matter not calcareous makes an impure asphalt; in fact, the bitumen or pitch remains as such, because no chemical combination takes place other than with calcareous substances. This condition is found in the pitch lake on the island of Trinidad, improperly called by some persons "Trinidad asphalt;" but where bitumen is found combined with a calcareous earth we find the true asphalt, which, in the language of Professor Ure, "forms a compact semi-elastic solid which is not liable to injury by the greatest alternation of frost and thaw, which often disintegrate in a few years the hardest stone, nor can it be ground to dust and worn away by the attrition of the feet of men and animals, as sandstones, flags, and even granite, are."

The received opinion among geologists is, that the bitumen or pitch (forming the true asphalt when in combination with a calcareous earth) is the product of vegetable matter in decay, which, under other circumstances, would have been changed into bituminous coal. The conceded knowledge of this fact forms the basis of my invention, as relates to the formation of an improved asphaltic compound for paving and other purposes.

In distilling coal for its gases for illuminating purposes, a thick, viscid, and tenacious residuum, termed "gas" or "coal" tar, is found. This coal-tar is a very complex compound, containing a dozen or more organic elements, the products of vegetable decay, which being distilled off by gradual elevations of heat, there is left behind a solid pitchy or bituminous substance identical with the bitumen in mineral asphalt. To eliminate successfully, under various degrees of heat, the protean elements in coal-tar for mechanical and other purposes is an accomplished fact in operative chemistry; but in doing so the valuable residuum or bitumen is injured to the extent as to make it wholly unserviceable for the durable purpose required for pavements. To obtain from coal-tar this bitumen in a pure state, and uninjured by the processes used to distill off the many compounds in coal-tar, and which are not essential, but absolutely injurious for paving purposes if retained, is the object of my invention.

The vessel or retort in which is placed the coal-tar to be distilled off is wholly surrounded and embedded in a sand-bath, in order that no injury may occur by charring (through the direct contact of fire and heat) to the bitumen composing the solid part of the tar.

When a moderate degree of heat—say about 225° Fahrenheit—is applied so that the naphthas and other light volatile products are about passing over in distillation, I add to every fifty gallons of tar one-half gallon fuming nitrous acid previously heated to the boiling-point. This acid violently attacks the naphthas and all the lighter volatile elements in the tar, and, by decomposing and consuming them, facilitates the distillation, and at the same time tends to render inodorous (by thus destroying and decomposing the volatile elements) the remaining bitumen or pitch. The heat of distillation is then run up to a few degrees short of the point when the carbolic acid or creosote of

coal-tar is eliminated—say 375° Fahrenheit—and no higher degree of heat applied, in order that the carbolic acid and other fixed elements in the tar may be retained in the bitumen.

About sixty per cent. of all gas-tar is made up of this bitumen or pitch, the remaining forty per cent. composing the ammoniacal waters, naphthas, and other volatile and odorous agents that are not necessary to be kept in for paving purposes. If they are retained, or a pavement made with crude coal-tar is laid down, however hard it may become in the shade, it will, when under the influence of the rays of the sun, become spongy and viscous, and too soft and elastic for a durable pavement.

Having thus extracted the bitumen from coal-tar, which I conceive to be about the same chemically as the bitumen in the mineral asphalt, I combine it with calcareous earth in the proportion of eighty parts of the latter to twenty parts of the prepared bitumen, this being the proportion that exists in the combination composing the native mineral asphalt, and therefore make an artificial asphalt which, for durability, tenacity, elasticity, and solidity, equals the native mineral itself, and when laid down, even upon crowded thoroughfares, will not suffer abrasion—a fact exemplified in Paris and elsewhere. Any calcareous earth or calcareous sand may be used for the union with the bitumen, care being taken to keep keep the percentage of each as above given.

The simplicity of this combination of only two substances—viz., the solid part or bitumen of coal-tar and any calcareous earth—to form a durable pavement (in short, the production of an artificial asphalt by this union) cannot be overlooked or its value overestimated, in view of the fact that in making pavements in which tar enters in a crude or prepared state, sometimes as many as a dozen or more ingredients are added to absorb the tar and harden the compound for a time, and to be ground into an impalpable powder by attrition from the feet of men and animals after being laid down as a composite pavement. Bitumen only requires a calcareous earth to unite chemically with it to render it durable and solid for paving purposes, and the addition of sand, gravel, ashes, cinders, stones, hydraulic cement, lime, uncombined, or any other substances, only tends to destroy the integrity and tenacity of the compound, while the materials themselves are convertible into impalpable powders, to annoy all who travel upon them.

The bitumen prepared as I have described is mixed, when melted and hot, with the calcareous sand or earth previously warmed over a gentle fire. In localities where calcareous earth is inaccessible, it may be artificially made by adding lime or plaster to very fine sand, in the proportion of one part of plaster or lime to ten parts of the finest earth-sand that can be procured.

The bitumen or pitch from wood or pine tar is so unlike in chemical nature with the bitumens of the mineral asphalts and coal-tar, and withal so brittle and made up of so many volatile and pungently odorous particles, that I deem the use of this kind of tar impracticable. Besides, a street-pavement laid with this kind of tar, either in its crude condition or after the lighter particles have been extracted by distillation, cannot, from the nature of the material, be durable. Coal-tars, however, manipulated in the manner I have described, so as to obtain only the solid or bituminous parts thereof, give us a material that is durable and so closely allied to the asphalt bitumens that it can be used in lieu thereof, and when combined with a substance having a natural affinity therefor—viz., a calcareous earth—an artificial asphalt is the result, which, in the language of Professor Ure, "is a compact semi-elastic solid, which will not disintegrate by the greatest alternation of frost and thaw, nor can it be ground to dust and worn away by the attrition of the feet of men and animals, as sandstones, flags, and even granite, are."

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The application of a sand-bath to a retort containing coal-tar in distillation, so as to obtain therefrom, uninjured by extreme heat, the bitumen or pitch for paving purposes, the heat in distillation for this purpose not exceeding, as the highest point, 325° Fahrenheit, in the manner substantially as set forth.

2. The treatment, by means of the fuming nitrous acid of commerce, to decompose and consume the volatile and odorous elements in the coal-tar during the process of distillation, in the manner and for the purpose substantially as set forth.

3. The product made by uniting chemically the bitumen or pitch thus prepared from coal-tar with any calcareous earth, so as to form an artificial asphalt for paving purposes, in the manner substantially as set forth.

J. R. HAYES, M. D.

Witnesses:
D. H. STONE,
WM. W. BADGER.