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COATED MINERAL AGGREGATE AND METHOD OF MAKING SAME

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It is well known that the superficial covering of modern roads is composed of crushed stone or fine gravel, or the like (i. e. of aggregate) which form the structure thereof and which are bound together with a plastic binder.

It has already been suggested that those materials should be given coatings of binding compositions.

According to certain known processes, the coating of the aggregate is heat-operated; on the one hand, the fine gravel is heated and on the other, the binder, after which the two are brought together and thoroughly mixed. There are disadvantages in this process however; in particular, the material for road-covering thus obtained is difficult to manipulate above all in winter and it is not possible to store it. What is more, the process of applying the road-covering is a difficult one because the tools used are quickly clogged when the material cools off.

A second known process provides for cold coating of the aggregate in hydrocarbon or other binders, turned into an emulsion by the addition of water and suitable emulsive agents. This process likewise has its drawbacks; the wet gravel is hard to cover because the emulsion is diluted in contact with the water of the gravel; work with this process has to stop during rain. Here again, it is impossible to store the material thus coated and it also clogs the tools utilised.

The present invention has for its object to provide a novel material for surfacing roads and other similar surfaces, as squares, streets and the like, said material comprising a mineral aggregate such as fine gravel or like material coated with two successive colloidal layers of binders, the first of which mainly comprises tar (coke oven tar, gas tar, water gas tar, wood tar or the like) and the second, which is semi-porous, a bituminous substance (oil asphalt or natural asphalt), said two layers being impregnated and the external surface of the second layer covered with a caustic alkaline lye (such as soda or potash).

This material offers the very important advantages of being able to be stocked for a very long time, even in winter and without calling for any special precaution; of being easy to handle even after having been stored for a long while and of rapid and simple application because it does not cling to the tools. What is more, setting is ensured in all weathers and in any season since it is prepared cold with any aggregate suitable for road surfacing whether such aggregate is dry, damp or even wet.

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This material can be obtained for instance, by successively coating said aggregate, without heating, with two emulsions of binders, the first which is of the "water-in-oil" type comprising tar of any kind (coke oven tar, gas tar, water gas tar, wood tar or the like) having good wetting (or covering properties) and soda, potash or other alkaline base capable of absorbing and then of expelling water eventually contained in the light gravel, and the second, which breaks up, in the presence of the base of the first, mainly comprising a bituminous substance (oil asphalt or natural asphalt) and being of "oil in water" type.

As second binder, preference can be given to the special product derived from mixing the bituminous substance with an aqueous phase obtained with the help of special soaps containing stearic, oleic and resinic acids with the addition of ammonia the object of which is to set up a rapid dialysis of the said aqueous phase.

By way of an example, to obtain the material accordance to the invention, the operation may be carried out as follows:

First of all the light gravel or other aggregate is coated with a first binder composition (A) that can be composed in the following approximative manner (in weight):

	Per cent
Tar	65 to 75
Soda lye containing from 30 to 40% by weight of anhydrous NaOH (or other alkaline lye)	25 to 35

If required, the tar can be filler treated by the addition of all the usual pulverulent agents such as powdered coal, powdered limestone, etc.

During the course of the first coating process with the binder (A), thanks to the wetting and covering power possessed by the tar and enhanced by the presence of the alkaline lye, said tar adheres rapidly and in a uniform manner to the surface of the light gravel even if the latter is dry, thus forming a first layer or continuous film.

On the other hand, if the aggregate is wet, the water is absorbed by the soda lye or other alkaline base, in such a way that finally, a perfectly coated gravel is always obtained.

The first coating operation is effected by thoroughly mixing in any well known way the aggregate with the binder A; the external surface of the aggregate so coated is covered with an oily layer formed by the greater part of the lye; should the aggregate contain any surplus water, then it is mechanically driven out whilst it is

being thoroughly mixed with the first binder (A).

Naturally, the quantity of the first binder (A) needed to produce the first coating in a suitable way, varies according to the geological nature, the granulometry of the gravel or other aggregate and the season. However that may be, the quantity should be such that after appropriate mixing of the aggregate and the binder (A), all the materials have a very uniform shining black appearance.

As guidance, an average proportion is 15 to 30 kgs. per ton of material for highways.

After the first cold-applied coating operation has been completed, the second operation is engaged, again cold-operated with the second binder (B). Due to the aqueous phase of this special binder, it can be composed as follows, the parts being by weight:

	Per cent
Bituminous substance (oil asphalt or natural asphalt)	50 to 60
Mixture of oleic acid, stearic acid and rosin soaps	0.5 to 1
Normal commercial ammonia	0.1 to 0.5
Water	quantity sufficient to make up 100%

During the course of this second coating operation, the special binder (B) finds itself broken up by the soda or other base contained in the first binder (A)—it will be recalled that this soda is found above all on the surface of the light gravel that has undergone a first coating.

This breaking-up of the binder (B) takes place progressively in such a way that the bituminous surface thus set free is deposited in a uniform manner as a second semi-porous layer or film—through ordinary mixing—on the film of tar already covering the aggregate.

The alkaline lye works through the deposited film of bituminous substance and, by dialysis, reaches the surface of the two binders deposited on the aggregate. A small part of that lye continues to impregnate the material thus coated, above all on the surface, whereas the surplus runs off with the water from breaking-up of the aqueous phases that were useful as appropriate conveyors for the binders.

The aggregate is then definitely covered and water no longer has any action on it.

The proportion of the second special binder (B) mainly comprising bituminous substance, also varies according to the nature of the material, the use for which they are intended and the season; for instance it can be to the extent of 50 to 75 kgs. per ton of light gravel.

In short, the light gravel or other aggregate is coated with two products, tar and bitumen, the respective proportions of which are directly a function in some way, of the geological nature of the material, of its granulometry and of the season; those two products are superficially protected by the lye held on mechanically at the time the binder (B) is broken up in contact with the binder (A); due to the presence of that residual lye on the coated light gravel, the latter is prevented from sticking and from clogging the tools utilised.

The material thus coated can be stored in heaps for a very long time, even in winter, in all kinds of weather. As a matter of fact, inside the heap, the aggregate remains protected so to speak, by its oily scale of alkalin lye whereas on the surface of the heap, under the influence of the air and its atmospheric agents, that oily scale causes setting of the material which rapidly hardens through oxidisation. The light superficial crust thus formed constitutes a protection for the remainder of the heap; it is only necessary to break it up in order to reach the material underneath which is in the same condition as it was at the time the coating operation was made.

In that way, when required for use, coated aggregate is always found, protected by the superficial oily layer of soda that prevents the aggregate from sticking to the tools. It will readily be understood that manipulation and application of the material as required, is simple and easy in all sorts of weather.

This application of the prepared gravel or other aggregate is conducted in the same way as for any coated material, by spreading out, levelling off followed by passage of the road-roller; this induces a rapid discharge by exudation of the interposed lye and in that manner causes a more rapid setting action and hardening. The same superficial hardening phenomenon through oxidisation takes place rapidly on the surface of the highway covering thus constituted just in the same way as it occurs on the surface of the stored heaps.

Due to such superficial oxidisation, the layers thus obtained according to the invention, rapidly acquire a characteristic grey colouring; they are distinctly anti-skidding and there is no fear whatever that as time goes on there will be any rising or exudation of the binders.

The fact that the materials coated according to the invention do not clog to the tools, makes it possible to produce thin layers, that is to say, economical coverings.

It should be noted moreover, that with those coated materials, it is very easy to obtain light coverings having the same colour as the light gravel that has been given a coating. It is merely necessary to spread sand at the time of steam-rolling. Under the influence of traffic, that sand does the work of an abrasive and ensures wear of the superficial thicknesses or films of tar and bitumen of the layer before those products have adhered definitely to the light gravel, under the influence of the soda and in contact with the air.

Finally, the material according to the invention, always retains a certain plasticity in the thickness of the covering thus producing layers that are distinctly noiseless, watertight and rough.

The process according to the invention going makes also possible to realise thin coverings on highways at all seasons, that is to say less costly, at the same time defining with certainty the quantity of light gravel put into use, necessary and sufficient.

To that end, the aggregate is previously treated in one of the binders to provide a covering, for preference in the special colloidal based on tar (A) of the type "water in oil"; the special colloidal binder (B) is spread, in a cold state, on the road and to the quantity desired; the aggregate previously covered with the special binder (A) is then spread over the highway, in its turn.

It will readily be seen that when the previously covered aggregate and binder A enter into contact with the binder (B) the latter colloidal binder is broken up. In that way the two hydrocarbon binders, tar and bitumen are liberated in a colloidal form and, at all seasons and in all weathers in which work can be engaged, normally, they enable the previously covered aggregate to set immediately and securely. The water

resulting from the breaking-up rises slowly to the surface of the layer after passage of the road-roller; they carbonate and assist rapid hardening of the superficial layer which, by reason of the process itself, retains a great plasticity.

To obtain a still better result and to produce a really thin carpeting of the covered material, it is advisable to proceed in the following manner.

When only part of the special cold-applied binder (B) has covered the highway, the aggregate covered with the binder (A), easily handled because it does not cling to the tools, is spread out and then rolled.

The aggregate is then sprayed on the surface with a second light spray containing the remainder of the binder (B). The whole is then sanded to allow traffic to be resumed at once but by reason of the colloidal breaking-up of the two special binders (A) and (B), immediate setting of the aggregate is obtained with all the characteristics of the semi-thick layers of film-covered light gravel.

It is quite understood that the aggregate can be treated previously with the binder (B) and make use of it on the highway previously sprayed with binder (A) but the aggregate treated previously with binder (B) are not able to be stored. In practice therefore, it is better to proceed according to the method described previously whereby it is possible to pile up, in advance, the aggregate treated previously in binder (A), ready to be utilised on the highway.

Naturally, the invention is in no way limited to the indicated products and proportions which have only been mentioned by way of examples.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. A material for surfacing roads and the like, said material comprising a mineral aggregate coated with two successive colloidal layers, the first layer being a tar of the group consisting of coke oven tar, gas tar, water gas tar and wood tar and colloidally dispersed therein an aqueous caustic alkali solution, the second layer being a semi-porous bituminous asphalt, said second layer being impregnated with and the external surface of the second layer being covered with a caustic alkali solution, the said caustic alkali solution impregnating and covering the second layer being a product of the rupture of a colloidal dispersion including said tar and said caustic alkali solution.

2. A process for the preparation of the material as claimed in claim 1, which comprises mixing said aggregate, without heating, with a first binder consisting of a water-in-oil emulsion of alkaline caustic lye with a tar of the group consisting of coke oven tar, gas tar, water gas tar,

and wood tar, and further mixing, without heating, the so coated aggregate with a second binder constituted by an emulsion of the "oil-in-water" type consisting of a bituminous substance selected from the group consisting of oil asphalt and natural asphalt emulsified in an aqueous phase.

3. A process as claimed in claim 2, in which said first binder contains:

	Per cent
Tar of the group consisting of coke oven tar, gas tar, and water gas tar, wood tar	65 to 75
Alkaline lye	25 to 35

4. A process as claimed in claim 2, in which the first binder contains:

	Per cent
Tar of the group consisting of coke oven tar, gas tar, water gas tar, and wood tar	65 to 75
Alkaline lye with 30 to 40% by weight of anhydrous NaOH	25 to 35

5. A process as claimed in claim 2 in which said second binder contains a bituminous substance of the group consisting of oil asphalt and natural asphalt, water of dissolution, a soap constituted substantially by a mixture of soaps of stearic, oleic and rosin acids, and ammonia.

6. A process as claimed in claim 2 in which said second binder contains, by weight:

	Per cent
Bituminous substance	50 to 60
Mixture of oleic acid, stearic acid and rosin soaps	0.5 to 1
Commercial ammonia	1.1 to 0.5
Water	to make up 100%

7. A process as claimed in claim 2, in which for one ton of aggregate, use is made of substantially:

15 to 30 kg. of said first binder and 50 to 75 kg. of said second binder.

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