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ROAD MAKING AND THE LIKE

Lawton B. Beckwith, San Pedro, Wallace E. Grebe, Wilmington, and Frederick S. Scott, Los Angeles, Calif., assignors to Union Oil Company of California, Los Angeles, Calif., a corporation of California

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This invention relates to a method for building roads in which asphalt or other bituminous substances are employed to coat and bind the stone aggregate normally used in such construction. The invention relates particularly to an improvement in one of the known methods for building roads by the so-called cold laying process in which the bituminous binding agent is used in the form of a powder.

According to the cold laying method described in the Radcliffe U. S. Patent No. 1,655,240 which has been reissued as United States Re. Patent Number 17,985, the stone aggregate is first coated with a slow drying liquid binder and then with a powdered bituminous binder and the mixture is later amalgamated on the road by rolling. In this method, no heat is employed either to melt the bituminous substance or to effect amalgamation on the road. The solvent liquid binder employed is sufficiently fluid at atmospheric temperatures so that no heat is applied either to liquefy the binder or during admixture with the aggregate. The powdered bituminous binder is of sufficiently high melting point so that when it is commingled with the liquid binder the resulting blend will have a desired melting point sufficiently high to resist summer heat.

Our invention relates to an improvement in the above cold laying method for building roads and the like. In the aforementioned method, some difficulty has been experienced in selecting a suitable fluxing oil or liquid binder which will have sufficient solvent power for the powdered bitumen to permit amalgamation without the application of heat. It is an object of our invention to improve the solvent power of the fluxing oil for the powdered bitumen.

It is a further object of our invention to use as part or all of the fluxing oil heretofore employed, an oil fraction which has a high solvent power for the bitumen.

A further object is to use a powdered bitumen which is characterized by a high solubility in oils and solvents.

Other objects of our invention will appear from the following description of our invention.

We have discovered a method for improving the solvent power of the flux oil for the powdered bitumen. We have found that when a highly aromatic or naphthenic oil fraction is used either to replace the fluxing oil heretofore employed or as an addition agent to the fluxing oil heretofore employed, a greatly improved amalgamation of the powdered bituminous binder is obtained. Thus, the highly aromatic or naphthenic oil fraction may be used directly as the flux oil or a portion may be added to other liquid binders for the purpose of increasing the solvent power of such binders for the powdered bitumen.

The solvent liquid which we have found to be particularly adapted for use as a solvent liquid binder or to increase the solvent power of other liquid binders is the so-called extract produced by treating oils with selective solvents which are capable of separating the non-paraffinic or aromatic or naphthenic oil constituents contained in the oil from the paraffinic constituents. One well known solvent which is adapted to separate the oil in this manner is liquid sulfur dioxide. Other solvents are mixtures of liquid sulfur dioxide and benzene, mixtures of acetone and benzene, chloraniline, nitrobenzene, furfurol, phenol, aniline and methyl formate.

The separation of the oil into non-paraffinic and paraffinic constituents may be accomplished by mixing the oil with the selective solvent at an appropriate temperature sufficient to dissolve only the aromatic constituents contained in the oil and allowing the mixture to stratify into two distinct layers. One of the layers, i. e. the raffinate layer, contains the more paraffinic hydrocarbons with only a small amount of the solvent while the other layer, i. e. the extract layer, will contain the bulk of the solvent in which are dissolved the more aromatic relatively less paraffinic hydrocarbons. By separating the two layers and stripping the solvent contained in each layer, two entirely different types of oils are produced. The oil produced from the raffinate phase will exhibit a high paraffinicity, while the oil obtained from the extract phase will exhibit a low degree of paraffinicity. This extract is the oil which we particularly desire to use as the fluxing oil or as a compatibility agent for blending the fluxing oil of less solvent power with the powdered asphalt during the process of road building.

The extract chosen is preferably one which is substantially free of light volatile hydrocarbons so that when it is used in building the road substantially none of it will evaporate to the atmosphere. When the extract is produced by extracting a lubricating oil containing light hydrocarbons, it is preferable to remove these light hydrocarbons by distillation before using the extract for road building. A typical example of an extract which we may use is the extract re-

sulting from the liquid sulfur dioxide treatment of a western paraffinaceous lubricating oil. This extract may possess an A. P. I. gravity of approximately 11.0, a viscosity of about 297 seconds Saybolt Universal at 210° F., a flash point of about 515° F. (Cleveland Open Cup) and a viscosity index of less than −30.

The solid bituminous binder which may be employed in the powdered form is preferably an asphalt having a high melting point of approximately 175° F. or higher. The asphalt may be produced by steam or vacuum distilling an asphaltic crude oil to produce an asphalt residue having the desired melting point. If desired, oxidized asphalt or other asphalts of high melting point may be used. The asphalt may be reduced to a fine powder by grinding in an impact ball mill or jaw crusher, or by air or steam atomizing.

In one modification of our invention, we prefer to employ as the powdered bituminous binder, an asphalt which is separated from asphaltic oils by precipitation with a solvent rather than by distilling the asphaltic oil to a residue. We have found that high melting point solvent precipitated asphalt is characterized by a high solubility in light and heavy petroleum fractions which permits ready amalgamation with the fluxing oil. Bitumen extracted in this manner is substantially free from oil and also from wax. It is precipitated from the asphaltic oil as discrete particles by means of a suitable asphalt precipitating solvent, such as liquefied propane, and by simple rewashing with the same type of solvent, the bituminous material is obtained in a powdered form ready for use as binder and will generally require no further powdering of the solid bituminous material.

The process for separating asphalt from asphaltic oils by precipitation with a solvent is well known. This process resides in mixing the asphaltic oil with a suitable amount of a solvent which is capable of dissolving oil and wax at room temperatures but which has a low solvent power for the bitumen or asphalt. Solvents capable of effecting this separation are liquefied normally gaseous hydrocarbons such as ethane, propane, butane, iso-butane or mixtures thereof. Such hydrocarbons are obtained by rectification of casinghead gasoline by the so-called stabilizing method now conventional in the natural gasoline industry. They comprise the overhead gaseous fractions of the stabilizing process. The gaseous fractions are liquefied by compression and cooling in the conventional manner and are drawn off into pressure chambers where they are maintained in the liquid state until they are used. The necessary pressure to maintain propane, for example, in a liquid state is approximately 125 lbs. per square inch gauge at 75° F.

When separating the asphalt by precipitation, the asphaltic oil is mixed with about five volumes of propane, for example, at a temperature of 75° F. or higher and a pressure of 125 lbs. per square inch or higher and the mixture is allowed to remain in a quiescent state until the precipitated asphalt has settled to the bottom of the container. The clear supernatant solution of oil and propane is then decanted. The remaining bottoms comprising discrete particles of asphalt may then be washed with further amounts of propane until substantially all of the oil is removed from the asphalt particles. These particles may then be dried at a temperature insufficient to melt the wax particles in order to remove entrained propane. If desired, however, the propane may be removed from asphalt particles by subjecting them to distillation at a temperature sufficient to melt the asphalt. The melted asphalt may then be cooled and solidified and the solidified asphalt may be ground to a fine powder, or the molten asphalt may be atomized by steam or air spraying.

It will be understood that the precipitated asphalt may be used in the herein described cold laying process either in conjunction with the extract fluxing oil or with a mixture of the extract fluxing oil and less aromatic fluxing oil or with the less aromatic fluxing oil alone. Since the precipitated asphalt is characterized by a high solubility, it is possible to use the less aromatic fluxing oil for the powdered asphalt without necessity of either altering or replacing the fluxing oil with extract.

In practicing the invention for building roads, the mineral or stone aggregate, properly graded is first coated with about 5% of the fluxing oil which may be conveniently done in a concrete mixer and preferably although not necessarily near the road to be made. The resulting mix is an oily, freely movable mass at atmospheric temperatures. About 5% to 10% of the powdered bitumen is then added to the above mixture, thus producing a finished road containing about 10% to 15% of the binder uniformly distributed. The powdered asphalt may be added at a suitable time to the stone coated with the fluxing oil before or while the coated stone is being laid down. The resultant mix is composed of stone aggregate particles coated with a first oily coating and a second exterior dust-like coating of powdered bitumen, the aggregate particles being thus separated from each other by the dust-like coating and are therefore freely movable with respect to each other.

The powdered bitumen may be added first to the mineral aggregate with subsequent addition of the fluxing oil, or the two components may be added simultaneously but not commingled until they are in intimate contact with the mineral aggregate.

Before the liquid part of the binder is amalgamated or fluxed with the powdered asphalt, sufficient time will have elapsed to allow proper handling and placing of the mix in position on the road. When the mix has been properly placed upon the road bed, it may then be consolidated by rolling with either a hand type roller or a power driven roller.

While we have described the use of approximately equal parts of fluxing oil and powdered asphalt, it will be readily understood that other proportions of these materials may be used. The proportions used will, of course, depend upon the characteristics of the fluxing oil and the powdered asphalt. In general, the proportions employed are such that the resulting asphalt in the road composition will have a penetration of 30 to 300 at 77° F. These considerations also apply where the extract is used as a compatibility agent for effecting better fluxing of the powdered asphalt with the fluxing oil.

When a paraffinic type of fluxing oil is used in the road mix, we may increase its rate of fluxing with the bitumen, by selecting another type of bitumen which is readily dispersed in fluxing oil, namely a residual produced from a highly aromatic crude or from a non-aromatic crude which has been increased in aromaticity by cracking operations.

The above description of our invention is not

to be considered as limiting our invention but only as illustrative of the invention, as many variations may be made within the scope of the following claims.

We claim:

1. A process for making material for roads wherein stone aggregate is coated with bituminous materials which comprises coating the aggregate with a substantially non-volatile, highly aromatic, non-paraffinic oil which is fluid at normal atmospheric temperatures and with a powdered bituminous binder having a high melting point and capable only under applied pressure of amalgamating while cold with said oil to form a substantially homogeneous composite binder.

2. A process for making material for roads wherein stone aggregate is coated with bituminous materials which comprises coating the aggregate with a substantially non-volatile, highly aromatic, non-paraffinic oil which is fluid at normal atmospheric temperatures and subsequently before drying applying to the coated aggregate while relatively cold, a powdered bituminous binder having a high melting point and capable only under applied pressure of amalgamating while cold with said oil to form a substantially homogeneous composite binder.

3. A process as in claim 1 in which the powdered binder comprises a precipitated asphalt.

LAWTON B. BECKWITH.
WALLACE E. GREBE.
FREDERICK S. SCOTT.