Patented Apr. 7, 1942

2,278,671

UNITED STATES PATENT OFFICE

2,278,671

METHOD OF ASPHALT MANUFACTURE

Joseph C. Roediger, Brooklyn, N. Y., assignor to Standard Oil Development Company, a corporation of Delaware

No Drawing. Application October 10, 1939, Serial No. 298,799

7 Claims. (Cl. 106—273)

This invention relates to improvements in the manufacture of bituminous materials such as are used as bonding agents for mineral aggregates in road construction. It relates particularly to the preparation of bituminous bonding materials from petroleum oils that have been subjected to high temperatures and are generally known as cracking coil tars.

The straight reduction of cracking coil tars generally produces asphalts having very poor (high) susceptibility to temperature change which, therefore, cannot be considered or sold on the same quality basis as the asphalt having good susceptibility to temperature change produced by straight reduction from asphaltic crudes.

If an asphalt which is highly susceptible is used as a filler in block pavements, either wood or stone, the heat under normal summer conditions will cause the asphalt to soften almost to the point of being fluid. This will ooze out of the joint onto the blocks, rendering them sticky. An asphalt with low susceptibility will not soften to any such degree under the same conditions and although expansion will take place, the bitumen will remain in a more or less solid, non-sticky condition. In an asphalt macadam road, other conditions being equal, a highly susceptible asphalt tends to lower road stability and cause displacement under the action of heavy traffic in hot weather, because the asphalt will soften to a greater degree and hence lose more of its bonding power than one of low susceptibility.

Cracking coil tars if reduced by vacuum flashing to a high softening point bottoms which is then blended with a low viscosity cracking coil tar produced from gas oil result in asphalts having slightly better susceptibility characteristics than that of a gas oil tar reduced to equal penetration or softening point. However, the blended asphalt generally has a high ductility, e. g. 100+ at 77° F., for grades having penetrations at 77° F. in the range of 30–200.

If cracking coil tar, reduced to a relatively high softening point in a similar manner as pointed out above, is blended with relatively low viscosity tars produced from the cracking or viscosity breaking of a reduced crude, an asphalt results with susceptibility characteristics, both at normal temperatures (softening point/penetration index) and at sub-normal temperatures (penetration 77/32° F. ratio), superior to straight reduced Mexican asphalt of equal penetration. The index and ratio are shown numerically in the following tables. Basic figures used for developing the arbitrary scales were obtained from accurate tests on vacuum-pipe still reduced asphalts from heavy Mexican and petroleum tar. Asphalts from heavy Mexican crude were arbitrarily chosen as 100 on the index scale as representing products having a low consistency-temperature coefficient, while those from petroleum tar were selected as the other extreme, that is, as 0 on the scale, representing asphalts with a high consistency-temperature coefficient. In this discussion, petroleum tar is to be considered as the residue from the cracking of virgin gas oil under high temperature and pressure.

TABLE 1

Numerical magnitude of softening point-penetration index

Asphalts*	Range of values for softening point-penetration index, paving range 30–90 penetration at 25° C.
Mexican	100
Venezuelan	85–88
Colombian	67–77
Heavy Smackover	82–94
West Texas	59–62
Healdton	70–76
Mid-Continent	59–65
Van Zandt	68–75
California (Kern River)	14–27
East Venezuelan	10–27
Petroleum tar from cracked gas oil	0

*Straight reduced asphalts.
Penetration range, penetration at 25° C. per 100 grams per 5 seconds.

TABLE 2

Numerical magnitude of the susceptibility factor at subnormal temperatures

$$\text{Susceptibility factor} = \frac{\text{penetration at 25° C. per 100 grams per 5 seconds}}{\text{penetration at 0° C. per 200 grams per 60 seconds}}$$

Asphalts*	Range of susceptibility factor values, paving range 30–90 penetration at 25° C.
Mexican	3.3
Venezuelan	3.4 – 3.8
Colombian	3.5 – 5.0
Heavy Smackover	2.71– 3.50
West Texas	4.6 – 5.8
Healdton	5.4 – 6.6
Mid-Continent	3.7 – 4.8
Van Zandt	3.2 – 4.2
California (Kern River)	12.5 –13.3
East Venezuelan	4.4 – 5.2
Petroleum tar from cracked gas oil	7.0 –17.0

* Straight reduced asphalts.
Penetration range, penetration at 25° C. per 100 grams per 5 seconds.

Although the production of the above blended composition is a decided advantage from a quality standpoint, the asphalts so produced generally have low ductilities which would limit their general use.

It is an object of this invention to produce an asphalt from cracked source materials that has both the desired ductility and the susceptibility to temperature change similar to that of asphalts produced by the reduction of asphaltic crude oils.

Another object of this invention is to regulate the susceptibility to temperature change and ductility of an asphalt.

According to this invention, high softening point reduced tar is blended with a suitable combination of both relatively low viscosity gas oil tar and low viscosity reduced crude tar. The proportions of each ingredient can be so regulated that the desirable susceptibility characteristics of a straight reduced asphalt produced from an uncracked crude oil and high ductility may be produced within the range of properties resulting when either low consistency tar is used alone in preparing the blend. The susceptibility characteristics of these blended asphalts can be regulated so they are equal to or slightly better than those of straight reduced asphalts, such as those produced from Colombia or Mexican crude oils. In the following table are disclosed the effects of blending a high melting point cracking coil tar with gas oil tars and with petroleum tars such as are obtained by the cracking of crude oil or reduced crude oil. The effects of the various constituents entering into a combination of these three ingredients and also the softening points of the ingredients are illustrated in the following table:

	1	2	3
I. Blend (percent by weight):			
250 softening point tar, °F., A.S.T.M...	48.0	33.0	40.5
Gas oil tar #1*	52.0	------	26.0
Visbreaker tar from crude oil**	------	67.0	33.5
II. Inspections on blend:			
Softening point, °F., A.S.T.M	109	123	117
Penetration 77° F., A.S.T.M	93	100	87
Penetration 32° F., A.S.T.M	28	48	33
Ductility 77° F., A.S.T.M	100+	26	90-95
III. Susceptibility:			
Softening point/penetration 77° index...	5	126	75
Penetration 77°/penetration 32° F	3.32	2.1	2.64

* Gas oil tar #1=121 furol/122 °F.
**Visbreaker tar=1512 furol/122° F.

	1	2	3
I. Blend (per cent by weight):			
350 softening point tar, °F., A. S. T. M..	35	25	30
Gas oil tar #2*	65	------	32.5
Visbreaker tar from crude oil**	------	75	37.5
II. Inspections on blend:			
Softening point, °F., A. S. T. M	108	125	114
Penetration 77° F., A. S. T. M	114	100	100
Penetration 32° F., A. S. T. M	24	49	37
Ductility 77° F., A. S. T. M	100+	15	100+
III. Susceptibility:			
Softening point/penetration 77° index....	14	136	70
Penetration 77°/penetration 32° F	4.75	2.0	2.7

*Gas oil tar #2=599 furol/122° F.
**Visbreaker tar=1512 furol/122° F.

The 250° F. and 350° F. softening point tars were produced by vacuum reducing in a pipe still a mixture of gas oil tar and reduced crude tar. This is for illustration only, as the high softening point tars may be prepared from gas oil tars or reduced crude tars alone. It should be noted that the asphalts produced by the blending of the three tars have susceptibility characteristics better than that prepared by straight reduction from Colombia crude and considerably better over the asphalt attainable by the reduction of the reduced gas oil tars alone.

	Susceptibility of normal crude asphalts	
	Softening point/penetration index	Penetration 77°/penetration 32° ratio
Mexican (Panuco) crude	100	3.3
Colombian crude	68	4.4
Reduced gas oil tar	0	12.0

It is obvious how the proportions of the two low viscosity tars in the final blend can be regulated to produce asphalts having different susceptibility characteristics and different ductilities within the range of the properties resulting when either tar is used alone in a blend.

By a reduction of the relatively low viscosity tars to suitable flash points and volatility characteristics, it is possible to produce blended asphalts according to the method cited in the above invention having controlled and desirable properties in respect to A. S. T. M. flash point and volatility test.

I claim:

1. A process of producing a bituminous bonding agent which comprises blending a high softening point cracking coil tar with a relatively low viscosity cracking coil tar produced from gas oil and low viscosity tars produced from the cracking of crude petroleum oil.

2. A process of producing a bituminous bonding agent which comprises blending a high softening point cracking coil tar with a relatively low viscosity cracking coil tar produced from gas oil and low viscosity tars produced from the cracking of reduced crude petroleum oil.

3. A process of producing an asphalt from cracked source materials which will have improved susceptibility characteristics over those capable of being produced by straight reduction of the gas oil or of reduced crude tars alone, which comprises blending a cracking coil tar of at least 185° F. softening point with a relatively low viscosity cracking coil tar produced from gas oil and low viscosity tars produced from the cracking of reduced crude petroleum oil.

4. A process of producing an asphalt from cracked source materials which will have improved susceptibility characteristics over those capable of being produced by the straight reduction of gas oil or reduced crude tar oil alone, which comprises blending a minor proportion of a cracking coil tar having a softening point of at least 185° F. with a major proportion of cracking coil tars produced from gas oil and low viscosity tars produced from the cracking of crude petroleum oils.

5. A process of producing an asphalt from cracked source materials which will have improved susceptibility characteristics, which comprises blending cracking coil tar having a softening point of at least 185° F. with a mixture of low viscosity tars produced from gas oil and reduced crude oils.

6. A process of producing an asphalt according to claim 5, in which the cracking coil tar has a softening point of 185° to 350° F.

7. A process of producing a bituminous bonding agent which comprises blending a cracking coil tar having a softening point of at least 185° and a gas oil tar having a furol viscosity at 122° F. of at least 121 to 599 seconds and a tar produced from petroleum oils having a viscosity of 1512 seconds furol at 122° F.

JOSEPH C. ROEDIGER.