Jan. 19, 1937. E. O. RHODES 2,068,304

MANUFACTURE OF ROAD MATERIALS

Original Filed May 18, 1932 3 Sheets-Sheet 1

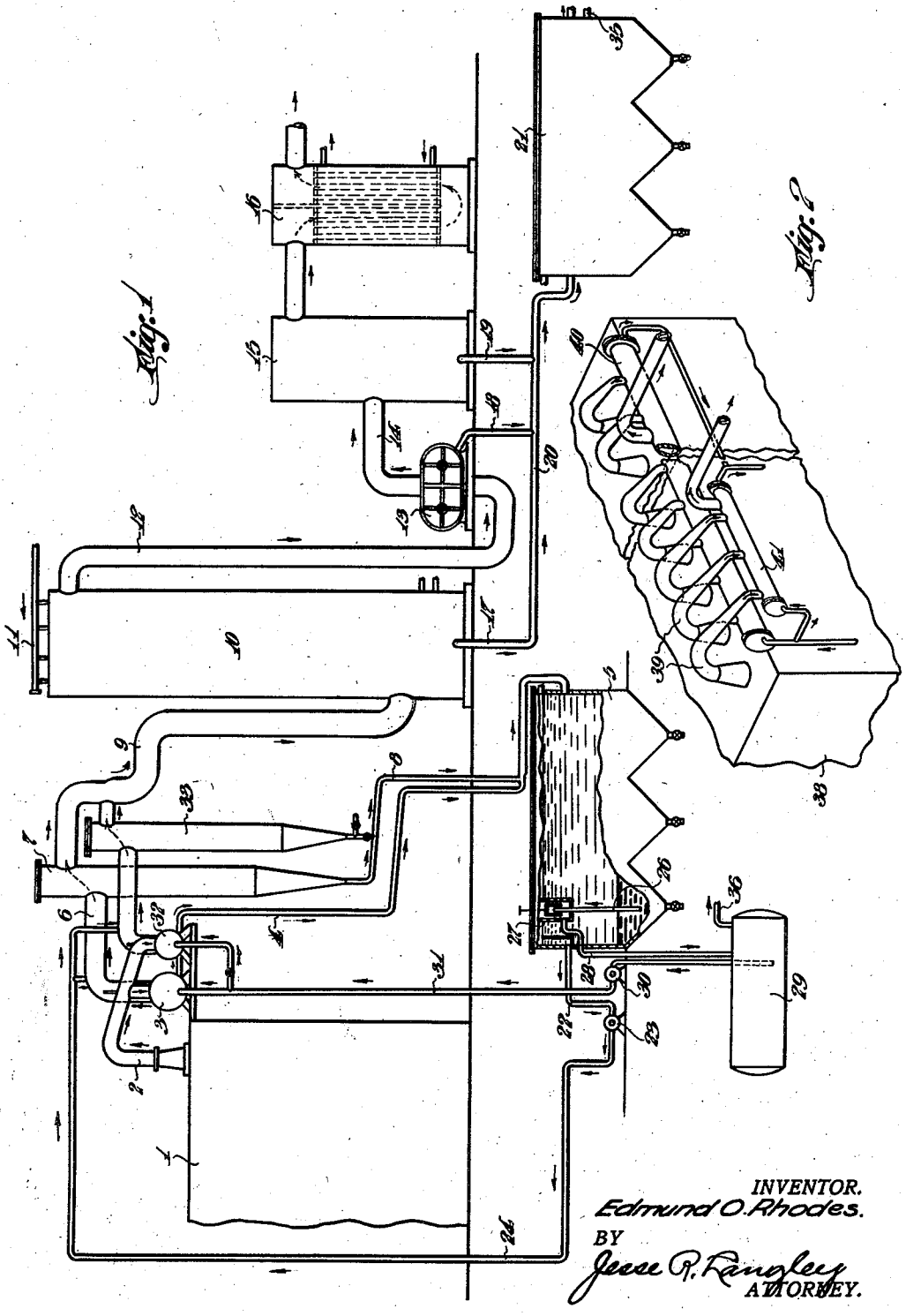


Fig. 1

Fig. 2

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Original Filed May 18, 1932 3 Sheets-Sheet 2

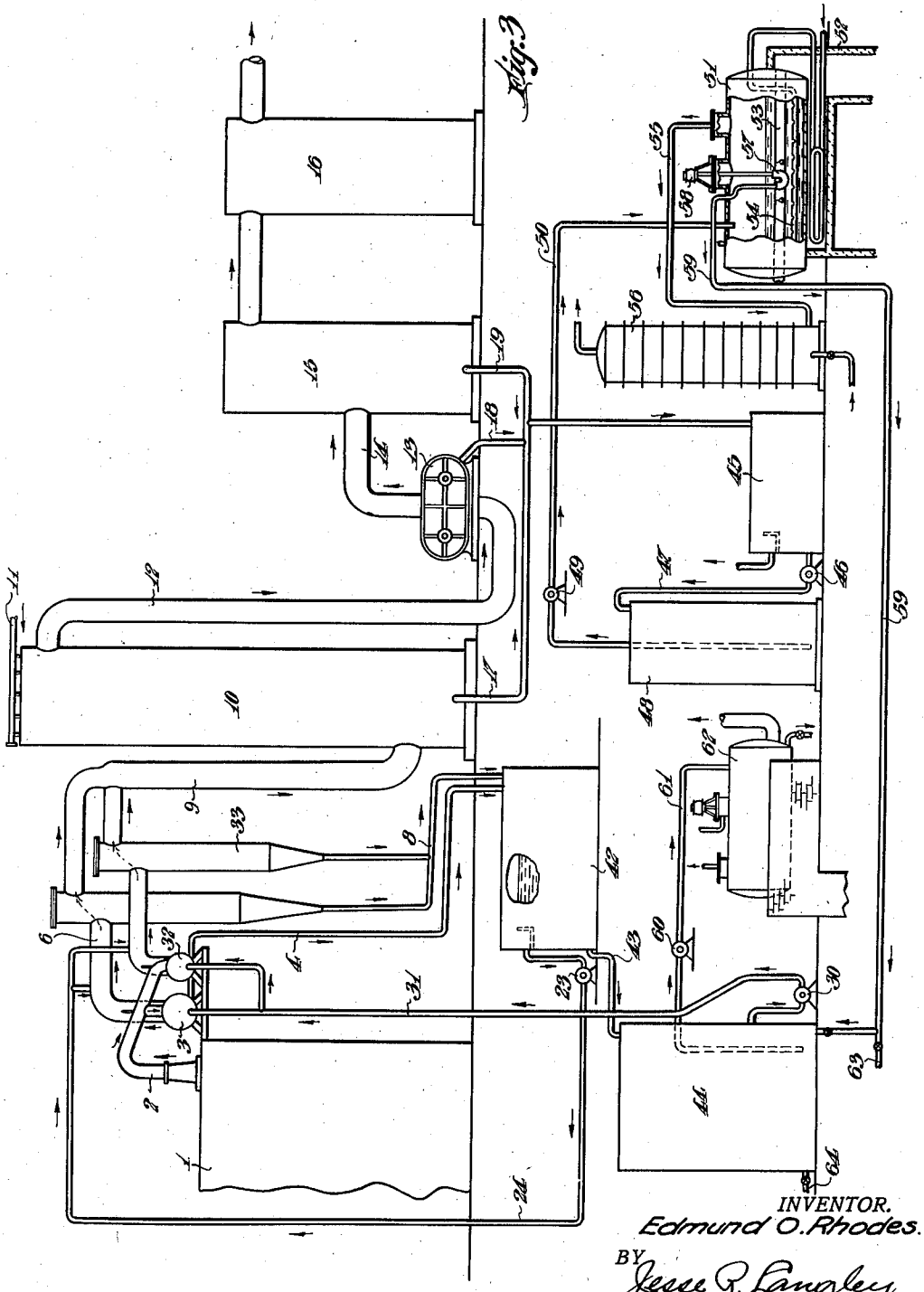


Fig. 3

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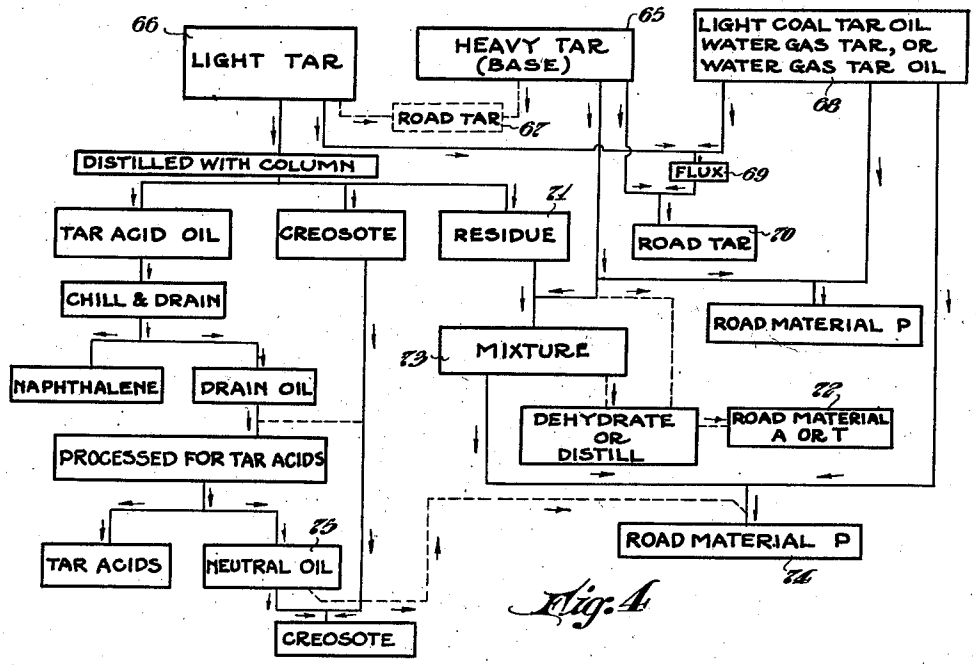


Fig. 4

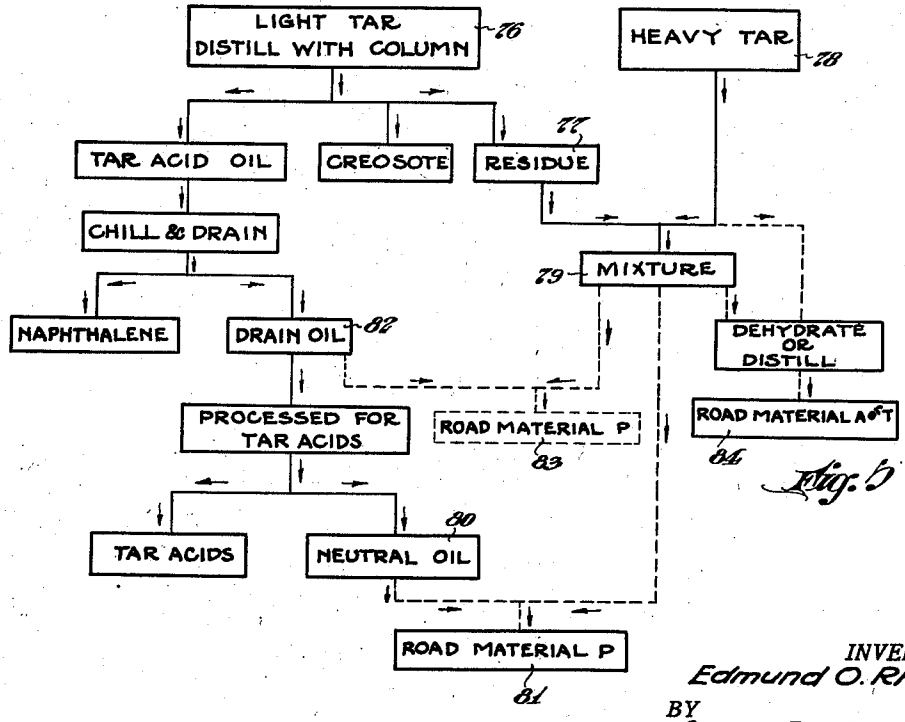


Fig. 5

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2,068,304

MANUFACTURE OF ROAD MATERIALS

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Application May 18, 1932, Serial No. 612,097
Renewed June 16, 1936

8 Claims. (Cl. 202—30)

This invention relates to improvements in processes of manufacturing bituminous road materials.

Heretofore in the recovery of tar from coal coking ovens at coke plants, tar was collected from various points in the coal gas treating system and conducted into a common receiving tank. This practice required the redistillation of the tar to prepare a base for use in making so-called "base and flux" road materials.

I have found that when tars from separate points in the system are combined in certain proportions, or combined with bituminous materials from other sources highly desirable products are obtained which find their immediate utilization in road construction. My process requires that tars be separately collected from certain points in the by-product recovery system. These separately collected tars are then mixed together or with certain other bituminous materials in the desired proportions, whereupon the mixed product is immediately available for use on roads. In the accompanying drawings,

Figure 1 represents an elevational view, partly in cross section, of apparatus which may be employed in a coke plant to recover the products of the present process;

Fig. 2 is a perspective view of one form of by-product coke oven vapor collecting system;

Fig. 3 is an elevational view, partly in cross section, of apparatus employed in a modified system; and

Figs. 4 and 5 are flow diagrams which indicate how the materials employed in the present process are treated.

Referring to Fig. 1, the process of the present invention is conducted by coking coal in a coke oven battery which may be represented by the numeral 1, and by treating the vapors coming from the various coke-oven chambers in a manner to be described. Vapors from a coke oven chamber pass out of the chamber through a standpipe 2 and into a collecting main 3.

The vapors from the coke ovens are collected in the collecting main 3 where they may be sprayed with ammonia liquor or tar. The condensates formed under such conditions are removed through a pipe 4 which conducts a mixture of the tar and ammonia liquor into a decanter tank 5. The uncondensed gases pass from the collecting main 3 through a suction main 6 into a downcomer 7 wherein additional tar separates out and passes downwardly through a pipe 8 into the decanter tank 5.

The gases passing out of the downcomer are conducted through a pipe 9 into a primary cooler 10 wherein direct or indirect cooling may be applied. In the tower 10 the gases are brought into direct contact with cooling liquor which is sprayed from a supply pipe 11 into the top of the tower and passes in counter-current relation with the gas. The gas passing from the top of the tower 10 through a pipe 12 is forced by means of an exhauster 13 through a pipe 14 into an electrical precipitator 15 or other suitable tar extractor and then into a reheater 16 from which the gas passes to additional apparatus for further treatment.

Draw-off pipes 17, 18 and 19 leading from the bottom of the tower 10, the exhauster 13, and the precipitator 15, respectively, are each connected to a pipe 20 which conducts the collected liquids to a decanter tank 21 which may be of the same construction as the decanter tank 5. In practice, a plurality of towers, exhausters, and precipitators may be employed in parallel.

As shown, the heavy tarry material which is collected in the decanter tank 5 settles to the bottom and the ammonia liquor floats on top. The ammonia liquor is drawn off through a pipe 22, and by means of a pump 23 the liquor is pumped through a pipe 24 back into the collecting main 3 or suction main 6 to cool further quantities of vapors from the coke ovens. In some cases ammonia liquor, as a cooling medium in the collecting mains and suction mains, may be omitted.

For the purpose of removing the heavy tar from the bottom of the decanter tank 5, a device is shown whereby tar is forced upwardly through an open end pipe 26 by maintaining its upper end below the liquor level. The tar enters a chamber 27 and is withdrawn therefrom through a pipe 28 and passed into a tank 29. If desired, tar from the tank 29 may be withdrawn by means of a pump 30 and passed through a pipe 31 into the bottom of the collecting main 3 for flushing purposes or sprayed into the top of the collecting main for condensing purposes.

In the drawings I have shown an extra collecting main 32 which may be used in addition to the collecting main 3. By suitable valve arrangements which are well known for directing gases into one main or the other, gases obtained during various periods of the coking operation may be separately collected and separately treated. Gases from the collecting main 32 are conducted to a separate downcomer 33 from which tar runs out into the pipe 8 and finally

into the decanter tank 5 or to a separate decanter tank. Tar and/or liquor employed for flushing passes into one end of the collecting mains, flows through the collecting mains to the other end, and out through the pipe 4 to the decanter tank 5.

With proper operation of the plant the tar removed from the decanter tank 21 through the pipe 35 is a light tar which when mixed in suitable proportions with the heavy tar collected in the tank 29 forms a product which may be used as a road material.

It has been found that by mixing about 5% to about 65% by volume of the light tar from the tank 21 with about 95% to about 35% of heavy tar from the tank 29, a mixture is obtained which is highly satisfactory for use as an improved so called cold application road tar for surface treatment or mixed-in-place tar.

As shown below, various other bituminous products may be mixed with the light tar or the heavy tar to produce materials suitable for road treatment.

It has been found also that by dehydrating or partially distilling the heavy tar alone or in combinatiion with other bituminous materials it is possible to produce an improved hot application or construction type road material.

It has now become customary in various coke plants to employ ovens of a battery for coking various bituminous materials besides coal. In some instances a certain number of the ovens of a battery may be employed for coking oils or tar or pitches and the remaining ovens of the battery may be employed for coking coals. Where such is the case, collecting mains of the type shown in Fig. 2 may be employed.

In Fig. 2 is shown a coke oven battery 38. Stand-pipes 39 conduct vapors from each of the coking chambers into the collecting mains. In certain cases where the number of ovens of a battery to be used for coking liquid bituminous materials or pitch is fixed, there may be one main 40 which extends along the entire length of the coke oven battery and a shorter main 41 of sufficient length to serve for collecting the vapors from the ovens in which the liquid bituminous materials or pitch are being coked. By suitable valves connection may be established in a well known manner with one or the other of these mains.

In coking pitch, for instance, in the first three ovens of the battery 38, for instance, the vapors from these ovens may be collected in the separate collecting main 41. If the remaining ovens of the battery are employed for coking coal, the vapors from the coal coking ovens, in that case, are conducted into the main 40. The mains 40 and 41 may be flushed with tar or oil and/or with liquor. The condensate from the pitch coking ovens is a highly viscous oil that may be mixed directly with the heavy tar obtained from the coal coking ovens to produce an improved base for road materials.

Alternatively, the condensate from the pitch coking ovens may be collected in the common collecting main 40 in which case it is recovered along with the heavy tar from the coal coking ovens. The proportions of condensate from the pitch coking ovens and heavy tar from the coal coking ovens may be regulated by varying the number of ovens used for each purpose. The location of the pitch coking ovens with respect to coal coking ovens may be varied to obtain best operating conditions and uniform results.

As shown in Fig. 3 wherein similar numerals designate apparatus similar to that employed in Fig. 1, heavy tar which is withdrawn from a decanter tank 42 is passed through a pipe 43 into a tank 44.

The light tar coming from the tower 10, the exhauster 13 and the tar collector 15 and passing into a decanter tank 45, is pumped by means of a pump 46 through a pipe 47 into a tank 48.

The light tar and the heavy tar are withdrawn respectively from the tanks 44 and 48 and may be directly but separately pretreated in a manner to be described.

Light tar from the tank 48 is pumped by means of a pump 49 through a pipe 50 into a continuous still 51. This still is mounted in a furnace setting 52 and is provided with fire tubes 53 which pass longitudinally through the still and through the material to be distilled. When the still is in operation hot gases pass through the tubes 53 and superheated steam supplied by the perforated pipe 54 is forced through the light tar. The rate of distillation is so controlled that light tar is continuously pumped into the still while residue is being continuously or intermittently removed.

Vapors from the still 51 pass out through a pipe 55 and may be conducted into a fractionation column 56 whereby a tar acid oil fraction and a creosote fraction are obtained. The tar acid oil fraction is treated as set forth below.

The residue from the light tar distillation step may be pumped by means of a submerged pump 57 operated by a motor 58, through a pipe 59 directly into the tank 44 to be combined with the heavy tar. The resulting mixture may be pumped by means of a pump 60 through a pipe 61 into a continuous still 62 substantially similar in construction to the still 51. In the still 62 the mixture is dehydrated or heated to remove the more volatile constituents, thereby forming an improved road material for hot application, construction or repair purposes.

If desired the dehydration or distillation of the mixture in the still 62 may be omitted. In this instance the residue from the still 51 may be withdrawn from the pipe 59 through the pipe 63 and mixed in desired proportions with heavy tar withdrawn from the tank 44 through a pipe 64.

As shown in the flow diagrams in Figs. 4 and 5, the tars obtained may be treated by the present process to produce high grade road tar materials. As previously described and with particular reference to the flow diagram in Fig. 4, the heavy tar 65 may serve as a base to be mixed with the light tar 66 as a flux to produce a road tar 67. Or, an improved flux may be obtained by mixing the light tar 66 with light coal tar oil, water gas tar or water gas tar oil 68, and the resulting flux 69 may be mixed with heavy tar 65 to form a road tar 70. For example, the flux may contain about 10% to 50% by volume of coal tar oil, water gas tar or water gas tar oil.

Alternatively, heavy tar 65 may be mixed with oil or tar 68 to form a road material, in which case the light tar would be employed for some other purpose.

By means of the column still 59 shown in Fig. 3, the light tar 66 may be further treated by fractionating to produce tar acid oil, creosote, and a residue. The residue 71 may be mixed with the heavy tar 65 and the mixture dehydrated or distilled to produce a road material 72. In certain instances, the heavy tar may be

dehydrated or distilled to produce directly a road material 72.

The mixture 73 produced by mixing the residue 71 with the heavy tar 65 may be further treated with the light coal tar oil, water gas tar or water gas tar oil 68 to obtain a road material 74.

In the treatment of the tar acid oil obtained from the light tar 66, various products are obtained which may be utilized for various purposes. In the further treatment of the tar acid oil, a neutral oil 75 is obtained which serves as a valuable addition to the road material 74.

Referring to Fig. 5, the light tar 76 is separated into fractions, namely, tar acid oil, creosote, and a residue. The residue 77 may be mixed with the heavy tar 78 to produce a mixture 79 which can be mixed directly with the neutral oil 80 to form road material 81. Or the mixture 79 may be directly mixed with drain oil 82 to produce road material 83. Furthermore, the mixture 79 may be dehydrated or distilled to produce road material 84.

If preferred, the heavy tar 78 may be mixed directly with drain oil 82, neutral oil 80, or the total distillate obtained from the light tar 76 to produce a road material.

I claim as my invention:

1. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling a tar acid oil fraction and a creosote fraction from light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, mixing the residue thus obtained with heavy tar which is separately obtained from the collecting main, and heating the resulting mixture to dehydrate or partially distill the same and to form a residuum for road material.

2. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling a tar acid oil fraction and a creosote fraction from light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, mixing the residue thus obtained with heavy tar separately collected in and between the said collecting main and downcomer, and mixing the resulting mixture with drain oil obtained by removing naphthalene from the said tar acid oil fraction.

3. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling a tar acid oil fraction and a creosote fraction from light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, mixing the residue thus obtained with heavy tar separately collected in and between the said collecting main and downcomer, and mixing the resulting mixture with neutral oil obtained by removing naphthalene and tar acids from the said tar acid oil fraction.

4. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling a tar acid oil fraction and a creosote fraction from light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, mixing the residue thus obtained with heavy tar separately collected in and between the said collecting main and downcomer, and mixing the resulting mixture with water-gas tar or oil.

5. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling a tar acid oil fraction and a creosote fraction from light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, mixing the residue thus obtained with heavy tar separately collected in and between the collecting main and downcomer, and mixing the resulting mixture with water-gas tar or oil and neutral oil obtained by removing naphthalene and tar acids from the said tar acid oil fraction.

6. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, removing a tar acid oil fraction therefrom and mixing the residue thus obtained with heavy tar separately collected in and between the said collecting main and downcomer of the said battery.

7. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke

oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, removing a tar-acid oil fraction therefrom, mixing the residue thus obtained with heavy tar separately collected in and between the said collecting main and downcomer of said battery and partially dehydrating or distilling the resulting mixture.

8. A process of preparing road material from materials condensed from vapors produced in a standard by-product coke oven plant comprising a coke oven battery for coking bituminous materials, a collecting main connected to the coke oven battery, a pipe connected to the collecting main and leading to a primary cooler, and a downcomer connected to said pipe between the collecting main and the primary cooler; which process comprises separately distilling light tar collected from cooled vapors after leaving the downcomer of the said by-product coke oven battery in which bituminous material is being coked, removing a tar-acid oil fraction from said separately distilled light tar; mixing residue, thus separately obtained, with heavy tar separately collected in and between the said collecting main and downcomer of said battery, and fluxing such mixture with a bituminous material or combination of bituminous materials selected from a group consisting of light coal tar oil, water-gas tar, water-gas tar oil, drain oil and neutral oil.

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