March 1, 1966 G. P. HAMNER ET AL 3,238,116

COKE BINDER OIL

Filed Dec. 12, 1963

2 Sheets-Sheet 1

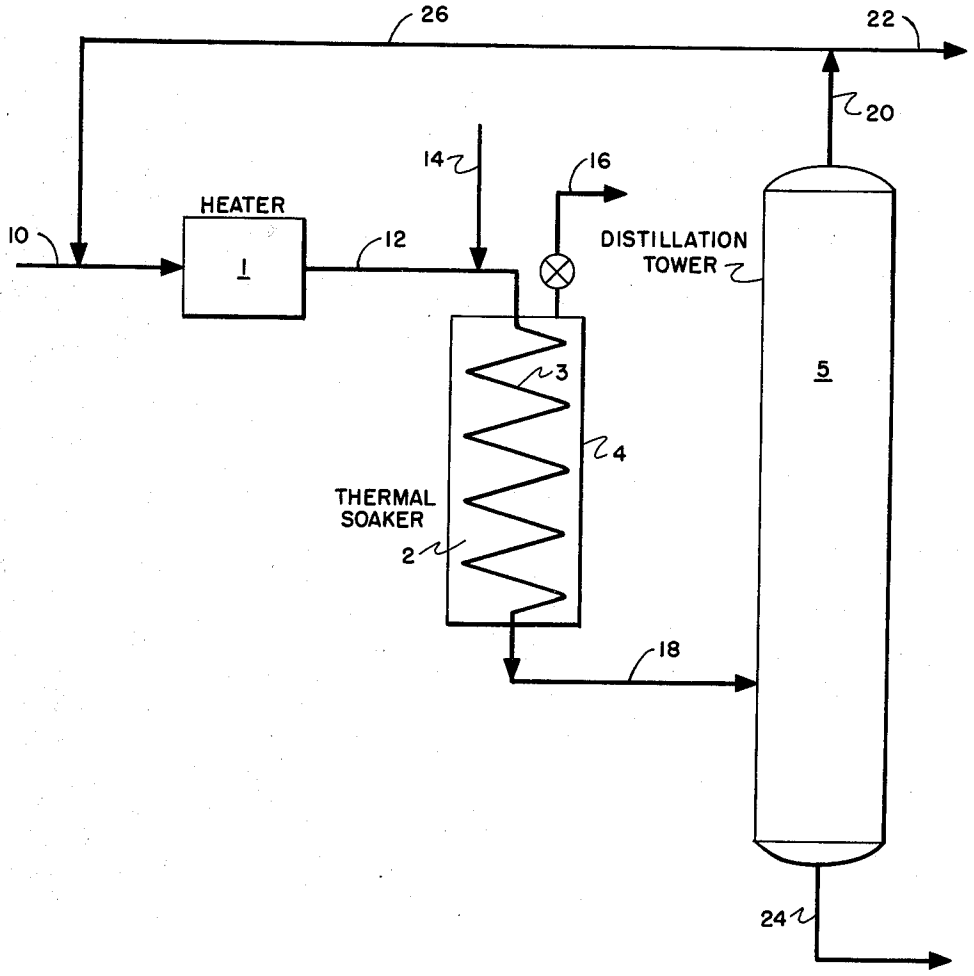


FIG. 1

GLEN PORTER HAMNER
WILLIAM JOSEPH METRAILER
RALPH BURGESS MASON
INVENTORS

BY C. B. Barris
PATENT ATTORNEY

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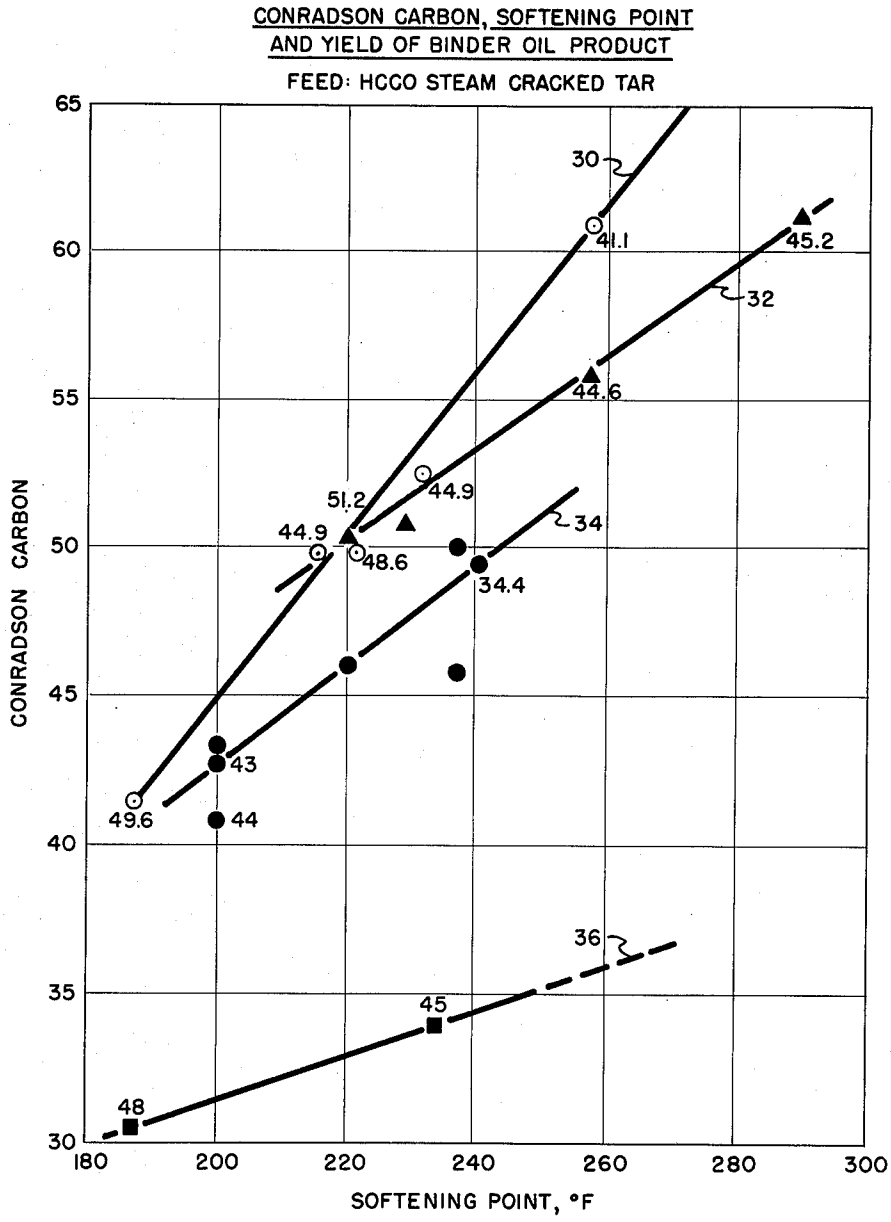


FIG. 2

GLEN PORTER HAMNER
WILLIAM JOSEPH METRAILER INVENTORS
RALPH BURGESS MASON

BY C. B. Barnes

PATENT ATTORNEY

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COKE BINDER OIL

Glen Porter Hamner, Baton Rouge, Ralph Burgess Mason, Denham Springs, and William Joseph Metrailer, Baton Rouge, La., assignors to Esso Research and Engineering Company, a corporation of Delaware

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This invention relates to the preparation of carbonaceous binders for use in the preparation of carbon or graphite electrodes. More particularly, this invention relates to binders prepared from coal tar or petroleum fractions.

In general, carbon or graphite electrodes are produced from a suitable hard carbonaceous material, usually calcined coke. As the coke has no natural adhesiveness, it must be bound together in suitable shapes with a compatible material. Hence, in producing electrodes, the coke is ground, mixed with a binder, molded and subsequently baked so as to carbonize the binder. It is well known in the art relative to electrode production that the nature and quality of the binder used is extremely critical. For example, if pitch is employed as the binder material, such pitch must fall within a relatively narrow range of specifications in order to be suitable as a binder material.

The specifications of these binder materials are empiric in nature. A low H to C atomic ratio is required in which to minimize the development of porosity during the electrode baking operation. A high coking value is necessary. The coking value is a measure of the amount of coke residue produced by a pitch when decomposed by heating at 1200° F. for 4 hours. A softening point of 180° F. to 290° F. is required. Softening points of less than 180° F. do not provide for sufficient physical binding of the fabricated electrodes and the formations tend to lose shape in the precalcination warmup. The extremely high softening point materials on the other hand, i.e., above 290° F., are not amenable to mixing with the coke particles, do not have enough plasticity to mold, etc. Hence, the softening point is between the temperatures of 180–280° F. The pitches softening in the lower portion of this range are designated as soft pitches, and those softening in the upper portion of the range are designated as hard pitches.

Since the Conradson carbon value is a measure of the coking properties, it is evident that a high Conradson carbon content at an acceptable softening point is desirable. Hence, the relationship between Conradson carbon and softening point becomes a criterion in evaluating the pitch product.

It is found, however, that petroleum pitches generally did not meet the above specifications and hence are generally undesirable as binders. On the other hand, coal tar pitch has been almost universally employed as the binder material in the manufacture of carbon products, e.g., carbon electrodes. The petroleum pitches were found undesirable because of a multitude of reasons, such as the electrodes so made were of uneven mechanical strength and varied in electrical conductivity. While highly aromatic tars resulting from cracking processes appeared potentially attractive, such tars failed to result in the production of a satisfactory pitch suitable as a binder. For example, if the coking value and content of

benzene insoluble matter of the resulting binders were high enough to satisfy desired specifications, then the softening point was found to be too high. Conversely, if the softening point was in the correct range, then the coking value and content of benzene insoluble matter was too low. Further, while some processes in the prior art relating to petroleum pitches resulted in a binder material which satisfied the desired specification, such processes had serious inherent disadvantages which made them commercially unattractive. One such disadvantage was the tendency to form insoluble fractions during processing which settled from the product in storage and/or caused fouling of the process facilities.

With regard to coal tar, as hereinbefore mentioned, pitch prepared from such coal tar has been almost universally employed as the binder material in the manufacture of carbon products. It thus naturally follows that it is also desired to provide a process which produces such binder material in yields higher than those heretofore realized while maintaining standards equal to or better than the specifications set forth.

It is an object of the present invention, therefore, to provide an improved binder material in yields superior to those heretofore realized.

It is another object of the present invention to provide a process which will produce a superior binder material from coal tar or petroleum fractions in yields higher than those heretofore realized.

It is another object of the present invention to provide a binder material from petroleum residue which will simulate the physical properties of a coal tar pitch binder.

It is a further object of this invention to provide a process for the production of highly desirable binders from petroleum residues without incurring the disadvantages heretofore known in the related art.

It is also an object of the prsent invention to provide a commercially feasible, continuous process for converting coal and petroleum tars to valuable electrode binder pitches.

Other objects will appear hereinafter.

In accordance with the present invention, it has been found that the above objects can be accomplished by subjecting a suitable feedstock, e.g. either a coal or petroleum tar to additional thermal treatment, i.e., thermal or heat soaking under critical reaction conditions in the presence of critical amounts of oxygen to obtain the desired product. Thus, it has been found that thermal soaking of a suitable feed at temperatures of from 750 to 950° F., under pressures of from 100 to 1000 p.s.i.g., and for contact times of from about 0.5 to 6 hours, while introducing oxygen in critical amounts, increases binder oil yield and also increases Conradson carbon for a given softening point. A petroleum pitch produced in this manner is found to exhibit physical characteristics markedly similar to those of coal tar pitch and prebaked electrodes made from the petroleum tar pitch product of the instant invention are found to equal the standard coal tar product of the prior art. Similarly, a minimum quality coal tar pitch when subjected to the process of this invention is found to exhibit physical characteristics superior to the untreated coal tar product.

The feedstock suitable for use in the process of the present invention is not found to be especially critical.

Since the major advantage of the invention is predicated on an improvement of feedstocks already known to the art relating to carbon products, such feedstocks may be broadly characterized as being any tar or pitch derived from either petroleum or coal which can be considered useful as a binder material. Thus, the scope of the feedstocks of the present invention may encompass materials, e.g. petroleum residues, which heretofore were not considered desirable, but which because of the advantages acruing from the present invention can now be transformed into binder materials which are desirable for use. Examples of feedstock suitable for use in the present invention include heavy virgin residual oils which are the bottoms fraction resulting from the distillation of a topped crude oil. Illustratively, such heavy virgin residual oils can be obtained by delivering the topped crude oil from an atmospheric tower in which, for example, a furnace oil and lighter fractions have been removed, to a vacuum tower. A distillate gas oil suitable for use as a catalytic cracking charge stock is discharged from the top of the vacuum tower and a bottoms fraction containing said heavy virgin residual oils is delivered from the bottom of the tower. Suitable residual fractions include those boiling above about 1000° F.

Another suitable feedstock includes the bottoms fraction obtained by the distillation of the cracked oil produced from the catalytic cracking of petroleum gas oils in the presence of catalysts such as the silica-alumina catalysts which are frequently employed in the fluidized state. The cracked oil produced as a result of the fluid catalytic cracking process is then subjected to distillation. The residue or distillation bottoms obtained as a consequence of such distillation process are transferred to a slurry settler for removal of actalyst and the resultant oil has been found to be a suitable feedstock for the process of this invention.

Other petroleum fractions available from either thermal or catalytic cracking also may be used as feeds to steam cracking for production of a suitable tar feed. The residue employed is the bottoms fraction taken from the fractionator used for fractionating the steam cracked products. This bottom fraction includes those fractions boiling above about 650° F.

A particularly preferred feed is that petroleum residue resulting from the processing sequence set forth in copending application Serial No. 328,835 to Glen Porter Hamner et al., filed December 9, 1963, which sequence forms no part of the present invention, but will be summarized herein.

This sequence involves processing the mid-boiling fractions of crude in the following manner:

(1) A mid-boiling fraction from petroleum is introduced to a one-pass catalytic cracking zone in which the naphthenes and isoparaffins are largely converted. Trace impurities such as nitrogen, sulfur, and metals are removed in this step prior to a steam cracking step.

(2) The mid-boiling fraction resulting from step 1 is sent to a steam cracking zone maintained at temperatures of 1200–1500° F. in which the straight chain paraffins are largely converted for further utilization as basic chemical raw materials.

(3) The high boiling aromatics and condensation products from step 2 are recovered as a steam cracked tar material. This material is found to be particularly suitable for feedstock in the process of this invention.

Another particularly preferred feed and one found to yield a suitable pitch is the tar bottoms fraction obtained by the distillation of the cracked oil produced from the steam cracking of light catalytic cycle oils or heavy catalytic cycle oils at temperatures between about 1200 and 1500° F. The tar material from steam cracking of catalytic cycle oil is then subjected to distillation at about 5 to 20 p.s.i.g. pressure to a maximum temperature of about 550 to 650° F. The residue or highly aromatic tar bottoms resulting from the foregoing distillation are transferred from the tower employed in said distillation and subsequently may be employed in the process of the present invention.

As hereinbefore mentioned, the present invention also contemplates the use of coal tar pitch as a feedstock. In general, any suitable coal tar pitch may be used as a feedstock in the invention. Thus, as used herein, the term "coal tar pitch" comprises any complex mixture of polynuclear aromatic compounds containing phenolic groups, amino groups, and other active hydrogen-containing groups. The consistency of the coal tar pitch employed may vary from that of a light tar up to a heavy tar. The coal tar pitch suitable for use as a feed of this invention has a softening point of about 150° F. to about 250° F.

Although the present invention will be described with reference to the use of steam-cracked light or heavy catalytic cycle oil, it is to be understood that generally any suitable feedstock, and especially those set forth above, may be utilized.

The present invention will best be understood and appreciated from the following description of the process taken in connection with the accompanying drawings in which:

FIGURE 1 is a flow sheet of an embodiment of the process.

FIGURE 2 is a graph showing Conradson carbon values of pitches of the present invention having given softening points as compared with various pitches produced by processing heretofore available.

Referring to FIGURE 1 of the drawings, coal or petroleum tar feedstock as referred to above, e.g., steam-cracked light or heavy catalytic cycle oil, is transferred directly from a steam-cracking zone or from a suitable storage vessel and delivered to heater **1** through line 10. In the heater **1**, the feed is heated to a temperature of between about 750 and 950° F. and preferably between 775 and 850° F. From heater **1**, the heated feedstock flows through line **12** to the thermal soaking zone **2** maintained between about 750 and 950° F., but preferably 775 and 825° F. where the feed is treated under conditions necessary to the instant invention.

In accordance with the invention, controlled amounts of oxygen are introduced via line **14** into line **12** through which the heated feed is delivered at superatmospheric pressure to a soaking vessel **2**. In carrying out the invention, oxygen is added to the feed as an oxygen-containing gaseous stream. Non-limiting examples of such gaseous, oxygen-containing mixtures include oxygen-nitrogen, oxygen-argon, oxygen-carbon monoxide, oxygen-carbon dioxide, and the like. Of the foregoing, an oxygen-nitrogen mixture is preferred. While air may be utilized, for the reasons set forth as follows relating to oxygen concentrations, the use of air is not advocated. The concentration of oxygen in such gaseous stream may be measured in trace amounts (i.e., as low as about 50 parts per million (p.p.m.)) in order to facilitate control of the quantity and rate of benzene insoluble type Conradson carbon in the final binder product. The upper concentration of oxygen in the stream will depend on the explosive limit of the cracked gas produced. Generally, however, the suitable upper limit has been found to be 3 weight percent. The preferred range of oxygen concentration in the gaseous stream introduced via line **12** is 0.22 to 2.2 weight percent or from 0.20 to 2.0 percent on a volume basis.

According to the invention, the oxygen is added to the tar feed in the heat soaking zone in limited quantities so that the oxygen addition based on the feed is at least trace amounts but is no more than 1.0 weight percent. A preferred range is 0.03 to 0.5 weight percent based on said feed. In order to accomplish this result, it has been found that the oxygen in the oxygen-containing gaseous stream should be added to the tar feeds in rates from 50 to 50,000 s.c.f./b./hr. and preferably 100 to 10,000 s.c.f./b./hr. It is obvious with the dehydrogenation reactions experienced a major part of the oxygen intro-

duced is removed in the form of water and a close correlation of oxygen introduced and oxygen remaining in the coke binder material does not exist. Also, it is to be remembered that the feedstocks and in particular the coal tar feeds contain appreciable quantities of combined oxygen in the form of phenols and the like, and in many instances the binder oil product may have a lower oxygen content than the feed even when appreciable oxygen is employed in the process. Regardless of the feedstock and the amount of oxygen added it is preferred to have a binder oil product of moderately low oxygen content. Binder oils of from 0.05 to 0.1% oxygen are eminently satisfactory. However, with coal tar feeds which vary greatly in oxygen content according to methods of production, the resultant binder oil may contain as much as 1% oxygen.

Soaking vessel **2**, which is preferably insulated, is also maintained at superatmospheric pressure as in line **12**, i.e., pressures of from about 100 to 1000 p.s.i.g., and preferably 200 to 400 p.s.i.g. Heat soaking vessel **2** may comprise a thermal cracking coil **3** having a soaking drum **4** of substantial capacity so as to retain the aromatic tar feedstock in the drum for a sufficient time to effect the desired treatment. Flow is so regulated through the soaking drum that the residence time for any increment of feedstock is between 0.5 and 6 hours and is preferably between 1 and 4 hours. In order to accomplish the objects of the present invention, for example, obtain a pitch which fulfills the requisite specifications and without forming any substantial amount of solid carbon, the oxygenated feedstock in the heat soaking vessel must be maintained at temperatures between 750 and 950° F. and preferably between 775 and 825° F. During this heat soaking step, some cracking is found to occur which results in the formation of substantial quantities of gaseous hydrocarbons. These volatile hydrocarbons are permitted to leave the soaking vessel **2** through conduit **16**, for example by means of a self-actuating pressure control valve. Flow of such volatiles is essentially continuous inasmuch as fresh feed is continuously supplied to soaking vessel **2**. It is found that as much as 3–7 percent C_3 and lighter hydrocarbons plus H_2, based on feed introduced is found in the flow of volatiles removed, the recovery of which greatly adds to the intrinsic advantage of the instant process.

The product from thermal soaker **2** comprises thermally treated feedstock and is delivered through line **18** into an atmospheric flash distillation tower **5**. Fractions boiling at 750° F. and lower temperatures are removed as distillate products from tower **5**, via lines **20** and **22**, and the pitch product is discharged as a bottoms product through line **24**. The flash temperature in tower **5** is controlled such that the overhead vapors range from about 725° F. up to about 800° F. The maximum flash temperature in the tower is somewhat critical since it is used to obtain the specific softening point desired in the final binder product.

In an embodiment of the present process, at least a portion of the distillate fractions separated in tower **5** is recycled via lines **20** and **26** to line **10** for further processing through heater **1** and thermal soaker **2**.

The final pitch product, which collects in the bottom of tower **5**, is continuously withdrawn as mentioned above.

The attractive advantage of this invention is the increased binder oil yields and the increased Conradson carbon values for binder oils of given softening points as compared with binder oils produced by other processes of the art as well as by similar processes, but employing different soaking times, temperatures, etc. As employed herein, the "Conradson carbon" value is defined as weight percent carbon residue after evaporation by destructive distillation (ASTM D189 procedure). The "softening point" is defined as that temperature at which a steel ball drops through a specific quantity of sample suspended in glycerine (ASTM D36–62T).

Referring to FIGURE 2 of the drawings, curve **30** illustrates the relationship between Conradson carbon value and the softening point of pitches prepared from steam-cracked tar when processing heavy catalytic cycle oil and utilizing the method of the present invention, i.e., employing soaking periods of about 4 hours at temperatures of about 775° F. and pressures of 200 p.s.i.g. plus oxygen treatment in an amount of 0.2 weight percent oxygen on feed. The curve identified by reference numeral **32** illustrates the relationship between the Conradson carbon value and the softening point of pitches prepared by a method similar to the foregoing, but without oxygen treatment. The curve identified by reference numeral **34** illustrates the relationship between the Conradson carbon value and the softening point of pitches prepared by a method also similar to the foregoing, but employed no oxygen treatment, as well as soaking periods and temperature conditions outside those of the invention, i.e., soaking periods of about 1–2 hours at temperatures of about 850–900° F. The curve identified by reference numeral **36** illustrates the relationship between Conradson carbon value and the softening point of pitches also prepared by a process other than that of the invention, i.e., by vacuum reduction of the steam-cracked tar feed for the present invention.

It is apparent from FIGURE 2 that the Conradson carbon numbers of pitches prepared by the process of the present invention are substantially higher than those prepared without oxygen treatment, at shorter contact times and at higher temperatuers. Further, the pitches made according to this invention range higher in softening points and are produced in substantially higher yields.

In keeping with the general discussion, it was found in determining the above relationship that 90% of the oxygen added in accordance with the invention was removed as water, and the gaseous oxides of carbon, leaving 10% unreacted. Also, it was observed that the oxygen content of the finished binder oil did not differ essentially from the feed. Hence, the improved properties of the binder oil are not a function of the combined oxygen as might be inferred from prior art or conventional oxidation.

In order to illustrate the unique features and advantages of the process hereinbefore described, reference is made to exemplary data obtained in evaluating the process of this invention.

EXAMPLE 1

A series of runs was made employing a feed comprising a heavy catalytic cycle oil which was steam-cracked at a temperature of about 1450° F. The feed which was subsequently preheated and introduced into a soaking drum had the following approximate qualities:

Gravity, ° API at 60° F.	−4.4
Viscosity, SSU at 130° F.	2078
Viscosity, SSU at 210° F.	120
Flash, COC ° F.	370
Conradson carbon, wt. percent	16.1
Benzene insolubles, wt. percent	Nil
Oxygen, wt. percent	<0.1
Sulfur, wt. percent	0.7
ASTM distillation (D–1160):	
5%	521
50%	745
70%	845
Nickel and vanadium, p.p.m.	<2

Five runs (Runs Nos. 1–5) were made utilizing the respective oxygen concentration set forth in the following Table I. Heat soaking conditions ranged from temperatures of from 1750 to 800° F., 2 to 4 hours contact time, and 200 p.s.i.g. pressure. The total liquid products resulting from the oxygen treatment and heat soaking were vacuum distilled to produce binders with softening points of from 186 to 269° F. Inspections of these binders are compared in Table I.

Table I.—Heavy Catalytic Cycle Oil Binder

Run No.	1	2	3	4	5
Process Conditions:					
Temperature, °F.	750	800	775	750	775
Pressure, p.s.i.	200	200	200	200	200
Contact Time, Hrs.	2	2	2	4	4
Oxygen Concentrations in Nitrogen Gas, Wt. percent	0.5	0.5	1.7	1.7	1.7
Binder Oil Yield, Wt. percent	49.6	[1] 52.4 (41.1)	44.9	44.6	47.9
Binder Oil Inspections:					
Softening Point, °F. R&B	186	[1] 195 (269)	234	216	223
Conradson Carbon, Wt. percent	41.8	[1] 46 (64.4)	52.3	49.6	49.7
Oxygen, Wt. percent	0.08	0.09	0.1	0.09	0.09
Carbon, Wt. percent	------	------	93.25	------	------
Hydrogen, Wt. percent	------	------	5.70	------	------
Quinoline Insolubles, Wt. percent	0.2	1.8	1.6	0.9	2.1
Acetone Insolubles, Wt. percent	27.6	33.4	36.5	36.0	36.5
Benzene Insolubles, Wt. percent	7.7	16.6	14.8	11.5	17.2
Coking Value, Wt. percent	44.4	48.9	------	------	------
Gas Composition, ex N_2, Wt. percent:					
H_2	------	------	0.5	------	------
C_1	------	------	56.0	------	------
C_2	------	------	27.1	------	------
C_3	------	------	8.4	------	------
C_4+	------	------	6.4	------	------
$CO+CO_2$	------	------	1.4	------	------
O_2	------	------	0.2	------	------

[1] Binder oil further distilled to remove volatiles; values in parentheses are bottoms reduced to higher softening value.

The foregoing data presented in Table I show that oxygen treatment and thermal soaking HCCO steam-cracked tar, while employing amounts of oxygen, treating temperatures, and contact times in accordance with this invention, results in impressive binder oil yields for a given softening point plus Conradson carbon values which are also impressive.

EXAMPLE II

An electrode was produced employing the binder oil set forth in Run No. 3 and another electrode was produced employing conventional coal tar. Inspections of the electrodes produced from the respective binders are compared in Table II.

Table II.—HCCO Electrode Binder Evaluation [1]

	Trace O_2 Added at 775° F.	
	Coal Tar [2]	Run No. 3
Binder Oil Yield	----------	44.9
Electrode Inspections:		
Weight Loss, percent Original	4.76	6.11
Baked Density, g./cc.	1.51	1.49
Crushing Strength, p.s.i.g.	4,400	3,500
Resistivity, Ohm. In. $\times 10^3$	2.53	2.53

[1] All electrodes from Reynolds standard delayed coke with 16% binder based on total mix with an identical coke formulation. All values are an average between the two electrodes tested except for crushing strength data.
Standard Limits: Density, 1.53±0.01 g./cc.; Crushing Strength, 4,020±470; Resistivity $\times 10^3$, 2.58±0.21 Ohm. In.

[2] Standard electrode made with coal tar for direct comparison with indicated binder oil.

The foregoing data clearly illustrate that the prebaked electrode produced with the improved product of this invention have physical properties which are substantially equal to the preferred electrodes, that is, electrodes made with standard coal tar.

EXAMPLE III

Two runs were made in order to compare the results of conventional oxidation techniques known to the art with those of the process of the present invention. The conditions employed in each of said runs are set forth in the following Table III. It is apparent that Run A represents the prior art and Run B, the instant invention.

Table III.—Heavy Catalytic Cycle Oil Binder Product

	A	B	Suggested Minimum Quality
Process Conditions:			
Temperature, ° F.	500	775	----------
Pressure	0	200	----------
Contact Time, Hrs.	24	2	----------
Oxygen Concentration in Treat Gas, Wt. Percent	20	1.7	----------
Binder Oil Yield, Wt. Percent	>85	44.9	----------
Binder Oil Inspections:			
Softening Point ° F. R&B	225	234	230
Condradson Carbon, Wt. Percent	40.3	52.3	50
Oxygen, Wt. Percent	0.98	0.1	----------
Quinoline Insolubles, Wt. Percent	0.02	1.6	----------
Benzene Insolubles, Wt. Percent	4.2	14.8	----------
Electrode Inspections:			
Baked Density, g./cc.	1.46	1.49	1.48
Cracking Strength, p.s.i.g.	3,000	3,500	----------
Resistivity, Ohm. In. 10^3	2.77	2.53	2.65

From the foregoing data it appears that the results issuing from the practice of the present invention differ with conventional practice, not in degree, but in kind. Inspections show extreme differences in softening points and Conradson carbon values as well as in insolubles. Further, the electrodes made from the binder material within the instant invention equal and surpass minimum quality specifications, while those of the prior art fail to equal same.

What is claimed is:

1. A process for the production of pitch from a feedstock chosen from the group consisting of coal tar and petroleum tar which comprises contacting said feedstock with from trace amounts up to 1 weight percent of oxygen contained in an oxygen-containing gas, introducing said oxygen-treated feedstock to a thermal soaking zone, subjecting said feedstock to temperatures of from 750 to 950° F., and pressures of from 100 to 1000 p.s.i.g., in said zone for a period of from 0.5 to 6 hours, thereby converting said feedstock to pitch and more volatile products, withdrawing said pitch and more volatile products from said thermal soaking zone, stripping the pitch of substantially all the more volatile products, and recovering a final pitch product containing less than 1 weight percent of oxygen.

2. The process of claim 1 in which the feedstock comprises a petroleum tar fraction resulting from the steam cracking of a heavy catalytic cycle oil.

3. The process of claim 1 in which the feedstock is contacted with from 0.03 to 0.5 weight percent of oxygen based on the feed contained in an oxygen-containing gas.

4. The process of claim 1 in which the feedstock is heated to a temperature of from 775 to 825° F. in said thermal soaking zone.

5. The process of claim 1 in which the feedstock is retained in said thermal soaking zone for a period of from 1 to 4 hours.

6. A process for the production of pitch from a feedstock chosen from the group consisting of coal tar and petroleum tar which comprises contacting said feedstock with from 100 to 10,000 s.c.f./b./hr. of an oxygen-containing gas containing from trace amounts to about 3 weight percent of oxygen, introducing the resulting oxygen-treated feedstock to a thermal soaking zone, subjecting said feedstock to temperatures of from 750 to 950° F. and pressures of from 100 to 1000 p.s.i.g., in said zone for a period of from 0.5 to 6 hours, thereby converting said feedstock to pitch and more volatile products, withdrawing said pitch and more volatile products from said thermal soaking zone, stripping the pitch of substantially all the more volatile products and recovering a final pitch product containing less than 1 weight percent oxygen.

7. The process of claim 6 in which the oxygen-containing gas is a mixture of gaseous oxygen and nitrogen.

8. The process of claim 7 in which the oxygen-nitrogen mixture contains 0.22 to 2.2 weight percent of oxygen.

9. The process of claim 6 in which the final pitch product contains from 0.05 to 0.1 weight percent of oxygen.

10. A process for the production of pitch from a feedstock comprising a petroleum tar fraction resulting from the steam cracking of cycle oil which comprises contacting said feedstock with an oxygen-containing gas, containing oxygen in amounts ranging from 0.22 to 2.2 weight percent of oxygen, based on the feed, introducing said oxygen-treated feedstock to a thermal soaking zone, subjecting said feedstock to temperatures of from 775 to 825° F. and pressures of from 100 to 1000 p.s.i.g., in said zone for a period of from 2 to 6 hours, thereby converting said feedstock to pitch and more volatile products, withdrawing said pitch and more volatile products from said thermal soaking zone, stripping the pitch of substantially all the more volatile products and recovering a final pitch product containing from 0.05 to 0.1 weight percent of oxygen.

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PAUL M. COUGHLAN, *Primary Examiner.*