



PATENT SPECIFICATION

686,000

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COMPLETE SPECIFICATION.

Improvements in or relating to the Production of Olefinic Hydrocarbons by Cracking Wax and Wax-Containing Materials and to the olefinic Hydrocarbons so Obtained.

We, "SHELL" REFINING AND MARKETING COMPANY LIMITED, a British Company, of St. Helens Court, Great St. Helens, London, E.C.3, PHILIP JAMES GARNER, B.A., PH.D., of 2 Woodclose, Hooton, Wirral, Cheshire, and SIDNEY EDGAR MILES, B.SC., of 5 Marlow Terrace, Wrexham Street, Mold, Flintshire, both British Subjects, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by

vaporisation in a flash evaporator unit at a suitable temperature which generally is just below 500° C. Thereafter cracking is effected in the vapour phase between 500° C. and 600° C. under moderately elevated pressures up to about 60 lbs. per square inch to yield the desired olefinic materials.

It is however frequently found that only a fraction of the initial material undergoes evaporation in the flash evaporator unit, and

SPECIFICATION NO. 586000

INVENTORS:— PHILIP JAMES GARNER AND SIDNEY EDGAR MILES

By a direction given under Section 17(1) of the Patents Act 1949 this application proceeded in the name of "Shell" Refining and Marketing Company Limited, a British company, of St. Helen's Court, Great St. Helen's, London, E.C.3.

THE PATENT OFFICE

12th December, 1952

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carbon waxes of various types have been subjected to cracking and notably paraffin wax containing materials have proved of value as cracking stock. Such materials may for instance include waxy material extracted from a mineral oil distillate or residue by chilling and pressing or by known solvent extraction processes. Purified products are not essential, and valuable hydrocarbons can for instance be obtained from a slack wax derived by solvent extraction of a waxy mineral lubricating oil.

In the treatment of a paraffin-wax containing material as for instance slack wax, to obtain olefinic hydrocarbons having at least five carbon atoms in the molecule, vapour phase cracking is effective, and to this end the material is subjected to preliminary

perature between 390° C. and 450° C. for a period varying between four hours and one quarter of an hour—which thermal treatment is hereinafter generally referred to as "soaking" or "thermal soaking" of the product—the nature of the residue can be so modified that on further flash evaporation further amounts of material are vaporised and the residue finally remaining is substantially reduced, say to 60% or less of the amount of the evaporator residue normally obtained. Moreover the additional material available for circulation to the cracking furnaces yields valuable olefinic hydrocarbons on being subjected to vapour phase cracking conditions.

Since the essential feature of the present invention is the thermal soaking of that

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hydrocarbon wax or material containing the same which is not initially volatile when subjected to flashing conditions including temperatures up to 500° C. in the evaporator, such thermal soaking may be applied either to the initial feed-stock of hydrocarbon wax or material containing the same, to a combination of fresh feed-stock and re-cycle feed-stock (that is to say, volatile uncracked or partially cracked hydrocarbon material which has been condensed in a fractionator and separated from the desired cracked olefinic hydrocarbons) or to the evaporator residue. However, it is generally preferred to subject only the evaporator residue to the said soaking treatment since smaller capacity equipment is thus needed. Furthermore, it has been found that products yielding a higher proportion of valuable olefinic hydrocarbons on cracking are obtained by soaking the evaporator residue without admixture of fresh wax feed or fresh wax feed combined with recycle feed-stock.

According to the present invention therefore the vapour phase thermal cracking of hydrocarbon wax or materials containing hydrocarbon wax, preferably paraffin wax-containing material, at a temperature in the region of 500° C. to 600° C. is characterised by subjecting at least that part of the feed-stock which is not initially vaporised under flashing conditions, with or without steam, at temperatures below 500° C., to a temperature between 390° C. and 450° C. for a period which decreases as the temperature increases and varies from four hours at 390° C. to one-quarter of an hour at 450° C., and the heat treated material is subjected to flashing at temperatures below 500° C. followed by vapour phase thermal cracking of substantially all of the resulting vapours at a temperature in the region of 500° C. to 600° C.

More specifically stated, in a vapour phase thermal cracking of a slack wax at a temperature intermediate between 500° C. and 600° C. in accordance with the present invention, at least that part of the feed-stock which cannot initially be vaporised under flashing conditions at 480° C. to 500° C. is subjected to a temperature between 410° C. and 440° C., and preferably between 405° C. and 425° C., for a period which decreases as the temperature increases and varies from two hours at the lower temperatures to one hour at the higher temperatures and the heat-treated material is subjected to flashing conditions at 480° C. to 500° C.

In the preferred method of practising the present invention cracking is effected in the presence of super-heated steam which may be present in the flash evaporator and the evaporator residue is subjected without admixture with initial feed-stock or recycle feed-stock to the above specified thermal soaking treatment after which it is subjected

to preheating followed by vaporising treatment in the flash evaporator with further amounts of fresh feed-stock and/or recycle feed-stock.

A process for cracking hydrocarbon oils has previously been proposed which comprises preheating the oil to a distillation temperature, vaporising the preheated oil, cracking the vapours, arresting the cracking reaction by cooling the cracked products by contact with a cooler hydrocarbon oil, reheating the unvaporised residue from the vaporising step so as to reduce its viscosity and to increase the percentage of vaporisable material in it, mixing the reheated material with the mixture of cooling oil and cracked products resulting from the arresting step, vaporising the mixture thus obtained and fractionating and condensing the resulting vapours to obtain the final distillate. The oil which is preheated may be a mixture of charge oil and fractionator bottoms (referred to as reflux condensate) from the fractionating tower in which the fractionation takes place and to which fractionating tower charging stock is supplied. By carrying out this previously proposed process, therefore, a certain proportion of the material from the reheated unvaporised residue from the vaporising of the preheated oil may be withdrawn from the fractionating column together with the fractionator bottoms and subsequently subjected to flashing and vapour phase cracking. Furthermore, any light material formed in the reheating step is removed from the system as fractionator tops without passing through the vapour phase cracking coil.

The process of the present invention is primarily distinguished from this previous proposal by the fact that after the period of heat treatment at a temperature between 390° C. and 450° C., or between 410° C. and 440° C., the heat-treated material is returned, without undergoing intermediate fractionation, to the flash evaporator which precedes the cracking stage so that substantially all of the vapour (i.e. light material) obtained from the heat-treated material is subjected to vapour phase thermal cracking.

The invention will now be further illustrated by reference to the diagrammatic drawing which accompanied the Provisional Specification and which shows a plant for cracking slack wax in accordance with the present invention.

This plant comprises a furnace F with a preheating coil 3 and a cracking coil 7, a soaking tank S, flash evaporator E and a fractionator D.

Fresh feed of slack wax at a temperature of about 100° C. is introduced through the pipe 1 at the bottom of the fractionator D when it mixes with hot re-cycle feedstock, and the mixture at 340° C. to 360° C., into which

steam may be injected, flows through pipe 2 to the preheating coil 3 in the furnace F, where its temperature is raised to about 480° C. to 500° C. Thence it passes by a pipe 4 to the flash evaporator E where it mixes with preheated steam initially at a temperature of 440° C. and a pressure of 60 to 90 pounds per square inch (gauge) introduced through the pipe 5. The mixture of vaporised hydrocarbons and steam then passes along the pipe 6 to the cracking coil 7 in the furnace F where the temperature is about 540° C. to 560° C. and where cracking takes place in about 1 to 3.5 seconds. The mixture from the cracking coil 7 passes via the pipe 8 to a fractionator D and receives an admixture of quenching water from the pipe 9 to assist condensation. A mixture of olefinic hydrocarbons is withdrawn from the top of the fractionator D and condensed hydrocarbons (re-cycle feed-stock) are re-cycled with fresh feed admitted to the pipe 1. The plant pressure is from 10 to 25 pounds per square inch gauge.

The evaporator residue which accumulates in the base of the evaporator E, is passed via a pipe 10 through a coil 11 in the furnace F to the soaking tank S. The volume of this tank S and the conditions in coil 11 are so related to the throughput rate of the plant that the required soaking conditions are established in this tank, for example 2 hours residence at 410° C. The soaked residue leaves the tank S through the pipe 12 and joins the stream of material in the coil 3.

In a continuous operation it is found that the build-up of evaporator residue in the case of a feed-stock such as slack wax often reaches proportions which prevent smooth running of the plant. In this connection it is to be noted that the evaporator residue may show a tendency towards coke formation and an excessive build-up of evaporator residue

can involve soaking conditions accentuating this tendency or leading to a development of coking which cannot be tolerated. To avoid such a contingency in continuous operation a pipe 15 leading from the base of the soaking tank S is used to bleed off continuously a quantity of evaporator residue equivalent to between 5% and 10% of the fresh feed. The exact quantity thus bled off is adjusted to be the minimum consistent with the prevention of coking and may generally be regarded as waste; in some cases, however, it is convenient to subject it to a soaking treatment in a location other than that of the continuous process described above. Bled-off residue soaked in this way is preferably accumulated in a storage vessel until a convenient quantity has been obtained for soaking treatment; this soaking is thus carried out as a discontinuous or batch treatment.

Valves V1, V2, V3, V4 and V5 and pipes 13 and 14 make it possible to pass either fresh feed from the pipe 1 or a recycle feed from the pipe 2 or mixtures of these two, as well as evaporator residue, to the soaking tank S, by means of valve manipulations which are evident from the drawing.

It will readily be understood that the process described above may be modified by allowing the evaporator residue to accumulate either in the evaporator or in a suitable storage vessel and then to carry out the soaking as a separate operation distinct from the main cycle of operations, for example in a separate apparatus.

The following Table I gives typical conditions obtaining in the flash evaporator when slack wax from a residual oil is used as the starting material in a vapour phase cracking process carried out in accordance with the present invention (Runs 3 and 4) and in a conventional manner with no thermal soaking (Runs 1 and 2).

TABLE I.

Run. No.			Evaporator Residue			
			1	2	3	4
90	Feed		Unsoaked		Soaked	
	Evaporator level	cm.	8	25	25	8
	Evaporator temperature	°C.	490	476	488	482
	Evaporator bottom temp.*	°C.	424	425	425	423
95	Unit pressure	p.s.i.g.	20	20	20	20
	Steam/hydrocarbon ratio	w/w	1.0 : 0.20	1 : 0.21	1 : 0.23	1 : 0.22
	Residue as % on feed		75	57	36	45

* Temperature of liquid in evaporator.

The conditions of soaking the evaporator residue in Runs 3 and 4 of Table I and certain results are shown in Table II.

TABLE II.

5	Temperature of soaking chamber, °C.	425
	Residence time in soaking chamber, minutes	45
	Gas evolved, % wt. on feed	2.6
	Distillate evolved, % wt. on feed	2.2
10	Mol. wt. of soaked material	600*
	Mol. wt. of feed	725*

* Mol. wt. calculated from refractive index and melting point.

The soaked residue had the appearance of heavy fuel oil, but it still had a definite set period. An increase of 30% in the residence time produced a material which was still liquid at room temperature.

The following Table III gives a comparison of the results obtained with various evaporator residues, soaked and unsoaked, when fed alone to the initial input of a cracking cycle working under similar conditions in each case. Data are also included for similar runs using a fresh (i.e. not previously subjected to flashing conditions) slack wax from a residual oil.

TABLE III.

30	Feed	C ₆ -C ₁₈ cracked distillate		alpha-olefine content ratio*
		% (on feed)	Br. No.	
	Fresh slack wax	30.8	85	100
	Wax from a residual oil evap. residue	11.2	64	57
	Wax from a residual oil soaked evap. residue	35.2	63	61
35	Wax from a distillate oil evap. residue	10.2	70	63
	Wax from a distillate oil soaked evap. residue	15.6	66	—

alpha-olefine content of cracked distillate of run

* ratio = $\frac{\text{alpha-olefine content of cracked distillate of run}}{\text{alpha-olefine content of cracked distillate fresh wax run}}$

40 The material increase in the C₆-C₁₈ cracked distillate product from the soaked evaporator residues, while maintaining comparable bromine numbers and alpha-olefine contents as compared with the unsoaked evaporator residues is apparent from the tabulated data in Table III. At the same time the alpha-olefine content is as much as about 60% of what it is for the fresh waxy feed.

50 According to a further modification of the process of this invention there is introduced into the soaking tank selected hydrocarbon fractions with the object of establishing therein equilibrium conditions which tend to produce larger amounts of products subsequently vaporisable for the desired cracking operation. Thus hydrocarbon fractions of gasoline boiling range may be introduced to increase the yields of waxy products suitable for vapour phase cracking from the material undergoing soaking. Since this modified technique involves maintaining sufficient pressure in the soaking tank to keep the gasoline boiling range fraction liquid, it is generally more conveniently carried out with batchwise soaking.

70 The additional cracked unsaturated hydrocarbons which can be made available by subjecting that part of the feed-stock which is not initially vaporised under flashing

conditions to a thermal soaking as specified above with the subsequent application of vapour phase cracking conditions to the material so treated constitute a range of products of very considerable value and interest in a diversity of syntheses in the chemical and the petroleum fields. The nature of these additional unsaturated products may perhaps differ a little from those obtained by the vapour-phase cracking of the untreated initial waxy feed-stock but the differences, if any, have not yet been elucidated and in any event certainly do not detract from their value as raw materials for various commercial manufactures.

What we claim is:—

1. A process for the vapour phase thermal cracking of hydrocarbon wax or materials containing hydrocarbon wax at a temperature in the region of 500° C. to 600° C. characterised in that at least that part of the feed-stock which is not initially vaporised under flashing conditions (with or without steam) at temperatures below 500° C., is subjected to a temperature between 390° C. and 450° C. for a period which decreases as the temperature increases and which varies from four hours at 390° C. to one quarter of an hour at 450° C. and the heat-

5 treated material is subjected to flashing at temperatures below 500° C. followed by vapour phase thermal cracking of substantially all of the resulting vapours at a temperature in the region of 500° C. to 600° C.

10 2. A process for the vapour phase thermal cracking of a slack wax at a temperature between 500° C. and 600° C. in which at least that part of the feed-stock which cannot initially be vaporised in a flash evaporator (with or without steam) at 480° C. to 500° C. is subjected to a temperature between 410° C. and 440° C. for a period which decreases as the temperature increases and which varies from 2 hours at 410° C. to 1 hour at 440° C. respectively and is thereafter returned directly to the flash evaporator.

15 3. A process as claimed in either of the preceding claims in which cracking is effected in the presence of super-heated steam.

20 4. A process as claimed in any one of the preceding claims in which only the unvaporised part of the feed-stock is subjected to a temperature between 390° C. and 450° C. or between 410° C. and 440° C.

25 5. A process as claimed in any one of the preceding claims in which cracking takes place at a temperature between 540° C. and 560° C. for a period between 1 and 3.5 seconds.

30 6. A process as claimed in any one of the preceding Claims 2 to 5 in which feed-stock enters the flash evaporator at a temperature between 490° C. and 500° C. and is there contacted with steam initially at a temperature of about 440° C. and a pressure of 60 to 90 pounds per square inch (gauge).

35 7. A process as claimed in any one of the preceding claims which operates continuously and in which the unvaporised part of the feed-stock is continuously fed from a flash evaporator to a soaking tank where it is subjected to a temperature between 390° C. and 450° C. for a period which decreases as the temperature increases and which varies 40 from four hours at 390° C. to one quarter of an hour at 450° C. and from which it is continuously withdrawn and fed to a pre-heating coil where it mixes with initial feed-stock and recycle feed-stock and passes to the flash evaporator together with these feed-stocks.

50 8. A process as claimed in Claim 7 in which a minor proportion of the unvaporised part of the feed-stock is continuously bled off in order to minimise or eliminate coke formation.

55 9. A process as claimed in Claim 8 in which the minor proportion of the unvaporised part of the feed-stock which is continuously bled off is separately subjected to a temperature between 390° C. and 450° C. for a period of time which decreases as the temperature increases and which varies from four hours at 390° C. to one quarter of an hour at 450° C.

60 10. A process as claimed in any one of the preceding Claims 1 to 6 in which the unvaporised part of the feed-stock is subjected to a temperature between 390° C. and 450° C. for a period which decreases as the temperature increases and which varies from four hours at 390° C. to one quarter of an hour at 450° C. in the presence of selected hydrocarbon fractions in order to establish equilibrium conditions tending to increase the yield of products subsequently vaporisable for the cracking operation.

65 11. A process for the vapour phase thermal cracking of hydrocarbon wax or materials containing hydrocarbon wax substantially as hereinbefore described with reference to the drawing accompanying the Provisional Specification.

70 12. Cracked hydrocarbons whenever prepared by the process claimed in any one of the preceding claims.

H. I. DOWNES,
Agent for the Applicants,
St. Helens Court,
Great St. Helens, London, E.C.3.

PROVISIONAL SPECIFICATION.

Improvements in or relating to the Production of Olefinic Hydrocarbons by Cracking Wax and Wax-Containing Materials and to the olefinic Hydrocarbons so Obtained.

90 We, "SHELL" REFINING AND MARKETING COMPANY LIMITED, a British Company of St. Helens Court, Great St. Helens, London, E.C.3, PHILIP JAMES GARNER, B.A., F.R.D., of 2 Woodcote, Hooton, Wirral, Cheshire, and SIDNEY EDGAR HILES, B.Sc., of 5 Mulrow Terrace, Wrexham Street, Mold, Flintshire, both British Subjects, do hereby declare the nature of this invention to be as follows:—

This invention is concerned with the thermal cracking of waxes such as paraffin wax to yield mixtures of olefinic hydrocarbons including various long-chain olefines, 100 as for instance those containing 15 or more carbon atoms.

The thermal cracking of waxes and waxy material has been known and practised for some time and with the aid of this technique 105

BAD ORIGINAL

a range of unsaturated aliphatic hydrocarbons can be secured which individually or in admixture can find application in the synthesis of a variety of useful commercial products. Waxes of various types have been the subject of cracking experiments and notably paraffin wax containing materials are of value as cracking stock. Such materials may for instance include waxy material extracted from a mineral oil distillate or residue by chilling and pressing or by known solvent extraction processes. Purified products are not essential, and valuable hydrocarbons can for instance be obtained from a slack wax derived by solvent extraction of a waxy mineral lubricating oil.

In the treatment of a paraffin-wax containing material, as for instance slack wax, to obtain olefinic hydrocarbons having at least five carbon atoms in the molecule, vapour phase cracking is effective, and to this end the material is subjected to preliminary vaporisation in a flash evaporator unit at a suitable temperature which generally is just below 500° C. Thereafter cracking is effected in the vapour phase at between 500° C. and 600° C. under moderately elevated pressures up to about 60 lbs. per sq. inch to yield the desired olefinic materials.

It is however frequently found that only a fraction of the initial material undergoes evaporation in the flash evaporator unit, and as much as 20 to 50% of the material may remain as a residue, herein referred to as "evaporator residue." From the standpoint of the efficiency of the cracking operation such an evaporator residue is a marked disadvantage, and the more so because such evaporator residue is not itself a product of much commercial value. Accordingly any steps which minimise the amount of evaporator residue and increase the volume of hydrocarbons passing to the cracking furnaces, thereby enhancing the yield of olefinic hydrocarbons, constitute a most desirable technical advance in this particular field.

It has now been found that by subjecting the aforesaid evaporator residue to a temperature between 390° C. and 450° C. for a period varying between 4 to 1 hours—which thermal treatment is hereinafter generally referred to as "soaking" or "thermal soaking" of the product—the nature of the residue can be so modified that on further flash evaporation further amounts of material are vaporised and the residue finally remaining is substantially reduced, say to an amount which is between one-twentieth and one tenth of the amount of the original feedstock. Moreover the additional material available for circulation to the cracking furnaces yields valuable olefinic hydrocarbons on being subjected to vapour phase cracking conditions.

Since the essential feature of the present invention is the thermal soaking of that waxy material which is not normally volatile when flashed in the evaporator up to 500° C., such thermal soaking may be applied either to the initial wax feed-stock, to a combination of fresh feed-stock and re-cycle feed-stock (that is to say, volatile uncracked or partially cracked hydrocarbon material which has been condensed in a fractionator and separated from the desired cracked olefinic hydrocarbons) or to the evaporator residue. However, since the evaporator residue is of smaller bulk than the other materials, it is preferred to subject only this material to the said soaking treatment since smaller capacity equipment is thus needed. Furthermore, it has been found that products yielding a higher proportion of valuable olefinic hydrocarbons on cracking are obtained by soaking the evaporator residue without admixture of fresh wax feed combined with recycle feed-stock.

According to the present invention therefore the vapour phase thermal cracking of waxy material, preferably paraffin wax-containing material, at a temperature in the region of 500° C. to 800° C. includes the step of subjecting at least that part of the feedstock which is not initially vaporisable when flashed with or without steam at temperatures just below 500° C. to a thermal soaking, viz. a heat treatment at between 390° C. and 450° C. for a period of 4 to 1 hours.

More specifically stated the present invention includes in a vapour phase thermal cracking of a slack wax at a temperature intermediate between 500° C. and 800° C., the step of subjecting at least that part of the feedstock which cannot be initially vaporised in a flash evaporator at 480° C. to 500° C., to a thermal soaking, viz. a heat treatment at a temperature intermediate between 410° C. and 440° C., and preferably between 405° C. and 425° C., for a period between 2 and 1 hours.

In the preferred method of practising the present invention cracking is effected in the presence of superheated steam which may be present in the flash evaporator and the evaporator residue is subjected without admixture with initial feedstock or recycle feedstock to the above specified thermal soaking treatment after which it is subjected to vaporising treatment in the flash evaporator with further amounts of fresh feed-stock and/or recycle feed-stock.

The invention will now be further illustrated by reference to the accompanying diagrammatic drawing which shows a plant for cracking slack wax in accordance with the novel process specified above.

This plant comprises a furnace F with a preheating coil 3 and a cracking coil 7, a

soaking tank S, flash evaporator E and a fractionator D.

Fresh feed of slack wax at a temperature of about 100° C. is introduced through the pipe 1 at the bottom of the fractionator D when it mixes with hot re-cycle feedstock, and the mixture at 340° C. to 360° C. flows through pipe 2 to the preheating coil 3 in the furnace F, where its temperature is raised to about 480° C. to 500° C. Thence it passes by a pipe 4 to the flash evaporator E where it mixes with preheated steam initially at a temperature of 410° C. and a pressure of 60 to 90 pounds per square inch (gauge) introduced through the pipe 5. The mixture of vaporised hydrocarbons and steam then passes along the pipe 6 to the cracking coil 7 in the furnace F where the temperature is about 540° C. to 560° C. and where cracking takes place in about 15—25 seconds. The mixture from the cracking coil 7 passes via the pipe 8 to a fractionator D and receives an admixture of quenching water from the pipe 9 to assist condensation. A mixture of olefinic hydrocarbons is withdrawn from the top of the fractionator D and condensed hydrocarbons (re-cycle feed-stock) are re-cycled with fresh feed admitted to the pipe 1. The plant pressure is from 10 to 25 pounds per square inch gauge.

The evaporator residue which accumulates in the base of the evaporator E, is passed via a pipe 10 through a coil 11 in the furnace F to the soaking tank S. The volume of this tank S and the conditions in coil 11 are so related to the throughput rate of the plant that the required soaking conditions are established in this tank, for example 2 hours residence at 410° C. The soaked residue leaves the tank S through the pipe 12 and joins the stream of material in the coil 3.

A pipe 15 leading from the base of the soaking tank S is used to bleed off continuously a quantity of evaporator residue equivalent to between 5% and 10% of the fresh feed. The exact quantity thus bled off is adjusted to be the minimum consistent with the prevention of coking and may generally be regarded as waste; in some cases, however, it is convenient to subject it to a soaking treatment in a location other than that of the continuous process described above. Bled-off residue soaked in this way is preferably accumulated in a storage vessel until a convenient quantity has been obtained for soaking treatment; this soaking is thus carried out as a discontinuous or batch treatment.

Valves V1, V2, V3, V4 and V5 and pipes 13 and 14 make it possible to pass either fresh feed from the pipe 1 or a re-cycle feed from the pipe 2 or mixtures of these two, as well as evaporator residue, to the soaking tank S, by means of valve manipulations which are evident from the drawing.

It will readily be understood that the process described above may be modified by allowing the evaporator residue to accumulate either in the evaporator or in a suitable storage vessel and then to carry out the soaking as a separate operation distinct from the main cycle of operations, for example in a separate apparatus.

According to a further modification of the process of this invention there is introduced into the soaking tank selected hydrocarbon fractions with the object of establishing therein equilibrium conditions which tend to produce larger amounts of products subsequently vaporisable for the desired cracking operation. Thus hydrocarbon fractions of gasoline boiling range may be introduced to increase the yields of waxy products suitable for vapour phase cracking from the material undergoing soaking. Since this modified technique involves maintaining sufficient pressure in the soaking tank to keep the gasoline boiling range fraction liquid, it is generally more conveniently carried out with batchwise soaking.

The additional cracked unsaturated hydrocarbons which can be made available by subjecting the initial feed-stock or evaporator residue to a thermal soaking as specified above with the subsequent application of vapour phase cracking conditions to the material so treated constitute a range of products of very considerable value and interest in a diversity of syntheses of interest both in the chemical and the petroleum fields. The nature of these additional unsaturated products may perhaps differ a little from those obtained by the vapour-phase cracking of the untreated initial waxy feed-stock but the differences, if any, have not yet been elucidated and in any event certainly do not detract from their value as raw materials for various commercial manufactures.

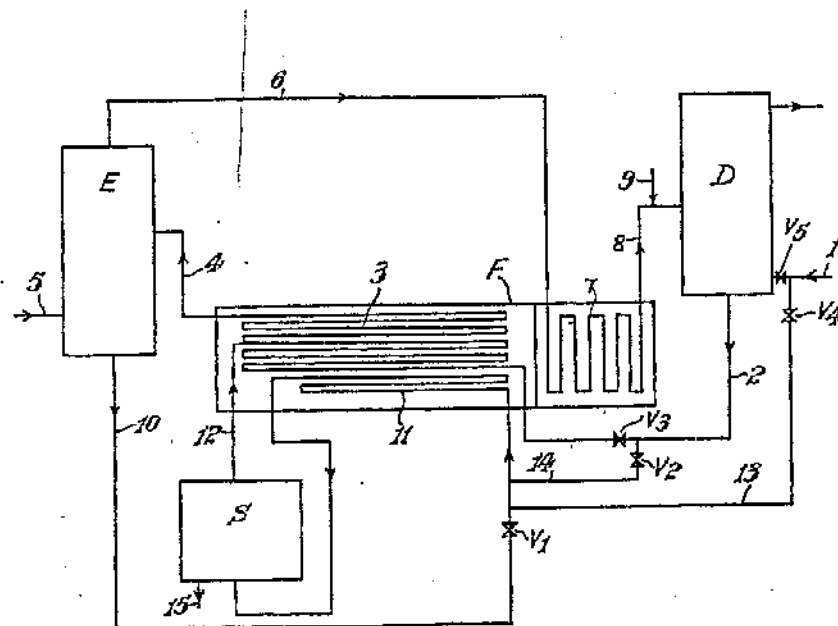
Dated this 27th day of July, 1949.

H. I. DOWNES,
Agent for the Applicants,
20, Bishopsgate, London, E.C.2.

686,000 PROVISIONAL SPECIFICATION

1 SHEET

This drawing is a reproduction of
the Original on a reduced scale.





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vaporisation in a flash evaporator unit at a suitable temperature which generally is just below 500° C. Thereafter cracking is effected in the vapour phase between 500° C. and 600° C. under moderately elevated pressures up to about 60 lbs. per square inch to yield the desired olefinic materials.

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temperature between 390° C. and 450° C. for a period varying between four hours and one quarter of an hour—which thermal treatment is hereinafter generally referred to as "soaking" or "thermal soaking" of the product—the nature of the residue can be so modified that on further flash evaporation further amounts of material are vaporised and the residue finally remaining is substantially reduced, say to 60% or less of the amount of the evaporator residue normally obtained. Moreover the additional material available for circulation to the cracking furnaces yields valuable olefinic hydrocarbons on being subjected to vapour phase cracking conditions.

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