UNITED STATES PATENT OFFICE.

EUGEN SCHAAL, OF STUTTGART, WÜRTEMBERG, GERMANY.

CONVERTING PETROLEUM AND SIMILAR HYDROCARBONS INTO ACIDS.

SPECIFICATION forming part of Letters Patent No. 335,962, dated February 9, 1886.

Application filed October 11, 1884. Serial No. 145,296. (Specimens.)

To all whom it may concern:

Be it known that I, EUGEN SCHAAL, doctor of philosophy, a subject of the King of Würtemberg, residing at Stuttgart, in the Kingdom of Würtemberg, Germany, have invented a new and useful Improvement in Processes of Converting Petroleum and other Hydrocarbons into Acids, of which the following is a specification.

This invention consists in subjecting petroleum or hydrocarbons of the series $C_nH_{2n}+2$ resulting from destructive distillation of brown coal, slate, peat, &c., in a metallic vessel in the presence of an excess of alkaline substances—such as caustic alkalies, alkaline earths, or their carbonates or substances of alkaline character—to the action of an oxidizing agent—such as a current of air or oxygen—whereby said hydrocarbons become converted into acids which combine with the alkalies. This result can be obtained by placing the hydrocarbons into a closed vessel, mixing them with an excess of alkali, and exposing them to a current of air or oxygen, by preference, at a high temperature, or the hydrocarbons may be finely diffused through neutral substances—such as infusorial earth or pumice-stone, &c., mixed with an excess of lime—and then subjected to the action of a current of air or oxygen. The conversion into acids also results when the hydrocarbons, mixed with an alkali, are finely diffused through neutral substances and then oxidized by the action of materials that give off oxygen—as, for example, by a mixture of chromates, chlorates, nitrates, permanganates, with acid sulphates, &c., absorbed in infusorial earth. The treatment on a large scale is such that, for instance, the hydrocarbons, intimately mixed with an excess of alkali, flow continuously into a closed vessel or retort, through which a current of compressed air is passed, and from which the resulting salts are withdrawn. The oxidation proceeds slowly at the ordinary temperature; but the operation can be facilitated by raising the temperature to from 150° to 300° centigrade, and the supply of hydrocarbons can be regulated to suit the rapidity of the conversion. Obviously the process might be carried on intermittently. Super-oxidation, sometimes manifesting itself by the formation of oxy-acids, can be counteracted by adding zinc powder to the alkaline mixture, or by directly treating the acids with zinc powder.

The following may be given as an example for carrying out my invention: I take, say, five hundred pounds of petroleum composed of hydrocarbons, the boiling-point of which varies between 150° and 400° centigrade, and bring the same into a metallic retort provided with a suitable agitator, and with a cooling-tube, which is upwardly inclined, so that the liquid resulting from the condensation of the vapors runs back into the retort. To the petroleum I add from twenty to thirty pounds of an alkaline substance—such, for instance, as oxide of calcium, or caustic soda, or a mixture prepared from equal parts of oxide of calcium, caustic soda, and carbonate of soda—and then the retort is heated so as to cause the mass to boil violently under constant stirring, while at the same time a current of atmospheric air or oxygen is passed through the mixture by means of an air-pump or otherwise, the boiling temperature being maintained for about from twenty to thirty hours. During this time about one hundred pounds of the alkali are gradually introduced under constant stirring, and at the end of the time above named oxidation is completed. By the action of the oxygen the petroleum is converted into acids, which combine with the alkali, forming salts, which being mostly insoluble in the mother-liquor, are precipitated to the bottom of the retort.

The same object can be attained by mixing five hundred pounds of the petroleum above named with about one hundred pounds of an alkaline substance—such as oxide of calcium or caustic soda, or a mixture prepared from equal parts of oxide of calcium, caustic soda, and carbonate of soda, and with indifferent substances—such as pumice, infusorial earth, or common salt—in a finely-divided state, so that the mixture forms a powder which is still dry. The mixture is brought in intimate contact with the air, and to effect this purpose it may be introduced into a rotating drum, which is heated cautiously with steam, until the petroleum boils.

The heat facilitates the operation; but the formation of the alkaline salts takes place at

the ordinary temperature if the mixture is exposed to the action of the oxygen for a sufficiently long period of time.

From the foregoing description it will be seen that by following my process the hydrocarbons named above are converted into acids which combine with the alkali employed in the treatment and form salts. The alkali, so to say, acts as an incentive to render the hydrocarbons capable of taking hold of the oxygen, and an excess of alkali is used to guard against super-oxidation, respectively decomposition and formation of carbonic acid, since by the alkali the acids as soon as formed are separated in the form of salts, and thereby withdrawn from the further action of the oxygen.

The alkaline salts obtained as above described are insoluble in the mother-liquor, and they are separated therefrom by precipitation or by distilling off the mother-liquor, and then the salts are decomposed by the action of mineral acids, which combine with the alkalies, setting the petrol-acids free. These petrol-acids are either solid or liquid, and the latter can be separated from the former by distillation.

The liquid petrol-acid produced from ordinary petroleum treated with zinc-dust is composed of C=70.85 or C=9.82, H=10.58 or H=18.2, O=18.57 or O=2, which indicates $C_{10}H_{18}O_2$. The analysis of other samples of liquid petrol-acid indicates $C_9H_{16}O_2$.

The solid petrol-acids appear to be formed by further oxidation of the liquid petrol-acids—that is to say, by replacing H_2 by O.

Both the liquid and the solid petrol-acids unite with alkalies to form soaps, particularly the liquid petrol-acids can be used with advantage in the manufacture of soaps for laundry and other purposes, as fully described in Letters Patent No. 319,854, granted to me June 9, 1885.

I do not claim in the present application for a patent the product or products obtained by the process above described, such products forming the subject-matters of separate applications, both of which were filed March 27, 1885, No. 160,279 and No. 160,280. Neither do I claim anything shown and described in Letters Patent No. 257,961, No. 240,923, and No. 222,408, since my process is not intended for purifying oils, but for converting petroleum into acids.

What I claim as new, and desire to secure by Letters Patent, is—

1. The process of converting petroleum or hydrocarbons of the series $C_nH_{2n}+2$ into organic acids, which process consists in subjecting the above-named hydrocarbons in the presence of an excess of alkaline substances—such as caustic alkalies, alkaline earths, or their carbonates—to the action of an oxidizing agent, then separating from the liquid the resulting alkaline salts, and, finally, extracting from these salts the mixture of organic acids.

2. The process of converting petroleum and other hydrocarbons of the series $C_nH_{2n}+2$ into organic acids, which process consists in subjecting the above-named hydrocarbons in the presence of alkaline substances—such as caustic alkalies, alkaline earths, or their carbonates—to the action of an oxidizing agent, then separating from the liquid the resulting alkaline salts, then from these salts the mixture of organic acids, then liberating from these salts the organic acids by decomposition with a mineral acid, and, finally, separating the said organic acids into liquid acids and solid acids by distillation, as herein described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EUGEN SCHAAL.

Witnesses:

JOHANN HENKES,

B. ROI.