Oct. 18, 1932. H. B. KIPPER 1,883,799

PRODUCTION OF ACETYLENE FROM PETROLEUM OIL

Filed Sept. 11, 1930

Fig. 1.

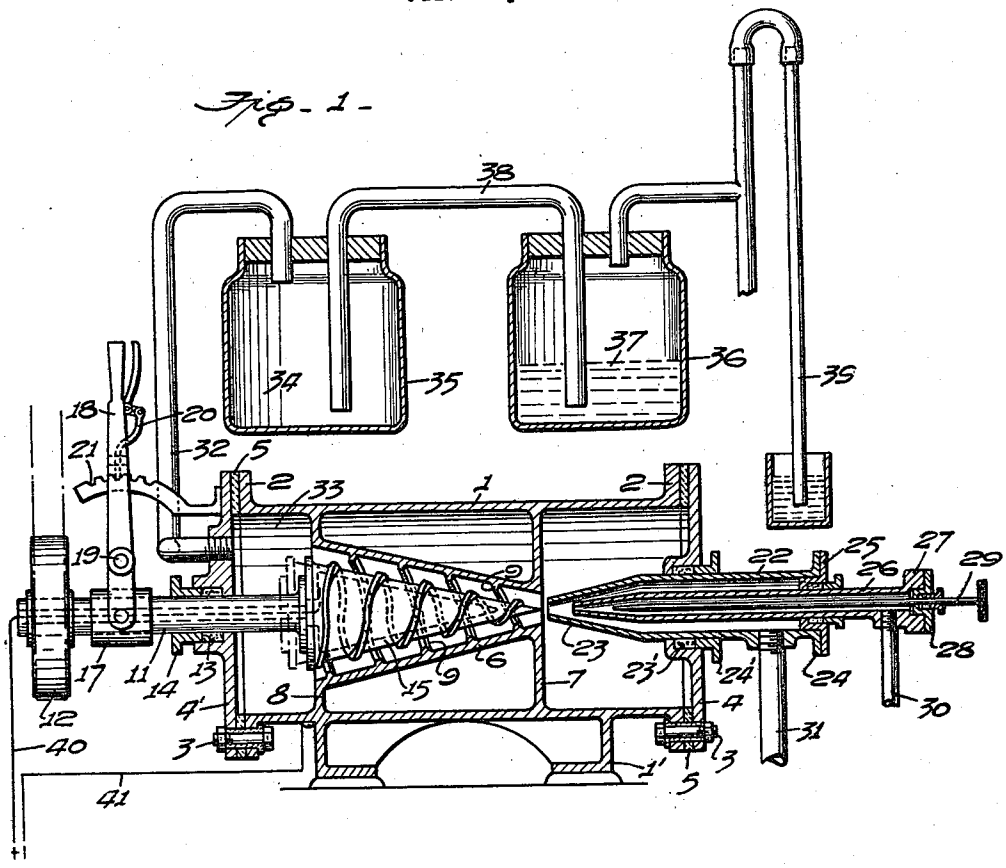


Fig. 2.

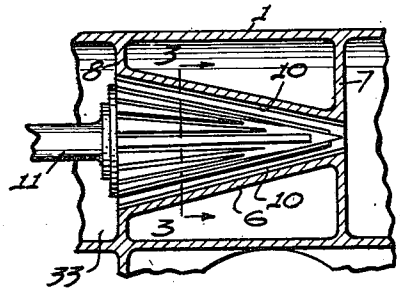
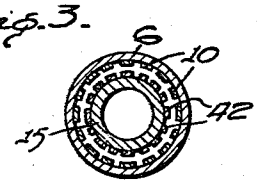


Fig. 3.



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UNITED STATES PATENT OFFICE

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PRODUCTION OF ACETYLENE FROM PETROLEUM OIL

Application filed September 11, 1930. Serial No. 481,253.

This invention relates to the production of hydrocarbons of the acetylene series from petroleum oil. More specifically, the invention relates to a process of making acetylene from crude petroleum oil by high temperature processing of the latter in the presence of hydrogen. The invention further relates to novel apparatus for carrying out the process.

The object of the invention is to manufacture acetylene from petroleum oil and to provide a novel apparatus for such manufacture. It is known in the art that qualitative evidence has been obtained of the existence of acetylenes in petroleum products. However, the amounts are extremely small, and may be accounted for in all probability by local superheating during distillation.

It has been commonly believed that, at temperatures above 700° C., oil would decompose in the presence of hydrogen to form a substantially equal amount of saturated and unsaturated hydrocarbons such as methane, ethane, propane, ethylene and propylene; and that a maximum of only about one-half of one percent of acetylene would be formed. I have discovered, to the contrary, that at temperatures above 700° C., but preferably above 1000° C. and upward to the temperature of the electric arc, that decomposition of petroleum oil in the presence of hydrogen and at pressures slightly under atmospheric proceeds with the formation of a large amount of acetylene, the efficiency of the process running as high as 90% and usually not less than 80%.

The preferred apparatus for carrying out my process is shown in the drawing,

Figure 1 showing a view in cross-section,

Figure 2 showing a modification of the rotatable electrode,

Figure 3 showing a section taken along the line 3—3 of Figure 2.

Referring to Figure 1, the numeral 1 indicates a cylindrical casing suitably supported on the base 1′ and having flanges 2, having attached thereto by bolts 3 the end portions 4 and 4′ and suitably insulated from the flanges 2 by the insulation 5. Within the cylinder 1 and integrally cast therewith is an electrode 6 having a cross-section in the form of an open truncated cone, the conical part of which is suitably supported within the cylinder 1 by the members 7 and 8. Upon the electrode 6 is the helical or spiral thread 9, as shown in Figure 1 or the longitudinal bars 10, as shown in Figures 2 and 3. The end member 4′ has an opening therein thru which a shaft 11 rotates by actuation of the pulley 12. A stuffing box 13 and gland 14 prevents leakage to or from cylinder 1 during operation. Fixed to the one end of the horizontal rotatable shaft 11 is the conical electrode 15 having thereon a spiral thread 16 in alternate spaced relationship to the thread 9 of the electrode 6. The electrode 15, it will be noted has its outer wall concentric to or parallel with the outer wall of the electrode 6. The rotatable electrode 15 is horizontally adjustable in relation to the electrode 6 by reason of the sleeve 17 actuable by the lever 18 pivoted at 19 and fixable in various positions on account of the element 20 engageable in the stops 21. The electrode 15 may be made horizontally adjustable by other means known to those skilled in the art, if so desired. The end portion 4 has an opening thru which the tube 22 passes, leakage being prevented by the stuffing box 23′ and gland 24′. Tube 22 converges at its inner end 23 and has a flanged portion 24 at its outer end. Associated with the flange 24 is the stuffing box 25 thru which passes an internal tube 26 corresponding to the tube 22 and spaced therefrom interiorally of the same.

Tube 26 is flanged at 27 with which a stuffing box 28 is associated and thru which the cleaning rod 29 passes. The tube 26 also has a conduit 30 entering thereto, while the tube 22 has a conduit 31 entering thereto. The end member 4′ has a conduit 32 entering therein and communicating with the chamber 33 of the cylinder 1, and with the chamber 34 of the safety vessel 35 which is in communication with the vessel 36 containing ammoniacal cuprous solution 37 by virtue of conduit 38. The vessel 36 is connected to a vacuum pump (not shown) with which is associated the mercury gauge 39.

The operation of the device is as follows: The whole system is first evacuated and then filled with hydrogen gas entering thru the conduit 30. A slight flow of hydrogen is then maintained by suitable regulating valves (not shown). A suitable current is impressed upon the electrodes 6 and 15 thru the lead wires 40 and 41, thus forming a high temperture electric arc. Oil is now fed thru the conduit 31 and is injected by the hydrogen gas flowing to and thru tube 26 so that the oil hydrogen mixture impinges at the conical ends of the electrodes 6 and 15, and therefore into the arc. The electrode 15 may be rotated, if desired and the arc may be made larger or smaller by suitably adjusting said electrode in a horizontal direction. The reaction products are withdrawn from the chamber 33 and may be purified to remove the acetylene therefrom by some counter current purifying operation with acetone, or the acetylene formed may be used directly for formaldehyde formation. If purification is made with acetone, the hydrogen may be separated therefrom and reutilized in the process. In the accompanying drawing, I have shown the reaction products passed thru the safety bottle 35 and the solution 37 where the acetylene is precipitated as copper acetylide.

It is to be understood, however, that in commercial operation of the process, instead of passing the reaction products through the ammoniacal copper solution, the acetylene produced may be absorbed in acetone or other suitable solvent, the solution thereby formed withdrawn from the absorption vessel or vessels, and that the acetylene, after removal from such solution, may be utilized at superatmospheric or other pressure as desired.

As will be understood by those skilled in the art, various modifications may be made in the process and in my apparatus without departing from my invention, such as, for example, preheating the oil before spraying the same in the reaction chamber, providing the electrode 15 with longitudinal ribs 42 such as are shown in Figure 3, and utilizing various hydrogen containing gases other than pure hydrogen which I have disclosed.

While my apparatus and process are preferably to be used with crude petroleum oils containing mostly straight chain hydrocarbons, such use does not preclude the use of crude petroleums which contain some cyclic hydrocarbons.

While I have operated at both reduced and at superatmospheric pressures, a pressure slightly below atmospheric is the most practical, while atmospheric pressure represents the optimum condition for most efficient processing.

What I claim is:

1. An apparatus for destruction of petroleum at a high temperature in a hydrogen atmosphere which comprises a casing defining a chamber, electrodes concentrically disposed in said chamber, a feeding tube horizontally disposed at one end of the chamber and adapted to direct a spray of oil and gas between said electrodes, means for rotating one of the electrodes with respect to the other and means for moving one of the electrodes longitudinally with respect to the other for varying the distance between the electrodes.

2. An apparatus for converting petroleum oil into acetylene which comprises a casing member, a stationary electrode having the cross-section of an open truncated cone secured internally of the casing and defining two chambers in the casing connected by a conical passageway, a rotatable conical electrode in said passageway and spaced from said stationary electrode, means on the electrodes to provide an obstruction to passage of solid matter between the electrodes from one chamber to the other chamber, tubular means in one chamber for injecting oil and gas into the passageway, and means in the other chamber for withdrawing reaction products.

3. In a conversion apparatus of the class described, the combination of a cylindrical casing, a stationary electrode supported therein and defining two chambers in the casing connected by a converging passageway from the front chamber to the rear chamber, end walls insulated from the cylindrical casing and defining respective boundaries for said chambers, a tubular member disposed in the front chamber and extending thru one end wall, said tubular member having an end portion converging toward the smaller opening of the passageway, a second tubular member supported in said first tubular member and extending therethru, conduit means entering the first tubular member for supplying oil thereto, conduit means entering the second tubular member for supplying gas thereto, a rotatable shaft entering the other end wall and disposed in the rear chamber and having a conical electrode secured thereto adapted to enter said converging passageway, means for actuating said shaft and electrode and means for horizontally adjusting same with respect to the stationary electrode.

In testimony whereof I have hereunto set my hand.

HERMAN B. KIPPER.