

UNITED STATES PATENT OFFICE

2,256,174

PROCESS OF PRODUCING ACETYLENE FROM HYDROCARBONS

Heinrich Schilling, Heidelberg, and Ludwig Heer, Ludwigshafen-on-the-Rhine, Germany, assignors, by mesne assignments, to Jasco, Incorporated, a corporation of Louisiana

No Drawing. Application July 1, 1937, Serial No. 151,542. In Germany July 4, 1936

2 Claims. (Cl. 204—171)

The present invention relates to the production of acetylene from hydrocarbons containing more than two carbon atoms in the molecule.

When preparing acetylene from hydrocarbons containing more than two carbon atoms in the molecule, in particular from hydrocarbons which are liquid at ordinary temperature, by the electric arc process, it is usually very important to convert the initial hydrocarbons as completely as possible into acetylene and to avoid to a far-reaching extent the formation of by-products, in particular carbon black. Thus the expenditure of energy for the acetylene preparation should be as low as possible and the content of acetylene in the electric arc waste gas as high as possible. The latter is also necessary *inter alia* in order to keep the amount of gas to be led in circulation as small as possible. By the known processes one or other of the said results has been obtained but a process which is satisfactory in every respect and which fulfills the said conditions simultaneously has not hitherto been known.

We have now found that such a process is possible by leading the hydrocarbons together with inert carrier gases, such as hydrogen or carbon monoxide or mixtures of both which may also contain lower hydrocarbons, such as methane, such as is the case for example with illuminating gas, through an electric arc in such manner that hydrocarbons containing more than two carbon atoms in the molecule are added to the carrier gas before and immediately behind the electric arc, the hydrocarbons behind the arc being fed substantially to meet only the gas issuing therefrom. The hydrocarbons supplied before the electric arc may be in the gaseous or vaporous or liquid state, but they must be gaseous or vaporous when reaching the arc form. The amount supplied is so measured that upon further addition the expenditure of energy for the formation of acetylene no longer decreases. It has been found that with increasing addition of hydrocarbons having more than two carbon atoms per molecule to the carrier gas, as for example illuminating gas, the expenditure of energy for the formation of acetylene at first decreases steeply, but a minimum value is soon reached and it then increases again upon further addition, probably because of the increased formation of carbon black which then commences. By working at or in the neighbourhood of that addition of hydrocarbon in front of the electric arc at

which the minimum for the expenditure of energy is just attained, the expenditure of energy in the electric arc per cubic metre of carrier gas can then be selected of such magnitude that almost all of the hydrocarbon introduced in front of the electric arc is converted into acetylene without any appreciable formation of carbon black or of other desirable by-products.

The addition of hydrocarbons immediately behind the electric arm is mainly for the purpose of quenching and it is therefore advantageous to use liquid hydrocarbons, preferably in a finely divided form. These hydrocarbons are so fed behind the arc that they mix with the gases issuing therefrom and do not enter the electric arc itself nor distribute over its whole surroundings which would cause considerable decomposition with the separation of carbon on the one hand and a useless atomizing of material on the other hand. When using oils, these simultaneously absorb the undecomposed portion or the insufficiently decomposed residue of the hydrocarbons supplied in front of the electric arc, so that by supplying this oil to the carrier gas in front of the electric arc, this residue is also rendered of further use in the simplest manner. As contrasted with quenching with water, any small amounts of carbon black are absorbed by the oil sprayed into the reaction gases for the purpose of quenching and may readily be separated again by centrifuging the oil.

The quenching with oil also offers the possibility of the direct exploitation of a part of the energy content of the hot electric arc gas in that acetylene and olefines are formed from the oil sprayed in.

A special oilwasher, which is trickled with cold oil which may be led in circulation, may also be provided.

The process according to this invention is especially suitable for the treatment of hydrocarbons which are liquid at ordinary temperature and which have not too high a vapour pressure.

The said manner of working is especially suitable for the preparation of acetylene from hydrocarbons when there is no other use for the residual gas obtained by the electric arc treatment. In this case, after removing the acetylene formed from the residual gas, which latter consists for example mainly of hydrogen, as much is let off as corresponds to the increase in volume in the electric arc. The remainder serves again as the carrier gas for the electric

arc and is led in circulation. A special advantage of working in this manner, in addition to those already mentioned, may be seen from the fact that the waste of acetylene is considerably reduced because, when working in circulation, the portion of the acetylene not converted in the removal of the acetylene formed for example by conversion into acetaldehyde is almost entirely returned to the electric arc treatment with the residual gas.

The following example will further illustrate the nature of this invention but the invention is not restricted to this example. The parts are by weight.

Example

Illuminating gas which is flowing at the rate of 31 cubic metres per hour is preheated to about 350° C. and then 21.5 kilograms of gas oil per hour are added in a very finely divided condition which under these conditions become vaporous, the mixture then being exposed to the action of an electric arc. The gas leaving the electric arc is quenched with the same gas oil. The gas leaving the electric arc contains 18.4 per cent of acetylene and its homologues and 6.0 per cent of hydrocarbons of the composition C_nH_{2n} .

The expenditure of energy per kilogram of acetylene and its homologues amounts to 8.5 kilowatt-hours and there is practically no formation of carbon black.

By quenching the reaction gas with the gas oil, the liquid hydrocarbons which have not been completely converted in the electric arc are recovered without trouble and returned to the electric arc again.

Including waste, about 1.7 kilograms of oil are

used for each kilogram of acetylene formed in the electric arc.

The oil used for quenching is employed in circulation and the amount of oil introduced in front of the electric arc is branched off therefrom. Fresh oil is continuously or periodically added at any suitable place in the cycle or directly into the electric arc.

The gas containing acetylene obtained is worked up in an aldehyde plant. The waste gas from this plant contains about 80 per cent of hydrogen in addition to olefines and about 7 per cent of paraffinic hydrocarbons. 31 cubic metres of this gas are returned per hour to the electric arc as a carrier gas after the addition of 21.5 kilograms of gas oil per hour.

What we claim is:

1. The process of producing acetylene from normally liquid hydrocarbons which comprises passing an inert carrier gas through an electric arc, adding said hydrocarbons to the gas before the arc, converting said hydrocarbons to the gaseous condition before the gas reaches the arc, quenching the gaseous products leaving the arc by admixing them immediately after their exit from the arc with a normally liquid hydrocarbon and preventing entry of the quenching liquid into the arc zone, thereby avoiding cooling of said zone.
2. The process in accordance with claim 1 in which the inert carrier gas is one substantially consisting of at least one of the gases selected from the group consisting of hydrogen and carbon monoxide.

HEINRICH SCHILLING.
LUDWIG HEER.