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PROCESS FOR THE MANUFACTURE OF ETHYLENE FROM OIL

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Fig. 1.

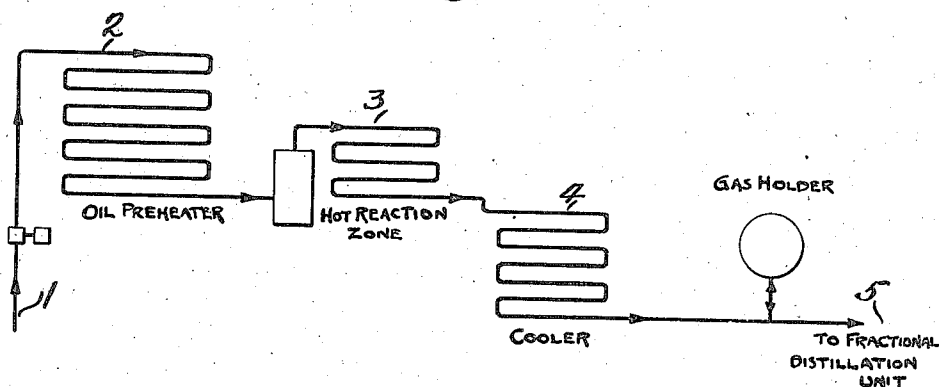
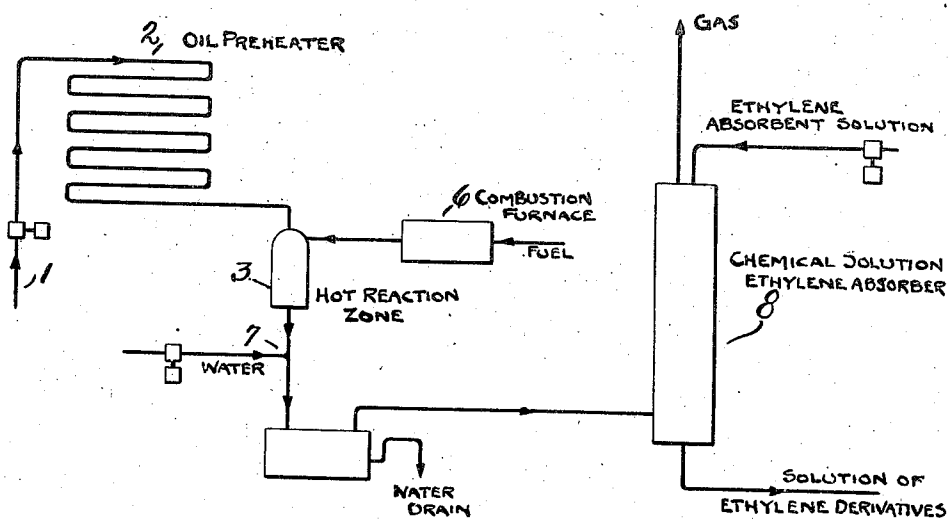


Fig. 2.



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PROCESS FOR THE MANUFACTURE OF
ETHYLENE FROM OIL

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2 Claims. (Cl. 260—170)

The subject matter of this invention is a new method for producing ethylene, a hydrocarbon gas C_2H_4 of the olefin series, from liquid hydrocarbon mixtures of the type found in petroleum, in which new process the correlation of temperatures, reaction velocities and reaction periods of time produce yields of ethylene far in excess of the yields by the current methods of producing ethylene from hydrocarbons.

10 In the oil industry ethylene is a by-product in converting heavy-oil to gasoline by pyrolysis and the yield of ethylene, depending upon whether the liquid or the vapor phase method of cracking is employed, varies in amounts up to approximately 6% by weight of the charging stock.

15 In the chemical industry, in the operation directed to the production of ethylene from liquid hydrocarbons, a variation of the vapor phase method used in the oil industry is employed.

20 In the oil industry the yield of liquids is in the order of 75% by weight of the charging stock and the ethylene yield as above indicated is only about 6%; in the chemical industry the yield of liquids is in the order of 40% by weight of the charging stock and the ethylene yield is in the order of 10% by weight of the charging stock.

25 As distinguished from these prior processes, the present invention provides a method wherein the yield of liquids is reduced to less than 10% by weight of the charging stock and the yield of ethylene is increased to as high as 45% by weight of the charging stock.

30 One of the objects of this invention is the production of ethylene as the primary product of the operation in converting substantially all of the charging stock to gases, the yield of condensible polymers being inhibited substantially to exclusion. This operation is not of necessity an adjunct to oil refinery operations but can be conveniently located wherever ethylene is desired for use either directly or as a process material.

35 Another object of this invention is the production of ethylene from liquid hydrocarbons, wherein I obtain a yield of ethylene as high as 45% by weight of the hydrocarbons charged, my method providing for the flash system cracking of preheated liquid hydrocarbons, the ethylene thus produced being prevented from polymerizing to heavier hydrocarbons, thereby insuring the maximum yield of ethylene and the minimum yield of liquids.

40 My new process produces these novel results from liquid hydrocarbons in a continuous operation, the process comprising the operations of preheating the oil to a sufficiently high temperature

while subjected to suitable pressure and velocity so that upon flashing the preheated oil into a hotter reaction zone substantially all of the oil is almost instantly heated and cracked to ethylene and hydrocarbons of less than four carbon atoms, this hot gas being immediately shock chilled below the polymerization temperature zone to practically exclude polymerization before a substantial amount of ethylene is polymerized.

45 In the accompanying drawing I have illustrated diagrammatically embodiments of my invention:

Fig. 1 illustrating an embodiment of the invention wherein the reaction zone is externally heated; and

Fig. 2 illustrating an embodiment of the invention wherein the reaction zone is internally heated.

As an example of the practice of my invention for the production of ethylene from gas oil, and with reference first of all to Fig. 1: The oil to be processed is taken from any suitable source of supply 1 and supplied to the pressure preheater 2 at a pressure in the order of, for example, 20 atmospheres or higher pressure, flowing continuously through the preheater to the reaction zone 3. The oil is preheated to a temperature in the order of 850° F. In the preheating step of my process temperature and pressure conditions are so controlled that the oil remains in the liquid phase. The preheated oil is continuously injected into the hotter reaction zone 3, flashing into vapor, the temperature of the hotter reaction zone being so controlled that substantially all of the oil vapor is converted to ethylene and hydrocarbons of less than four carbon atoms at a temperature of in the order of 1400° F. The hot gases are immediately shock chilled to below 1000° F. in the cooler 4 so as to practically exclude polymerization before a substantial amount of ethylene is polymerized, thereby avoiding yields of a substantial quantity of liquid, i. e., not in excess of 10% by weight of the charging stock.

45 The cooled gas flows to a fractional distillation unit 5, which separates the ethylene from the products of pyrolysis.

In the embodiment of my invention as illustrated in Fig. 2 the procedure is the same as outlined above, the reaction zone being internally heated by hot products of combustion from source 6. Chilling of the hot gas is effected by water injected into the gas as indicated at 7. The ethylene is separated from the products of pyrolysis by chemical reaction as shown at 8.

In the example given above I have mentioned a temperature in the order of 1400° F. with refer-

ence to the gas in the reaction chamber. This was in connection with the use of gas oil as the charging stock. It is to be understood that with different charging stocks the temperature at which the reaction takes place and the time necessary to obtain the optimum yield of ethylene therefrom vary, but in any case the temperature should not be less than approximately 1200° F. and the reaction time should not exceed approximately one and one-half seconds to avoid producing condensates. Furthermore, the temperature should not exceed 1600° F. because at such temperature ethylene decreases. Preferably the temperature ranges between 1300° F. and 1500° F. and the time varies in inverse relation to the temperature, preferably ranging from approximately one and one-half seconds to less than one-half second in order to obtain the optimum yield of ethylene.

What I claim is:—

1. The process of producing ethylene from oil, which process comprises preheating the oil under superatmospheric pressure while maintaining the oil slightly below its vaporizing temperature at that pressure, injecting all of the preheated liquid oil into a flowing gaseous medium which contains sufficient heat for heat exchange to the preheated oil to flash heat the preheated oil to within the temperature range of 1300° F. to 1600° F., at which temperature all of the hydrocarbons of the

oil are instantly decomposed to ethylene and hydrocarbons of not more than four carbon atoms, and immediately upon attaining this temperature shock cooling the gaseous mixture to below 1000° F. to exclude polymerizing reactions forming gasoline hydrocarbons and to retain the hydrocarbons as ethylene and hydrocarbons of not more than four carbon atoms.

2. The process of producing ethylene from gas oil, which process comprises preheating the oil to a temperature in the order of 850° F. while subjected to superatmospheric pressure, controlling pressure and time conditions while preheating so that the oil remains in the liquid phase, injecting all of the preheated oil into a flowing gaseous medium which contains sufficient heat for heat exchange to the preheated oil to flash heat the preheated oil to within the temperature range of 1300° F. to 1600° F., at which temperature all of the hydrocarbons of the oil are instantly decomposed to ethylene and hydrocarbons of not more than four carbon atoms, and immediately upon attaining this temperature shock cooling to below 1000° F. to exclude polymerizing reactions forming gasoline hydrocarbons and to retain the hydrocarbons as ethylene and hydrocarbons of not more than four carbon atoms.

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