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High Pressure Experiments
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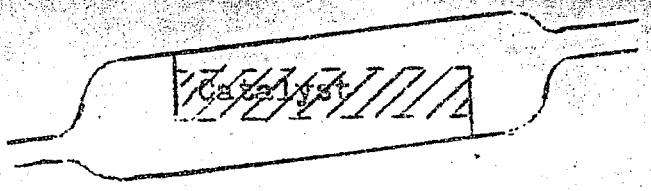
EXPERIENCE WITH THE SYNTHESIS REACTOR STALL 506

(Discussion of gas circulation versus foaming process)
By Dr. Michael

The synthesis reactor in stall 506 was originally designed for a yearly production of 800 - 1,000 te. It has been constructed as a so-called wide bed reactor with the idea of a best utilization of the pressured space while maintaining a small height of the catalyst layer. The gas inlet and outlets were arranged un-



symmetrically and there was in addition a change in the gas circuit and the reactor cross sectionsin the proportion of 1 : 10 between the circuit and the converter. It has been assumed that the pressure difference produced by the catalyst bed will bring

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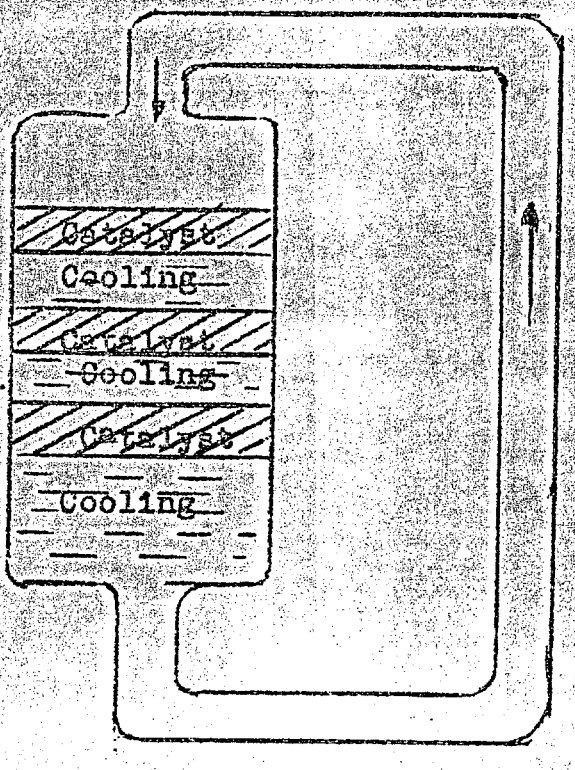
about a uniform passing through the catalyst layer. It is, however, absolutely essential to avoid places with a slowed-down flow, because an overheating of the catalyst is bound to occur there resulting from insufficient heat removal. Such overheating results in the formation of soot on the hot spots, which will necessitate the replacement of the catalyst.

Such a wide bed reactor has never been operated for any longer period without disturbances, and the replacement of the catalyst necessary after 6 - 7 weeks of operation has confirmed our conviction, that the fault lay in part in the construction of the reactor. The soot deposits were always located in analogous spots, which proved clearly, that the shape of the converter does not insure a uniform flow of the gas.

The first attempted corrections consisted in installing baffles, which brought about no visible improvement. A real improvement was only obtained when the catalyst was arranged in layers in several parallel trays, each layer of a limited height, which, however, reduced the space filled by the catalysts to 60 - 70 percent. It gave us, however, the conviction that the best shape of the reactor must be different from that originally planned in which the lasting changes in velocity of 1 : 10

should not occur, nor spots present in which the gas had to make sharp changes in direction.

For these reasons in the fall of 1940 the undersigned with Mr. Plauth have intended to design reactors of a different construction in which the above mentioned draw-backs were avoided.



Layers of catalysts and cooling tubes were to be alternated in a vertical cylinder introducing some 7 aggregates of the both and placed in series with the gas stream returned from the bottom aggregate to the top. The whole cylinder was passed by parallel

streams of gas and eddies formation were impossible. The distribution of gas could be regulated at the inlet and outlet by suitable dampers.

Construction details of such a shape of apparatus have been developed. The actual construction was, however, not attempted at that time, because the newly developed foaming process offered some definite advantages. These were:

1). An absolute equality of temperature throughout the whole catalyst space;

2). Minimum gasification, which resulted in a larger yield of the products;

3). The simplest construction of reactors (such as the foaming plate reactors);

4). The use of powdered catalysts as the simplest possible form of the catalysts;

5). The possibility of renewal of catalysts without interrupting operations;

6). The use of small amounts of catalysts for the same yield;

7). Better quality of the product.

The changing over of the mixer reactors from laboratory size to industrial size offers still difficulties of a purely technical nature, not based

on any chemical obstacles (the bearings and stuffing boxes). A 30 li foaming plate reactor operates, however, very well, and there is no doubt that it will operate equally well as a large industrial unit. 1 1/2 cbm reactor is being prepared at present.

The production of 0.2 reached with our foaming plate reactors in the method for middle oil production can be still further improved. It is, however, entirely economical even today, because the foaming plate reactor represents but an empty cylinder after all.