I. G. Farbenindustrie A. G., Ludwigshafen, September 14, 1943.

PATENT APPLICATION

PROCESS FOR CATALYTIC REACTION OF HYDROCARBONS. (FLUID CATALYST PROCESS)

~~A method has been found which permits to carry out catalytic re-~~ actions as well as regeneration of the spent catalyst in the same unit in the case that the catalyst used is a finely-divided, "fluid-type" solid.

The reaction and regeneration zones can be arranged in a single reactor and the various zones can be separated from each other by installing passable trays on which the fluid catalyst can collect and act as seal. The trays can be designed so that they are invertable; vibrating screens can also be used. The powdered catalyst which falls from the higher reactor zones on an intermediate tray is held on the trays by the pressure of the regenerating gas or the oil vapors which enter the zone through inlets above the tray and thereby prevent the vapors or the regenerating gas from passing into the next lower zone. At the same time the resistance to flow of the catalyst layer on the tray is greater than that of the regenerating gases entering at the upper end of the regenerating zone below, and the catalyst on the intermediate tray is not whirled up; it thereby prevents the regenerating gases from passing into the zone above. The main requirement for this sort of seal is the uniform distribution of the catalyst on the intermediate trays. Judging from the behavior of dry dust at ordinary temperature, it was not to be expected that this would be successful since dry dust at ordinary temperature has a tendency to bridging and would fall on the next lower tray when the intermediate tray is inverted. Unexpectedly, however, it was found that hot, finely-divided clay which is charged with gas bubbles or vapors behaves like a liquid and distributes itself equally on the support.

The process can be explained by means of the attached diagram which shows the cracking and regenerating zones arranged in a single reactor; (1) represents the cracking zone and (2) the regenerating zone. The unit is supported by the frame (3). It contains two purging zones - (4) and (5) of which the first lies between the cracking and the regenerating zone and the latter at the outlet of the regenerating zone. The purging zone (4) is separated by two separating zones - (6) and (7) - (containing several intermediate trays) above and below zone (4). The purging zone (5) is only secured by the separating zone (8) bounded by intermediate trays. The catalyst passes through the unit from top to bottom through the various intermediate trays (9) which are designed according to previous patent applications (I 74507 IV b/12g or I 74797 IV b/12g) - either so that they can be inverted or pulled out or are constructed as vibrating screens. The oil charge enters the cracking zone at (10). The cracking products leave the cracking zone at (11).

In the regenerating zone (2) the regeneration of the catalyst is carried out (according to the patent application I 74936 IV d/23B) with

removal of the heat liberated. At (12), air, heated to about 840°F., enters the regeneration zone, whereas the waste gases leave it at (13). Air of ordinary temperature is introduced through the line (14) which permits to control the temperature of the regenerating gases within the desired limits so that superheating of the catalyst is avoided.

The catalyst is removed by means of a conveyor - (15) - and returned to the upper part of the reactor (17).

An inert gas, preferably nitrogen, is introduced into the two purging zones - (4) and (5) - and leaves the purging zone at (19) and (21). The pressure in the two purging zones exceeds somewhat that in the other parts of the unit.

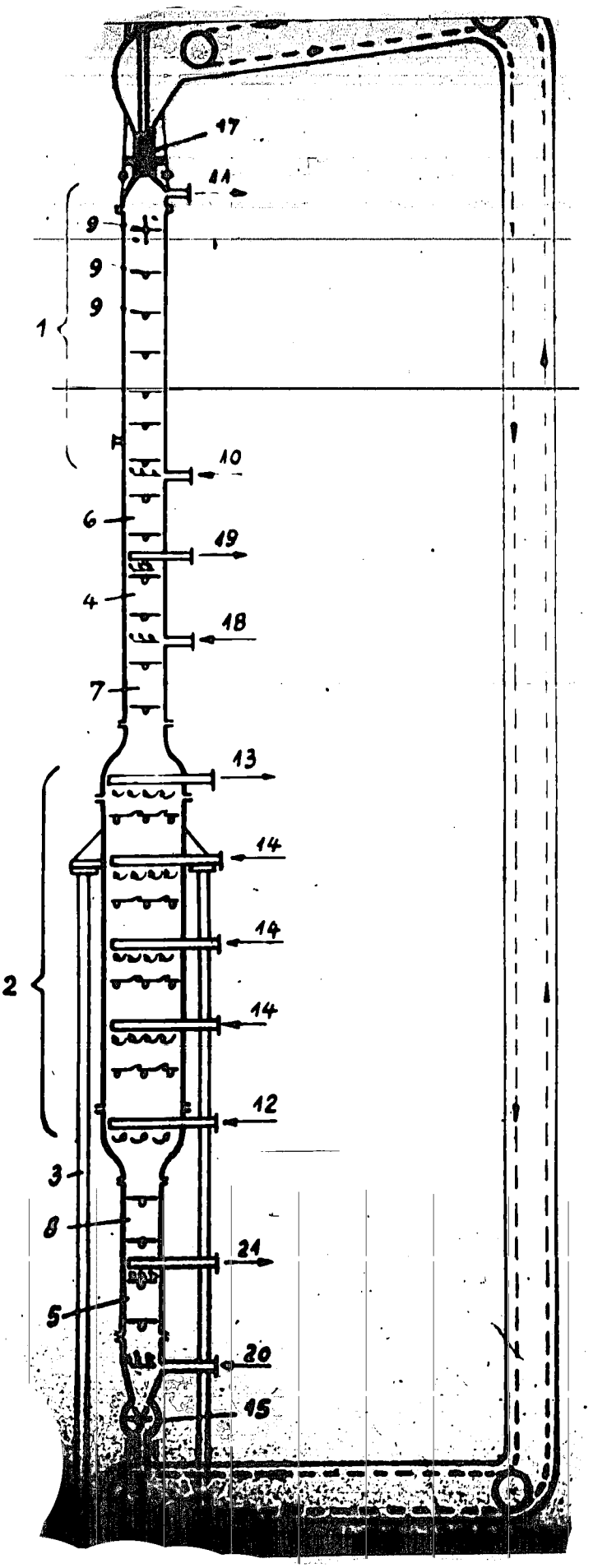
The intermediate trays below and above the two purging zones (4) and (5) which are covered with catalyst in the same way as the other intermediate trays - (9) - are entirely sufficient to guarantee a satisfactory separation of the two purging zones from the neighboring reaction zones. Since each separating zone consists of two intermediate trays arranged one above the other, the flow of the catalyst in the direction from the top to the bottom of the reactor can take place through the intermediate trays of the separating zones without difficulty. When one of the two intermediate trays which separates the zones is operated to let catalyst pass, the second intermediate tray which, at this time is in a stationary position, is sufficient to separate the neighboring zones from each other; this separation is so perfect that even a small pressure difference between the zones does not cause passing of gases or vapors from one zone into the other.

Claim 1.

Process for the operation of catalytic reactions of carbon-containing compounds, especially cracking of hydrocarbons in the gas or vapor phase in the presence of fluid-type catalysts; the catalysts are regenerated by passing oxygen-containing gases, especially air, through them and are moved through reaction, regeneration and purging zones in the direction from top to the bottom of the reactor. The process is characterized by arranging reaction and regenerating zones, together with the necessary purging zones, in a single reactor and effecting the separation of the individual zones, especially the purging zones from the neighboring zones, by means of the finely-divided catalyst which collects on passable intermediate trays.

Claim 2.

Process according to claim 1 which is characterized by constructing the passable intermediate trays so that they can be inverted or opened or that they represent vibrating screens.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