PUBLISHED
JUNE 1, 1943.

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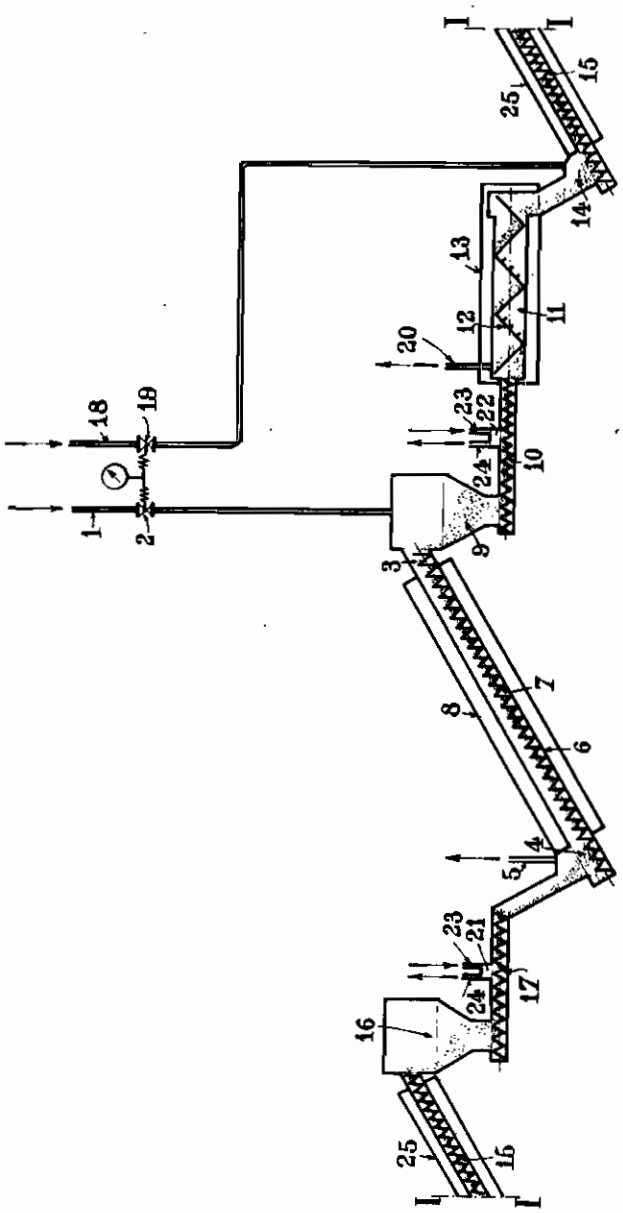
CATALYSIS PROCESS WITH CONTINUOUS REGENERATION OF THE CATALYSER

Filed March 12, 1942

Serial No. 434,440



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Published June 1, 1943

Serial No. 434,440

ALIEN PROPERTY CUSTODIAN

CATALYSIS PROCESS WITH CONTINUOUS REGENERATION OF THE CATALYSER

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Application filed March 12, 1942

In many reactions which are effected in presence of a catalyser, the latter becomes modified during the operation. Outside the "intoxication" of the catalyser by foreign substances which become chemically fixed thereon, the ageing of the catalyser can take place by another mechanism; the covering of the active particles by products arising from the very reactions and which hinder the exchanges at the surface of the catalysing particles. The activity of the catalyser gradually decreases, the yields of the operation diminish and it becomes necessary to replace the spent catalyser, either by fresh catalyser, or by regenerated catalyser, that is to say by spent catalyser having recovered, owing to an appropriate treatment, a suitable activity. As type of a cycle of this kind can be cited the catalysis during which hydrocarbons in the vapour phase are treated at the required temperature on a catalyser, which is granular or in solid fragments, of alumina, porous silica, active clay, etc. In these conditions, the hydrocarbon molecules are decomposed and carbon or heavy bodies rich in carbon can be released; this inert residue of the kind of cracking thus effected, settles on the catalyser, surrounds it, reduces the closeness of the contact of the substances in reaction, slackens the exchanges and leads to a progressive diminution of the yield. The regeneration of such a spent catalyser can be easily effected by causing an air stream to pass over the catalyser heated to a sufficiently high temperature (of the order of 600°) so that the carburetted deposit becomes oxidized and gradually disappears by burning. The catalyser is then revived by said combustion which has freed its surface, and, brought to the temperature chosen for catalysis, it can be used again, become again spent, and be regenerated again, and so on.

It is generally deemed advantageous to use catalysers as active as possible; it is therefore necessary to replace the catalysers as soon as the diminution of their activity becomes evident. An important constraint and a very serious complication of the operations result therefrom, owing to the fact that one is led to use the catalyser only for a short time—sometimes only a few minutes—so as to use it only during the period of maximum activity. Sets of catalysing chambers must therefore be available which are put in service successively, while the spent chambers are subjected to regeneration.

The present invention is intended to do away with this arrangement by effecting in a single continuous operation the cycle of catalysis and regeneration of the catalyser; moreover, the operations can be adjusted in such a manner that the catalyser only remains in service for a period as short as desired before being regenerated, so that the catalyser is always ready for catalysis with its maximum efficiency. Furthermore, the duration of the regenerating period can be simultaneously lengthened so as to ensure said regeneration completely and in the best conditions.

The accompanying drawing diagrammatically illustrates a method for carrying out the present invention, the ends sectioned at I—I forming in reality the extension of each other.

The gases or vapours to be treated are admitted at 1 and first pass through a pressure regulator 2 the function of which will be indicated later on. The products then reach the catalysing zone which extends from 3 to 4, then escape, once treated, into 5. The catalysing chamber proper is formed of an inclined tube 6 enclosing an Archimedean screw 7 and can be brought to the required temperature by any suitable means such as the casing 8 heated by a current of steam or of oil, an electric winding, etc. The regenerated catalyser is taken up at 4 by the Archimedean screw, and gradually rises, whereas catalysis takes place on continuously renewed surfaces; the catalyser is finally poured at 9 into a hopper where it accumulates, awaiting regeneration.

The spent catalyser is then taken up at 9 by an Archimedean screw 10 which conveys it to the regenerating zone proper 11. There, the catalyser advances under the action of the Archimedean screw 12 whilst it is treated and subjected to regenerating temperature by any suitable means such as the casing 13. The regenerated catalyser falls at 14, where an Archimedean screw 15 takes it up again and feeds it into the hopper 16. A last Archimedean screw 17 then conveys the catalyser to 4 where, taken up again by the screw 7, it begins its cycle over again.

During regeneration, the catalyser must be heated in an oxidizing atmosphere (gas containing oxygen, generally air). Said air is admitted at 18 and passes under the control of a pressure regulator 19, passes through the regenerating zone 11 and escapes at 20. Said pressure regulator 19 is rigid with the pressure regulator 2 with which its function is rigidly connected and the unit 2—19 operates closely in parallel, so that the products to be treated and the air for regeneration reach and pass through the apparatus in which the reactions take place with the

same pressure, losses of charge being taken into account; this equality of pressure must essentially be obtained in the two regions in which the catalysing zone and regenerating zone are contiguous. It is important, in fact, that the fluids should remain juxtaposed and not penetrate each other, either because of a difference of pressure, or by diffusion, so as to avoid any formation of an explosive mixture liable to cause accidents, by contact with a hot point where a deflagration might occur.

In addition to the condition of equality of pressure, obtained as just stated, the mixture or the diffusion of the fluids is also prevented, on the one hand, owing to the arrangement of hoppers in which the catalyser accumulates, the grains of the packed catalyser themselves forming an obstacle to the free circulation of the gases and, on the other hand, by providing two steam cushions at 21 and 22. The steam admitted through 23 and issuing through 24 evolves through crowns or grids perforated with holes at a pressure slightly higher than that existing in the general enclosure of the apparatus and thus pushes back on either side, the traces of gas which might tend to become mixed.

Most often, the temperature at which regeneration must be effected is higher than catalysing temperature. The arrangement of an enclosure 25 is provided on the path followed by the catalyser, in which enclosure the latter cools from the temperature it had at the issue from regeneration down to that which it must have during catalysis. This excess of heat might, of course, be recovered and used to improve the thermal output of the plant.

It will be easily understood that the useful working period of the catalyser and the period of regeneration are adjustable by the dimensions of the Archimedean screws and by their speed of rotation.

It is to be understood that the invention is not in any way limited to the embodiment given simply as an indication and not in a limiting sense and that numerous modifications of detail and even of structure may be made without departing thereby from the scope of the present invention; it is thus for instance that, in some cases, the catalysing chamber can be horizontal, the regenerating chamber inclined, the steam cushions be separated or not from the gases to be treated by cushions of catalyser, etc.

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