AMENDED SPECIFICATION.

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PATENT SPECIFICATION

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1225

COMPLETE SPECIFICATION (AMENDED).

Improvements in Catalytic Gas Reactions.

We, I. G. FARBENINDUSTRIE AKTIENGESELLSCHAFT, of Frankfort-on-Main, Germany, a Joint Stock Company organized under the Laws of Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

In catalytic gas reactions, especially those which are carried out under pressure, as for example in the synthesis of ammonia from its elements or in the production of methanol by the catalytic reduction of oxides of carbon, but particularly in the destructive hydrogenation of carbonaceous materials, such as coal, tars, mineral oils and the like, i.e. the treatment thereof with hydrogen under pressure, the highest possible catalytic effect is always aimed at. This depends not only on the equality of the catalyst employed, but also on the fact that as much as possible of the substances, which are to enter into reaction, should come into contact with the catalyst in the unit of time. Often, however, it is very inconvenient to establish the rate of the speed of the gas current required to secure sufficient shortness of the duration of the direct contact between the substances and the catalyst.

We have now found that the efficiency of the said catalytic gas reactions may be considerably increased by bringing the catalyst in a more or less fine state of division into a state of suspension in the reaction chamber by means of an eddying gas current which passes through porous plates or through a layer of granular material, preferably in such a manner that the gas will traverse all parts of the cross-section at approximately the same rate, a uniform distribution of the gas current being thus obtained which ensures the whirling particles of the contact substance being present in every part of the reaction space. The bulk of the catalyst remains in the reaction chamber and is not removed therefrom by the reaction gases. The said gas current may be a component in the reaction or an inert gas. According to this method of working the largest possible amount of the substances, which are to enter into reaction, comes into contact with a given amount of the catalyst and is catalytically influenced thereby.

If the rate of the gas current, the specific density of the gas, the size of the particles of the catalyst and its specific gravity are suitably adapted to one another, the height of the reaction sphere may be kept constant. The catalysts which are thus whirled up, may be of granular nature consisting of coarse or fine grains, or they may be employed in a finely divided state. They may even be employed in the finest degree of dispersion, so that substances will act as catalysts, which otherwise would not do so.

The process according to the present invention has the further advantage that the distribution of heat is effected very rapidly and thoroughly, so that both in exothermic and endothermic reactions, a uniform temperature throughout the reacting space is easily maintained.

Any fine particles of the catalyst which are carried forward are removed from the reaction gases before they reach the cooler parts of the apparatus, where otherwise condensations or undesirable reactions and the like might take place. The said removal of catalyst dust may be effected by suitable devices, such for example as baffles, sieves or screens, electric dust precipitators or other suitable means. For example, if iron dust is employed as a catalyst for the synthesis of ammonia, the dust may be removed with the aid of a magnetic field.

The following example will further

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illustrate how the said invention may be carried out in practice but the invention is not limited to this example.

EXAMPLE.

A current of hydrogen charged with the vapours of a heavy middle oil is passed into a high pressure reaction vessel from below, at 460° Centigrade and 200 atmospheres pressure, through a porous plate of fire-proof material, extending over the whole cross-section of the said vessel and tightly fixed therein, and on which a molybdenum-chromium catalyst rests in a granular state or in the form of dust. At a proper speed of the oil loaded gas current, the catalyst is brought into suspension in the reaction space, the particles being whirled about and fairly uniformly distributed throughout the whole of the reaction space. Before the reaction product reaches the cooler parts of the apparatus, the catalyst dust is removed from the gas current by means of baffles or a dust separator consisting of a wire screen with very fine meshes.

On cooling the gases leaving the reaction vessel a product is obtained containing more than 70 per cent of benzine.

Owing to the whirling movements of the catalyst, its efficiency is far greater than without the employment of such whirling movements of the catalysts, under otherwise similar conditions of working.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process for carrying out catalytic gas reactions, which consists in bringing the catalyst into a state of suspension throughout the reaction space by means of a gas current which passes through porous plates or through a layer of granular material, the particles of the catalyst being whirled about and dispersed homogeneously within the reaction space by the said gas, which may or may not participate in the reaction, the bulk of the said catalyst remaining in the reaction chamber and not being removed therefrom by the reaction gases.

2. A modification of the process claimed in the preceding claiming clause which consists in removing any fine particles of the catalyst from the reaction gases before they reach the cooler parts of the apparatus.

3. The application of the process claimed in the preceding claiming clauses for the destructive hydrogenation of carbonaceous materials.

4. The process for carrying out catalytic gas reactions substantially as described in the foregoing example.

Dated this 25th day of July, 1927.

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