[Second Edition.]

PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in the Manufacture and Production of Organic Compounds Containing Oxygen.

I, JAMES YATE JOHNSON, a British subject, of 47, Lincoln's Inn Fields, in the County of London, Gentleman, do hereby declare the nature of this invention (which has been communicated to me from abroad by the Badische Anilin & Soda Fabrik, of Ludwigshafen-on-Rhine, Germany, a corporation organized according to German laws) and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

For the catalytic production of methanol or other organic compounds containing oxygen from carbon oxides and hydrogen at elevated temperatures and pressures, it has been suggested to employ gases containing an excess of one of the reacting gases, or even inert gases, and it has also been suggested to work in a circulatory system and to maintain the composition of the circulating gas by the proper addition of fresh gases, see for example Specification No. 229,714.

My foreign correspondents have found that the said catalytic process can be effected in a highly economical manner by employing gas mixtures which contain a high percentage of gases not required for the reaction and working in a circulatory system with a continuous removal of part of the circulating gases enriched in inert gases and its replacement by fresh gas mixture in such proportion as to maintain a constant composition of the circulating gas mixture.

Corresponding to the considerable proportion of inert constituents a comparatively large part of the circulating gas must be withdrawn after passage through the contact mass in order to secure a smooth operation. It is obvious that the composition of the circulating gas is different from the fresh gas introduced, as part of the latter undergoes chemical combination and is removed from the system in the form of the product obtained.

According to this invention it is possible to work regularly and continuously and to maintain exact conditions of working notwithstanding the presence of the large mass of inert gases. By reason of their presence it may be preferable to work at a smaller speed of the gas current or at higher temperatures or at higher pressures than when employing undiluted gas mixtures. The yields obtained by this process are equal to and sometimes even higher than those obtained with pure gases under the usual conditions of working. The use of gases rich in inert gases is very advantageous in that the excess heat developed by the reaction is absorbed or easily carried away and the difficulties sometimes caused by the said development of heat are avoided. The process herein described may also be employed with gases containing a large excess of one of the reaction gases which then acts as an inert diluent, or when in the course of the reaction, gases useless for the reaction are formed by side reactions.

The process herein described is of special importance economically as it is possible to utilise gases which are available in large quantities at a low cost and which could not be employed hitherto for the manufacture of oxygen containing organic compounds.

The following example shews a method of carrying the invention into practical effect but the invention is not limited to this example.

EXAMPLE.

Power-gas containing 5.5 per cent. of carbon dioxide, 27.8 per cent. of carbon monoxide, 15.6 per cent. of hydrogen, 2.6 per cent. of methane and 48.5 per cent. of nitrogen, is first passed in mix-

ture with steam over a suitable catalyst, for example iron oxide at an elevated temperature so as to decompose so much of the carbon monoxide with steam that the resulting gas mixture contains carbon monoxide and hydrogen in a proportion of about 1 to 2. After the carbon dioxide is absorbed by water under pressure the gas containing about 15.3 per cent. of carbon monoxide, 30.6 per cent. of hydrogen, 2.8 per cent. of methane and 51.3 per cent. of nitrogen, is circulated over a contact mass suitable for the synthesis of methanol, at about 400 degrees Centigrade under a pressure of about 1000 atmospheres.

The said initial gas contains 45.9 per cent. of reacting constituents. In the course of the reaction large quantities of methanol are formed which are separated on cooling the gases. By the reaction the amount of reacting constituents in the circulated gas is diminished, whereas the amount of inert gases remains unaltered. After some time the gas contains 36 per cent. of reacting constituents and 64 per cent. of inert gases, the latter corresponding to the 54.1 per cent. of such gases contained in the original gas. It results from the above figures that when, for example, 150,000 cubic metres of the gas were contained in the circulatory system, it now contains 126,500 cubic metres. Accordingly, when the composition of the circulating gas is to be maintained for example at the said 36 per cent. of reacting and 64 per cent. of inert constituents, the ratio of fresh gas to the desired final gas is 150,000 to 126,500, which means that 15,000 cubic metres of fresh gas must be gradually added and 12,650 cubic metres of final gas gradually withdrawn. Thereby the percentage of the circulating gas is maintained at 12 per cent. of carbon monoxide and 24 per cent. hydrogen. The actual rate at which fresh gas is added and final gas withdrawn, depends on the rate of conversion into methanol and can easily be determined for example from the fall in pressure or from the amount of methanol separated in the cooler.

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

1. A process for the manufacture and production of methanol or other organic compounds containing oxygen by catalytic hydrogenation of carbon oxides under pressure and at an elevated temperature and in the presence of a catalyst capable of causing the formation of methanol or other organic compounds containing oxygen, consisting in employing gas mixtures which contain a high percentage of gases not required for the reaction and working in a circulatory system with a continuous removal of part of the circulating gases enriched in inert gases and its replacement by fresh gas mixture in such proportion as to maintain a substantially constant composition of the circulating gas mixture.

2. The process claimed in the preceding claiming clause in accordance with the foregoing example.

3. Methanol or other organic compounds containing oxygen when obtained in accordance with the preceding claiming clauses.

Dated this 19th day of October, 1925.

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Agents.

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