[Second Edition.]

PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in the Manufacture and Production of Oxygenated Organic Compounds.

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 company incorporated 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:—

My foreign correspondents recently found that by the action of suitable catalysts on mixtures of oxides of carbon and hydrogen, at an elevated pressure and temperature, methanol or other oxygenerated organic compounds are produced with good yields.

When carrying out this process on an industrial scale however, it has been found that certain difficulties are experienced, the catalysts soon losing efficiency, or giving rise to undesirable secondary reactions, resulting in the formation of hydrocarbons and the like.

A thorough investigation has shewn that such irregularities are caused owing to the fact that the gases subjected to the catalytic action even if carefully purified in the usual way, are not pure enough for the purpose in question and that it is indispensable to remove, besides organic compounds of sulphur, even traces of volatile compounds of iron, especially iron carbonyl compounds. Provided the gases are purified to such a degree that neither sulphur, nor iron, compounds can be found in them by an intimate analytic examination the contact masses will work reliably and continuously, producing methanol and other oxygenated compounds.

According to the present invention it is rendered possible to employ a great variety of industrial gases. These should be suitably composed so as to contain hydrogen in an amount exceeding that of carbon oxides. For example, blue gas composed of, by volume, 40 *per cent.* of carbon monoxide, 55 *per cent.* of hydrogen, 4 *per cent.* of nitrogen and 1 *per cent.* of hydrocarbons, may be employed, or coal gas, coke oven gas, low temperature carbonisation gas or mixtures, and if so required, insufficient percentage of carbon monoxide, or hydrogen may be completed by adding proper gases, or removing an excess present until the proportion desired is attained, for instance 3 or 4 volumes of hydrogen to each one volume of carbon monoxide. Such corrections may be made either before, or after purification of the industrial gases.

In order to effect the purification desired the bulk of the impurities is first removed in the usual way and unsaturated, or aromatic hydrocarbons should also be removed while methane hydrocarbons are not injurious, and subsequently a purifying treatment, as efficient as possible, should be applied. Carbon oxy-sulphide and other organic sulphur compounds may be absorbed by active carbon or decomposed with soda lime or potash lime, or absorbed as well as decomposed, either successively or simultaneously. Or, the gas may be passed over a hot mass containing caustic alkali. A very efficient method of purification consists in mixing the gas with steam, conveying the mixture over a contact mass, suitable to convert part of the carbon monoxide into carbon dioxide, while liberating hydrogen, for example, iron oxide, the organic sulphur compounds being thereby decomposed and sulphuretted hydrogen formed which can be removed without difficulty.

In order to completely remove iron

[*Price* 1s.]

Price 4s 6d

carbonyl compounds from the gas which will not be retained by the ordinary means of removing contact poisons, special methods must be resorted to. To the said end, the gas may be led through a layer of active carbon, or it may be conducted over hot copper-containing masses that is to say any masses containing metallic copper or copper salts for instance metallic copper itself in various shapes, alloys containing copper, copper compounds alone or with suitable supports, saturated, soaked, or coated with copper compounds or a mass substantially similar to the methanol forming catalyst, while employing a temperature below 300° Centigrade in order to avoid the formation of methane, and the mist of iron particles, if any, produced retained by a filter.

All or part of these operations may be effected at increased pressure.

At the same time it is also advisable to keep the contact mass free from sulphur and other obnoxious admixtures, though small amounts of sulphur, chlorine, phosphorus, arsenic, or the like are in most cases only slightly injurious especially when the contact mass contains a strong base, and of course, care must also be taken that the pure gases be not contaminated afresh with volatile iron carbonyl compounds on their way to the catalyst.

I make no claim to anything which is described or claimed in my prior Specification No. 20,488 A.D. 1913.

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. The process of producing methanol or other oxygenerated organic compounds by catalytically reducing, under pressure, carbon oxides with hydrogen, which consists in subjecting the gas mixture prior to the catalytic treatment to an exhaustive purification treatment in order to remove besides other impurities, including particularly organic compounds of sulphur, also iron carbonyl or other volatile iron compounds.

2. The specific method of carrying out the process according to the foregoing claiming clause which consists in using, for the removal of volatile iron compounds active charcoal or a hot copper-containing mass, or both.

Dated this 23rd day of August, 1923

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Agents.

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