[Second Edition.]

PATENT SPECIFICATION

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1352

PROVISIONAL SPECIFICATION.

Improvements relating to the Lining of Apparatus for Use when Reacting Carbon Monoxide with Hydrogen at Elevated Temperature and Under Pressure.

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 I. G. Farbenindustrie Aktiengesellschaft, of Frankfort-on-Main, Germany, a Joint Stock Company organized under the Laws of Germany) to be as follows:—

It has already been proposed when working with gases containing carbon monoxide under pressure at elevated temperature, for example for the production of methanol, to line the internal parts of the apparatus with metals, such as chromium, manganese, molybdenum, tungsten, uranium and copper.

My foreign correspondents have now found that coatings which are very stable in the said treatment can also be obtained when employing metals which are more readily accessible by providing the parts of the surface which come into contact while hot with carbon monoxide with a coating of a zinc alloy or preferably a cadmium alloy produced by diffusion.

In order to prepare the coatings, the surfaces which may consist, for example, of iron or iron alloys and which are to withstand pressure and to come into contact with the gas containing carbon monoxide may be embedded for example in zinc powder or preferably in cadmium powder (the latter preferably in admixture with an inert substance, such as sand or alumina) or sprayed with or dipped into liquid zinc or cadmium, and then heated, if desired in the presence of non-oxidising gases, such as hydrogen, nitrogen or carbon dioxide, to such high temperatures, usually above 500° and preferably between 700° and 900° Centigrade that diffusion takes place and an alloy composed of the applied metal and the metallic substratum is formed in the surface of the metal. It is especially advantageous to expose the parts of the apparatus concerned to an atmosphere containing zinc or cadmium vapour, while excluding oxygen, for long periods, for example for from 12 to 36 hours and usually for about 24 hours at temperatures above the melting point of zinc or cadmium but preferably below 900° Centigrade.

The following Example will further illustrate the nature of this invention but the invention is not restricted to this Example.

EXAMPLE.

In an apparatus intended for the preparation of methanol from carbon monoxide and hydrogen and consisting of chromium-steel, the hot parts coming into contact with free carbon monoxide, are treated at about 800° Centigrade with cadmium vapour while carefully excluding oxygen. The duration of the treatment depends on the thickness of the desired protective layer and may amount to from several hours to a few days. A layer of a cadmium alloy is thus obtained which is in intimate combination with the base metal. It is entirely inert and stable to the gas mixture comprising carbon monoxide and hydrogen during the operation carried out at elevated temperature and pressure so that injurious side reactions of any kind are avoided.

Dated this 29th day of March, 1935.

J. Y. & G. W. JOHNSON,
47, Lincoln's Inn Fields, London, W.C.2,
Agents.

COMPLETE SPECIFICATION.

Improvements relating to the Lining of Apparatus for Use when Reacting Carbon Monoxide with Hydrogen at Elevated Temperature and Under Pressure.

We, COUTTS & COMPANY, a Company with unlimited liability, incorporated under the Companies' Act, of 440, Strand, in the County of London, and FREDERICK JOHNSON, a British Subject, of 218, Victoria Drive, Eastbourne, in the

[Price 1s.]

County of Sussex, legal representatives of JAMES YATE JOHNSON, deceased, late of 47, Lincoln's Inn Fields, in the County of London, do hereby declare the nature of this invention (which has been communicated from abroad by I. G. Farbenindustrie Aktiengesellschaft, of Frankfort-on-Main, Germany, a Joint Stock Company organized under the Laws of Germany) and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

It has already been proposed when reacting carbon monoxide with hydrogen under pressure and at elevated temperature, for example for the production of oxygen containing organic compounds, to line the internal parts of the apparatus with metals, such as chromium, manganese, molybdenum, tungsten, uranium, copper, cadmium and zinc or with alloys of those metals.

Our foreign correspondents have now found that coatings which are particularly stable in the reaction of carbon monoxide with hydrogen at elevated temperature and under pressure are obtained when providing those parts of the surface of the apparatus employed which come into contact while hot with the carbon monoxide with a coating of a zinc alloy or preferably a cadmium alloy produced by diffusion.

In order to prepare the coatings, the surfaces which may consist, for example, of iron or iron alloys and which are to withstand pressure and to come into contact with the gas containing carbon monoxide may be embedded for example in zinc powder or preferably in cadmium powder (the latter preferably in admixture with an inert substance, such as sand or alumina) or sprayed with or dipped into liquid zinc or cadmium, and then heated, if desired in the presence of non-oxidising gases, such as hydrogen, nitrogen or carbon dioxide, to such high temperatures, usually above 600° and preferably between 700° and 900° Centigrade that diffusion takes place and an alloy composed of the applied metal and the metallic substratum is formed in the surface of the metal. It is especially advantageous to expose the parts of the apparatus concerned to an atmosphere containing zinc or cadmium vapour, while excluding oxygen, for long periods, for example for from 12 to 36 hours and usually for about 24 hours at temperatures above the melting point of zinc or cadmium but preferably below 900° Centigrade.

The following Example will further illustrate how the said invention may be carried out in practice but the invention is not restricted to this Example.

EXAMPLE.

In an apparatus intended for the preparation of methanol from carbon monoxide and hydrogen and consisting of chromium-steel, the hot parts coming into contact with free carbon monoxide, are treated at about 800° Centigrade with cadmium vapour while carefully excluding oxygen. The duration of the treatment depends on the thickness of the desired protective layer and may amount to from several hours to a few days. A layer of a cadmium alloy is thus obtained which is in intimate combination with the base metal. It is entirely inert and stable to the gas mixture comprising carbon monoxide and hydrogen during the operation carried out at elevated temperature and pressure so that injurious side reactions of any kind are avoided.

If instead of the cadmium vapour zinc vapour be employed a layer of the corresponding alloy is obtained which is also entirely inert to the hot gas mixture.

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. In the reaction of carbon monoxide with hydrogen at elevated temperature and under pressure the use of an apparatus in which the surfaces coming into contact while hot with carbon monoxide are coated by diffusion with an alloy of zinc or of cadmium.

2. An apparatus for the reaction of carbon monoxide with hydrogen at elevated temperature and under pressure in which the surfaces coming into contact while hot with carbon monoxide are coated by diffusion with an alloy of zinc or of cadmium.

3. The reaction of carbon monoxide with hydrogen at elevated temperature and under pressure substantially as hereinbefore described and ascertained.

Dated this 21st day of January, 1936.

J. Y. & G. W. JOHNSON,
47, Lincoln's Inn Fields, London, W.C.2,
Agents.

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[Wt. 8012B.—50/4/1937.]