[Second Edition.]

PATENT SPECIFICATION

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1404

COMPLETE SPECIFICATION.

Improved Method of Working with Reducing Gases in Apparatus made of Copper or its Alloys and Apparatus therefor.

I, JAMES YATE JOHNSON, a British subject, of 47, Lincolns' 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 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:—

When working with gases containing hydrogen or other reducing gases in apparatus or pipes made of copper or its alloys, difficulty is experienced from the fact that when a temperature of about 100° Centigrade is exceeded the metal becomes permeable to the gas. This difficulty is experienced especially when working at elevated or high pressures, for example at several hundred atmospheres such as have been found useful in the synthesis of methanol from oxides of carbon and hydrogen which also must be carried out in the absence of iron. Even if an escape of gases is in this case prevented by surrounding the copper wall by an iron or steel shell, trouble is experienced from the fact that carbon monoxide would diffuse through the copper lining and thus coming into contact with the steel wall would give rise to iron carbonyl which when diffusing back into the reaction gases would spoil the desired process.

My foreign correspondents have discovered that the above mentioned difficulty is caused by the copper or alloys of copper often having included therein especially at the welding-seams and the like, small quantities of oxides of copper and of metals associated therewith which oxides are reduced by the hot gas, and so the wall of the vessel or pipe becomes perforated in a sieve-like manner. These perforations though not directly visible, permit of gas leaking through the wall.

My foreign correspondents have now found that in order to overcome the said difficulty in working with reducing gases in apparatus or pipes of which the pressure resisting walls are made of or lined with copper or its alloys the said walls should be protected from direct contact with the reducing gas by a layer of a gas of a character non-reducing towards copper oxide or the associated metal oxides, such as nitrogen or carbon dioxide.

For example the vessels or pipes made of copper or its alloys or made of steel or the like and lined with copper or its alloys are provided with a second or inner wall or jacket of copper or its alloys so that a narrow space is formed between the outer and inner walls through which space the inert gas is slowly passed. Or the gas jacket is simply filled with the gas without any flow or circulation. Preferably the inert gas is maintained under subtsantially the same pressure as the reducing gas so that it is not necessary that the inner wall be made to resist the pressure. When the apparatus is employed for the synthetic manufcature of methanol, the gas is reliably prevented from being contaminated by any trace of metal carbonyl formed and nevertheless the apparatus will keep tight permanently.

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. Improved method of working with reducing gases in apparatus having an inner surface of copper or its alloys

[Price 1/-]

which consists in protecting the walls of the apparatus from direct contact with the reducing gas by a layer of a gas of a character non-reducing towards the oxides of copper and of the metals alloyed with copper.

2. An apparatus for working with reducing gases having an inner surface of copper or its alloys which is protected from direct contact with the reducing gas by a layer of a gas not reducing the oxides of copper and of the metals alloyed therewith.

3. An apparatus for working with reducing gases more especially for use in the synthetic manufacture of methanol from carbon monoxide and hydrogen, the said apparatus comprising an outer wall with an inner surface of copper or its alloys capable of resisting the pressure occuring in the apparatus, and an inner wall of a copper containing metal, and means for filling the space between the said walls with a gas not reducing the oxides of copper and the metals alloyed therewith.

Dated this 2nd day of June, 1926.

JOHNSONS & WILLCOX,
47, Lincoln's Inn Fields, London,
W.C. 2,
Agents.

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