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COMPLETE SPECIFICATION.

Process for Purifying Gases from Sulphur.

We, Professor Dr. FRANZ FISCHER, a citizen of the German Republic, of 1, Kaiser-Wilhelm-Platz, Mülheim on the Ruhr, Germany, and Dr. Engineer HANS TROPSCH, a citizen of the Czechoslovak Republic, of 1, Kaiser-Wilhelm-Platz, Mülheim on the Ruhr, 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:—

This invention relates to a process for the desulphuration of gases and vapours by converting the carbonous sulphur combinations of such gases and vapours into sulphuretted hydrogen and by absorption of the thus formed sulphuretted hydrogen. It has already been proposed to use for this purpose contact-substances, specially metallic oxides, preferably oxide of zinc, and to conduct the gases or vapours at very high pressure over these metallic oxides or the like. It has further been proposed to use metals especially those of the iron-group for this purpose, but the metals of this group induce reactions between the gaseous carbon compounds if hydrogen is present producing methane, the formation of which is often very undesirable. It has also been proposed to purify gases from carbon-disulphide by passing them over a catalyst consisting of nickel or other metal mixed with suitable proportions of one or more oxides which increase the activity of the metal in promoting action between the hydrogen and carbon disulphide.

The present invention consists in a catalytic process for purifying gases and gas mixtures from sulphur compounds, the essential feature of the invention being that for the contact-means such metals as lead and tin or corresponding metal alloys are used which do not otherwise alter the gases or gas mixtures as would be the case if iron, cobalt or nickel were used, the said used metals being arranged in a finely divided state and in intimate admixture with inorganic substances which remain solid at the reaction temperature, such as bases or acid anhydrides, the catalytic process being performed at a temperature exceeding that of the melting point of lead, namely 334° C. Such a contact preserves its activity for months. The working can be carried out preferably at a temperature of 400 to 600° C. under atmospheric pressure, all sulphur-combinations of the gas then being converted into easily absorbable sulphuretted hydrogen. The permanency of the contact is so high that it is not necessary in its application to remove from the technical gas first the present free sulphuretted hydrogen in the usual manner, and to only subsequently convert with the aid of the contact-substance according to the invention the other sulphur-combinations into sulphuretted hydrogen. On the contrary the raw-gas can be directly conducted over the contact. After the separation of the originally present and freshly formed sulphuretted hydrogen by absorption or the like, the gas or gas mixture is practically free from all sulphur-combinations. For instance we have succeeded in reducing in this manner the percentage of sulphur of gases to less than 0.1 gr. in 100 cubic meters.

When the said metals as lead or tin or corresponding metal alloys are used at temperatures above their melting point, the added substances which remain solid at the reaction temperature, as bases or acid anhydrides, and with which said metals are intimately mixed, prevent the conglomerating of the contact metals or the flowing together of the same to form drops at the reaction temperature. It is

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therefore advisable to use as solid carriers for the easily fusible metals substances of large surface or to add such substances, such as highly porous sybstances.

As contact substance chromate of lead may be used for instance, in which case, owing to the reducing effect of the gas employed, a mixture of chromic oxide and finely divided lead is produced, which exerts the desired effect and retains its activity for months. Instead of the chromates other salts, for instance silicates, aluminates and the like may be used, or such salts in which the effective metal is contained in the basic portion of the salt, for instance calcium-plumbate. To such substances other substances might further be added either for increasing the effect, for instance small quantities of copper or copper-oxide, or for enlarging the surface, for instance infusorial silica or the like. Several of the above stated or of other effective salts might be used in mixture. But we may also start at once from the free metal and bring the same, in a mechanical manner, into intimate admixture with the inorganic substances which remain solid at the reaction temperature. Or we may apply, for the production of the contact, an organic salt, as acetate of lead, spread upon a solid inorganic body possessing a large surface, as a porous slab of clay or earthenware, or pumice, and subsequently dry and reduce the mass.

The selection of the contact-means applied depends on the kind of gases or vapours to be purified. In any case the contact-substances should not contain any metal of the iron-group. In the stated manner any technical gases, as lighting-gas, generator gas or water gas and the like, can be completely freed from their contents of carbonic disulphide and of other sulphur combinations by making the hydrogen reduce the sulphur-combinations quantitatively to sulphuretted hydrogen through the action of the contact-means, the sulphuretted hydrogen being then also quantitatively removed in a manner known per se, for instance by gas-purifying mass or by active carbon.

EXAMPLE:

In a tube of a cross section of 5 square centimeters a quantity of 300 cubic centimeters of contact mass is arranged over a length of 60 centimeters, said contact mass consisting, in equal parts, of chromate of lead and oxide of copper. This mass is first reduced by means of a reducing gas, for instance hydrogen, watergas or generator-gas at 400° C., so that it cannot possess any longer oxidising properties. This mass then possesses neither the capability to separate carbon from gases containing carbonic oxide nor that to form methane therefrom, but it possesses the desirable property of converting the organic sulphur-combinations of such gases into sulphuretted hydrogen.

If the gas has passed over this contact-mass, the sulphuretted hydrogen is removed with the aid of the commonly used means, as for instance meadow iron ore or active carbon. This contact-mass therefore is not an absorption-means for sulphur combinations but a catalytic converter. For this reason the mass remains active for any length of time. For instance over the above mentioned 300 cubic centimeters of contact-mass sulphur containing gas has been conducted at 500° C. during several months at a speed of 1 cubic meter per hour, and the contact-mass did not show any decrease of its activity. It has also been ascertained that even more than 1 cubic meter of gas could be conducted per hour over said contact-mass.

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 purifying gases from sulphur by converting the carbonous sulphur-combinations into sulphuretted hydrogen in the presence of hydrogen by means of contact-metals intimately mixed in a finely divided state with inorganic substances which remain solid at the reaction temperature, and absorption of the sulphuretted hydrogen formed, characterised by the feature that such metals as lead and tin or corresponding metal-alloys are used for the contact means which do not otherwise alter the existing gases or gas-mixtures as would be the case if iron, cobalt or nickel were used, the catalytic process being performed at a temperature exceeding that of the melting-point of lead.

2. A process as claimed in Claim 1, characterised by the use of mixtures of several different metals in the contact means

3. A process as claimed in Claim 1, characterised by the use of such inorganic non-fusing substances which have a great surface, for carrying said contact metals.

Dated this 3rd day of June, 1926.

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