

UNITED STATES PATENT OFFICE.

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METHOD OF PRODUCING OXIDES OF NITROGEN.

No Drawing.

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To all whom it may concern:

Be it known that I, HENRIK GUSTAV ALLAN RAMSAY, a subject of the King of Sweden, residing at St. Larsgatan 27, Linköping, in the Kingdom of Sweden, have invented certain new and useful Improvements in Methods of Producing Oxides of Nitrogen, of which the following is a specification.

manner of burning the pulverous substance will probably be to proceed in the same manner as in burning pulverous coal, i. e. by injecting the same into a combustion chamber.

Examples.

1. Pulverous lime nitrogen is injected into a vertical tube heated to 900° C. while air is forced through the tube in opposite direction to the lime nitrogen. Hereby 12 per cent of the nitrogen introduced into the tube were transformed into oxides of nitrogen. The residue contained 40% of the original amount of nitrogen. The air was dried, but this is not necessary.

2. Pulverous lime nitrogen was forced through a tube of the character set forth under 1 which was kept heated at 950° C. The pressure within the tube was reduced to 90 millimeter column of mercury and pure oxygen was forced through the same. An output of 42.5 per cent of the original amount of nitrogen was obtained.

3. This experiment was executed as set forth under 1 with the difference that pure oxygen was used. An output of 7 per cent nitrogen as the oxides of nitrogen was obtained.

The concentration of the oxides of nitrogen was sufficient for technical purposes.

The expression "metallic compounds which contain CN" is used as a generic expression for metallic cyanamides (such as calcium cyanamide CaN.CN) or cyanides (such as calcium-cyanide Ca(CN)_2).

I claim:

1. Method of producing oxides of nitrogen, consisting in burning solid metallic compounds which contain CN in presence of an oxygen containing gas.

2. Method of producing oxides of nitrogen, consisting in burning pulverous metallic cyanamides in the presence of an oxygen containing gas.

3. Method of producing oxides of nitrogen, consisting in burning pulverous lime nitrogen (calcium cyanamide) in the presence of air.

4. Method of producing oxides of nitrogen consisting in burning pulverous lime nitrogen in the presence of air at a pressure lower than that of the atmosphere.

5. Method of producing oxides of nitrogen consisting in mixing pulverous solid

My present invention has for its object a method of producing oxides of nitrogen which is principally characterized by the fact that lime nitrogen (calcium cyanamide) or other metal cyanimides or cyanides are burnt in air, oxygen or ozone, if necessary mixed with other inert gases, such as carbonic acid at ordinary or reduced pressure.

The lime nitrogen or other metal cyanamide or cyanide may be used alone or mixed with one or several substances that are able to facilitate the combustion, due to catalytic or other action, or with solid inert substances adapted to regulate the temperature, such as lime, quartz, ferric oxide or other metal oxides. One may also add to the charge the residue from a foregoing operation. It is suitable but not necessary to inject pulverous lime nitrogen or other starting material into the combustion chamber, air, oxygen or ozone, suitably preheated, being forced through the oxidation chamber in the same direction as or in the opposite direction to the pulverous material.

Although the invention may be carried on at atmospheric pressure, the best results are obtained at a reduced pressure. The temperature may vary within wide limits, but hitherto executed experiments seem to show that good results may be obtained between 600 and 1000° C. and that the best results are obtained at 850-950° C. At temperatures above 1000° C. a destruction of the oxides of nitrogen rapidly occurs wherefore the temperature should not be raised much above said limit.

Since the process is exothermic great quantities of heat are liberated. Therefore, after the process has been started no further heating of the reaction chamber is required. Probably, it will in practice be necessary to cool the reaction apparatus, so that heat from the process may be utilized for other purposes.

In the execution of the process the best

substances which contain CN with inert solid substances adapted to regulate the temperature and burning said mixture in the presence of an oxygen containing gas.

- 5 6. Method as set forth in claim 1, characterized by the fact that the pulverous solid metallic compound which contains CN is mixed with the residue from a foregoing operation before being burnt in the presence
10 of an oxygen containing gas.

7. Method according to claim 1, characterized by the fact that the reaction is executed at temperatures between 600 and 1000° C.

- 15 8. Method according to claim 1, characterized by the fact that the gaseous sub-

stance containing oxygen is dried before being brought into contact with the solid substance to be burnt.

9. Method of producing oxides of nitrogen consisting in burning pulverous solid metallic compounds which contain CN in the presence of an oxygen containing gas mixed with an inert gas. 20

10. Method of producing oxides of nitrogen consisting in burning pulverous lime nitrogen in the presence of an oxygen containing gas mixed with carbonic acid. 25

In testimony whereof I have affixed my signature.

HENRIK GUSTAV ALLAN RAMSAY.