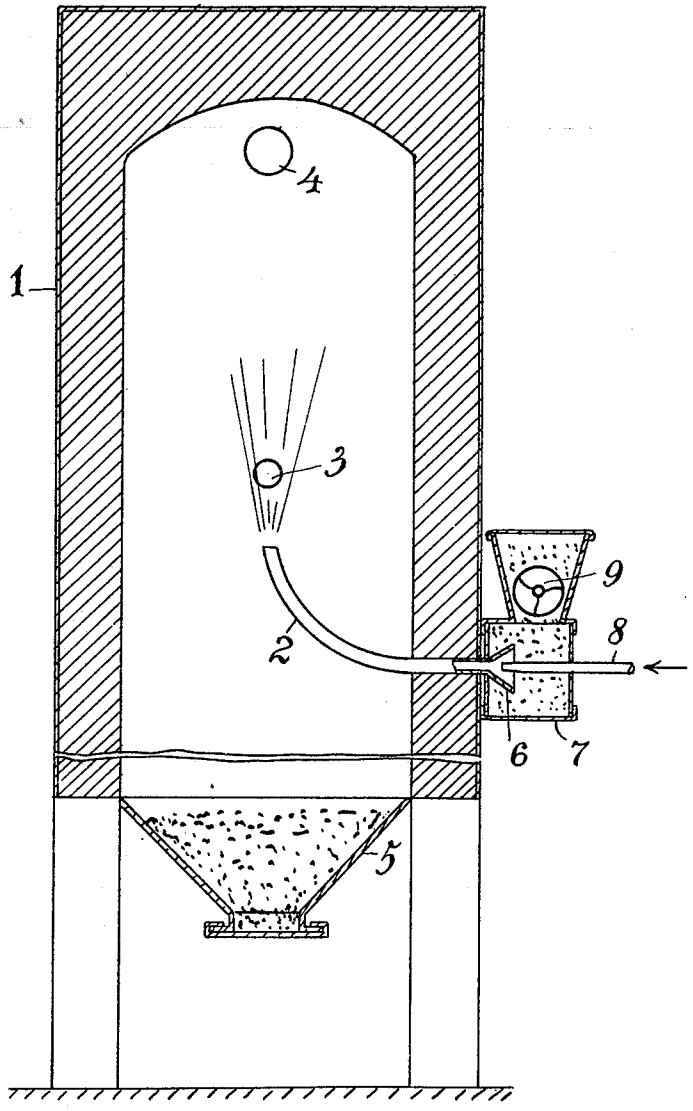
M. SEM.

PROCESS OF PRODUCING NITROGEN COMPOUNDS OF METALS.

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1,256,935. **Patented Feb. 19, 1918.**



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PROCESS OF PRODUCING NITROGEN COMPOUNDS OF METALS.

1,256,935. Specification of Letters Patent. Patented Feb. 19, 1918.

Application filed November 21, 1916. Serial No. 132,597.

To all whom it may concern:

Be it known that I, MATHIAS SEM, a subject of the King of Norway, residing at Christiania, Norway, have invented certain new and useful Improvements in the Processes of Producing Nitrogen Compounds of Metals; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the manufacture of nitrogen compounds by the action of gaseous nitrogen upon carbids and has for its object a continuous process of producing such compounds by producing a suspension or cloud of pulverulent carbid in a current of gaseous nitrogen.

The various known processes of continuously producing cyanamids in electrical furnaces have met with many difficulties mainly on account of the specific consistency of the material during the reaction which involves that the material burns on to the walls or other parts of the furnace and makes it difficult to convey the material through the furnace. To avoid these difficulties it has been proposed by Tofani (German Patent No. 246077) to produce a shower of carbid dust in a towershaped furnace and to cause the nitrogen gas to ascend through this shower in counter current to the carbid dust. By means of producing variations in the velocity of the gas current he intends to control the time of descent of the powder through the furnace.

It is not possible however in this manner to bring about a complete nitrification of the carbid during the short time which it takes the carbid to descend. For this purpose the distribution of the powder in the gas is much too uneven and not sufficiently fine.

The present invention has for its object a process of continuously producing cyanamid and other nitrogen compounds, in which the said difficulties are avoided by causing the nitrification to take place under conditions where the exothermic character of the process could be utilized partly to maintain the necessary temperature in the furnace and partly to bring about a very rapid nitrification.

The process being exothermic and thus taking place under evolution of heat it may be compared with combustion processes. Under certain conditions a combustion process may evolve a very high temperature and then frequently displays a flame, that is a confined zone is produced within which the temperature is higher than in the rear as well as in the front strata. This zone secures an even supply of combustible and oxygen, an automatic maintenance of the combustion and a most complete combustion.

In a nitrification process it is also possible to provide conditions allowing of producing such a zone, a sort of "reaction flame" whereby the continuity and completion is secured. In contradiction to ordinary combustion the nitrification is a process in which a large reduction of volume takes place, the nitrogen being absorbed by the carbid. When carbid in the form most suitable for obtaining a powerful reaction—viz. the atomized state or in the form of a dust—is brought together with nitrogen and this mixture is blown in the form of a cloud of dust into a chamber, in which an initiation of the nitrification process is brought about either on account of the temperature in the chamber or by ignition by means of an electric arc or the like, a "reaction flame" will be produced, which could be maintained by itself. The evolution of heat by the nitrification process is certainly not so high as in an ordinary combustion process, but as the gas is absorbed in the solid substance by the reaction, the evolution of heat will be distributed over a so much smaller volume, and to an increasing extent in accordance with the proceeding of the nitrification process that at a certain distance from the point where the mixture of carbid dust and gas enters the furnace chamber there will be formed and automatically maintained a zone representing the maximum temperature of the furnace. This zone will have a higher temperature than that which is necessary to initiate

the nitrification and it is only necessary to provide certain controlling arrangements in order to prevent the radiation of heat to the brick-work or to the front strata in the furnace from becoming greater than the evolved heat (whereby the "flame" would be extinguished.) From practical reasons one will however make such arrangements for instance by providing an electric arc which could be easily ignited or which could be maintained constantly burning that an extinction of the flame is prevented.

According to the present invention the nitrification is effected in the manner that carbid in the form of dust is blown into a furnace chamber together with the nitrogen or part of the nitrogen, which is to be combined with the carbid. The nitrogen as well as the carbid should be preheated for instance to about 700–800° C. and before the process is started the brickwork of the furnace should preferably be brought up to the same temperature as that which by experience has been found to be most suitable for the process. This may for instance be effected by means of one or more electric furnaces. By means of altering the quantity of carbid dust supplied, the degree of preheating and the quantity of nitrogen introduced into the furnace it is in one's power to regulate the temperature of the furnace as desired. As mentioned the nitrogen gas may be wholly or only partly introduced into the furnace together with the carbid (for instance through an atomizer nozzle.) That portion of the nitrogen which may as an alternative be introduced separately may however be introduced with a so much higher temperature, that losses of heat by radiation, etc., is compensated for. Highly heated nitrogen gas may also be used to start the working of the furnace and the ignition of the same (in case of the reaction flame being extinguished).

The preheating of the nitrogen gas may be effected by means of an arrangement of channels or gas passages in the parts of the furnace where a reduction of the furnace temperature is desirable.

The process may be carried out in a shaft furnace of suitable shape and dimensions so that the products which are in the form of dust are allowed to fall freely through the various zones of the furnace.

An apparatus, which may be employed for carrying the process into effect is diagrammatically illustrated in the accompanying drawing which shows a vertical sectional view of the apparatus.

In the drawing 1 designates the shaft of the furnace, 2 a pipe for the supply of carbid and nitrogen, 3 electrodes, 4 a gas outlet, and 5 the funnel-shaped bottom of the furnace. 6 and 8 designates an injector device, and 7 a chamber into which carbid is introduced by means of a feeding device 9.

By carrying the nitrification into effect the carbid dust may be supplied with the usual additional substances (such as CaF_2 etc.). This is however not necessary.

I claim:

1. The process of producing nitrogen compounds of metals comprising the step of introducing a carbid in the form of dust together with nitrogen into a reaction chamber, and heating the reaction components so introduced to the reaction temperature by means of the heat evolved by the reaction between carbid and nitrogen previously introduced.

2. The process of producing nitrogen compounds of metals comprising the step of introducing a carbid in the form of dust together with nitrogen into a reaction chamber, and heating the reaction components so introduced to the reaction temperature by means of the heat evolved by the reaction between carbid and nitrogen previously introduced a reaction zone being hereby produced which effects the ignition of further quantities of reaction components introduced.

3. The process of producing nitrogen compounds comprising the step of atomizing carbid by means of nitrogen gas, blowing the atomized carbid into a reaction compartment by means of gaseous nitrogen, the said nitrogen and carbid being blown into the said reaction chamber in a reaction zone in which a sufficiently high temperature is maintained by the reaction between carbid and nitrogen.

4. The process of producing nitrogen compounds comprising the step of blowing carbid together with heated nitrogen gas into a reaction zone in which a high temperature is maintained by means of the heat evolved by the reaction between carbid and nitrogen.

5. The process of producing nitrogen compounds of metals comprising the step of introducing a carbid in the form of dust together with nitrogen into a reaction chamber, and heating the reaction components so introduced to the reaction temperature by means of the heat evolved by the reaction between carbid and nitrogen previously introduced, the ignition of the reaction components being effected by means of a source of heat provided for this purpose.

6. The process of producing nitrogen compounds of metals comprising the step of introducing a carbid in the form of dust together with nitrogen into a reaction chamber, and heating the reaction components so introduced to the reaction temperature by

means of the heat evolved by the reaction between carbid and nitrogen previously introduced the ignition of the reaction components being effected by means of a source of heat provided for this purpose, the said source of heat comprising an electric arc arranged within the reaction compartment.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

MATHIAS SEM.

Witnesses:
C. NORMAN,
C. F. HANSEN.