

UNITED STATES PATENT OFFICE.

OTTO DIEFFENBACH AND WILHELM MOLDENHAUER, OF DARMSTADT, GERMANY.

PROCESS OF PRODUCING NITRIC OXIDS AND NITRIC ACID. *from 7/10/11*

No. 914,813.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, OTTO DIEFFENBACH, doctor of philosophy, professor at the Technical High School at Darmstadt, and
5 WILHELM MOLDENHAUER, doctor of philosophy, lecturer at the Technical High School at Darmstadt, both subjects of the German Emperor, and residents of Darmstadt, in the Grand Duchy of Hesse, Germany, (the
10 post-office address of OTTO DIEFFENBACH is Ohlystrasse No. 71, that of WILHELM MOLDENHAUER Lucasweg No. 19,) have invented a new and useful Improvement in the Process of Producing Nitric Oxids and
15 Nitric Acid, of which the following is a specification.

It is well known that ammonia can be transformed into nitric oxid at high temperatures with the use of oxygen or air and
20 by the aid of suitable catalysts, and it is clear that this process should conceivably possess great commercial possibilities.

Since now hydrocyanic acid has recently been prepared synthetically in a simple and
25 cheap manner, the important question arises whether it can be further transformed into oxynitrogen compounds.

During the combustion of hydrocyanic acid in air, there is formed besides carbon
30 monoxid and water-vapor, only free nitrogen and no nitric oxid, since the temperature at which this combustion takes place lies above the decomposition temperature of the latter compound. When hydrocyanic acid
35 is burned or exploded with oxygen it is true that traces of nitric oxid can be detected (cf. Bertelmann's "The Technology of the Cyanogen Compounds" 1906, page 14), but this nitric oxid cannot have originated from
40 the combustion-process, since the temperature of combustion lies in this case still higher than in the case when air is used, so that a direct transformation of the nitrogen of the hydrocyanic acid into nitric oxid is
45 clearly impossible under these conditions. On the contrary, the formation of the latter can be explained only on the supposition that the temperature of explosion is so high that a partial combination with oxygen of
50 the free nitrogen initially formed, to form nitric oxid takes place, that is to say, the formation of nitric oxid is in this case a secondary reaction which is preceded by the formation of free nitrogen, and for whose
55 production very high temperatures are

requisite. The quantity of nitric oxid formed in this manner is, however, so small as to be of no practical value. The ordinary combustion of hydrocyanic acid cannot therefore be applied to the object in view. 60
Nevertheless this object may be attained by conducting combustion in the presence of suitable catalysts, particularly platinum, palladium, iridium, manganese dioxid and the like. In the presence of these catalysts 65
the combustion may be caused to take place at a very much lower temperature than it does in their absence, and a very perfect transformation of the hydrocyanic acid into nitric oxid is obtainable if the temperature 70
is between the limits of 300° C. and 600° C. It is true that the possibility of transforming cyanogen into carbon monoxid and nitric oxid by passing it in admixture with oxygen over heated platinum wire, was al- 75
ready known, but it was not possible to foretell the behavior of hydrocyanic acid from the consideration of that of cyanogen, for apart from the very different behavior 80
in every other respect of these two substances, the considerably higher combustion temperature of hydrocyanic acid rendered it very probable that in the present case, also, as in the case of the direct combustion with air, nitrogen would be set free in its 85
elementary state.

Now what we claim and desire to secure by Letters Patent is the following:

1. A process for the transformation of hydrocyanic acid into oxynitrogen com- 90
pounds, which consists in passing over suitable catalysts a mixture of hydrocyanic acid and a gas containing oxygen at a temperature from 300° to about 600° C. substantially as described. 95

2. A process for the transformation of hydrocyanic acid into oxynitrogen compounds, which consists in passing over suitable catalysts a mixture of hydrocyanic acid and air at a temperature from 300° to 600° 100
C. substantially as described.

3. A process for the transformation of hydrocyanic acid into oxynitrogen compounds, which consists in passing over a catalytic agent composed of platinum a mixture of hydrocyanic acid and a gas contain- 105
ing oxygen at a temperature from 300° to about 600° C. substantially as set forth.

4. A process for the transformation of hydrocyanic acid into oxynitrogen com- 110

pounds, which consists in passing over a catalytic agent composed of platinum a mixture of hydrocyanic acid and air at a temperature of from 300° to about 600°, substantially as set forth.

5 In testimony, that we claim the foregoing as our invention, we have signed our names

in presence of two witnesses, this second day of April 1908.

OTTO DIEFFENBACH.

WILHELM MOLDENHAUER.

Witnesses:

KARL WEBER,

FRIEDRICH DARMSTÄDTER.