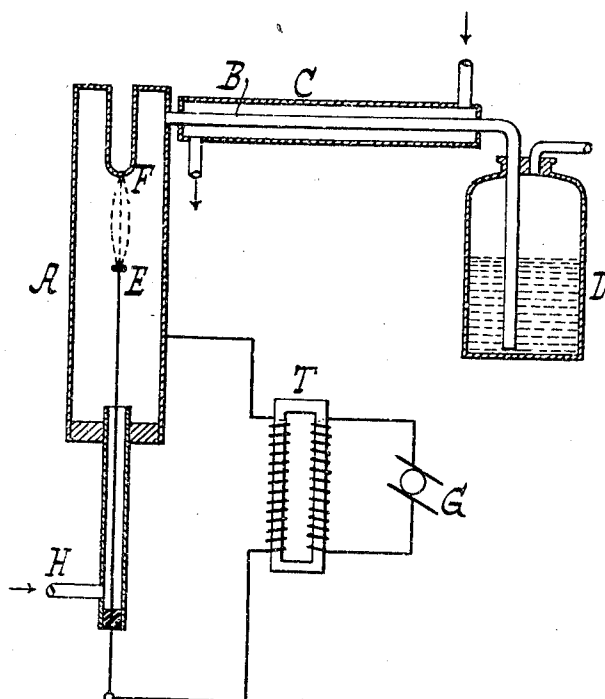


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O. SCHÖNHERR & W. GAUS.
PROCESS OF MAKING NITRITES.

APPLICATION FILED OCT. 16, 1906.



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PROCESS OF MAKING NITRITES.

No. 871,640.

Specification of Letters Patent.

Patented Nov. 19, 1907.

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To all whom it may concern:

Be it known that we, OTTO SCHÖNHERR and WILHELM GAUS, doctors of philosophy and chemists, subjects, respectively, of the King of Saxony and the King of Prussia, residing at Ludwigshafen-on-the-Rhine, Germany, have invented new and useful Improvements in the Process of Making Nitrites, of which the following is a specification.

It is well known that if nitric oxide (NO) be mixed with an excess of oxygen at ordinary temperature it becomes, after a time, completely oxidized to nitrogen tetroxide (N_2O_4 or NO_2). Berthelot (see *Bulletin de la Société Chimique de Paris* XXI, 1874, page 100) stated that this oxidation takes place in two phases, the first phase (represented by the formula $4NO + O_2 = 2N_2O_3$ and resulting in the production of nitrogen trioxide) taking place very rapidly, whereas the second phase (resulting in the oxidation of nitrogen trioxide to nitrogen tetroxide according to the formula $2N_2O_3 + O_2 = 2N_2O_4$) proceeds comparatively slowly.

Raschig has recently studied the quantitative course of this reaction (see *Zeitschrift für angewandte Chemie*, 1905, page 1281) and has come to the conclusion that it should be possible to produce nitrites quantitatively from the nitric oxide which is produced by causing electric discharges to take place in atmospheric air, if the apparatus be so constructed that, within about one second after the nitric oxide be formed, the nitrogen trioxide, produced by its oxidation, be absorbed by the absorbing medium. Such a construction of apparatus is, of course, extremely difficult to carry out, especially on a practical scale for commercial production.

We have now discovered that in order to produce nitrites it is by no means necessary to absorb the nitric oxide so immediately after its formation, but that pure nitrites can be obtained if the nitrous gases arising from nitric oxide, which consist, according to Raschig, of N_2O_3 , or according to other authors, of a mixture of NO and NO_2 , be maintained sufficiently hot until they are treated with the absorbing medium. Accordingly, when producing nitrites from gases containing nitrogen trioxide, or nitric oxide and oxygen, or a mixture of nitrogen trioxide and nitric oxide and oxygen, the said gases are,

according to our invention, until they are treated with the absorbing medium, maintained at a temperature at which no further oxidation, or practically no further oxidation, of the nitrogen trioxide takes place. A temperature of about three hundred (300) degrees centigrade is an advantageous temperature for this purpose.

For absorption purposes, when proceeding according to this invention, the hydroxides of the alkalies and of the alkaline earths, and also the alkali carbonates, are particularly suitable, but the invention is not limited to the use of such absorbents. When the hot gases are passed into solutions of such compounds, however, a considerable quantity of steam is evolved and, in consequence, the gases become diluted. As the absorption takes place much more slowly when the gases are diluted, it is preferred to use, for absorbing purposes, a solution which gives rise to as little steam as possible. Hence the solution should be kept cold and have the lowest practicable vapor tension, for instance solutions which already contain considerable quantities of nitrite can be used.

Our invention is particularly suitable for application to the gases which are produced by causing electric discharges to take place in the air, but it is applicable to any gases which contain nitrogen trioxide, or nitric oxide and oxygen, or a mixture of these, or which, upon treatment with air give rise to nitrogen trioxide and nitrogen tetroxide.

Since the date of this invention the controversy as to whether nitrogen trioxide exists in the gaseous condition has been revived. On the one hand it is pointed out that the gas having the composition represented by the formula N_2O_3 does not obey Avogadro's law, if that be its composition. On the other hand, it is universally admitted that this gas or mixture behaves towards alkaline absorbents as if it were the individual N_2O_3 . The foregoing specification is written taking the view that the said gas is nitrogen trioxide and not a mixture, but the process described and claimed remains the same, whatever may be ultimately decided to be the chemical nature of the gases dealt with.

The drawing accompanying this specification will help to illustrate the nature of our invention and a mode of carrying the same

into practical effect, but we do not limit our invention to the method and apparatus shown in the said drawing which represents a vertical section through the apparatus.

5 An electrical current from the generator G after having been transformed in the transformer T is used to produce a discharge between the insulated electrode E and the electrode F which preferably forms part of
10 the conducting vessel A in which the two electrodes are situated and within which the discharge takes place. At the same time air is passed through the vessel A entering through the aperture H and the hot mixture
15 of unaltered air and nitrous gases passes from the vessel A through the pipe B into the absorber D. The pipe B is jacketed with another pipe C after the manner of a Liebig condenser and a current of hot fluid is passed
20 between the two pipes B and C in order to prevent the gases passing through B from losing too much heat before they enter the absorbing medium in D. The fluid which is
25 passed through C depends on the temperature required and may consist of heated air, or of a vapor of a liquid which boils at the desired temperature, for instance alpha-naph-

thylamin which boils at three hundred degrees centigrade (300° C) can be used if this temperature be desired.

What we claim is:

1. The process of producing nitrites which consists in treating gases containing nitrogen trioxid with a hereinbefore defined absorbing medium and in maintaining the
35 gases, until they are treated with the absorbing medium at a temperature at which practically no oxidation of the nitrogen trioxid takes place.

2. The process of producing nitrites which
40 consists in treating gases containing nitrogen trioxid with caustic soda solution and in maintaining the gases until they are treated with the caustic soda solution at a temperature at which practically no oxidation of the
45 nitrogen trioxid takes place.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

OTTO SCHÖNHERR.
WILHELM GAUS.

Witnesses:

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