Patent nr. 20407

Announcement by Patent Commission
Method for production of nitrous gasses from mixtures of nitrogen and oxygen by means of the electrical arc.

Badische Anilin- & Soda-Fabrik aus Ludwigshafen, Germany.
Representative: Engineer Alfred J. .Bryn, Kristiania.)
Patent in Norway from 22nd July 1908.

The invention describes a method for production of nitrous gasses from a mixture of nitrogen and oxygen, preferably air by means of the electrical arc comprising treating the gas mixture low pressure in a space with a shape in which the arc is completely or nearly filling, while the arc by natural heat loss or by special cooling methods is imposing a sufficient cooling.

Hereby enhances the concentration of nitrogen oxide in the treated gasses.

In one example easy to achieve a concentration of 9.5-10% nitrogen oxide when applying air, and 13.5-14% nitrogen oxide in a mixture of equal fractions of oxygen and nitrogen.

In literature there are descriptions of tests performed with the purpose of producing nitrous gasses, by applying high voltage discharges to mixtures of nitrogen and oxygen at pressures from the atmosphere; specifically has Rayleigh Journ. Chem. Soc. 1897 bd. 71 s. 181 tested both higher and lower pressures.

At an halt atmosphere pressure did he find poorer results, compared to the normal pressure of one atmosphere; he is however indicating that the results should be interpreted to an overall independence of the pressure.

This result is in reality inasmuch correct, as lowering the pressure alone is not enough to get results that significantly differ from what is found at normal pressure.

The present method is different from older methods by, the driving method in the older proposals aimed at achieving as high temperature as possible, and subsequently at the extreme temperature quenching the formed products.; by the presented method is on the contrary the the arc kept relatively cold, and the path of the arc is prevented from acquiring any extreme temperature.

The lower pressure is also functioning in the same direction as the path of the arc is expanding and reaching the walls in the space, where the heat transfer takes place, while the discharge at normal pressure is contracted to a narrow canal, where the temperature can reach extraordinary levels. In this way it is possible to establish electrical flames, which is not, or just to an unnoticeable degree, showing show the well-known brown zone, where it is assumed that the decomposition of the nitrogen oxides take place.

The walls of the tube etc. which is coming in contact with the discharge, must naturally be kept so cold that the current is transferred to them, where else a disturbance of the arc-discharge easily can occur. Even if the wall consists of a material that is a complete isolator at ambient temperature, it may acquire conductor's properties when heated to high temperature by the arc. When the natural heat conduction is insufficient, other special means of cooling may be applied (to remedy).

The advantageous approach is establish an arc between metal- or electrolytic- electrodes and leave it burn in a long cylindrical container which walls are cooled externally if necessary.

In order to establish the discharge when the distance between the electrodes are large, it is possible to significantly lower the pressure in the apparatus.

When the arc is established, can the pressure be allowed to increase.

If the electrodes are not cooled - which under certain circumstances may be advantageous – they will start to glow and thereby ease the transfer of current significantly.

In this way it is possible to establish an arc column, which for the eye looks stationary and if the tube diameter and air pressure is properly selected, will fill the tube completely of nearly completely.

Electrolytic electrodes is in general advantageous vs metal electrodes, in that they are less prone to release dust (release metal dust).

The nitrogen-oxygen mixtures are led through the room filled or almost filled with the arc column, in such a way that the pressure is kept significantly below one atmosphere.

The before mentioned percent levels are achieved without the sudden cooling, taking place when the gasses are removed from the reaction room, as for instance by suction through a metal cooler. They (the before mentioned percent levels) were as such achieved, when the arc was left burning in a water cooled quartz tube and the air respectively nitrogen oxygen mixture entered in and out of the arc at a speed as low as 0,2 meter per second, while the pressure was 90 mm mercury.

In order to prevent that the nitrogen oxide shall decompose through contact with the glowing electrodes, it is possible to arrange gas entry and exit in order not to disturb the gas layer around the electrodes is not replaced.

It is advantageous to select the currents density in order for the current strength per cross section of the tube diameter becomes as large as possible.

The limits where in the pressure can be varied, is difficult to define accurately. To go below 80 mm Hg pressure is in any case no advantage. With respect to higher pressures, the consideration is, at higher pressure the higher the decomposition rate of the nitrogen oxide will be.

Tests performed at 200 mmHg pressure, however showed that the upper pressure limit, before falling down at the normal low concentrations, was still not reached.

CLAIM:

Method for production of nitrous gasses from mixtures of nitrogen and oxygen, preferable air, by means of the electric arc operating at lowered pressure characterized by, exposing the gas mixture to a sufficiently low pressure and in a space of a such a shape in which the arc will fully or nearly fully fill the space, where in simultaneously the arc, is by natural heat loss or by special cooling means given sufficient cooling.