No. 884,919. PATENTED APR. 14, 1908.

A. GRAU & F. RUSS.

PROCESS FOR MAKING NITROGEN OXIDS FROM AIR.

APPLICATION FILED OCT. 8, 1907.

Fig. 1.

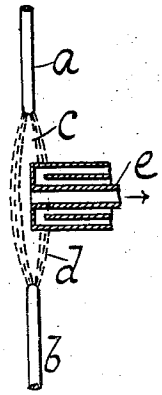


Fig. 2.

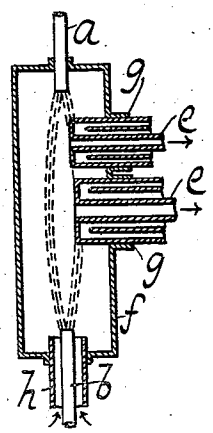


Fig. 3.

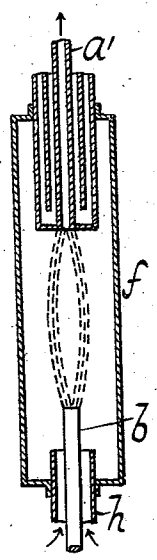
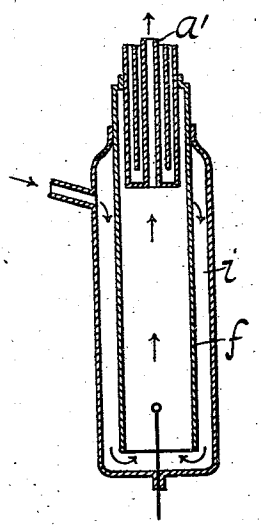


Fig. 4.



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PROCESS FOR MAKING NITROGEN OXIDS FROM AIR.

No. 884,919. Specification of Letters Patent. Patented April 14, 1908.

Application filed October 8, 1907. Serial No. 396,436.

To all whom it may concern:

Be it known that we, AUGUST GRAU, professor of electrical arts, and FRANZ RUSS, doctor of technical sciences, subjects of the Emperor of Austria-Hungary, residing at Vienna, Austria-Hungary, have invented certain new and useful Improvements in Processes for Making Nitrogen Oxids from Air, of which the following is a specification.

Our invention relates to the production of oxids of nitrogen by exposing a mixture of nitrogen and oxygen to the action of an electric arc.

It is well known that the higher the temperature to which the mixture of nitrogen and oxygen, hereinafter referred to as air, is exposed the greater is the percentage of oxids of nitrogen obtained, and also that the reaction at the very high temperatures of the electric arc is practically instantaneous. When the gases, however, are cooled down slowly from the highest temperature, dissociation of the oxids of nitrogen back again into oxygen and nitrogen takes place and many methods have been suggested for cooling down the hot reaction gases as rapidly as possible in order to prevent such dissociation from taking place to any great extent. Now since the inner part of an electric arc is hotter than the outer zones, the concentration of the oxids of nitrogen is greater in the inner than in the outer zones.

In carrying out our invention we draw the gases from the center or inner zone of the electric flame to the exclusion or substantially to the exclusion of the outer zone or outside of the flame, and we do not permit the gases to become partially dissociated by passing through the outer zones, and in this way our invention differs from the methods hitherto described. In order to take the gases substantially from the central zone of the flame we use a tube of small diameter projecting into the said inner zone of the flame and withdraw the gases through this tube. We also cool this tube, for instance by means of a water- or air-jacket, on the one hand to prevent the tube from melting and also to rapidly cool the gases being withdrawn down to a temperature under 1500° C. since the dissociation below this temperature is only very small. If desired, two or more such tubes may be introduced into the flame, or one electrode itself may be hollow and act as the tube through which the gases are withdrawn. It is of course preferable that the electric flame should be as steady as possible, otherwise gases other than those from the central zone will be drawn through the tube and for this purpose it is preferred to make use of a perpendicular flame surrounded by a tube. If desired, this surrounding tube can be closed with the exception of inlet and outlet pipes so that other mixtures of nitrogen and oxygen, for instance air, mixed with oxygen, can be treated in the flame.

The drawings accompanying this specification will help to illustrate further the nature of our invention, which, however, is not limited to the use of the apparatus shown therein.

Figures 1, 2, 3, and 4 are all diagrammatic sections of apparatus showing where the flame is formed and how the gases are withdrawn from the central zone.

In Fig. 1 *a*, *b* are electrodes, *c* is the inner zone and *d* are the outer zones of the electric flame and *e* is the narrow tube through which the gases are withdrawn.

In Fig. 2, *a*, *b* are electrodes and the flame is shown surrounded by a tube *f*, the air, or other mixture of oxygen and nitrogen, enters through *h* and the gases are withdrawn through two narrow tubes *e*, *e*, passing through openings *g*, *g*, in the side of the tube *f* and projecting into the central zone of the flame.

Fig. 3 represents an apparatus in which the electrode *a* is hollow and serves as the narrow tube through which the gases are withdrawn from the central zone, *b* is the other electrode, *f* is the tube surrounding the flame, and *h* is the opening through which the air enters the tube *f*.

Fig. 4 represents a modification of the apparatus shown in Fig. 3 in which the tube *f* in which the flame is formed is surrounded by a wider tube *i*. The air to be treated is made to pass between the tubes *i* and *f* and then to enter the tube *f*, thus cooling the tube *f* and at the same time warming the air which is to be treated in the flame. In this case also the gases are drawn from the central zone of the flame through the electrode *a*.

In this application we make no claim to the apparatus described and illustrated herein, since we desire to claim such apparatus in another application of like date with the present application Serial No. 396,437.

What we claim is:

The process of making nitrogen oxids from the air by passing air into an electric arc flame and withdrawing the treated gases directly from the central zone of the electric flame substantially to the exclusion of gases from the outer zones and immediately cooling the said gases substantially as described.

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

AUGUST GRAU.
FRANZ RUSS.

Witnesses:
GUSTAV PHILIPPITSCH,
ROBERT W. HEINGARTNER.