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METHOD OF FIXATION OF ATMOSPHERIC NITROGEN.

APPLICATION FILED OCT. 25, 1917.

1,317,705. Patented Oct. 7, 1919.

Fig. 1.

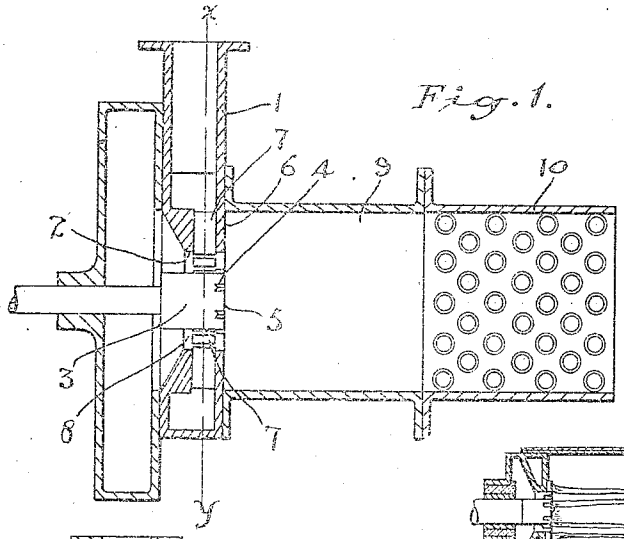


Fig. 5.

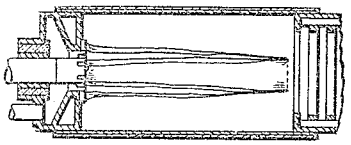
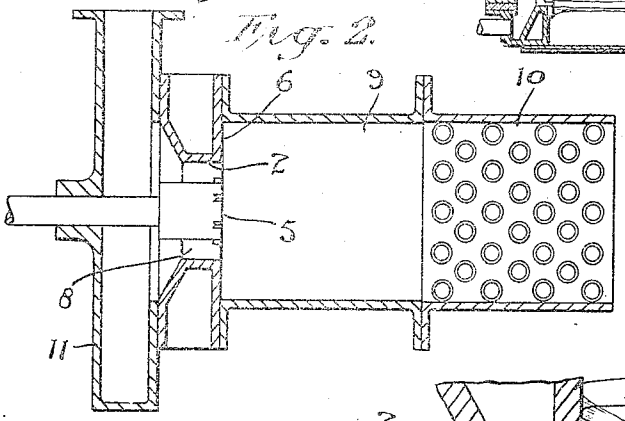


Fig. 2.



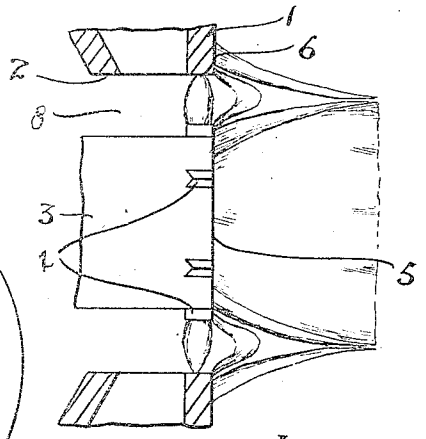


Fig. 3.

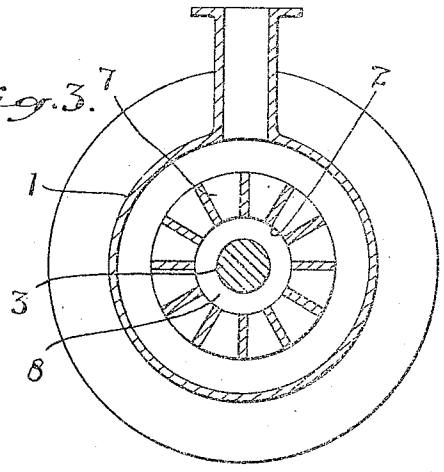


Fig. 4.

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METHOD OF FIXATION OF ATMOSPHERIC NITROGEN.

1,317,705. Specification of Letters Patent. Patented Oct. 7, 1919.

Application filed October 25, 1917. Serial No. 198,330.

To all whom it may concern:

Be it known that I, JAMES SIMPSON ISLAND, a subject of the King of Great Britain, and resident of the city of Hamilton, county of Wentworth, in the Province of Ontario, in the Dominion of Canada, have invented certain new and useful Improvements in Methods of Fixation of Atmospheric Nitrogen, as described in the following specification and illustrated in the accompanying drawings, that form part of the same.

The principal object of this invention is to materially reduce the cost of producing oxids of nitrogen and to effect the maximum fixation and recovering of atmospheric nitrogen at the minimum expenditure of electric energy.

The principal feature of this invention consists in the novel method of bringing air into the influence of an electric flame, whereby the air is brought into active association with the electric flame in such a manner as to be caused to actually penetrate and pass through a zone of electric flame, and whereby the zone of influence of the flame upon the air is extended to the maximum and the extreme intensity of the heat is dissipated.

In the accompanying drawings, Figure 1 is a longitudinal diagrammatic sectional view of a form of furnace for carrying the present process into effect.

Fig. 2 is a longitudinal diagrammatic view showing a modification of the furnace illustrated in Fig. 1.

Fig. 3 is a cross sectional view through the line *x—y* of Fig. 1.

Fig. 4 is an enlarged diagrammatic illustration showing the manner in which the electric flame is distended by the flow of air through the apparatus.

Fig. 5 is a sectional view of a modified form of apparatus shown on a reduced scale.

The problem of the fixation of atmospheric nitrogen has evolved several well known processes in which the fixation has been effected by the use of the electric arc and which have been brought into commercial use to a more or less limited extent.

The actual results achieved in the best known processes have however fallen very far short of production in quantity at low cost and the present process has been devised with the object of obtaining maximum results at minimum cost.

In carrying the present process into effect an annular zone of electric flame is created by the arrangement of an electrode of annular form as illustrated by the electrode 1 in the central opening 2 of which is arranged the companion electrode 3 and the electric flame is caused to form a complete annulus by suitable means. This result can be effected in various ways but is most readily accomplished by rotating one of the electrodes and in the present illustration the central electrode is the rotary member. This arrangement of the electrodes forms an annular space across which an electric flame is induced and through which the air to be treated is directed.

The rotating electrode is preferably cylindrical in form and may be provided as shown with one or more radial projections 4 for effecting the starting of the electric arc. The circular-shaped end 5 of the central electrode 3 is preferably arranged in the plane of the outer face 6 of the electrode 1. The rotation of either of the electrodes causes the electric flame formed between the shortest points to be drawn out and induced to follow around the inner periphery of the outer electrode, thus forming a complete annulus of electric flame.

In the form of the apparatus illustrated in Fig. 1, the outer electrode 1 is hollow and is connected with a suitable fan or other form of air pump through which a supply of air is directed at the desired speed and pressure. The air thus introduced into the hollow electrode flows through the radial opening 7, which may or may not be divided into radial channels and enters the annular space 8 between the electrodes and flows outwardly. The effect produced is to cause the zone of electric flame extending between the electrodes to be extended outwardly into the expansion chamber 9 and the flame is stretched out so that there is actually formed an annular chamber of acute V-shape in cross section between the walls of the electric flame extending from the circular end 5 of the electrode 3 and the outer face 6 of the electrode 1. The passage of air into this zone of electric and thermal influence has the effect of producing the maximum oxidation of the nitrogen contained therein and the pressure of constant flow causes the oxidized gases to eventually penetrate through the drawn out arc and emerge into

the expansion chamber 9 where they immediately expand and are then carried through a suitable cooling chamber which is shown in the drawings as a tubular condenser 10 arranged at the outer end of the expansion chamber.

The manner of introduction of the air to the annular space between the electrodes may be varied, though it is preferred to introduce the same through a hollow electrode because of the cooling influence upon the metal but, as in the form of apparatus illustrated in Fig. 2, the air may be introduced directly into the annular passage between the electrodes or into an annular receptacle 11 communicating with the annular passage 8.

In the diagram shown in Fig. 4 the electric flame is illustrated in various stages of distension and this is intended to show how when the flow of air through the annular space 8 commences the zone of flame which naturally forms in the shortest path in a straight line between the electrodes, is bowed outwardly and flows from the end surfaces of the electrodes and as the pressure is constant the force of the air gradually elongates the flame until it distends to form a long tapering annular zone bounded on each side by the electric flame. The strength of the arc and the flow of air are regulated so that the pressure of the air will not be sufficient to prevent the flow of the current and therefore the arc is not destroyed but is elongated to such an extent as to allow of its penetration at different points around the perimeter of its zone of flame and the products of the electro-thermal influence upon the air pass beyond and into the expansion chamber. This peculiar condition results in a remarkably low temperature of the resultant gases within the expansion and cooling chambers and the ultimate results produced in actual operation of this process insure the production of oxids of nitrogen in great quantities and at a minimum cost.

What I claim as my invention is:—

1. A method of fixation of atmospheric nitrogen consisting in directing a current of air through an annular zone of electric flame to distend the flame into an unrestricted space creating a flame annulus of double walled tubular formation.

2. A method of fixation of atmospheric nitrogen consisting in creating a double walled tubular flame emanating uniformly from a pair of electrodes and maintaining a constant flow of air between the tubular walls and directing the oxidized air into a cooling chamber immediately it passes from the zone of electro-thermal influence.

3. A method of fixation of atmospheric nitrogen consisting in directing a current of air through an annular passage between the electrodes into an unrestricted space in a direction substantially at right angles to the faces of the electrodes and forming a tubular zone of electro-thermal influence.

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