

W. SIEBERT.
 METHOD OF PRODUCING ENDOTHERMIC COMPOUNDS FROM THEIR COMPONENTS.
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1,033,126.

Patented July 23, 1912.

Fig. 1.

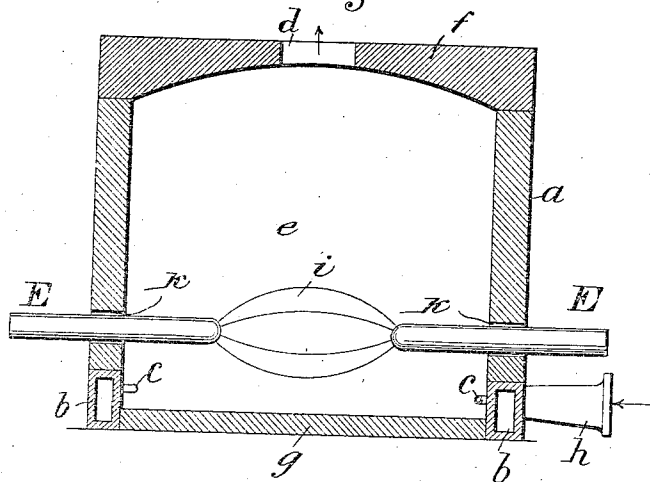
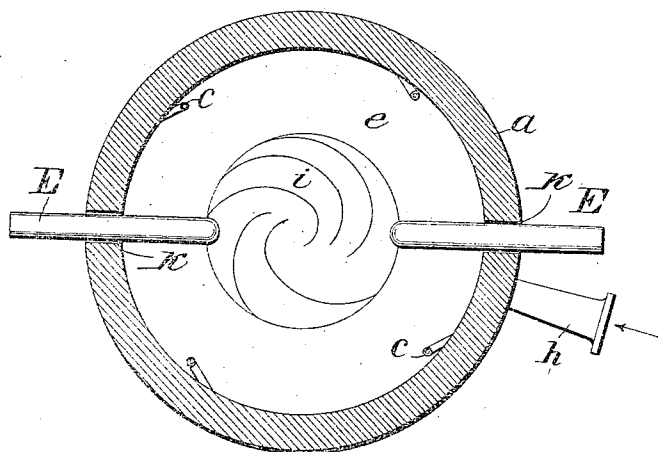


Fig. 2.



Witnesses

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METHOD OF PRODUCING ENDOTHERMIC COMPOUNDS FROM THEIR COMPONENTS.

1,033,126.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WERNER SIEBERT, a subject of the King of Prussia, residing at Rheinfelden, Baden, Germany, have invented a certain new and useful Method of Producing Endothermic Compounds from Their Components, of which the following is a specification.

The invention relates to a method of and apparatus for producing endothermic compounds from their components by means of an electric arc.

Electric furnaces are already known in which there are employed two concentric annular electrodes between which an arc discharge is set up and is then spread out by setting up a rapid rotation of the air within the cylindrical space of the furnace so as to cause the arc discharge between the two electrodes to assume a circular motion.

I have discovered that in the employment of the electric arc for endothermic gas reactions, and more particularly for the production of nitric oxid from the air, the effective output can be materially increased by increasing the rapidity of rotation of the gases since the decomposition of the endothermic compounds, which always tends to occur, can be avoided by a violent motion of the gases so as to cause a rapid mixture of the incoming cold gases with the hot gases within the furnace; and I have furthermore discovered that when such a powerful whirl of gases is employed a suitable arc formation, capable of satisfactorily yielding a good output, may be attained by the simple expedient which consists in striking the arc between two electrode pencils, and utilizing the violent whirl of the gases to spread the arc into a disk shape. It is necessary that the straight line connecting the extremities of the two electrodes shall be at right angles, or substantially so, to the axis of the whirl of gases, so that the arc can be deflected from its normal shortest path, and spread out on both sides, by the violent motion of the gases, to form a compact disk-shaped flame in which the energy supplied is concentrated in the smallest possible space.

I will now proceed to describe my invention with reference to the accompanying drawings, in which:

Figure 1 is a vertical longitudinal section through an electrode furnace embodying my improvements, only so much being shown as is necessary for the understanding of the

invention, and Fig. 2 is a horizontal section through the furnace in the plane of the two electrodes.

Similar letters of reference refer to similar parts in the two views.

The lining of a cylindrical electrode furnace is indicated at *a*, the mantle not being shown, since it forms no part of the invention and may be of any suitable construction. The lining *a* is supported on an annular metallic conduit *b* cast integral with a supply connection *h*, and provided with four nozzles *c* within the flame chamber *e*. The four nozzles *c* may be of any known construction and are placed at an acute angle to the inner periphery of the conduit *b*. I find it satisfactory to use a furnace in which the vertical height or length is approximately equal to the diameter, as indicated in Fig. 1. In the cover *f* of the furnace there is provided a central outlet *d*, which may be connected in any suitable manner to a discharge conduit (not shown). The furnace or lining *a* is provided with two diametrically opposite holes *k k*, in which two electrodes *E* and *E'* are guided. It will be convenient to provide suitable mechanism (not shown) for moving the electrodes *E* and *E'* toward and from one another to establish the circuit and draw the arc.

The gaseous components of the endothermic compound to be produced, and to which heat must be supplied for bringing about the reaction, are supplied to the annular conduit *b* through the supply connection *h* and are caused to pass at a high speed, at least 40 or 50 meters per second, through the nozzles *c* and into the flame chamber *e*, whereby a most violent whirl of the gases is produced within the chamber. The two electrodes *E* and *E'* are first brought into contact with one another for establishing the circuit, and are then separated to draw the arc between them, the energy supplied being properly regulated. The maximum distance of separation will depend upon the size of the furnace, the speed of the gases, etc., but can be easily determined in practice by those skilled in the art. The violent gas whirl will spread the arc, which is normally bent upward, horizontally to both sides, so that it will form a compact disk shaped flame *i*. The heat of this flame is utilized for the combination of the gases to form the endothermic gas compound, which passes upwardly in the direction of the ar-

row through the outlet *d*, and is conducted through the discharge tube to storage vessels or the like, for use or for further treatment, as the case may be.

5 The method and apparatus described, since they permit a great concentration of energy in a very small space, are of great efficiency; and are particularly useful for the production of nitric oxid from air.

10 The current for producing the flame *i* may be direct current or single phase or multi-phase alternating current. In case a multi-phase alternating current is employed, the several electrodes are preferably 15 guided in holes in the bottom *g* of the furnace, and are inclined so that they may be brought together and separated to form the arcs. In all cases it is essential to produce in the chamber *e* so powerful a gas whirl as 20 to deflect the upwardly bent arc or arcs and spread it or them horizontally.

The necessary great velocity of the gases leaving the nozzles *c* may be produced in any known manner. For example the gases 25 may be compressed before their introduction through the connection *h*, so that their pressure will force them through the nozzles at a sufficiently high speed. Or a blower of any known construction may be employed 30 for forcing the gases through the connection *h*, the annular conduit *b* and the nozzles *c* into the flame chamber *e*.

The structural form of the electric furnace may be varied in many respects without departing from the spirit of my invention. 35

I claim:

1. The method of producing endothermic compounds from their components consisting 40 in forming an arc in the center of a cylindrical electric furnace between electrodes, the points of which are in a horizontal plane, forcing the gaseous components through nozzles distributed along the inner periphery 45 of the furnace at so great a speed as to produce within the furnace a violent whirl

of gases capable of horizontally spreading the arc, whereby a disk-shaped flame is formed, the heat of which can combine the gaseous components to form the endo- 50 thermic compound, and in discharging the compound formed from the furnace.

2. The method of producing nitric oxids from the air, consisting in forming an arc in the center of a cylindrical electric furnace 55 between electrodes, the points of which are in a horizontal plane, forcing the air through nozzles distributed along the inner periphery of the furnace at so great a speed as to produce within the furnace a violent 60 whirl of air capable of horizontally spreading the air, whereby a disk-shaped flame is formed, the heat of which can combine the essential components of the air to form nitric oxids, and in discharging the nitric 65 oxids formed from the furnace.

3. In an electric furnace for endothermic operations, the combination with a vertical cylindrical furnace, of electrodes guided in 70 holes of said furnace and adapted to be longitudinally moved, while their points are maintained in the same horizontal plane, so that an arc or arcs can be formed between them, nozzles distributed over the inner periphery of said furnace and placed at an 75 acute angle thereto, means for forcing gaseous components through said nozzles at so great a speed as to produce within said furnace a violent whirl of gases capable of horizontally spreading the arc or arcs, whereby 80 a disk-shaped flame is formed, the heat of which can combine the gaseous components to form the endothermic compound, and means for discharging the compound formed 85 from said furnace.

In witness whereof, I have hereunto set my hand this 16 day of February 1911.

WERNER SIEBERT.

Witnesses:

MAX HAMBURGER,
FRITZ GÖTHE.