F. H. A. WIELGOLASKI & O. SCHÖNHERR.

PRODUCTION OF CONTINUOUS ELECTRIC ARCS AND APPARATUS THEREFOR.

APPLICATION FILED MAR. 12, 1910.

1,028,516.

Patented June 4, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

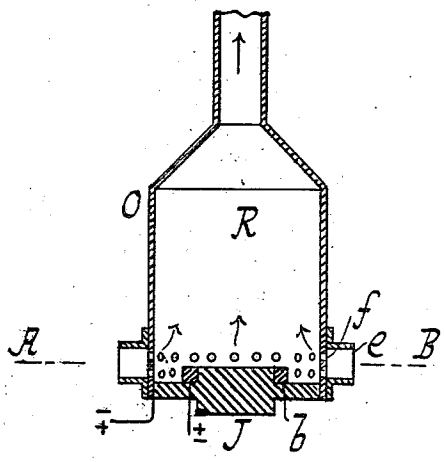

Fig. 3.

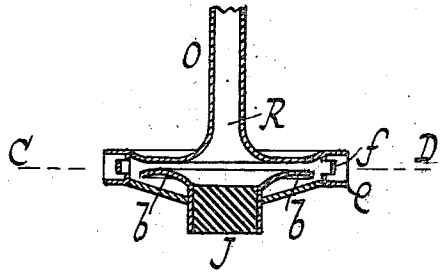

Fig. 2.

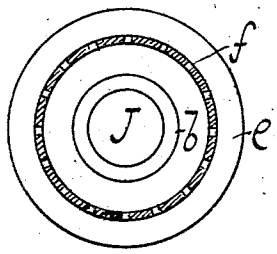

Fig. 4.

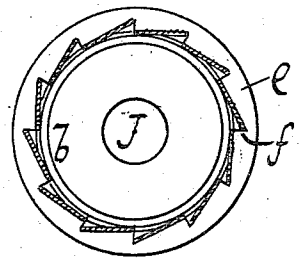

Fig. 5.

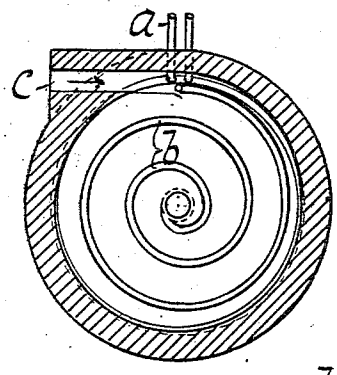

Fig. 6.

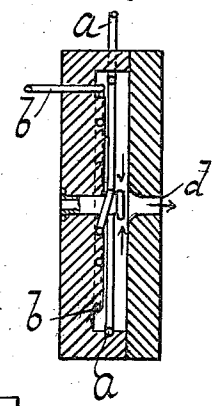

Fig. 7.

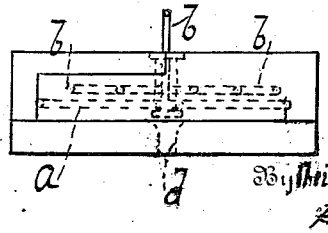

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Fig. 8.

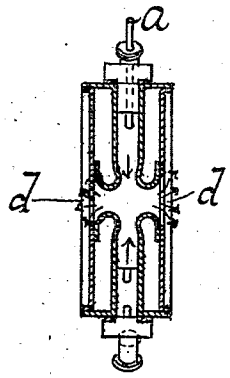


Fig. 9.

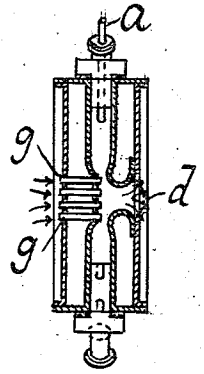


Fig. 10.

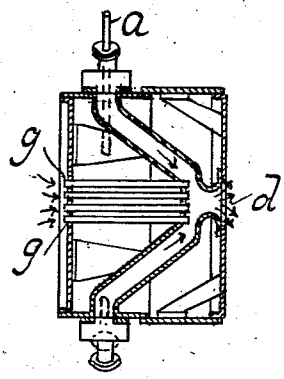
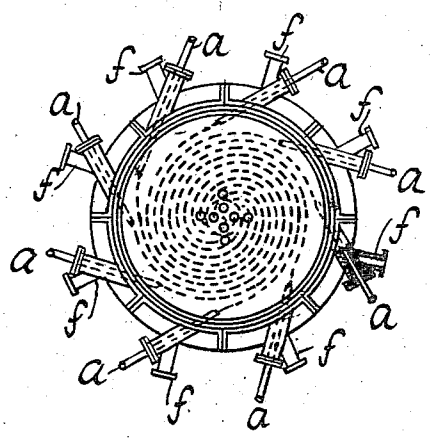


Fig. 11.



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UNITED STATES PATENT OFFICE.

FRANZ H. A. WIELGOLASKI AND OTTO SCHÖNHERR, OF CHRISTIANIA, NORWAY, ASSIGNORS TO BADISCHE ANILIN & SODA FABRIK, OF LUDWIGSHAFEN-ON-THE-RHINE, GERMANY, A CORPORATION.

PRODUCTION OF CONTINUOUS ELECTRIC ARCS AND APPARATUS THEREFOR.

1,028,516. Specification of Letters Patent. Patented June 4, 1912.

Application filed March 12, 1910. Serial No. 548,957.

To all whom it may concern:

Be it known that we, FRANZ HENRIK AUBERT WIELGOLASKI, engineer, and OTTO SCHÖNHERR, chemist, subjects, respectively, of the King of Norway and the King of Saxony, residing at Christiania, Norway, have invented new and useful Improvements in the Production of Continuous Electric Arcs and Apparatus Therefor, of which the following is a specification.

In the specification of Letters Patent No. 930,238 is described the production of long stable electric arcs by enveloping the arc in a current of fluid, and in particular in the said patent is described the production of a long electric arc inside a tube fitted with an electrode by passing a current of air or other gas along the tube. We have now discovered a process and apparatus therefor for producing continuous electric arcs in which the arc is not situated or not entirely situated along the central axis of the tube, but from the periphery of the furnace toward the center thereof.

We carry out our invention by providing the furnace with one or more peripheral electrodes and by blowing a suitable fluid, which we shall hereinafter refer to for the sake of convenience as air, from openings at or near the periphery of the furnace and by preferably withdrawing the air which has been treated in the arc at a point situated in proximity to, that is to say, at or near the center of the furnace, either in the same plane as the peripheral electrodes or else situated more or less outside this plane. The air may be withdrawn from the furnace either through one hole or through several holes, and these two methods are equivalent, since the nature of the invention is not changed thereby. The furnace may also be provided with an electrode situated at or toward the center thereof, or if such central electrode is not present one of the other peripheral electrodes or the wall of the furnace may act in its stead forming that part on which the electrode ends. For instance the wall at this point may be drawn out into the form of a tube into which the end of the arc enters. In the above cases the peripheral electrode and the wall of the furnace respectively are equivalent to the central electrode. We are now able to produce one or more arcs in one furnace in such a manner that the gases as they near the center of the furnace are brought into intimate contact with the arcs immediately before they are removed from the furnace. This is of great advantage for carrying out exothermic reactions in gases, such for instance as the production of oxids of nitrogen from the air. It is also further an advantage that the gases possess the greatest velocity at the point where the electric arc requires the greatest power to divert its course. The furnace itself may be disk-shaped, or it may possess the shape of a cone, or it may be spherical, or of any other suitable shape which allows an electric arc to be produced with the aid of peripheral electrodes. For instance the furnace can be so arranged that the electric arcs are situated radially from the periphery to the center thereof. This is generally the case when the currents of air supplied to the furnace are directed radially. If, however, the air is directed at an angle to the radius, the electric arcs tend to assume the form of a spiral. In the case in which the furnace is provided with one or more insulated peripheral electrodes and air is blown tangentially into the furnace, the electric arc springing from each insulated electrode tends to assume a stationary spiral form. If on the other hand the furnace contain only one circular peripheral electrode extending all around the furnace, the arcs which spring between this electrode and the electrode or part of the furnace which acts as the electrode situated at or toward the center of the furnace assume a spiral form and at the same time continually rotate around the furnace, the velocity depending to a certain extent upon the angle and speed at which the air is supplied to the furnace.

The shape and dimensions of the furnace can be varied in any suitable manner, and can be adapted to the conditions under which the process is being carried out, for instance it can depend upon the tension and strength of the current, and upon the quality of air being supplied. The cross-section of the furnace can be either circular or oval or angular, and its height can be diminished so that the diameter is considerably greater than the height. The electric arc or arcs can be started in any suitable manner, for instance according to the methods described

in the aforesaid Letters Patent No. 930238. If desired, the wall of the furnace itself may be made to act as the circular peripheral electrode.

A modification consists in providing the furnace with one or more insulated electrodes more or less spirally shaped and extending from the center toward the periphery of the furnace. The electrode, or each of the electrodes, can be connected to a pole of a source of electricity, the other pole being connected with one or more electrodes situated at the periphery of the furnace. The spirally formed electrode, or electrodes, should preferably possess such a form that the current of air blown into the furnace with a tangential motion flows practically parallel to the said electrode or electrodes.

In the case in which the furnace is provided with one circular electrode, the arc, or arcs is, or are, carried around by the current of air, and the appearance to the eye is that of a disk of flame filling the whole furnace. During the process fresh air is continually supplied from the periphery and the gases produced are continually removed from the center of the furnace where the inner ends of the electric arcs are situated. The manner in which the air can be removed from the center of the furnace can also be varied, for instance it can be removed through one or more openings either side by side or opposed to one another, say, one at the center of each of the disk-shaped sides of the furnace. These openings can be provided with cooling arrangements so that the gases being removed from the furnace are cooled down. One method consists for instance in passing the gases immediately through the flues of a boiler; in this way steam can be generated which can be used for various purposes, for instance for evaporating solutions of nitrites and nitrates which can be prepared from the gases leaving the furnace. Another method of reducing the temperature of the gases which leave the furnace consists in blowing in cold air immediately after the hot gases have left the furnace.

When carrying out the process of this invention the electrodes can be situated in the openings through which the gas is introduced into the furnace, and they can be so formed that at one point they approach so near to the center electrode that should the arc be extinguished for any reason it can be formed again of its own accord; or the electrodes can be connected with a solenoid coil and a spring in such a manner that should the arc be extinguished and consequently the electric current ceases, the electrodes are caused to approach the central electrode and then as soon as the arc has been formed the solenoid coil draws them back again to their right position.

Referring to the drawings which accompany this specification, Figures 1 and 3 represent vertical sections of furnaces suitable for carrying out the process of our invention, while Figs. 2 and 4 represent cross-sections of Figs. 1 and 3 taken along the line A B and C D respectively. Figs. 5, 6 and 7 represent cross-sections of another form of furnace, Fig. 5 being a horizontal cross-section while Figs. 6 and 7 are vertical sections taken at right angles to one another. Figs. 8, 9 and 10 are cross-sections of three further forms of furnace, and Fig. 11 is a vertical section of Fig. 10 taken through the electrode *a*.

In Figs. 1 and 2, R represents the furnace, the wall O of which is connected to one pole of a source of electricity and is provided with holes *f*, preferably cut tangentially, through which the air passes from the outer chamber *e* into the interior of the furnace R. *b* represents a ring-shaped electrode situated toward the center of the furnace and connected with the other pole of the source of electricity. It is filled and supported by insulating material J.

Figs. 3 and 4 represent a form of furnace which is broader than it is deep. The parts shown are, however, similar to those in Figs. 1 and 2 and are similarly lettered.

In Figs. 5, 6 and 7 the furnace is provided with a circular peripheral electrode *a* and a central spiral electrode *b*, the former being preferably connected to earth and to one pole of a source of electricity, while the latter is connected to the other pole of the said source of electricity. *c* is an opening through which the air or other material which is to be treated in the arc is introduced into the furnace with tangential motion and the spiral electrode is preferably so arranged that it is parallel to the direction of motion of the air which gradually approaches the center of the furnace and leaves through the opening *d* as shown by the arrows in Fig. 6.

Figs. 8, 9, 10 and 11 represent furnaces in which the electrodes *a* are introduced at the periphery of the furnace, air being blown into the furnace past them, for instance through opening *f* shown in Fig. 11, and after treatment in the arcs the air leaves through the opening *d*, of which the furnace in Fig. 8 has two, while those represented in Figs. 9 and 10 have only one. On one side of the wall opposed thereto are openings through which cold air can be blown as indicated by the arrows *g* for the purpose of cooling the products of reaction. The furnaces shown in Figs. 9 and 10 differ from one another in that in Fig. 9 the air remains in practically one plane while it is in the furnace, whereas the furnace shown in Fig. 10 is drawn out sidewise so that the air moves sidewise as well as spirally.

Now what we claim is:—

1. The process of producing continuous electric arcs by stretching an electric arc from an electrode situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of a current of fluid, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

2. The process of producing continuous electric arcs by stretching an electric arc from an electrode situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of a current of fluid, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc, and removing the fluid from a point in proximity to the center of the furnace.

3. The process of producing continuous electric arcs by stretching an electric arc from an electrode situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of a current of fluid directed at an angle to the radius of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

4. The process of producing continuous electric arcs by stretching an electric arc from an electrode situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of a current of fluid directed at an angle to the radius of the furnace and removing the fluid from a point in proximity to the center of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

5. The process of producing continuous electric arcs by stretching electric arcs from a plurality of electrodes situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of currents of gas, said current of gas being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

6. The process of producing continuous electric arcs by stretching electric arcs from a plurality of electrodes situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of currents of gas, said current of gas being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc, and removing the gas from a point in proximity to the center of the furnace.

7. The process of producing continuous spiral-shaped electric arcs by stretching electric arcs from an electrode or electrodes situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of currents of gas directed at an angle to the radius of the furnace, said current of gas being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

8. The process of producing continuous spiral-shaped electric arcs by stretching electric arcs from an electrode or electrodes situated at the periphery of a furnace to an electrode situated in proximity to the center of the furnace by means of currents of gas directed at an angle to the radius of the furnace and removing the gas from a point in proximity to the center of the furnace, said current of gas being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

9. An apparatus of the kind described comprising a furnace provided with one or more peripheral electrodes and with an electrode situated at or near the center of the furnace and means for blowing air from the periphery toward the center of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

10. An apparatus of the kind described comprising a furnace provided with one or more peripheral electrodes and with an electrode situated at or near the center of the furnace and means for blowing air from the periphery toward the center of the furnace and means for removing the air from a point in proximity to the center of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

11. An apparatus of the kind described comprising a furnace provided with one or more peripheral electrodes and with an electrode situated at or near the center of the furnace and means for blowing air into the furnace from the periphery at an angle to the radius of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

12. An apparatus of the kind described comprising a furnace provided with one or

more peripheral electrodes and with an electrode situated at or near the center of the furnace and means for blowing air into the furnace from the periphery at an angle to the radius of the furnace and means for removing the air from a point in proximity to the center of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

13. An apparatus of the kind described comprising a furnace provided with one or more peripheral electrodes and with spiral-shaped electrodes situated in proximity to the center of the furnace and means for supplying air from the periphery of the furnace toward the center thereof.

14. An apparatus of the kind described comprising a furnace provided with one circular peripheral electrode and with an electrode situated in proximity to the center of the furnace and means for supplying air into the furnace from the periphery thereof at an angle to the radius of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

15. An apparatus of the kind described comprising a furnace provided with one circular peripheral electrode and with an electrode situated in proximity to the center of the furnace and means for supplying air into the furnace from the periphery thereof at an angle to the radius of the furnace and means for removing the air from a point in proximity to the center of the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

16. An apparatus of the kind described comprising a furnace provided with one or more peripheral electrodes and with an electrode situated in proximity to the center of the furnace and means for blowing air from the periphery toward the center of the furnace and means for removing the air from a point in proximity to the center of the furnace and means for cooling the gases leaving the furnace, said current of fluid being so directed relatively to the arc, that it will flow through the furnace substantially in the same direction as the longitudinal direction of the arc.

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

F. H. A. WIELGOLASKI.
OTTO SCHÖNHERR.

Witnesses:
M. TULLORNSEN,
N. PEDERSON.