O. SCHÖNHERR & J. HESSBERGER.

PROCESS AND APPARATUS FOR PRODUCING LONG STABLE ELECTRIC ARCS.

APPLICATION FILED AUG. 6, 1910.

1,003,299. Patented Sept. 12, 1911

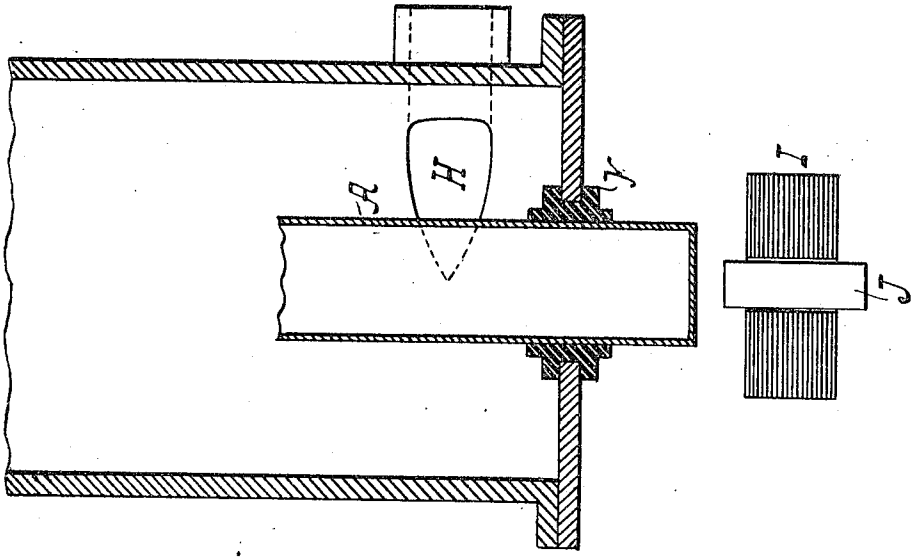

Fig. 2.

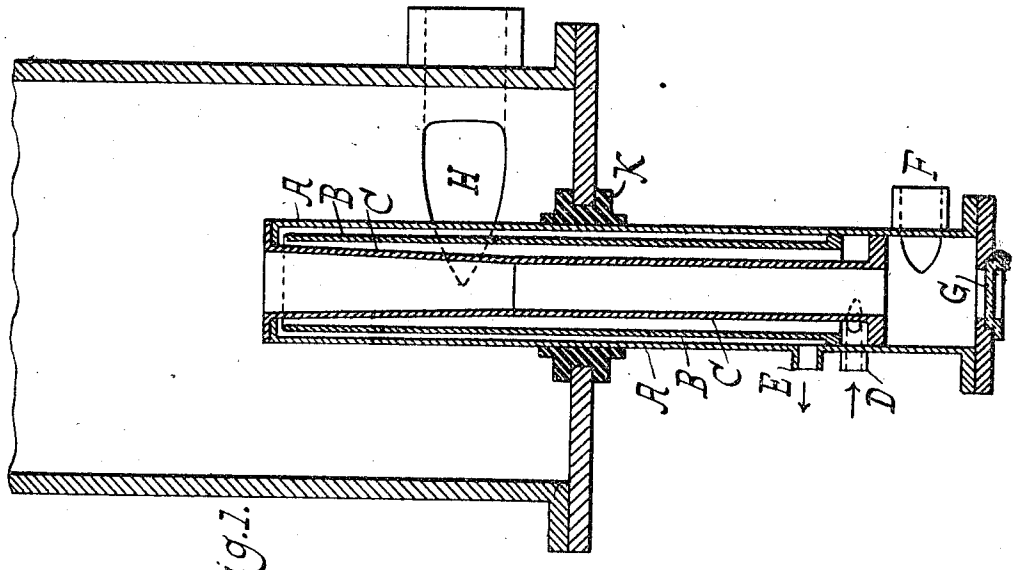

Fig. 1.

Witnesses:
William Miller
Hazel V. McElroy

Inventors
Otto Schönherr.
Johannes Hessberger.
By Attorneys
Haupt & Haarland.

UNITED STATES PATENT OFFICE.

OTTO SCHÖNHERR, OF CHRISTIANIA, AND JOHANNES HESSBERGER, OF CHRISTIANSSAND, NORWAY, ASSIGNORS TO BADISCHE ANILIN & SODA FABRIK, OF LUDWIGSHAFEN-ON-THE-RHINE, GERMANY, A CORPORATION.

PROCESS AND APPARATUS FOR PRODUCING LONG STABLE ELECTRIC ARCS.

1,003,299. Specification of Letters Patent. **Patented Sept. 12, 1911.**

Application filed August 6, 1910. Serial No. 575,976.

To all whom it may concern:

Be it known that we, OTTO SCHÖNHERR, Ph. D., chemist, and JOHANNES HESSBERGER, electrician, subjects, respectively, of the King of Saxony and the King of Prussia, residing, respectively, at Christiania and Christianssand, Norway, have invented new and useful Improvements in Processes and Apparatus for Producing Long Stable Electric Arcs, of which the following is a specification.

In the specification of Letters Patent No. 930,238 we described the production of long stable electric arcs beside a conductor tube or passage by maintaining the supporting current of fluid as a shield between the arc and conductor. In the said specification the use of an electrode insulated from the tube or furnace is described at the end of the furnace where the air or other gas to be treated enters it, and it is recommended that at the other end of the furnace where the long arc ends the part of the wall of the furnace which constitutes the second electrode, in that the arc ends upon it, shall be cooled by means of a water-jacket, or any other convenient way. Such second cooled hollow electrodes at the exit end of the furnace are further described and illustrated in the specification of application for patent Serial No. 351,664 of January 10, 1907, Figure 11, and application Serial No. 475,886, of February 3, 1909, see for instance 8 of Fig. 5.

Now we have found that when using electrodes containing the solid iron core from which the arc springs at the entrance end of the furnace, not only does the iron gradually burn away so that it is necessary to renew it from time to time, but the products of combustion may be harmful in various ways. We have invented improvements in the process by means of which these disadvantages can be obviated or to a great extent obviated. For this purpose we employ a hollow cooled electrode not merely at the exit end of the furnace, but also at the entrance, so that the arc springs from such a hollow electrode, and we have invented a suitable electrode for use at this place. We further cause the starting point of the arc at this new electrode to move about on the surface thereof, the arc itself as a whole remaining stable and substantially stationary.

Our invention may be carried out as follows, but we do not limit ourselves to the precise means hereinafter described.

Fig. 1 of the accompanying drawing represents in vertical section an electrode for the purposes of this invention. In the inclosed space between the two tubes A and C is a third tube B, which divides the said space into two longitudinal portions communicating with each other at top. Water, or other cooling agent, to cool the electrode, is passed through this space, entering, for example, by a pipe attached to the opening D and leaving by the opening E and a pipe attached thereto. On passing air, or other gas, into the tube M (by the opening at H) past the electrode, preferably with a rotary, whirling, or tangential, motion and taking care that the center of the whirl coincides, or practically coincides, with the axial line of the electrode, the arc does not spring from the top circular surface of the electrode, but originates from the inside of the electrode, and the starting point continually moves about on the inner surface of the electrodes, taking a circular, or a helical, path, so that it moves over a considerable portion of the inner surface of the electrode, and if desired the movement can be assisted by passing a portion of the air, or other gases, through the electrode itself, in either

direction through the opening F. Thus, if the air, or other gases, at the opening F, and at the opening H, respectively, be at the same pressure, the air, or other gases, will enter the tube, constituting the furnace, through the opening H, as aforesaid, and air, or other gases, will also pass through the opening F and through the electrode into the said tube. If, however, the pressure at the opening H be greater than that at the opening F, then although the greater part of the air, or other gases, entering the said tube through the opening H travels along the said tube toward the other end thereof, a small proportion of the air, or other gases, will pass downward through the electrode and out by the opening F. If the strength of the current of the portion of the air, or other gases, passing through the electrode be varied, it is possible to work so that the wearing away of the surface of the electrode is extremely small, especially if the electrode be cooled. Instead of causing the starting point of the arc to move about on the inner surface of the electrode, it can be caused to move about on the outer surface of the electrode, for instance by sending suitable proportions of the current of air, or other gases, into the tube constituting the furnace through the electrode and by the side of the electrode respectively. Thus, if the current of air, or other gases, passing through the electrode be increased sufficiently relatively to the quantity of air passing into the tube, or furnace, by the opening H, there will be less pressure on the gases some way down the outer wall of the electrode than just at the end thereof and, consequently, the starting point of the arc will move about over the outer surface of the electrode, because the arc tends to spring from the points where the gases are under the least pressure. The electrode can be made either cylindrical, or conical, and of suitable form in cross-section, such for instance as circular, or elliptical. A peephole G, closed by a suitable window, can be provided to enable the inner surface of the electrode and the position of the arc, to be observed whenever required. It is preferred that any air, or other gases, passed through the electrode into the tube, or furnace, shall have rotary motion imparted to it, or them.

Fig. 2 illustrates another example of how this invention may be carried into effect. A represents a hollow electrode closed at the lower end so that no air is sent through it. The electrode here shown is not provided with a cooling jacket and, when not so provided, it is preferred to make the electrode comparatively thin and of a good conductor of heat and to have a sufficient circulation of air around it to prevent it from becoming too hot. In this case also it is very desirable to cause the starting point of the arc to move about on the surface of the electrode. Although we have hereinbefore described a suitable current of air, or other gases, as being used for the purpose of causing this movement of the starting point of the arc about the surface of the electrode, the invention is not limited to the use of air, or other gases, for this purpose, as the said movement of the starting point of the arc can be effected by other means, either in substitution for, or in addition to, the use of a current of air, or other gases, for the purpose. For instance, the said movement of the starting point of the arc about the surface of the electrode can be effected by magnetic influence, for example as illustrated in Fig. 2, where 1 represents a coil through which an electric current is passed and J represents the core in the center of the coil 1 to exert the magnetic influence requisite to cause the said movement.

In both the figures, K represents insulating material.

The use of the electrodes hereinbefore described in the production of electric arcs is of particular value when it is desired to carry out endothermic reactions in gases by means of electric arcs.

Now what we claim is:—

1. The process of maintaining a long stable electric arc by means of a current of gas, causing that end of the arc at or near which the gas is admitted into proximity to the arc to move about upon the surface of a hollow electrode and maintaining the greater portion of the arc substantially stationary.

2. The process of maintaining a long stable electric arc by means of a current of gas, causing that end of the arc at or near which the gas is admitted into proximity to the arc to move about upon the surface of a hollow electrode and maintaining the greater portion of the arc substantially stationary, and causing a portion of the gas to pass through the hollow electrode.

3. Apparatus for producing long electric arcs comprising a tube or passage, a hollow electrode inserted at one end of the said tube and connected with a source of electricity, and means for introducing gas into the said tube in proximity to the said hollow electrode, substantially as hereinbefore described.

4. Apparatus for producing long electric arcs comprising a tube or passage, a hollow electrode inserted at one end of the said tube or passage and connected with a source of electricity, means for introducing gas into the said tube in proximity to the said hollow electrode, and means for causing the

starting point of the electric arc to move about on the surface of the hollow electrode, substantially as hereinbefore described.

5. Apparatus for producing long electric arcs comprising a tube or passage, a hollow electrode inserted at one end of the said tube or passage and connected with a source of electricity, means for introducing gas into the said tube in proximity to the said hollow electrode, and means for passing gas through the said hollow electrode, substantially as hereinbefore described.

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

OTTO SCHÖNHERR.
JOHANNES HESSBERGER.

Witnesses to the signature of Otto Schönherr:

HENRY BORDEWICH,
MARTIN GUTTERMSEN.

Witnesses to the signature of Johannes Hessberger:

BÖRRE ROSENKILDE,
H. PETTERSEN.