O. WEBER & G. SCHREIBER.

MEANS FOR ELECTRIC ARC REACTIONS ON GASES.

APPLICATION FILED MAR. 7, 1910.

981,727.

Patented Jan. 17, 1911.

2 SHEETS—SHEET 1.

Fig. 1

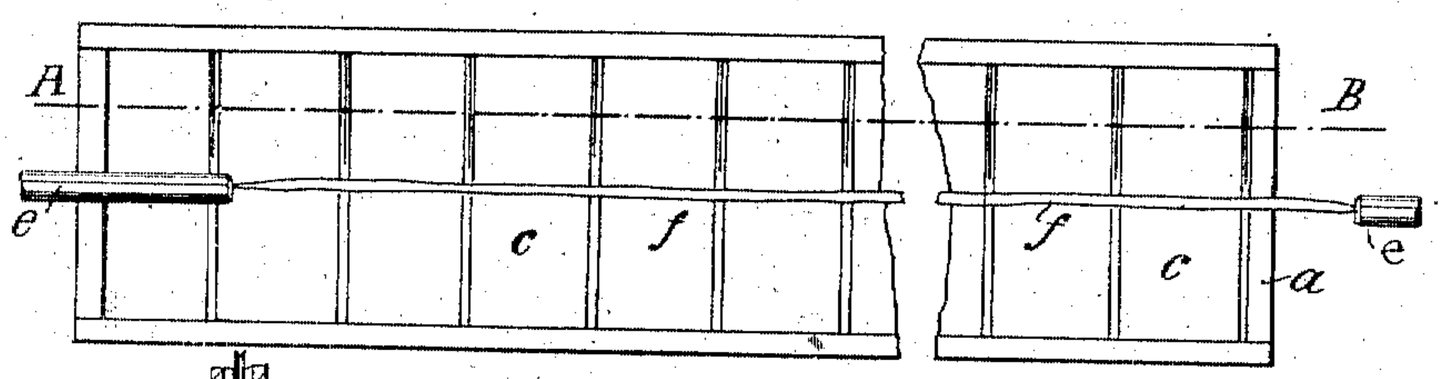


Fig. 2

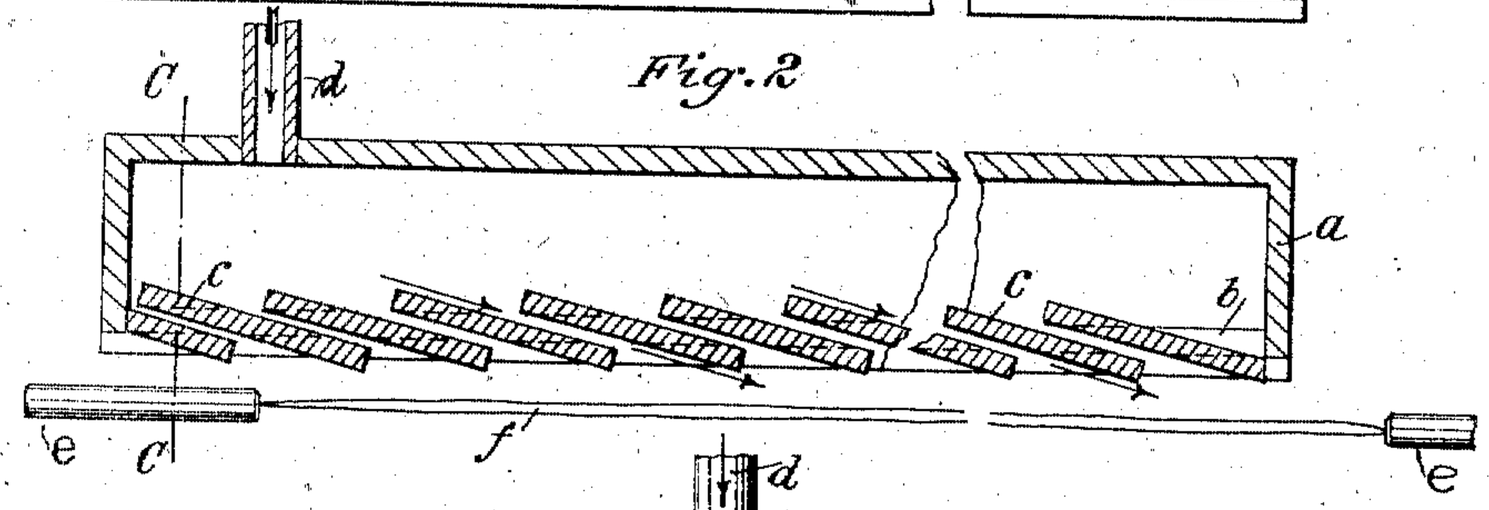


Fig. 3

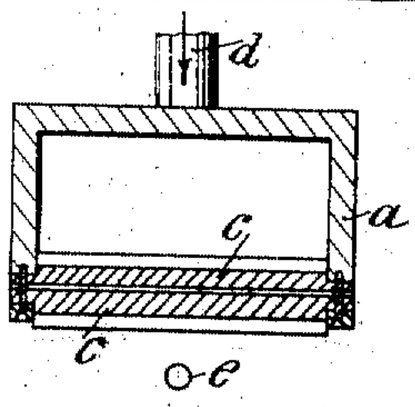


Fig. 4

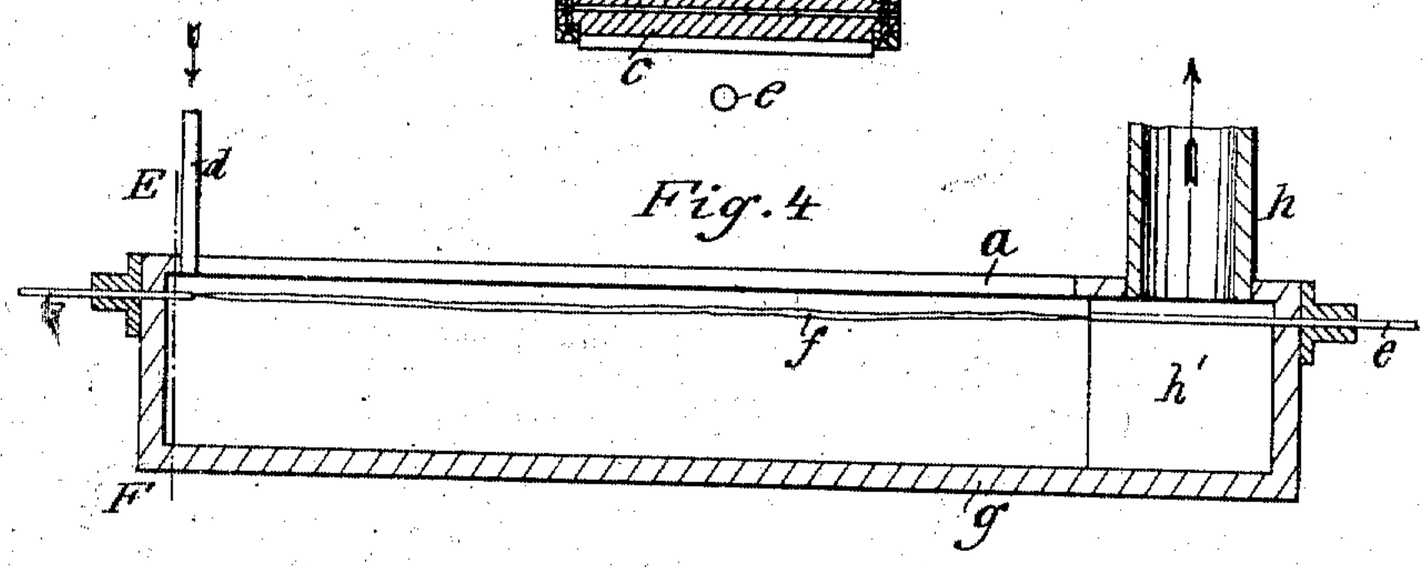
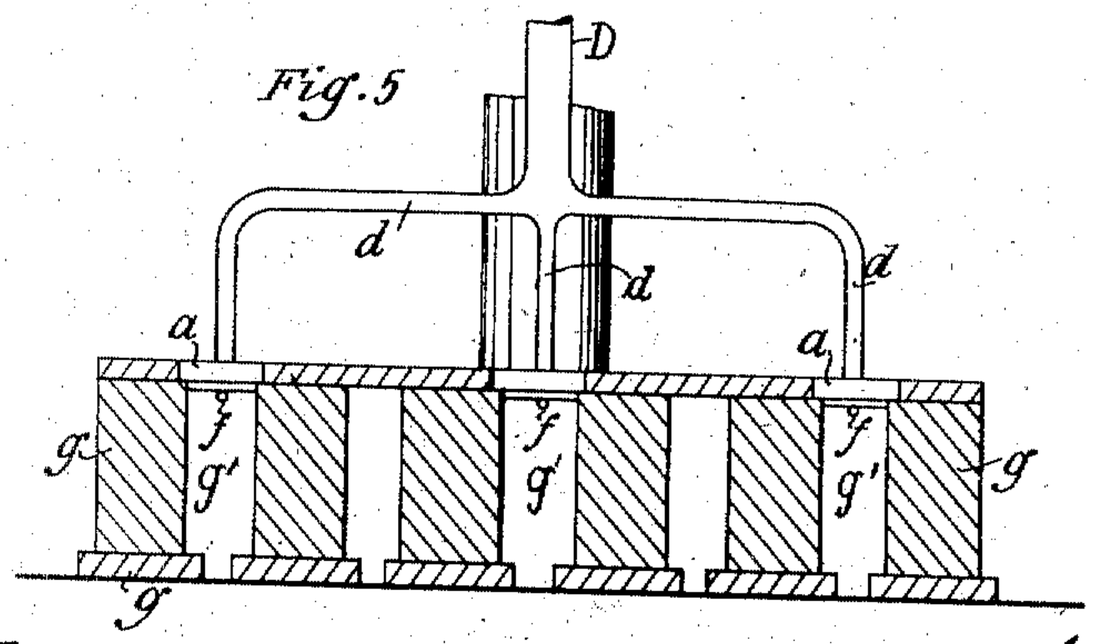


Fig. 5



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2 SHEETS—SHEET 2.

Fig. 6

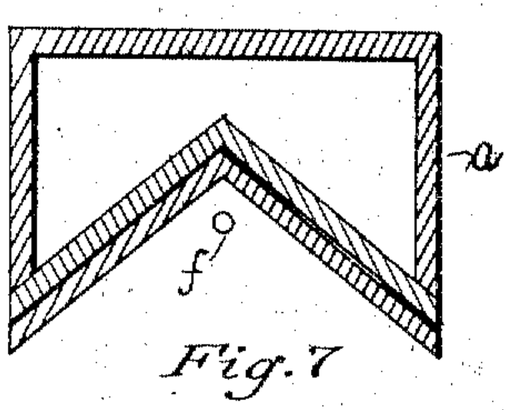


Fig. 7

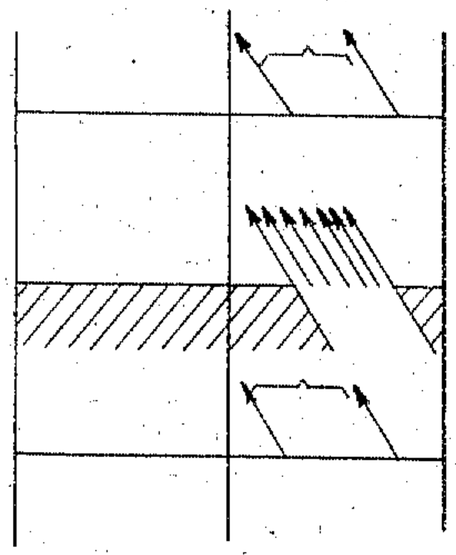
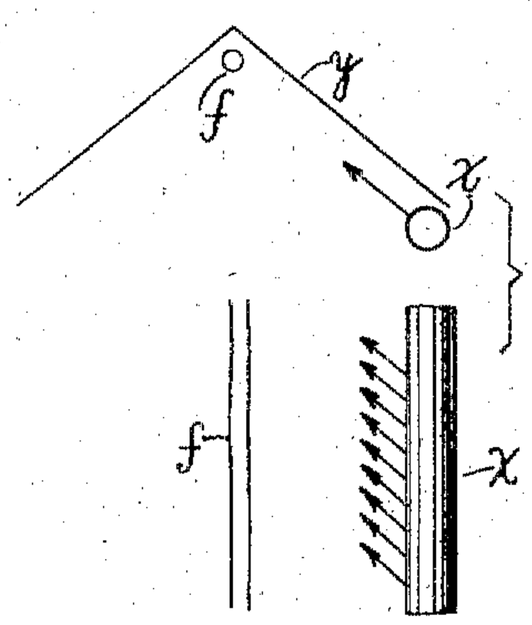


Fig. 8



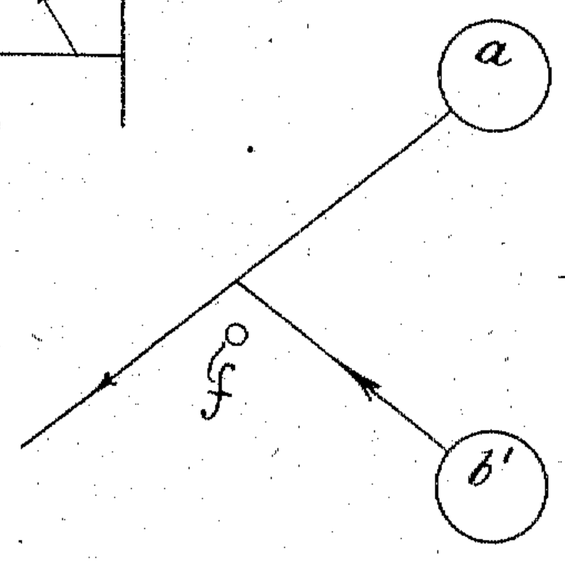


Fig. 9.

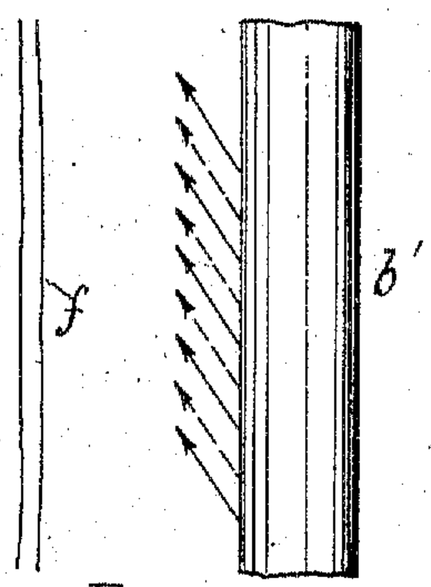


Fig. 10

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UNITED STATES PATENT OFFICE.

OSKAR WEBER AND GUSTAV SCHREIBER, OF GRIESHEIM, GERMANY, ASSIGNORS TO CHEMISCHE FABRIK GRIESHEIM-ELEKTRON, OF FRANKFORT-ON-THE-MAIN, GERMANY, A CORPORATION OF GERMANY.

MEANS FOR ELECTRIC-ARC REACTIONS ON GASES.

981,727. Specification of Letters Patent. **Patented Jan. 17, 1911.**

Application filed March 7, 1910. Serial No. 547,779.

To all whom it may concern:

Be it known that we, OSKAR WEBER and GUSTAV SCHREIBER, subjects of the German Emperor, and residents at Griesheim-on-the Main, Germany, have invented certain new and useful Improvements in the Means for Electric-Arc Reactions on Gases, of which the following is a specification.

This invention relates to improvements in a process of and apparatus for generating and maintaining electric arcs of great length for carrying out reactions of gases.

One of the most common forms of the electric arc used in performing reactions of gases is the arc which is generated within a tubular body, in which the zone of the arc is surrounded by a coaxial layer of nonconductive gas of lower temperature, which layer is inclosed by the wall of the tubular body and is thereby prevented from being radially expanded. In this system the direction of the flow of the gases is necessarily parallel to the direction of the arc, and this is the case whether the arc is conducted in a perpendicular or horizontal direction, or along a curved path.

Experiments have shown that long and stable arcs can be produced between two electrodes disposed at a considerable distance apart, without inclosing the gas within a tubular body, and without causing the gas to flow in a direction parallel to that of the arc. This is effected by forcing the gas through a series of slots and angularly against the arc, whereby the arc is deflected from its normal upwardly bowed form, in case it is horizontal, into a horizontal direction, and at the same time forced forward. Preferably the said slots are formed by a plurality of louvered plates of refractory material which forms the bottom of a gas chamber. In this case the arc if located horizontally below the said bottom and therefore normally is bowed upwardly, is deflected back into substantially horizontal direction, and at the same time is carried forward. The longer the series of slots in the bottom of the gas chamber is, the more can the arc be lengthened by separating the electrodes, since the amount and the direction of the gas are constant. By such a flow fresh gases are continually supplied which form a continuous and substantially horizontal arc, since these gases can enter the arc from the side and pass through it, and are therefore prevented from again reëntering the same. In this way, some of the decomposed gases are not again subjected to the arc as in prior processes where the gases travel along the arc. Simultaneously, the treated gases are cooled by those gases which do not pass the arc. For the purpose of providing a lateral guide for the gases which have passed the arc, and for preventing eddies, the gas chamber is preferably mounted on a masonry structure provided with channels which are open at their bottoms and extend far enough in the direction of the flow of the gases as to prevent an irregular and backward flow of the gases.

For the purpose of explaining the invention, several examples of apparatus embodying the same have been shown in the accompanying drawings, in which the same letters of references have been used in all the views to indicate the corresponding parts.

In said drawings Figure 1 is a bottom view of the gas chamber which is provided with the devices for directing the gases against the arc; Fig. 2 is a longitudinal section on the line A—A, Fig. 1; Fig. 3 is a cross section on the line C—C Fig. 2; Fig. 4 is a longitudinal section of the masonry base portion which is provided with channels for conducting the gases to a discharge pipe; Fig. 5 is a cross section on the line E—F Fig. 4; Fig. 6 is a vertical cross section showing another form of the gas chamber; Fig. 7 is a diagrammatical plan of the bottom o fthe gas chamber illustrated in Fig 6; Fig. 8 shows a diagrammatical end view and plan illustrating another form of this invention; Fig. 9 shows a diagrammatical end view; and Fig. 10, a plan illustrating another form of this invention.

Referring to the example of the apparatus illustrated in Figs. 1 to 5 of the drawings, the walls of an air tight gas chamber *a* are located on a masonry structure *g*. The said gas chamber has a box like form which is closed at its top and open at its bottom. The bottom is formed of louvered stones or plates *c* of refractory material which provide inclined slots or passages for the passage of the gases. These plates are secured to the side walls of the gas chamber *a* in an air tight manner by means of side pieces *b*. The walls of the gas chamber are heated to the

temperature of the preheated air supplied thereto, and the heat imparted to the bottom by radiation is transmitted to the gases flowing through the same, so that the said gases are further preheated and the temperature of the bottom is held within suitable limits. Instead of a bottom of nonconductive material a bottom of metal may be used, which may temporarily be connected to one of the electrodes for the purpose of starting the arc. Between the electrodes *e* an electric arc *f* is formed. The gas is supplied through a pipe *d*, and the gases of the reaction escape through a pipe *h*.

The bottom of the apparatus is preferably divided so as to form a plurality of longitudinally extending chambers *g'* as shown in Fig. 5. Each of these chambers is provided with a set of electrodes *e* arranged to form an arc *f*, which extends longitudinally of the chamber. Above each of the chambers is located a gas supply chamber *a* provided with directing passages or nozzles as shown in Fig. 2, and supplied with the gases by the branch pipes *d* leading from a common supply pipe D. The chambers *g'* can all discharge into a common end chamber *h'* from which the treated gases are withdrawn by means of a main discharge pipe *h*.

In the operation, gases are supplied to the supply chamber or chambers *a* and directed by the nozzles formed by the louvered plates at an acute angle to the length of the arc so that the gases will pass through the arc and will be thoroughly subjected to its action and passed in the direction of the outlet. In this way, it is insured that the gases will be thoroughly treated. At the same time, the treated gases after having once been subjected to the action of the arc will not again come into contact with the same as in prior processes, where the gases pass along the arc, but the treated gases are withdrawn quickly so that they are protected against decomposition. At the same time, by supplying the gases in excess, the gases are thoroughly cooled, thus providing further protection against decomposition. By constructing the chambers *g'* narrow, eddies are prevented.

The bottom of the chamber *a* is not necessarily plane, as is shown in Figs. 1 to 5, but it may be constructed in the form of a vaulted roof. In this case the gases need not necessarily be discharged over the whole area of the bottom, but the gases may enter at one side of the bottom in such a way that they are simultaneously directed upward and against one of the electrodes. In this case the gases to be subjected to the reaction must escape at the opposite side of the bottom into a larger chamber after having carried the arc forward a certain distance. Therefore they are not conducted parallel to the arc over the whole length of the same, but at an angle thereto. Thereby a decomposition of the gases formed by the reaction is avoided.

In order to enable the louvered roof shaped or vaulted bottom to act as a blowing apparatus, the slots formed between the said plates are closed over a part of their length as is indicated in Figs. 6 and 7. In this case a new jet of gas enters through each slot, and a corresponding amount of gas escapes at a point which is opposite and forward of the slot. The angle at which the gases strike the arc is such that the gases remain within the arc only as long as is necessary for being subjected to the reaction.

Instead of the construction shown in which the gas is forced angularly into the reaction chamber through a louvered bottom, a blow pipe *x*, Fig. 8, may be provided which is located at the side of the arc and which forces the gas along the arc in the same way as the slots provided in the bottom. In this case the louvered bottom can be replaced by a plane vaulted roof *y*, and the gas flows below the roof in a forward direction while simultaneously ascending along the vaulted roof. The arc is formed centrally of the channel provided by the roof and it is prevented by the gases from coming in contact with the bottom.

Experiments have shown that the gas inclosing the arc does not need any confining wall at all, such as is provided by the bottom or the roof. By using a blowing apparatus of the character shown in a diagrammatical way in Figs. 9 and 10, an arc can be produced which burns perfectly free without being inclosed by a wall of any kind. As shown the blower consists of two parallel tubes *a'* and *b'* having apertures arranged angularly to their axes, through which the gases are forced angularly against the arc as shown in Figs. 9 and 10.

An arc produced in accordance with this invention burns almost without any coronal whatever, and it therefore acts on the gases almost without any re-decomposition of the same. Besides the efficiency of the arc which is thus greatly cooled is very high. As the temperature of the arc is very high and can be cooled considerably, its chemical action is very strong. For this reason this arc is particularly adapted for carrying out gas reactions, and more particularly for producing oxids of nitrogen from air.

In this process not all the gas supplied through the blowing apparatus is subjected to the reaction, so that a somewhat diluted mixture of gases is produced, but this drawback is compensated for by the increased efficiency of the process.

While for the purpose of describing the invention reference has been made to apparatus in which the arc has a horizontal direction, it should be understood, that the in-

vention is not limited to the embodiment described, but that the invention may be embodied in processes in which the arc has other directions.

Claims:

1. The process of subjecting gases to the action of an electric arc, comprising directing the gases on the arc at an acute angle to its length.

2. The process of subjecting gases to the action of an electric arc, comprising supplying the gases from one side and directing them on the arc at an acute angle to its length, and withdrawing them from the other side.

3. The process of subjecting gases to the action of an electric arc, comprising supplying the gases from the side, over the whole length of and at an acute angle to the length of the arc.

4. The process of subjecting gases to the action of an electric arc, comprising supplying the gases from one side and directing them on the arc at an acute angle to its length, and withdrawing them from the other side and in the direction of the movement given to the gases as supplied.

5. The process of subjecting gases to the action of an electric arc, comprising supplying the gases to the arc in excess for the purpose of cooling, and directing them on the arc at an acute angle to its length.

6. In an apparatus for subjecting gases to the action of an electric arc, the combination with a set of electrodes adapted to establish an arc, of means for directing gases on said arc at an acute angle to its length.

7. In an apparatus for subjecting gases to the action of an electric arc, the combination with a set of electrodes adapted to establish an arc, of means for directing gases on said arc at an acute angle to its length, and means for withdrawing the treated gases in a direction given the gases by the directing means.

8. In an apparatus for subjecting gases to the action of an electric arc, the combination with a casing, of a set of electrodes adapted to establish an arc therein, means for supplying gases to said casing, and nozzles on said casing for directing the gases on the arc at an acute angle to its length.

9. In an apparatus for subjecting gases to the action of an electric arc, the combination with a casing, of a set of electrodes adapted to establish an arc therein, a plurality of louvered plates on said casing forming directing nozzles, and means for supplying gases to said nozzles.

10. In an apparatus for subjecting gases to the action of an electric arc, the combination with a casing, of a set of electrodes adapted to establish an arc thereon, a wall in said casing extending along the arc and having a plurality of nozzle openings formed therein, and means for supplying gases to said nozzle openings.

11. In an apparatus for subjecting gases to the action of an electric arc, the combination with a casing, of a set of electrodes adapted to establish an arc therein, means for supplying gases to said casing and for directing said gases at an acute angle to the length of the arc, and means at one end of said casing for withdrawing the treated gases in a direction given the same by the directing means.

12. In an apparatus for subjecting gases to the action of an electric arc, the combination with a casing having a plurality of longitudinally extending chambers, of electrodes adapted to establish arcs longitudinally of said chamber, and means for directing gases on said arcs and at acute angles to their lengths.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

OSKAR WEBER.
GUSTAV SCHREIBER.

Witnesses:
FRANZ HASSLACHER,
ERWIN DIPPEL.