

F. H. A. WIELGOLASKI.
METHOD AND APPARATUS FOR THE PRODUCTION OF LONG ELECTRIC ARCS FOR THE
TREATMENT OF GASES.

APPLICATION FILED SEPT. 19, 1912.

1,061,892.

Patented May 13, 1913

2 SHEETS-SHEET 1.

Fig. 1.

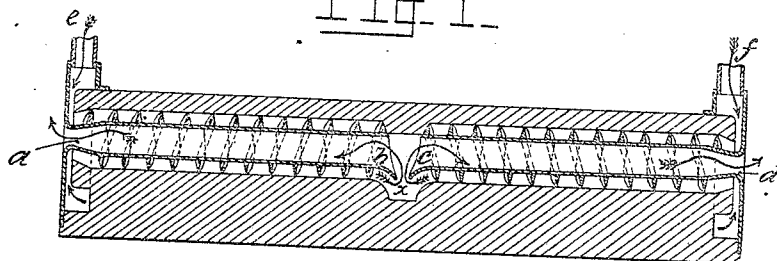


Fig. 2.

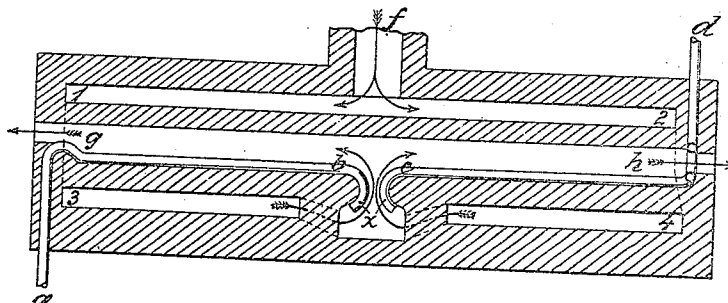
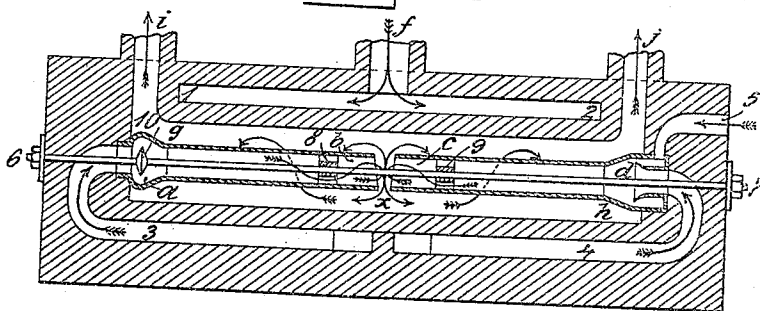


Fig. 3.



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Fig. 4.

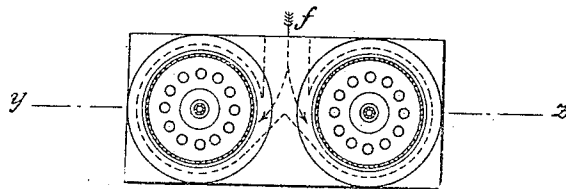
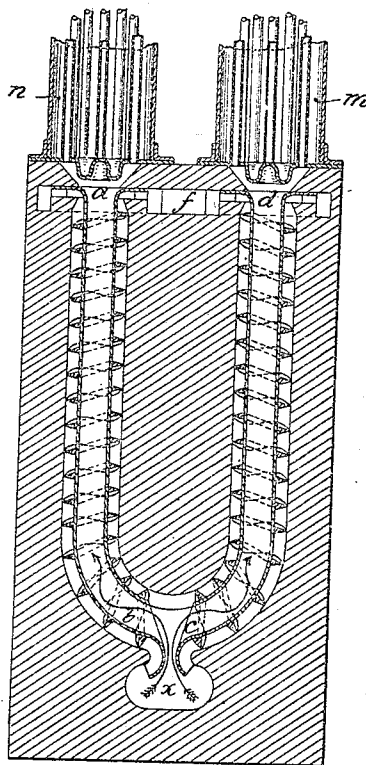


Fig. 5.

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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR THE PRODUCTION OF LONG ELECTRIC ARCS FOR THE TREATMENT OF GASES.

1,061,892.

Specification of Letters Patent.

Patented May 13, 1913.

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To all whom it may concern:

Be it known that I, FRANS HENRIK AUBERT WIELGOLASKI, engineer, citizen of Norway, residing at Odins Gate 1, Christiania, Norway, have invented a new and useful Improvement in Methods and Apparatus for the Production of Long Electric Arcs for the Treatment of Gases; and I do hereby declare the following to be a full, clear, and exact description of the same.

There are at present known a plurality of methods and apparatus for producing long electric light arcs, which might be divided into several main classes with their subdivisions:

The main class to which the present invention belongs, comprises the processes and apparatus that are based upon displacement or drawing-out of the light arcs along electric conductors—electrodes—by means of currents of gas moving along said electrodes. This main class may be divided into two subdivisions viz.: First subdivision comprising such methods and constructions in which both ends of the light arc are displaced by the currents of gas. The light arc in this case has hitherto generally burned discontinuously, and its longitudinal direction has been more or less perpendicular to the direction of motion of the gas currents and to the longitudinal direction of the electrodes, and the electrodes have both been placed in one and the same furnace chamber and have been of a longish rod or string-shape. Second subdivision comprises such methods and constructions in which only one end of the light arc is displaced along a longish conductor, the other end remaining more or less at rest depending from quite a short electrode which only just extends into the furnace chamber. The light arc in this case burns continuously—stably—and its longitudinal direction has been more or less parallel to the direction of motion of the gas currents and to the long electrode extending through the whole of the furnace chamber and at the same time wholly or partially forming the walls of the furnace chamber.

The present invention comprises a method with appertaining furnace constructions, which must be considered as lying between the subdivisions mentioned, since in this case both ends of the light arc are displaced during the first part of the drawing-out

along longish electrodes according to the same principle as in ordinary horn-shaped electrodes or horn-shaped lightning arresters while the light arc in the drawn-out condition will burn continuously or stably and the longitudinal direction of the light arc will be parallel to the gas current as well as to the electrodes. This is attained by disposing each of the two electrodes in its separate channel-shaped furnace chamber and causing each of the two ends of the light arc formed between these electrodes to be moved by one branch of the gas current in such a manner that one half of the light arc is drawn out through and will be located in one of the furnace chambers, or in one half of the furnace chamber, regarding the same as a whole, treating or heating one half of the gases, while the other half of the light arc is drawn out through and will be located in the other furnace chamber or the other half of the furnace chamber, looking on the same as a whole, where it heats or treats the other half of the gases. The electrodes of the two furnace chambers will thus form counter-electrodes to each other, but each furnace chamber only contains one electrode.

The two channel-shaped furnace chambers may be so arranged as to extend in opposite directions from the common gas inlet, that is to say with their center-lines in alignment with each other, or the two furnace chambers may extend parallel to each other or in any direction from the common gas inlet. Since now each of the two halves of the light arcs acts upon its gas current it is also in this case attained, what the inventor has aimed at in his previous U. S. application Serial No. 697778, viz. to enable light arcs of double the length and accordingly of double the voltage to be utilized as compared with other furnace constructions hitherto known and based upon the drawing-out of light arcs by means of currents of gas. In each furnace chamber, accordingly, there is only one electrode and this may either be constituted by the wall of the furnace itself, the whole of which must then be electrically conductive, or it may be constituted by an electric conductor placed within the furnace wall which is otherwise non-conductive, or, by a conductor placed inside each furnace chamber. In the latter case the arrangement is advantageously so

made that the light arc will circulate transversely of its longitudinal direction around the electrode simultaneously with and after the drawing out in the longitudinal direction.

5 In the accompanying drawings Figures 1 to 3 show longitudinal vertical sectional views of several possible embodiments of the invention; Fig. 4 shows a section of another modification, the section being
10 taken on the line $y-y$ of Fig. 5, and Fig. 5 is a transverse sectional view of the modification of Fig. 4.

Fig. 1 represents, in longitudinal section,
15 a construction in which the electrodes $a-b$ and $c-d$ also form the electrically conductive walls of the two furnace chambers. At $-x-$ is the gas inlet common to both furnace chambers, where the gases with the
20 greatest advantage are blown in tangentially. At $-x-$ is also formed the light arc, the electrode tubes $a-b$ and $c-d$ in this instance lying so near to each other that a light arc will be formed by itself or by
25 special means between the electrode ends $-b-$ and $-c-$, which in this instance are given a form suitable for the purpose, as soon as said electrode tubes $a-b$ and $c-d$ are connected each to one pole of a source
30 of electricity with sufficiently high voltage. Of course there is nothing to prevent the arrangement of a larger distance between the electrode ends and the production of the light arc in a different manner. This light
35 arc is now acted upon by a gas current which as already mentioned is preferably blown in tangentially to the electrode tubes and which in such case, will enter helically and will pass likewise helically through said tube-
40 shaped electrodes with one branch of the gas current in each electrode, each of these gas currents carrying with it its end of the light arc through its electrode tube which the
45 gases leave at their outer ends at a and $-d-$. The electrode tubes must of course be cooled well from outside and most advantageously to the greatest possible extent by means of the gases to be treated, which
50 gases are thereby heated before being blown in at $-x-$. For this purpose it will be of advantage to provide the electrode tubes exteriorly with helical ribs as shown in Fig. 1, whereby are formed helical channels through which the gases may pass while
55 traveling from the inlets $-e-$ and $-f-$ to $-x-$. The arrows in the figure indicate the movement of the gases. The electrode tubes may either be cooled in their entire length exclusively by the gases as shown in the figure, or they may, if necessary, be extra-
60 cooled at their hottest ends at $-a-$ and $-d-$ by means of a liquid, *e. g.* water, or by still more effective means, *e. g.* liquid gases and the like.

65 Figs. 4 and 5 represent, in longitudinal

section on the line $y-z$ and in cross-section through the cooling apparatus $-m-$ and $-n-$ respectively, a furnace construction corresponding to the one shown in Fig. 1 and in which the two tubular electrodes or
70 furnace chambers are forming with each other an angle of 360° instead of 180° as in Fig. 1. The cooling apparatus $-m-$ and $-n-$, which have otherwise nothing to do
75 with the invention itself, serve to quickly reduce the temperature of the gases below the dissociation temperature of the products formed, which may also be attained in different
80 manners. These two cooling apparatus $-m-$ and $-n-$ must be insulated from each other to prevent the electric current from being entirely or partially conducted across. The cooling apparatus $-m-$ and $-n-$ may also at the same time serve
85 as counter-electrodes for which purpose they are connected directly each to its pole of the source of electricity. In this case the electrode tubes $a-b$ and $c-d$ advantageously receive their current from said cooling apparatus $-m-$ and $-n-$ and preferably
90 through a suitable resistance to facilitate the passage of the light arc from the electrode tubes $a-b$ and $c-d$ across to the cooling apparatus $-n-$ and $-m-$ respectively
95 through the highly heated and consequently conductive gases at $-a-$ and $-d-$. The gases are blown in at $-f-$ and distribute themselves as indicated by the arrows to the helical channels around the electrode tubes
100 in the same manner as in Fig. 1. Such cooling apparatus may also be arranged in connection with the furnace constructions shown in Figs. 1, 2 and 3.

Fig. 2 represents in longitudinal section a
105 furnace construction in which the two furnace chambers together form an electrically nonconductive channel $g-h$ extending with one half in each direction from the common
gas inlet at x , thus actually forming two channel-shaped furnace chambers $g-x$ and
110 $x-h$ in the walls of which the electrodes $a-b$ and $c-d$ are laid. The light arc is formed and the gases blown into the channel $g-h$ at x in the same manner as in Fig. 1, and each end of the light arc is also in
115 this case drawn out through its half of the furnace in the same manner as in Fig. 1. At the gas outlets at $-g-$ and $-h-$, where the ends of the light arcs will be resting, the electrodes should either, as shown on the
120 right hand side at $-g-$, be given a hunch-shaped curvature, or, as shown on the right hand side at $-h-$, form an annular eye around the gas current. In the latter case the end of the light arc will get a rotating
125 movement on this eye or ring, if the gases are blown in so as to rotate in the furnace chamber. Also in this case an arrangement similar to the one shown in Figs. 4 and 5 may be made with cooling apparatus also
130

serving, perhaps, as counter-electrodes. The gases to be treated enter at $-f-$ and also in this instance pass, on their way to $-x-$, through a channel system 1-2-3-4 of a shape suitable for the purpose, in order to be themselves preheated while cooling the walls of the furnace.

Fig. 3 represents in longitudinal section a furnace construction in which the two furnace chambers likewise together form a channel $g-h$ of electrically non-conductive material. The two electrodes in this instance are formed of two tubes $a-b$ and $c-d$ placed in the furnace chambers and approaching each other in the middle of the furnace at $-x-$ where the light arc is formed. Here the gases issue in a rotating motion from the interior cavity of the electrode tubes through the slot between the ends of the electrodes at $-x-$, drawing out the ends of the light arc along the exterior of the electrode tubes, while at the same time the whole of the light arc is whirled around the electrode tubes. The latter should preferably be enlarged at their extreme ends $-a-$ and $-d-$ as indicated in the drawing. The light arc in its completely drawn-out state will then rotate with its ends around these enlargements. The inner ends $-b-$ and $-c-$ of the electrode tubes are supported by a metal rod 6-7 insulated from the tubes and tightly stretched through the whole length of the furnace tubes, which metal rod of course is kept cooled by the gases flowing through the electrode tubes. The electrode tubes may for instance rest on said rod by means of porcelain pieces 8- and 9- provided with gas passages which cause the gases to rotate. The electrode tubes, for the sake of a better cooling, may also be provided interiorly with helical ribs. On the left hand side at a and on the right hand side at $-d-$ are shown two different arrangements for making the cooling by the gas of the electrode enlargements, on which the light arcs rotate, as efficient as possible. It is evident that in this instance as well as in Fig. 2 there may also be employed the still more effective cooling methods mentioned in the description of Fig. 1. From the inlet $-f-$ the gases on their way to $-x-$ also in this instance, as indicated by the arrow, pass through a channel system 1-2-3-4 to be themselves preheated while cooling the walls of the furnace chambers and, by their entrance into the electrode tubes, to cool the inlet ends of the same. This latter cooling of the enlarged electrode ends, on which the ends of the light arc play, may be made particularly efficient either, as shown at a in Fig. 3, by attaching to the inner supporting rod a little disk 10- forcing the gases outward toward the walls of the enlargement of the tube, or, as shown at $-d-$, by

blowing in gases extra, preferably tangentially, through a special channel 5-. This gas current will then circulate briskly around and cool the interior of the electrode ends. Also the constructions shown in Figs. 2 and 3 may be arranged with their furnace chambers, and accordingly the electrodes, pointing in any direction relatively to each other in a similar manner as shown in Fig. 4.

As it will be seen, the constructions above described and illustrated in the drawings are all based upon one and the same principle consisting in forming the light arc between the divergent ends or end edges, which are nearest to each other, of two conductors (electrodes) the longish extensions of which are either placed each in its channel or are formed as tubes in such a manner that the generation of the light arc and its first development take place on the same principle as in ordinary hornshaped electrodes or horn-shaped lightning arresters, the gas current striking the light arc at a more or less right angle and carrying the whole of the same with it with one end sliding along one of said divergent electrode or electrode-end edge, and the other end sliding along the other electrode or electrode-end edge up to the point where the divergence in the present sense ceases, each of the electrodes, as already mentioned, being extended into its channel or formed into tubes, and from which point the extension of the light arc continues in the manner that each end of the light arc is displaced by means of its gas current along its conductor, each in its channel or along the interior or exterior of its tubularly extended electrode.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A method of producing a long continuously burning electric arc, said method consisting in forming an electric arc between the inner ends of a pair of electrodes having their inner ends adjacent and their outer ends remote from each other; and blowing back the roots of the arc from said inner ends toward said outer ends by passing separated currents of gas, substantially continuously adjacent and parallel to the respective electrodes, from said inner ends to said outer ends.

2. A method of producing a long continuously burning electric arc, said method consisting in providing a furnace space having branching channels in which the walls comprise a pair of electrodes having their inner ends adjacent and their outer ends separated; forming an arc between said inner ends; and blowing the roots of the arc toward said outer ends by passing currents of gas from said inner ends toward said outer end of the electrodes.

3. A method of producing a long electric arc, said method consisting in forming an electric arc between the inner ends of a pair of electrodes disposed in a pair of branching
5 channels, the inner ends of the channels and electrodes being nearer each other than the respective outer ends, and blowing the roots of said arcs back from the inner ends of the channels by passing currents of gases
10 through the channels from the inner to the outer ends thereof.

4. In means for forming a long electric arc, the combination of a furnace provided with a branching furnace space, and a pair
15 of electrodes comprised in the wall of said branches and having their respective inner ends nearer together than their outer ends, said furnace being adapted to cause currents of gas to flow from said inner ends toward
20 said outer ends.

5. In means for forming a long electric arc, the combination of a furnace provided with an elongated chamber, and a pair of
25 tubular electrodes disposed within said chamber and having their respective inner ends near each other and their outer ends separated and secured in the ends of the chambers, said tubular electrodes forming with said chamber an outer space between

the electrodes and the wall of the chamber, 30 and forming an inner space within the electrodes; said furnace body being provided with channels communicating with said spaces respectively.

6. In means for forming a long electric 35 arc, the combination of a furnace provided with an elongated chamber, and a pair of tubular electrodes disposed within said chamber and having their respective inner ends near each other and their outer ends 40 separated and secured in the ends of the chambers, said tubular electrodes forming with said chamber an outer space between the electrodes and the wall of the chamber, and forming an inner space within the elec- 45 trodes; said furnace body being provided with channels communicating with said spaces respectively whereby gas may pass through certain of said channels and between said inner ends and out through the 50 other channels.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

FRANS HENRIK AUBERT WIELGOLASKI.

Witnesses:

AXEL LAHN,

MOGEUS BUGGE.