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METHOD OF AND APPARATUS FOR PRODUCING AND UTILIZING DISK LIKE ELECTRIC ARCS FOR EFFECTING GAS REACTIONS.

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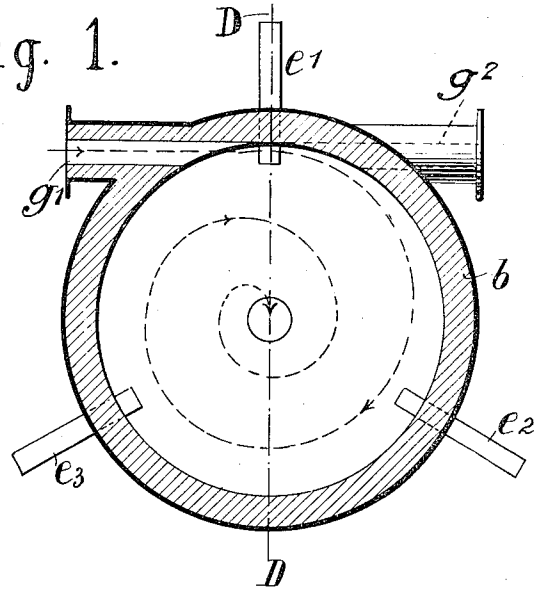
1,018,990. Patented Feb. 27, 1912.

Fig. 1.



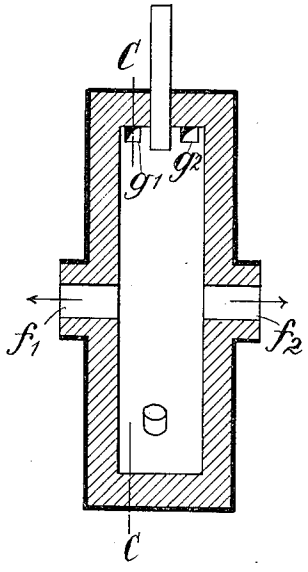


Fig. 2.

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METHOD OF AND APPARATUS FOR PRODUCING AND UTILIZING DISK-LIKE ELECTRIC ARCS FOR EFFECTING GAS REACTIONS.

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To all whom it may concern:

Be it known that I, FRITZ ROTHE, a subject of the King of Prussia, and a resident of Dessau, Anhalt, Germany, have invented certain new and useful Improvements in Methods of and Apparatus for Producing and Utilizing Disk-Like Electric Arcs for Effecting Gas Reactions; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

It has been proposed heretofore to utilize electric arcs for effecting gas reactions by drawing out the arcs to a great length by means of whirling air currents, or by means of air admitted through openings distributed along the entire length of the arc; or, in some instances, by whirling the arc by magnetic means into surfaces of various forms. The efficiency of these methods depends upon the expanse of surface of contact between the gases and the arc. Furthermore, the possibility of drawing the arc out to an extraordinary great length depends upon the avoidance of renewal of the gases between the electrodes of the arc. The present invention contemplates a process wherein these fundamental features are included in an operation embodying the further characteristic that the flaming arc or a plurality of flaming arcs are spread out into a disk-like flame discharge by the gas movement alone, and preferably wherein the gases are in contact with both sides of the flame discharge.

In carrying out the invention, a flat cylindrical furnace is employed in whose central plane lie the electrodes, and wherein the arc is generated between two or more electrodes; the gases to be treated being forced in tangentially to the periphery of the interior thereof and preferably on both sides of the flame-zone lying in the central plane. The gases pass out of the furnace at or near the middle line of the longitudinal section of the furnace. Preferably, one outlet passage is provided on each side of the plane of the electrodes, corresponding to the inlet passage at the interior periphery of the furnace. In this way, the gases follow spiral paths of comparatively great length between respective inlets and outlets, while the flame-zone lies in the central plane between the spiral path in the preferred arrangement. In consequence of this movement of the gases, the arc formed between the electrodes is so affected that a disk-like flame discharge of large superficial area is produced, along which, preferably on both sides, the injected gases in comparatively thin sheets, rub in spiral paths of great length, whereas, in the plane of the electrodes a zone is formed in which little or but slight renewal of gases takes place. This formation of a disk-shaped flame discharge is surprising, because it would be expected that either the arc would persist directly between the electrodes or that the arc would be blown out as soon as formed, so that an arc would not be continually maintained.

It has been demonstrated that the flame disk produced by the method herein described is particularly suitable for carrying out endothermic gas reactions; for instance, in the employment of air for the oxidation of the nitrogen thereof, good concentrations as well as good yields have been obtained.

A furnace suitable for carrying out the method herein described is shown diagrammatically in the accompanying drawings, wherein—

Figure 1 is a cross-section through the furnace; and Fig. 2 is a longitudinal section thereof on the line D—D of Fig. 1.

The furnace b is of relatively moderate width (or height) with respect to its diameter, in order that the gases to be treated shall likewise be in the form of comparatively thin sheets. The interior cross-section of the furnace must likewise be so chosen that the movement of the gases shall follow in a spiral path. As illustrated in the drawing the interior is of circular contour, but it may be elliptical or of polygonal shape. The electrodes are arranged in the central plane of the furnace; for instance, when a three-phase current is employed the three electrodes e^1, e^2, e^3, are arranged at equal distances apart. In all cases the electrodes are insulated from each other. At the opposite sides of the plane of the electrodes, the gas-injecting ports or inlet passages g_1 and g_2 are arranged tangentially to the interior periphery of the furnace lining, while the two gas outlet passages f_1 and f_2 are located on the central line.

In Fig. 1 the gas-injecting ports or inlet passages g_1 and g_2 are shown facing in opposite directions, so that the gases will move in opposite directions to each other on opposite sides of the flame zone; whereas in Fig. 2 the inlet passages g_1 and g_2 are shown facing in the same direction, in which case the gases on the opposite sides of the flame zone will move in the same direction. If now, gas is injected into the furnace through the inlet passages g_1 and g_2, the gases move uniformly in spiral paths to the outlet passages f_1 and f_2, while the arcs which have in the meantime been produced, in any well known manner such as by separating the electrodes after they have been brought into contact with each other, between the electrodes e^1, e^2 and e^3, are drawn out and re-formed into a disk-like single flame discharge.

The method permits flame discharges of large energy consumption combined into a single flame disk; it further permits the employment to advantage of direct current, or of single-phase alternating current or of polyphase alternating current, the number of electrodes being correspondingly chosen. Furthermore, a number of circuits can be employed connected up in parallel or in other relation as desired. When polyphase current is employed (for instance, a six-phase current, or a current of a still greater number of phases), the yield of the electric furnace is materially increased.

It will be understood that the furnace may be used in either a horizontal or a vertical position; and that it is feasible to operate it with the gas admitted at but one side, the opposite side of the flame-disk being occupied in that case by a practically stationary layer of gas taking no part in the gas movement. Furthermore, the gases to be treated may be admitted through more than one tangentially-arranged port; for instance, through two, three, four or more symmetrically distributed ports of the same kind on each side of the flame disk. It is also feasible to have the gases move in opposite directions to each other on opposite sides of the flame zone.

Having thus described my invention, what I claim is:

1. The method of producing an electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in substantially parallel planes in proximity to the arc on opposite sides thereof, and spreading the arc out by the movement of the gases into a sheet discharge intermediate the planes of movement of the gases and distinct therefrom; substantially as described.

2. The method of producing an electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in opposite directions on opposite sides of the arc and in proximity thereto, and spreading the arc out into an intermediate sheet discharge by the movement of the gases; substantially as described.

3. The method of producing an electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in proximity to the arc on opposite sides thereof, and spreading the arc out into an intermediate sheet discharge by the movement of the gases and without substantial renewal of such of the gases as collects within the disk zone; substantially as described.

4. The method of producing an electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in opposite directions on opposite sides of the arc and in proximity thereto, and spreading the arc out into an intermediate sheet discharge by the movement of the gases and without substantial renewal of such of the gases as collects within the disk zone; substantially as described.

5. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in a spiral path in a plane substantially parallel with and adjacent to but distinct from the plane of the arc, and drawing the arc out into disk form by the movement of the gases; substantially as described.

6. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in spiral paths on opposite sides of the arc, and drawing the arc out into disk-form by the movement of the gases; substantially as described.

7. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in spiral paths in opposite directions, on opposite sides of the arc, and drawing the arc out into disk-form by the movement of the gases; substantially as described.

8. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in a spiral path in a plane substantially parallel with and adjacent to but distinct from the path of the arc, and drawing the arc out into disk form by the movement of the gases and without substantial renewal of such gas as collects within the disk zone; substantially as described.

9. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in causing the gases to move in spiral paths on opposite sides of the arc and drawing

the arc out into disk-form by the movement of the gases and without substantial renewal of such of the gas as collects within the disk zone; substantially as described.

10. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in establishing an electric arc within an inclosed space, forcing the gases tangentially to the periphery of said space, and in a plane adjacent to but distinct from the arc, and conducting the products of the reaction from the said space axially thereof; substantially as described.

11. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in establishing an electric arc within an inclosed space, forcing in the gases tangentially to the periphery of said space, and in planes adjacent to the arc but on opposite sides thereof, and conducting the products of the reaction from the said space axially thereof; substantially as described.

12. The method of producing a disk-like electric arc and utilizing the same for the production of gas reactions, which consists in establishing an electric arc discharge between electrodes by means of a polyphase current within an inclosed space, forcing in the gases tangentially to the periphery of said space, and in a plane adjacent to but distinct from the electric arc discharge, and conducting the products of the reaction from the said space axially thereof; substantially as described.

13. An electric flame discharge apparatus, provided with arcing electrodes, a flat furnace of substantially circular form, an inlet passage on each side of a central plane of the furnace and tangentially disposed to the interior periphery of the furnace, and an outlet passage on each side of the central plane and axially disposed near the center of the furnace; substantially as described.

14. An electric flame discharge apparatus comprising a flat furnace of substantially circular form, a plurality of circumferentially disposed electrodes between which an arc or arcs are formed in substantially the central plane of the furnace, an inlet passage at one side of the central plane for introducing the gases tangentially to the interior periphery of the furnace and an outlet passage near the center of the furnace for discharging the gases axially of the furnace; substantially as described.

15. An electric flame discharge apparatus comprising a flat furnace of substantially circular form, a plurality of circumferentially disposed electrodes between which an arc or arcs are formed in substantially the central plane of the furnace, an inlet passage on each side of the central plane for introducing the gases tangentially to the interior periphery of the furnace, and an outlet passage on each side of the central plane and near the center of the furnace for discharging the gases axially of the furnace; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

FRITZ ROTHE.

Witnesses:
MAX HAMBURGER,
OSKAR SINGER.