

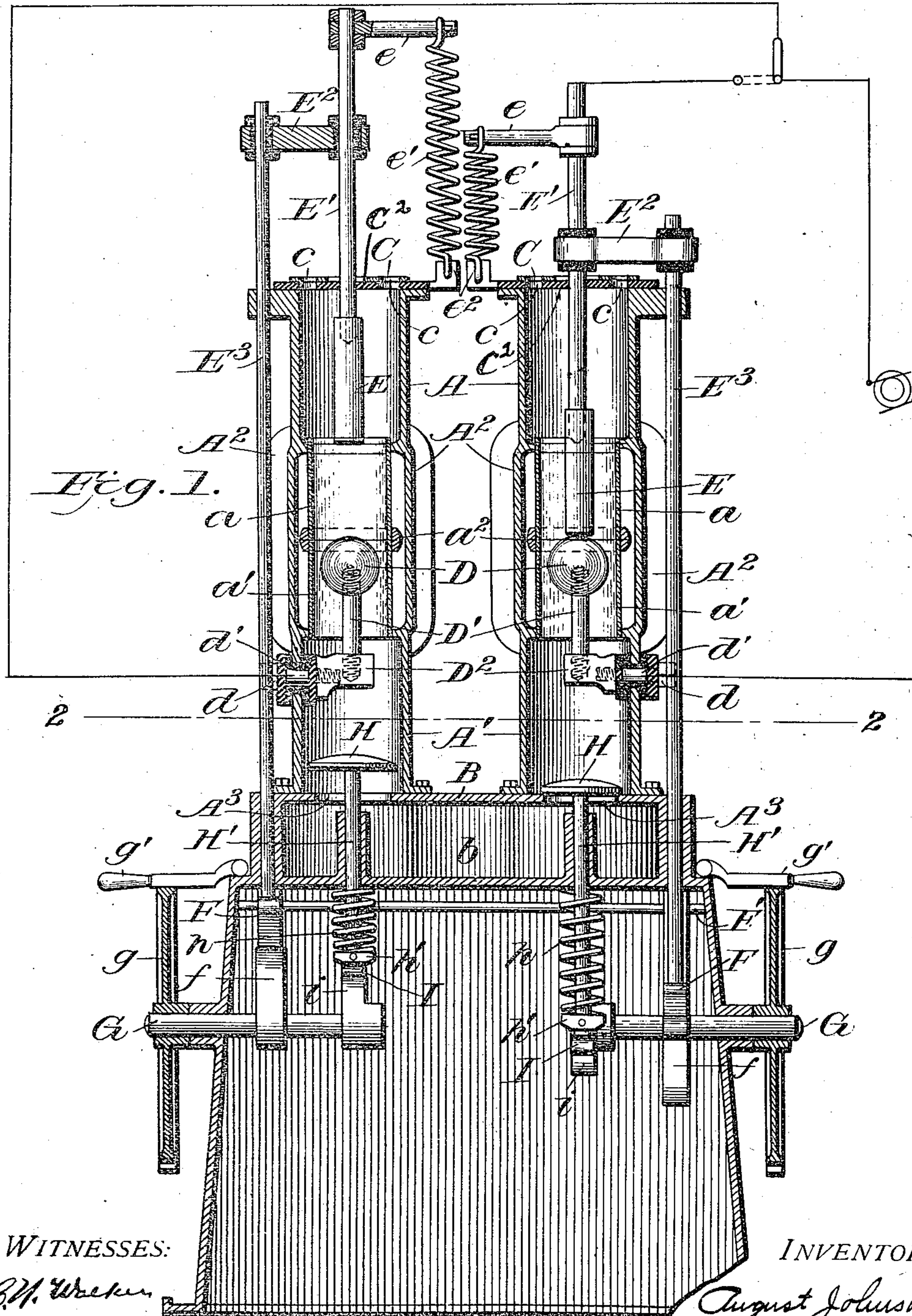
No. 798,511.

PATENTED AUG. 29, 1905.

A. JOHNSON.  
APPARATUS FOR ELECTROLYZING AIR.

APPLICATION FILED JAN. 5, 1905.

3 SHEETS—SHEET 1.



WITNESSES:

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James P. Mansfield

INVENTOR

August Johnson

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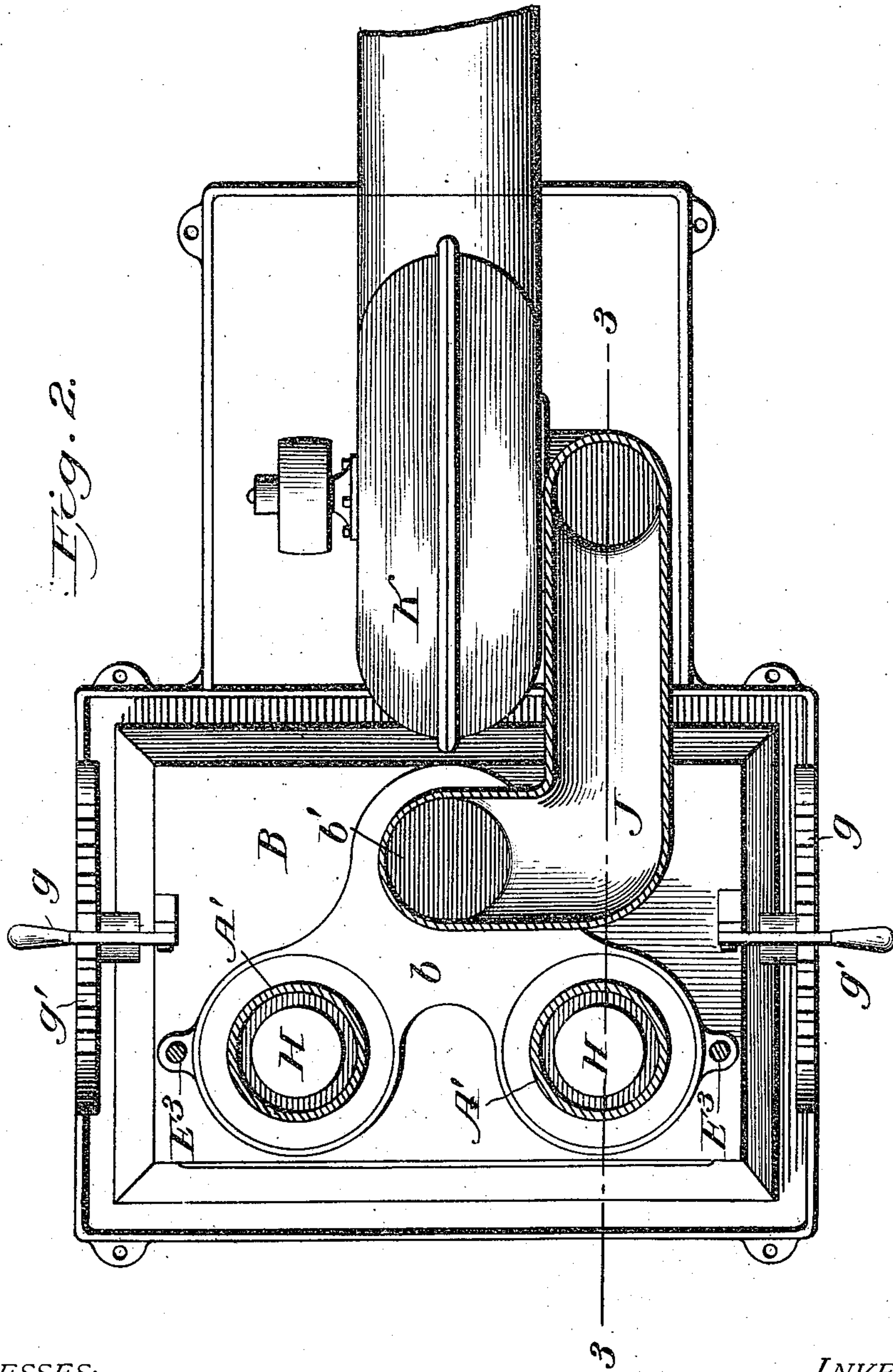
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3 SHEETS—SHEET 2.



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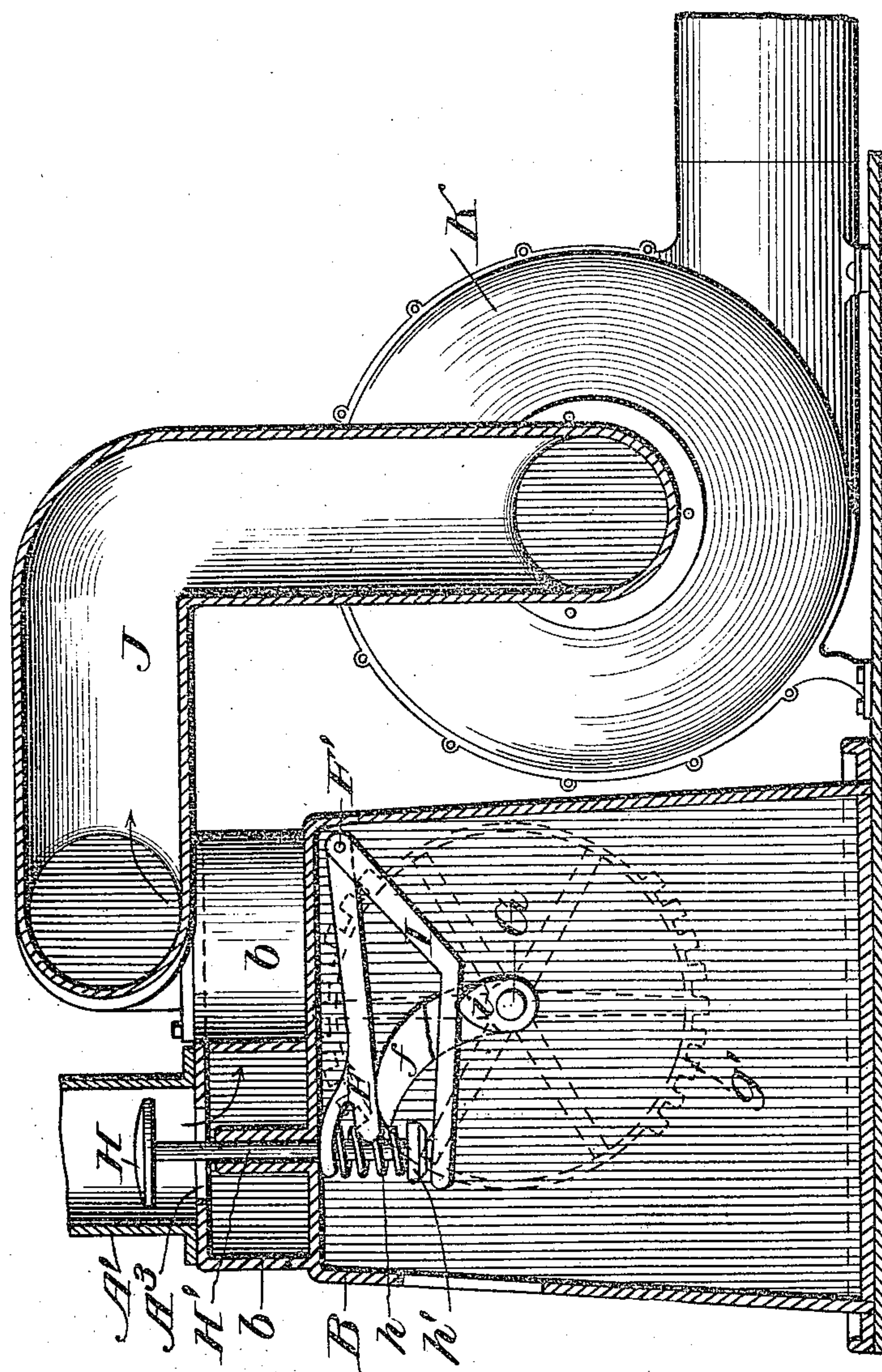
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3 SHEETS—SHEET 3.

Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR ELECTROLYZING AIR.

No. 798,511.

Specification of Letters Patent.

Patented Aug. 29, 1905.

Application filed January 5, 1905. Serial No. 239,821.

*To all whom it may concern:*

Be it known that I, AUGUST JOHNSON, of Moline, in the county of Rock Island and State of Illinois, have invented certain new and useful Improvements in Apparatus for Electrolyzing Air; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

This invention is an improved apparatus for electrolyzing air or other gaseous fluids by decomposing them by an electric arc; and it is designed particularly for converting air into a gaseous medium to be used in the process of bleaching flour and other useful purposes in the arts.

The principal objects of the invention are to control both the quantity and intensity of the gaseous medium produced by the apparatus and to use a continuous arc for decomposing the air.

The apparatus in brief comprises one or more decomposing-chambers in which the gaseous fluid is decomposed by the action of an electric arc. It also comprises means for forcing or drawing such fluid through such chambers, means for regulating the length of the arc, means for regulating the admission of the quantity of gaseous fluid admitted into the chambers, and means whereby the flow of the fluid may be stopped simultaneously with the closing of the arc and started simultaneously with the formation of the arc, all substantially as hereinafter described and claimed. Hereinafter in the description and claims I will simply refer to air, which is one gaseous fluid that can be treated by the apparatus, but do not restrict or limit the use of my apparatus to any particular gaseous fluid.

The nature of the invention and the preferred construction of the apparatus embodying it will be hereinafter particularly described in connection with the drawings, and the features for which protection is desired are summarized in the claims.

In the drawings, Figure 1 is a vertical longitudinal section through a complete apparatus embodying the invention, showing two decomposing chambers or tubes, which may be used successively or simultaneously, according to the amount of gaseous medium desired. The electrical connections between

the apparatus and dynamo are indicated diagrammatically in connection with said figure. Fig. 2 is a horizontal section on line 2 2, Fig. 1. Fig. 3 is a vertical section on line 3 3, Fig. 2.

The generating-chambers in which the electrolyzing is effected are preferably made tubular, with upper and lower metal cylinders A A' arranged in axial alinement and connected by arms A<sup>2</sup>. The space between these two cylinders and within the arms is preferably closed by transparent walls of suitable material, such as glass, and for convenience these walls may be made in two cylindric sections a a', united at their meeting ends by a collar or collars a<sup>2</sup> and having their other ends suitably sealed within the ends of the cylinders A A', respectively. Two such chambers are shown in the drawings, and both are mounted vertically upon a hollow base B and may be securely fastened thereto by bolts and flanges, as indicated in the drawings. As the chambers are exactly alike, the description of one applies to both. The upper end of the chamber may be closed by a perforated plate C, preferably of insulating material and provided with a central aperture for the passage of one of the electrode-holders and with a concentric series of apertures c for the admission of air. A circular similarly-perforated valve C' overlies plate C, and by rotatably moving valve C' the amount of air admitted into the chamber can be nicely regulated.

Within the central part of each chamber is located the positive electrode D, which is mounted on a short stud D', of conducting material, attached to a bracket D<sup>2</sup> in the lower part A' of the chamber, said bracket being removably secured in the chamber by means of a bolt d, which passes through a plug d', of insulating material, inserted in an aperture in the wall of part A' and by which the electrode D is insulated from the walls of the chamber.

The negative electrode E is attached to the lower end of a holder-rod E', which passes through a vitreous disk C<sup>2</sup>, inserted in the central aperture of plate C, and is attached to an arm E<sup>2</sup> on the upper end of a vertically-movable rod E<sup>3</sup>, which extends through suitable guides into the base B, where it rests upon the free end of a lever F, pivoted on a transverse shaft F' in the base, as shown in Figs. 1 and 3. The rod E<sup>3</sup> and the electrode connected



therewith are normally moved downward by gravity and the action of a helical spring  $c'$ , attached to a stud  $c$ , connected to arm  $E'$  and to a binding-post  $c''$  on a lateral extension  $C''$  of plate  $C$ , as shown, said spring  $c'$  also serving as a conductor, the current passing through spring  $c'$ , arm  $c$ , and holder  $E'$  to the negative electrode  $E$ . Arm  $E''$  should be insulated from the holder or rod  $E''$ , so that current cannot escape from the holder through said arm. As shown, arm  $E''$  is insulated from rod  $E''$  at  $E''$ . The bolt  $d$  may serve as a binding-post for the connection of the positive conductor from the source of electric current.

Lever  $F$  can be raised and lowered by means of a cam  $f$ , attached to a short shaft  $G$ , journaled in the base  $B$  below the lever and extending at right angles thereto. This shaft  $G$  is provided with a toothed wheel  $g$  on its outer end, which can be locked in any adjusted position by means of a latch  $g'$ , pivoted on the base adjacent to the wheel. The latch may be disengaged from the wheel by hand when it is desired to adjust the electrodes.

In the upper part of base  $A$  is a chamber  $b$ , with which the lower end of the chamber communicates through an opening  $A''$ , closable by a puppet-valve  $H$ . The stem  $H'$  of valve  $H$  is guided in a sleeve in chamber  $b$  and extends through and below said chamber and rests upon the free end of a lever  $I$ , pivoted on shaft  $F'$ . A spring  $h$  is interposed between the bottom of chamber  $b$  and a collar  $h'$  on the stem  $H'$ , so as to normally press the latter down upon lever  $I$  and close the valve when the lever permits. The lever  $I$  is moved upward at the proper times by means of a small cam  $i$ , fixed on shaft  $G$  adjacent to cam  $f$ .

In the drawings two generating-chambers are shown, each identical in construction and appurtenances with that already described; but I do not confine myself to any precise number of generating-chambers, that depending upon the capacity of the apparatus.

The chamber  $b$  has an outlet  $b'$  communicating with a pipe  $J$ , leading to the inlet of a suction-fan  $K$ , which should be closely housed, and its outlet is connected with the receiver or chamber in which the generated gases are to be stored or utilized.

Preferably the lower electrode  $D$  is the positive and the upper  $E$  is the negative, and preferably the positive electrode is made globular, and the upper may be cylindrical, as shown.

The object of the globular electrode is to cause a diffusion or spreading of the arc greater than would result between two ordinary cylindrical pointed electrodes. Furthermore, the electrodes are preferably made up

of a composition containing metals of different conductive properties, as of a metal of high and a metal of low resistance, the object of such composition being to cause the arc to shift from point to point as it seeks to escape where there is least resistance and practically

appears to melt the metal at the point where it strikes the electrode, and as the resistance is enhanced by the melting of the metal the arc shifts to a new point of less resistance, this shifting preventing rapid destruction of the electrode. The spherical electrode affords a larger surface for the arc to shift over and spreads the arc, so that a more nearly perfect electrolysis of the air passing through the chamber is realized.

Operation: When the apparatus is in position and ready for use, it is started by first rotating shaft  $G$ , so that the electrode  $E$  is lowered into contact with electrode  $D$ , closing the circuit, and at same time valve  $H$  is closed. Then the shaft  $G$  is turned so as to separate the electrodes, simultaneously opening valve  $H$ , and this separation of the electrodes establishes a continuous arc therebetween. The fan is then put in operation (if not already started) and air is sucked into the generating-chamber past and through the electric arc, by which it is decomposed and converted into gases suitable for use in bleaching flour and for other purposes, these gases being sucked through chamber  $b$  and pipe  $J$  into the fan-chamber and discharged into suitable receivers or utilizers. Cams  $f$  and  $i$  being both attached to same shaft, the changing of the length of arc and the opening of the valve  $H$  are accomplished simultaneously. By turning valve  $C'$  the amount of air admitted into the generating-chamber can be varied so that the action of the arc and the attenuation of the gases can be measurably controlled. The arc can be varied in intensity by varying the distance between the electrodes, and it can be maintained continuously during the operation of the apparatus.

By this apparatus the quantity and intensity of the gaseous mediums produced are under control. A constant flow thereof can be maintained without substantial variation in the quality or chemical nature of the resultant gases, owing to the uniformity and continuity of the arc.

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

1. In an apparatus for electrolyzing gaseous fluids, the combination of a generating-chamber, normally separated electrodes therein adapted to maintain a continuous arc; a valved outlet from said chamber, and means for holding said valve open while the electrodes are separated, and for closing the valve when the electrodes are brought into contact, substantially as described.

2. In an apparatus for electrolyzing gaseous fluids, the combination of a generating-chamber, normally separated electrodes therein adapted to maintain a continuous arc, a valve for varying the quantity of fluid admitted to said chamber; a valve controlling the outlet of fluid from said chamber; and means for



holding the outlet-valve open while the electrodes are separated, and for closing said valve when the electrodes are brought together.

3. In an apparatus for electrolyzing gaseous fluids, the combination of a generating-chamber, normally separated electrodes therein adapted to maintain a continuous arc, a valve for regulating admission of fluid to said chamber, a valve controlling the outlet of fluid from said chamber, and means for closing the outlet-valve when the electrodes are in contact, and for opening said outlet-valve when the electrodes are separated; with means for maintaining a constant uniform flow of air through the generating-chamber, substantially as described.

4. In combination, a generating-chamber, relatively fixed and movable electrodes therein adapted to be normally separated to maintain a continuous arc, a valve for regulating admission of fluid to said chamber at one end thereof, a valved outlet at the other end of said chamber, and mechanism for simultaneously operating said outlet-valve and said movable electrode, so as to close the outlet when the electrodes are in contact and open the outlet when the electrodes are separated, substantially as described.

5. In an apparatus for electrolyzing gaseous fluids, the combination of a generating-chamber, and relatively movable electrodes therein adapted to be normally separated to maintain a continuous arc; with a vertically-movable rod for operating the movable electrode, a valved outlet from said generating-chamber, and means adapted to simultaneously operate the said rod and said valve, for the purpose and substantially as described.

6. In an apparatus for electrolyzing gaseous fluids, the combination of a generating chamber, a fixed electrode and a movable electrode therein normally separated to maintain a continuous arc; with a vertically-movable rod for operating the movable electrode, a valved out-

let from said generating-chamber; and a shaft provided with cams adapted to simultaneously operate the said rod and said outlet-valve, for the purpose and substantially as described.

7. In an apparatus for electrolyzing gaseous fluids, the combination of a generating-chamber, a pair of electrodes therein adapted to be normally separated and maintain a continuous arc; means for varying the relative positions of the electrodes, a suction-chamber with which the generating-chamber communicates, a valve for controlling communication between the generating and suction chambers, and mechanism for closing said valve when the electrodes are in contact, and for holding the valve open while the electrodes are separated, substantially as described.

8. In combination, a generating-chamber, electrodes therein, means for holding said electrodes normally apart to maintain a continuous arc, an inlet-valve at one end of the chamber, and an outlet-valve at the other end of the chamber; with a rock-shaft, cams and levers for simultaneously adjusting the said electrodes and the said outlet-valve, substantially as described.

9. In an apparatus for electrolyzing gaseous fluids, the combination of a generating-chamber, a globular electrode fixed therein, a relatively movable electrode, said electrode being normally separated to maintain a constant arc, an inlet-valve at one end of the chamber, an outlet-valve at its other end, and mechanism for closing the outlet-valve as the electrodes are brought into contact, and for holding the outlet-valve open while the electrodes are separated, substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

AUGUST JOHNSON.

In presence of—

CHARLES A. BARNARD.

STEPHEN D. RAY.