E. I. RAINS.

ELECTRICAL STEAM GENERATOR.

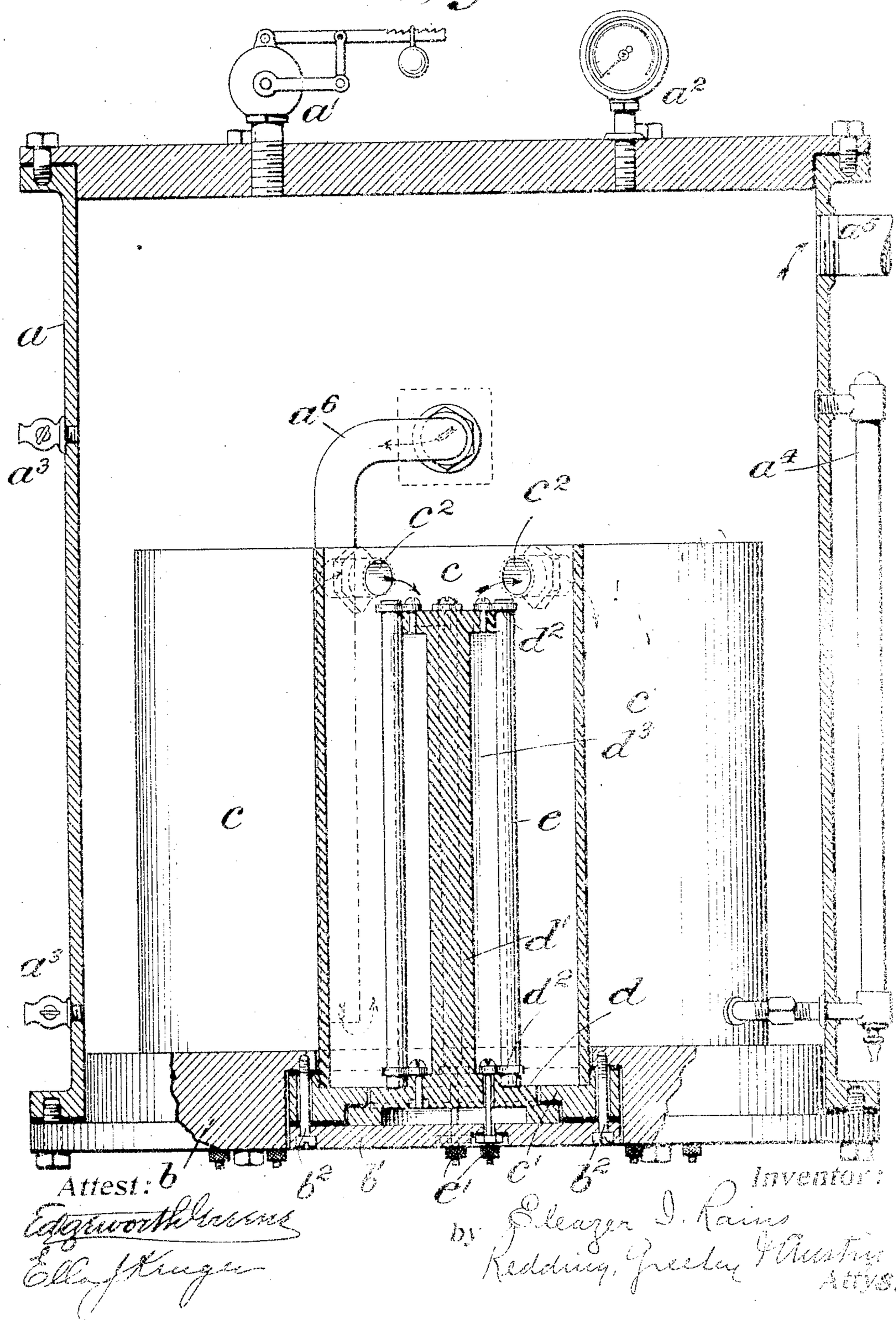
APPLICATION FILED FEB. 11, 1909.

944,050.

Patented Dec. 21, 1909.

4 SHEETS—SHEET 1.

Fig. 1.



Attest: Edgeworth Bruce
Ella J. Krueger

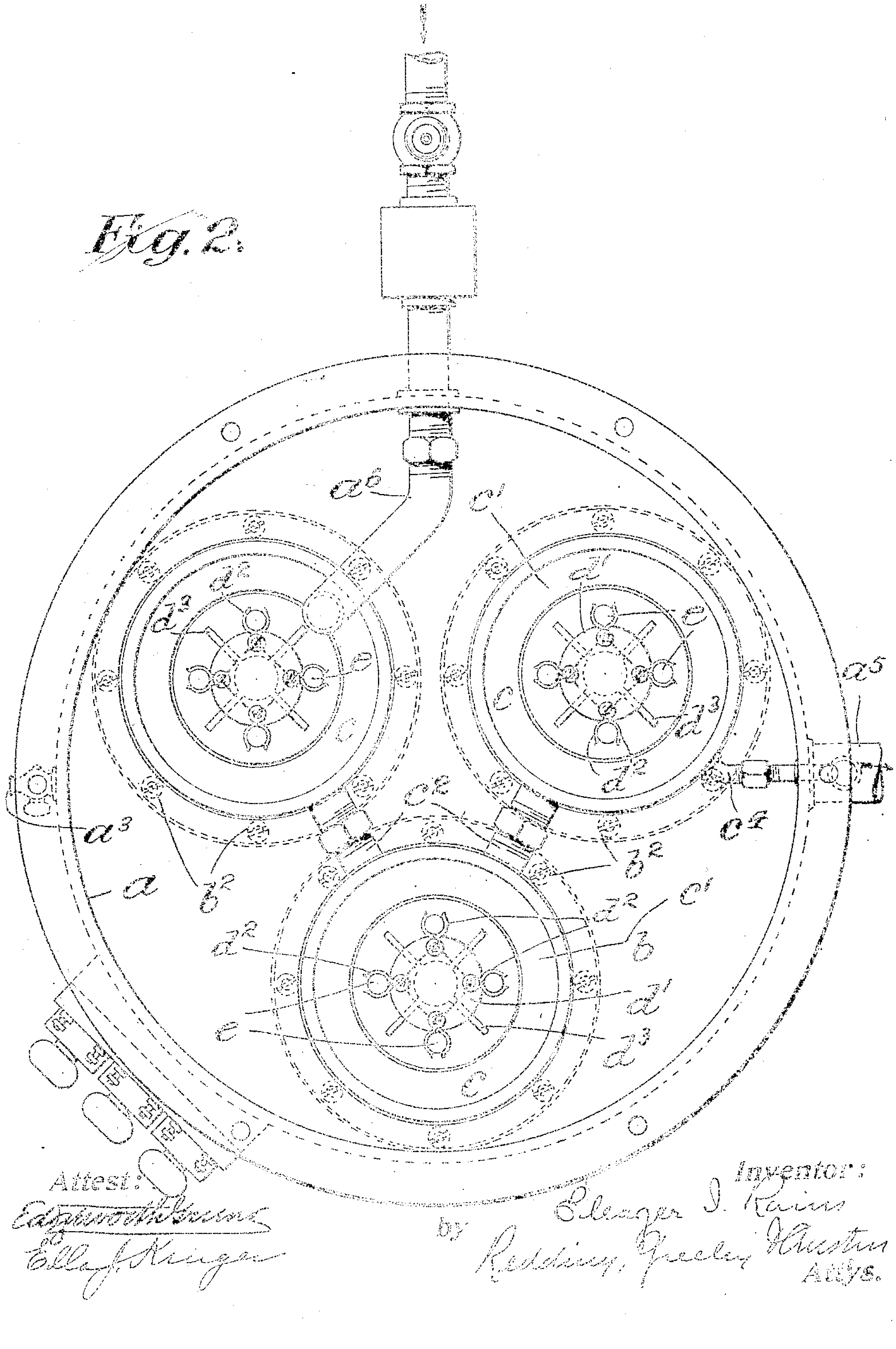
Inventor:
by Eleazer I. Rains
Redding, Greeley & Keating
Attys.

E. I. RAINS.
ELECTRICAL STEAM GENERATOR.
APPLICATION FILED FEB. 11, 1909.

944,050. Patented Dec. 21, 1909.

4 SHEETS—SHEET 2.

Fig. 2.



Attest:
Edgeworth Greene
Ella J. Kruger

Inventor:
Eleazer I. Rains
by Redding, Greeley & Austin
Att'ys.

E. I. RAINS.

ELECTRICAL STEAM GENERATOR.

APPLICATION FILED FEB. 11, 1909.

944,050.

Patented Dec. 21, 1909.

4 SHEETS-SHEET 3.

Fig. 5.

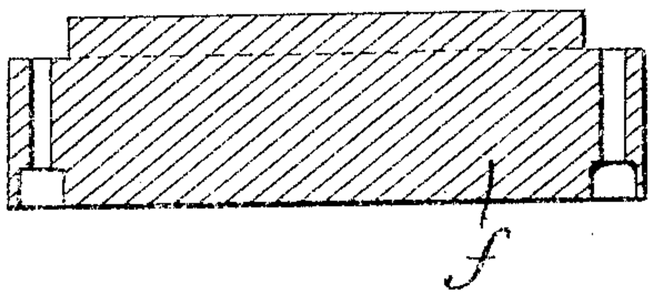


Fig. 3.

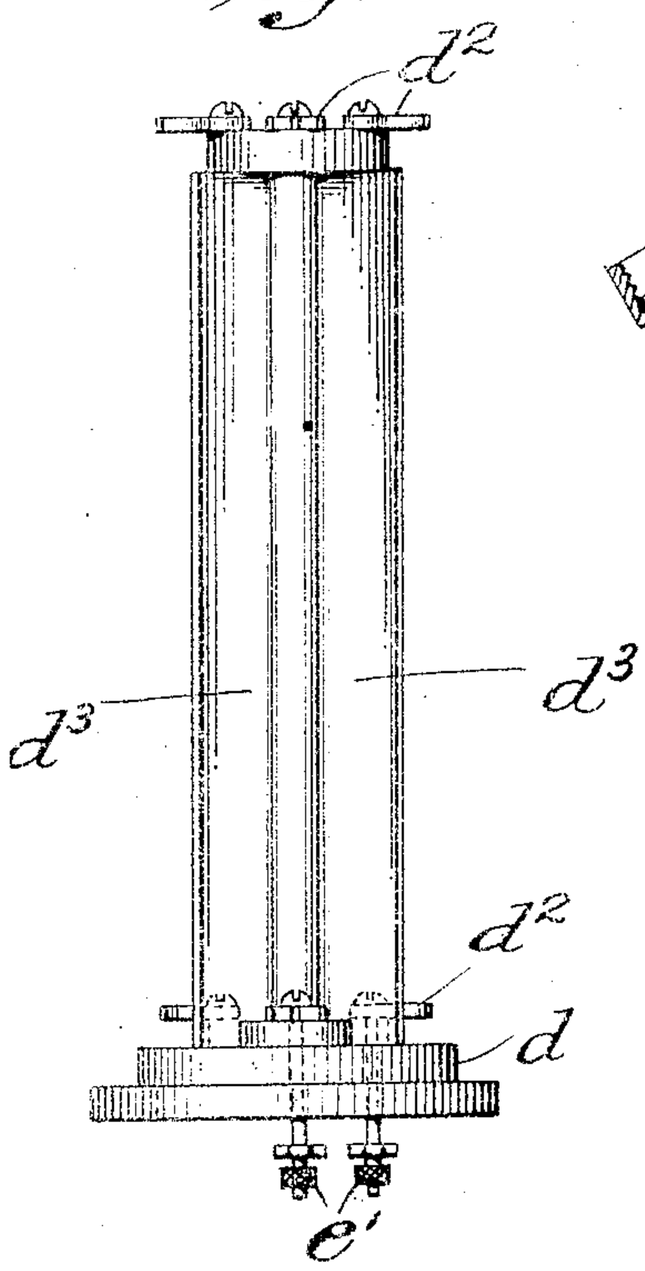


Fig. 6.

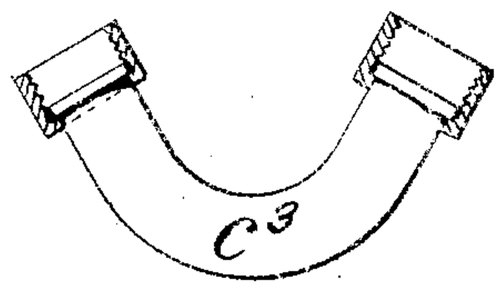


Fig. 4.

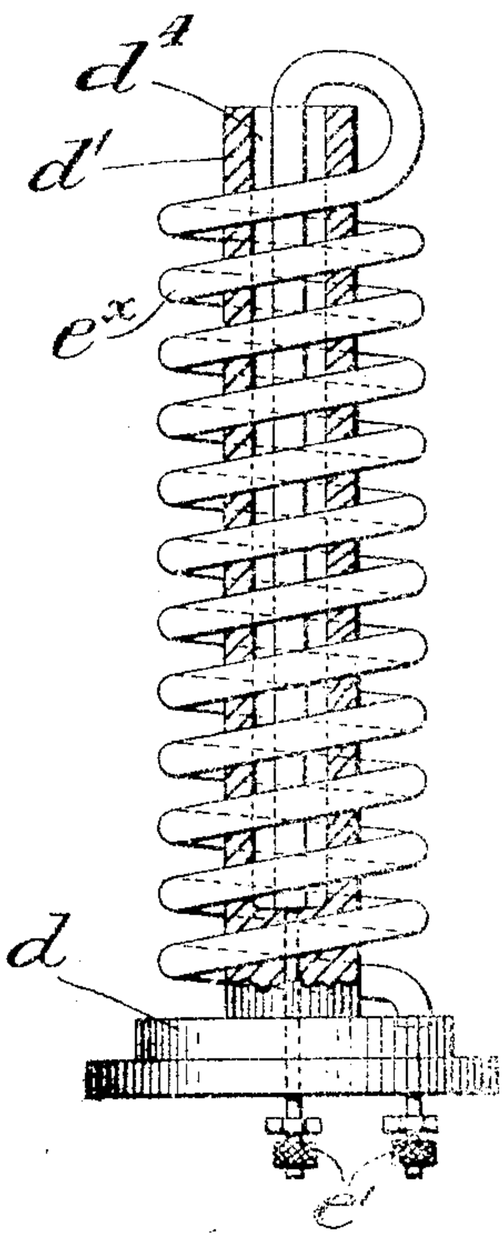
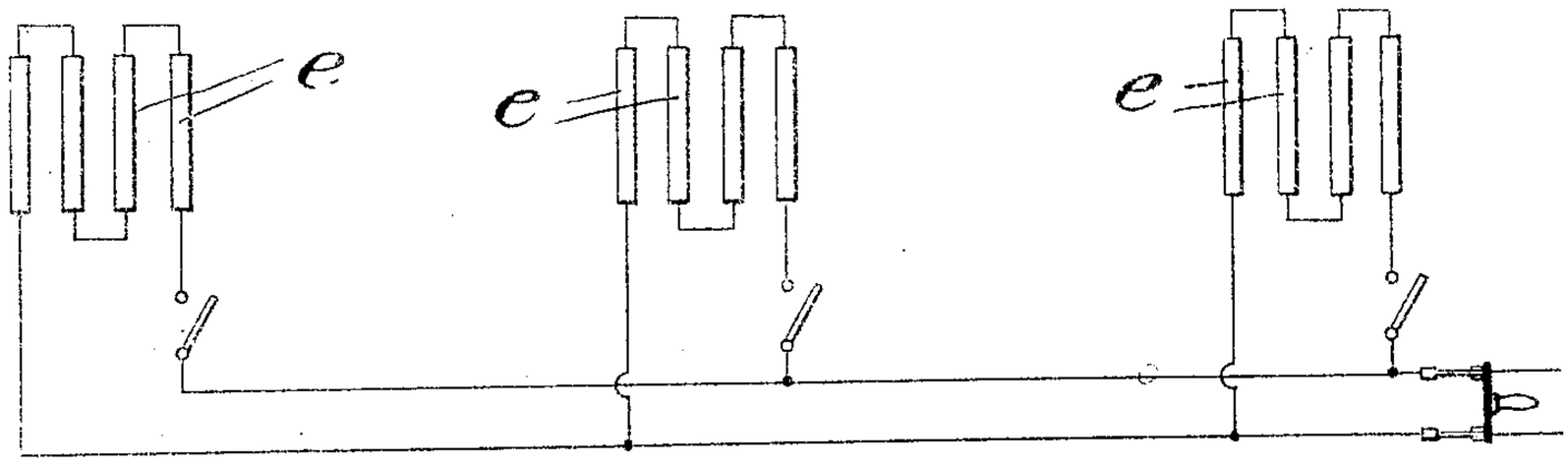


Fig. 7.



Attest:

Edgar Worthington

Ella J. Krueger

Inventor:

by Eleazer I. Rains

Redding, Greeley & Austin

Atty's.

E. I. RAINS.

ELECTRICAL STEAM GENERATOR.

APPLICATION FILED FEB. 11, 1909.

944,050. Patented Dec. 21, 1909.

4 SHEETS—SHEET 4.

Fig. 8.

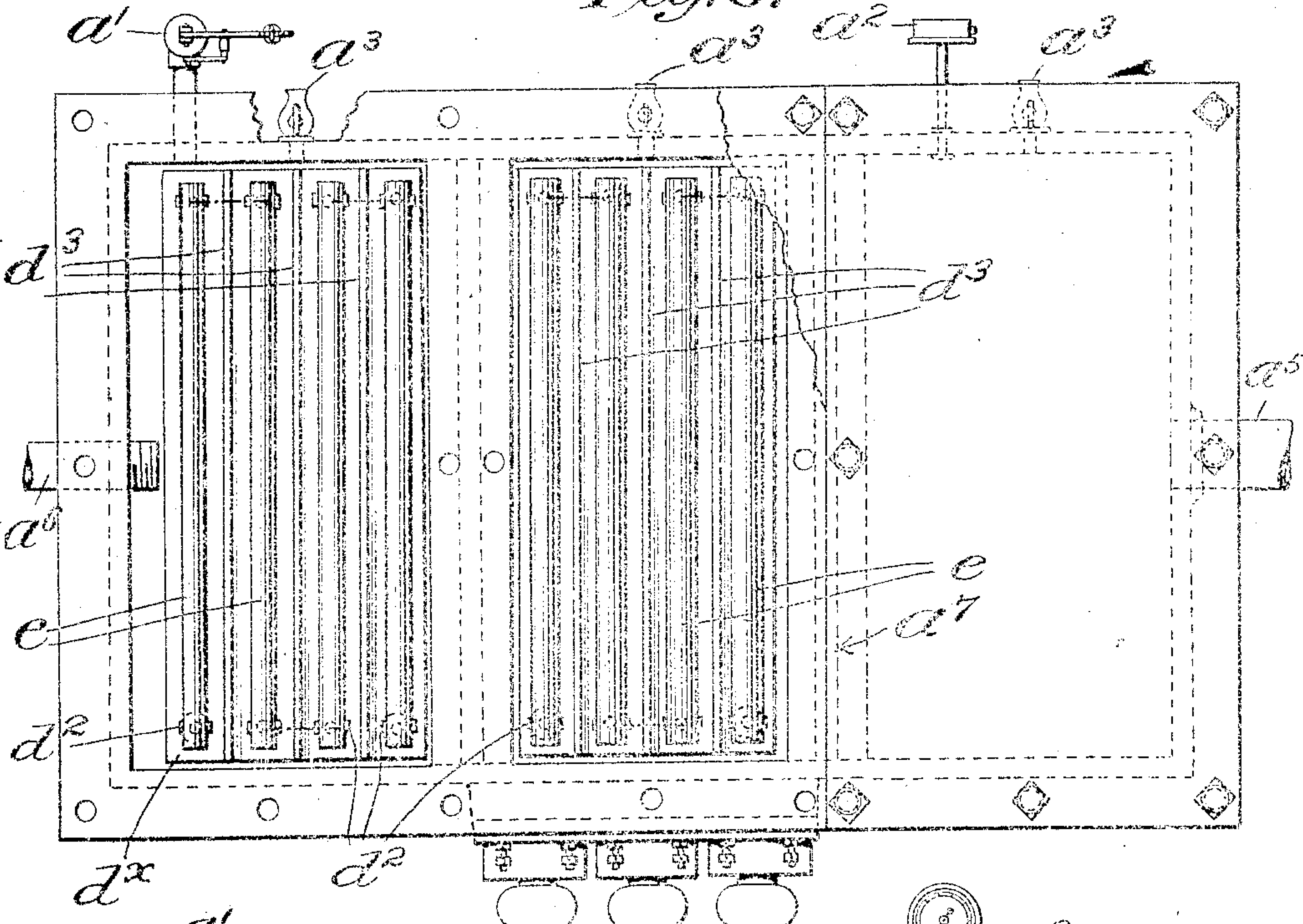
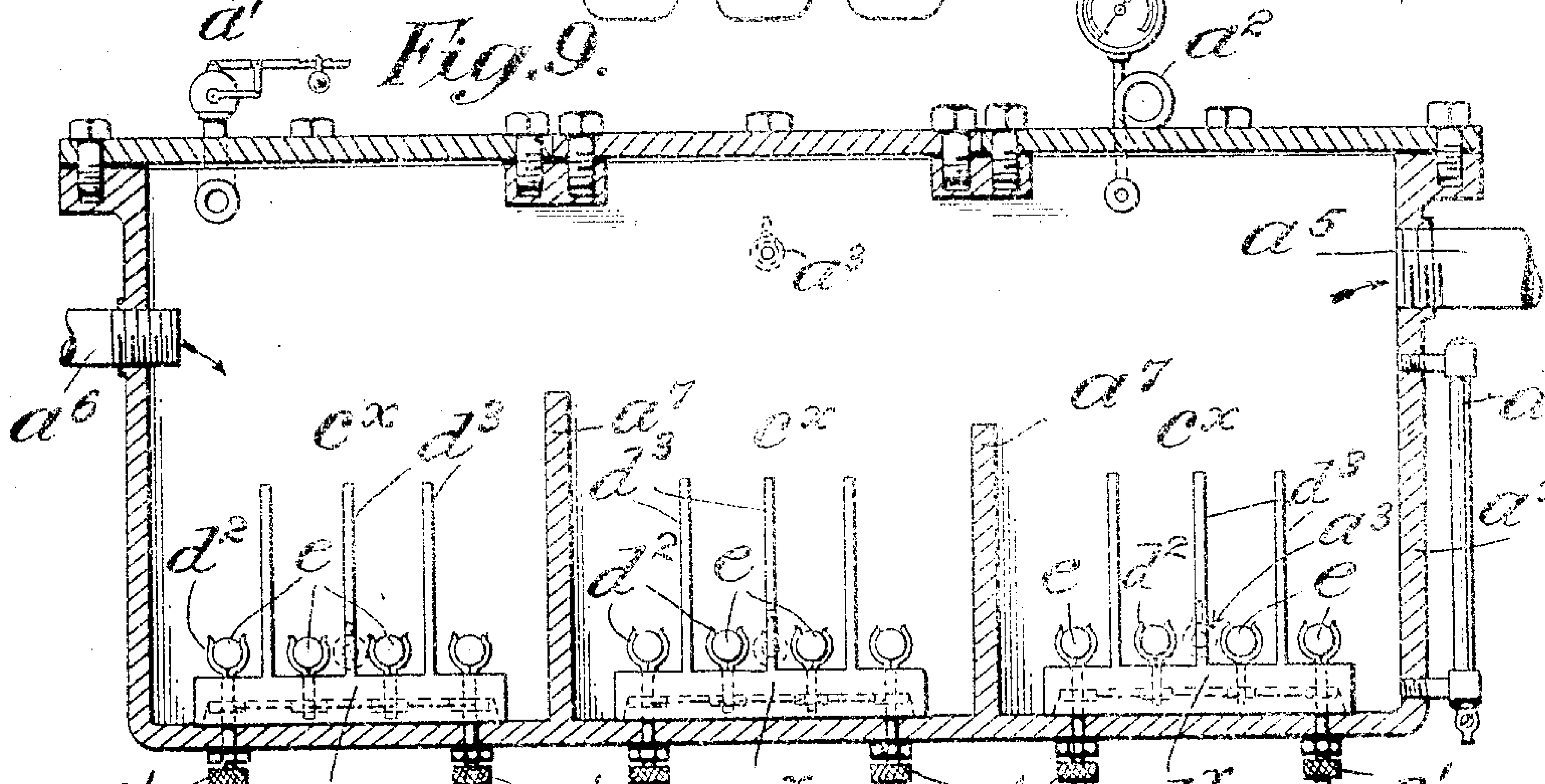


Fig. 9.



Attest:

Edgeworth Greene

Ella J. Kruger

Inventor:

Eleazer I. Rains

by Redding, Greeley & Austin

Att'ys.

UNITED STATES PATENT OFFICE.

ELEAZER I. RAINS, OF NEW YORK, N. Y.

ELECTRIC STEAM-GENERATOR.

944,050. Specification of Letters Patent. Patented Dec. 21, 1909.

Application filed February 11, 1909. Serial No. 477,391.

To all whom it may concern:

Be it known that I, ELEAZER I. RAINS, a citizen of the United States, residing in the borough of Manhattan, of the city of New York, in the State of New York, have invented certain new and useful Improvements in Electrical Steam-Generators, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

The general object of this invention is to produce a steam generator for use where electric current can be used more advantageously than fuel as the source of heat. In order that such a generator may be both efficient and economical it is desirable that the extent of the heating element in use at any one time be somewhat proportionate to the consumption of steam. In steam generators of this character as heretofore designed it has been proposed to vary the amount or extent of the heating element used without varying the volume of the water to be heated, but this plan has proved to be unsatisfactory in operation. In accordance with this invention, however, provision is made whereby the volume of water is varied according to the consumption of steam as well as the amount or extent of the heating element employed, so that the volume of water to be heated is proportionate both to the consumption of steam and to the amount or extent of the heating element employed. Practical operation shows that the employment of a plurality of independent, small generators, some or all of which may be used as conditions require, does not give satisfactory results, apparently through the waste of heating units. Under the present invention, therefore, two or more water containers, each fitted with its own heating element, are disposed within a common steam container, which may also receive more or less of the water heated in the separate containers.

The invention will be more fully explained hereinafter with reference to the accompanying drawings in which different embodiments thereof are illustrated and in which—

Figure 1 is a view in vertical section of a vertical cylindrical generator constructed in accordance with the invention. Fig. 2 is a top view thereof with the top plate removed. Fig. 3 is a detail view in elevation of one of the heating elements. Fig. 4 is a detail view, partly in section, of a different form of a heating element. Fig. 5 is a detail view in section of a substitute bottom plate, which may be employed when one of the water containers is cut out. Fig. 6 is a detail view of a connection which may be employed to connect two of the containers when another intermediate container is cut out. Fig. 7 is a diagrammatic view of the electrical connections. Fig. 8 is a top view, with a portion of the top plate removed, of a rectangular generator which embodies the invention. Fig. 9 is a view in vertical longitudinal section of the generator shown in Fig. 8.

In the embodiment of the invention represented in Figs. 1 and 2 of the drawings, there is provided a steam tight casing a, of sufficient strength to withstand, with a due margin of safety, the steam pressure to be generated therein, and of a size suited to the duty to be performed and to receive within it the required number of separate water containers. The primary purpose of the shell or casing a is to act as a common steam dome and steam receptacle for the several containers in which the steam is generated, and it might be adapted for that purpose only, but it may also, as represented in the drawings, be adapted to receive a body of water about the separate containers and may be provided with a safety valve a', a steam gage a^2, pet cocks a^3 and a gage glass a^4, which at its upper end opens directly into the steam space above the water containers and at its lower end is connected with the battery of water containers. The shell or casing is suitably connected, as at a^5, to the steam line. The bottom plate b of the shell a is adapted to support the several water containers c, and in order to permit of easy repair or of the easy disconnection of any one of the battery of water containers, each of such water containers is preferably inserted through the bottom plate b from the outside and is supported by a plate b' held by bolts or screws b^2 to the bottom plate b.

Each water container c, in the construction shown in Figs. 1 and 2, consists of a cylindrical vessel, open at its upper end, so as to discharge steam freely into the steam dome, such vessel having a bottom plate or head c' which is adapted to receive and support the electrical heating element hereinafter described. A water supply pipe a^6, passing through the wall of the casing a, supplies water to the battery of water con-

tainers in any convenient manner. As shown it delivers water to one of such water containers c and water is thence conducted to the other water containers in succession by a suitable connection c^2 near the top, so that the body of water in each container is separate from and independent of the body of water in each of the other containers, so far as the generation of steam therefrom is concerned. Suitable connections, such as are shown, for example, at c^3 in Fig. 6, may be provided for so connecting different containers of the battery as to permit any one to be cut out of operation and to be removed for repair. Any one or all of the containers may be connected to the gage glass a^4, as indicated at c^4 in Fig. 2.

In each of the water containers c is located an electrical heating element, the several heating elements being preferably connected, as indicated diagrammatically in Fig. 7. As shown in Figs. 1, 2 and 3, each heating element may consist of a base plate d with a vertical post or pillar d', of suitable non-conducting material, provided with suitable clips d^2 to receive the current resistant elements e, of graphite or other suitable material, in which the energy of the electrical current is converted into heat, and with suitable electrical connections e' which are extended through the base d and through the plate b'. The support or holder d, d' for the elements e is preferably formed or provided also with vanes or wings d^3 which stand out between the elements e, as clearly shown in Fig. 2. The elements e are connected at top and bottom alternately in series from the binding posts e'.

Another form of heating element is shown in Fig. 4, in which the post or pillar d', erected on the base plate d, is chambered longitudinally, as at d^4, and the resistant element $e^\times$ is coiled, in an open coil, around the outside of the post or pillar d', one end being connected to the corresponding binding post externally to the post or pillar d' while the other end is connected to the other binding post through the lower end of the post or pillar.

In case it should be desired to remove one of the heating elements for repair or any other purpose, there is provided a substitute bottom plate, shown at f in Fig. 5, which may be bolted or secured in place of the plate b' and the base of the heating element.

In the embodiment of the invention represented in Figs. 8 and 9, the shell or casing $a^\times$ is rectangular in shape and the independent water containers are formed therein by partitions a^7, which may be successively lower from the inlet end of the shell to the outer end, so as to permit the overflow water to pass from one to the other in succession. The casing may be provided as before with a safety valve a', a steam gage a^2, pet cocks a^3, a gage glass a^4, a water inlet a^6 and a steam outlet a^5. In each water container $c^\times$ is an independent heating element, constructed substantially as previously described but changed in form so that it may be adapted to the rectangular water container. As shown, it comprises a supporting block or plate $d^\times$ provided with suitable clamps d^2 to support the heating rods e, which are connected in series with the binding posts e' which pass through the bottom of the shell $a^\times$. The block $d^\times$ is provided with walls d^3 to prevent the jumping of electric current from one rod to another.

In the use of the improved generator all of the energy of a heating element is applied in the heating of a body of water, the volume of which is such as to secure the greatest economy and the greatest efficiency in the use of the electric current, while the capacity of the whole generator may be regulated according to requirements by using a suitable number of the independent water containers and their heating elements. Moreover, since all of the water containers and their heating elements are combined in one structure, with a common steam space, the waste of heat through radiation into the atmosphere, when only a portion of the water containers and heating elements are in use, is reduced to a minimum, the heat which is not used in one of the water containers in developing steam therein being taken up by the water in an adjacent container which is not then in use. Furthermore, repairs can be made readily at any time without requiring more than a brief discontinuance of the use of the whole generator, since the heating element can be removed easily from any one of the water containers and suitable connections made between the remaining water containers and heating elements to permit the use of such remaining water containers and heating elements to be continued.

It will be understood that the form and arrangement of the outer shell or casing and of the water containers and their heating elements and connections may be varied to suit different conditions of use, and that the invention is not, therefore, restricted to the precise construction and arrangement shown and described herein.

I claim as my invention:

1. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers therein, each adapted to receive and hold a body of water separate from and independent of that in each of the other containers, and communicating with a common steam space, and a plurality of independent electrical heating elements distributed in the several water containers, whereby the water in each container may be heated independently of that in the other containers.

2. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers therein, each adapted to receive and hold a body of water separate from and independent of that in each of the other containers, and communicating with a common steam space, connections whereby water is supplied to one of said containers and from one to another and a plurality of independent electrical heating elements distributed in the several water containers, whereby the water in each container may be heated independently of that in the other containers and whereby water may be passed from one container to another in series.

3. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers therein, each adapted to receive and hold a body of water separate from and independent of that in each of the other containers, and communicating with a common steam space, and a plurality of independent electrical heating elements distributed in several water containers, each of said heating elements comprising an insulating support, a heating rod mounted on said support and electrical connections extended through the outer wall of the shell or casing.

4. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers therein, each adapted to receive and hold a body of water separate from and independent of that in each of the other containers, and communicating with a common steam space, and a plurality of independent electrical heating elements distributed in the several water containers, each of said heating elements comprising an insulating support, a plurality of heating rods mounted on said support and insulating walls between said rods to prevent the jumping of the current from one to another.

5. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers therein, each adapted to receive and hold a body of water separate from and independent of that in each of the other containers, and communicating with a common steam space, a plurality of independent heating elements distributed in the several water containers, each of said heating elements consisting of a base plate with a vertical pillar and radially extending insulating wings, heating rods mounted on said support and connected in series and electrical connections to said rods.

6. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers inserted through the bottom of said casing and each container being adapted to receive and hold a body of water separate from and independent of that in each of the other containers, plates secured to the bottom of the shell or casing to support and retain the water containers, and a plurality of independent electrical heating elements distributed in the several water containers.

7. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers inserted through the bottom of said casing and each container being adapted to receive and hold a body of water separate from and independent of that in each of the other containers, plates secured to the bottom of the shell or casing to support and retain the water containers, and a plurality of independent electrical heating elements distributed in the several water containers, each of said heating elements comprising a supporting plate or post and heating rods, such heating elements being inserted through the bottom of the water container and held in position by said plate.

This specification signed and witnessed this 9th day of February, A. D., 1909.

ELEAZER I. RAINS.

Signed in the presence of—

ELLEN J. KRUGER,

AMBROSE L. O'SHEA.