(No Model.) 3 Sheets—Sheet 1.

R. G. FERGUSON.

PORTABLE STEAM GENERATOR AND RADIATOR COMBINED.

No. 399,512. Patented Mar. 12, 1889.

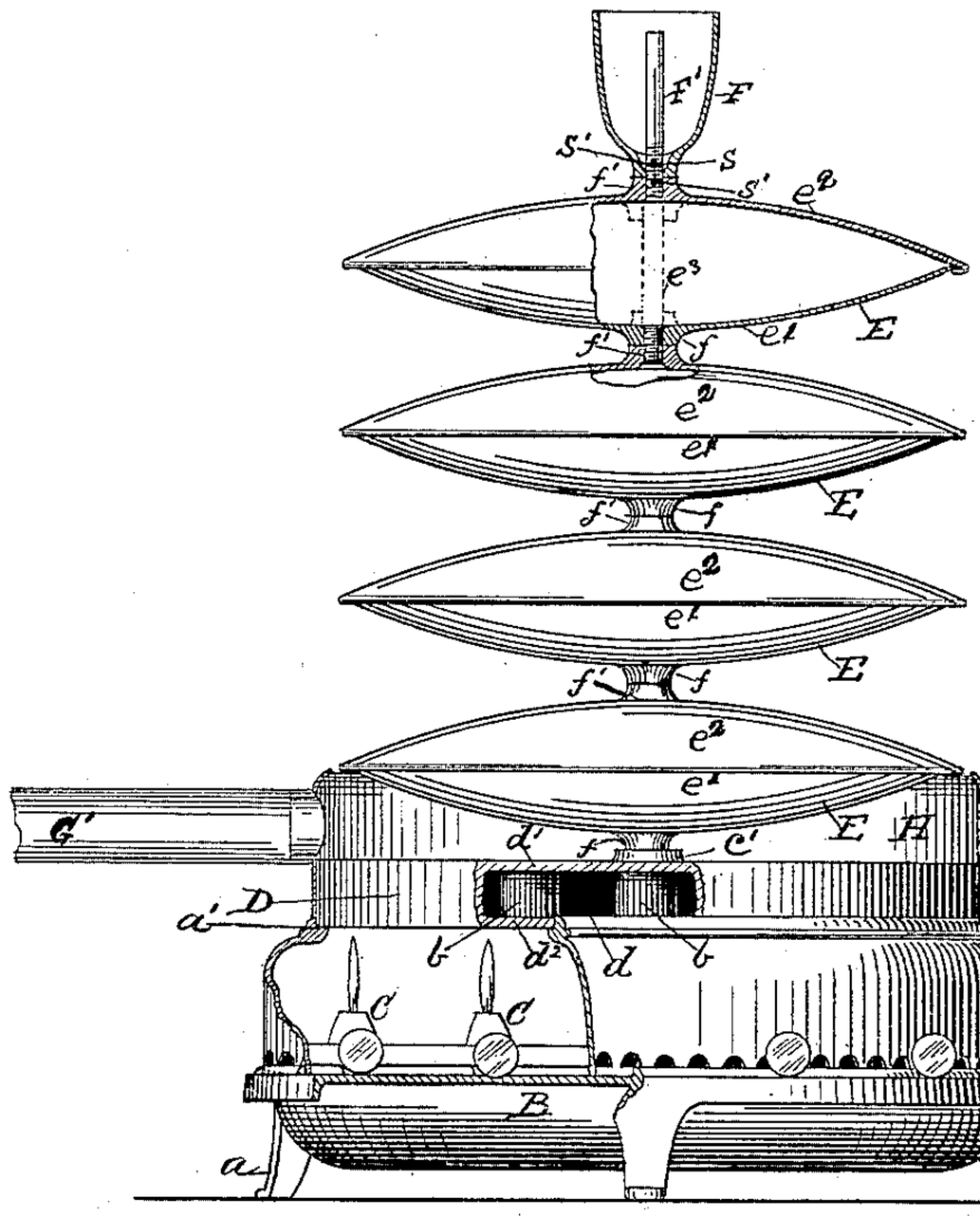


Fig. 1.

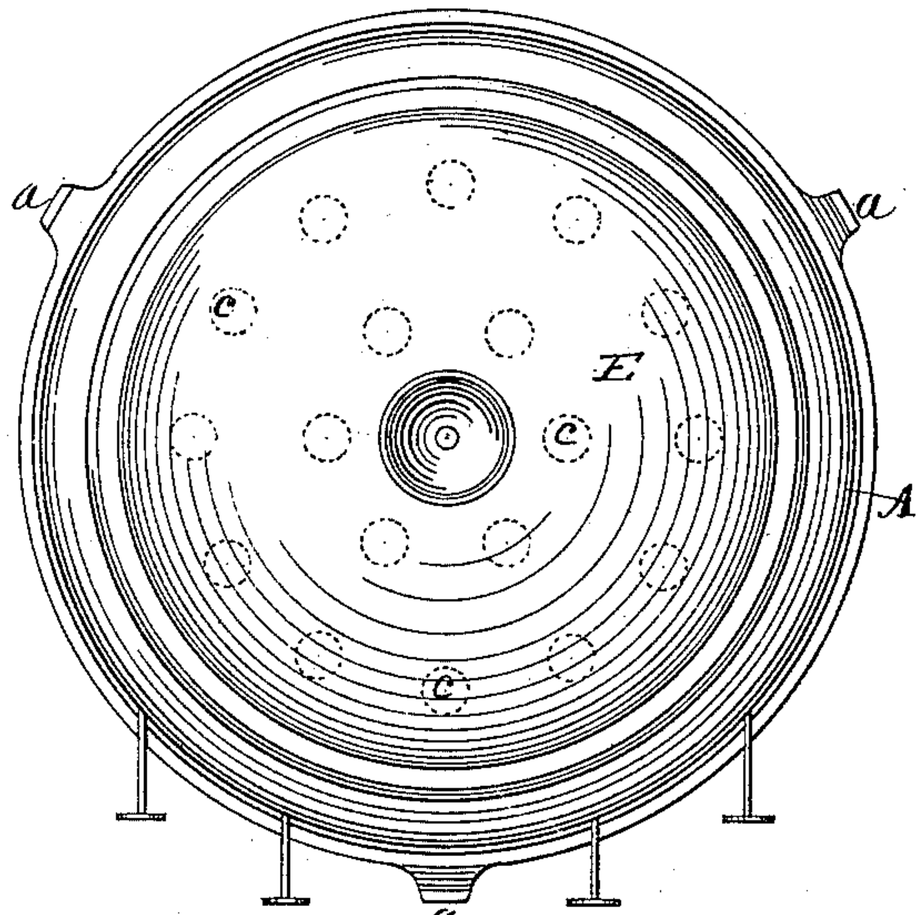


Fig. 2.

Witnesses:
Charles Dewey.
Calvin Shaffer.

Robert G. Ferguson
Inventor:
by his atty. Alex Gilkinson

(No Model.) 3 Sheets—Sheet 2.

R. G. FERGUSON.

PORTABLE STEAM GENERATOR AND RADIATOR COMBINED.

No. 399,512. Patented Mar. 12, 1889.

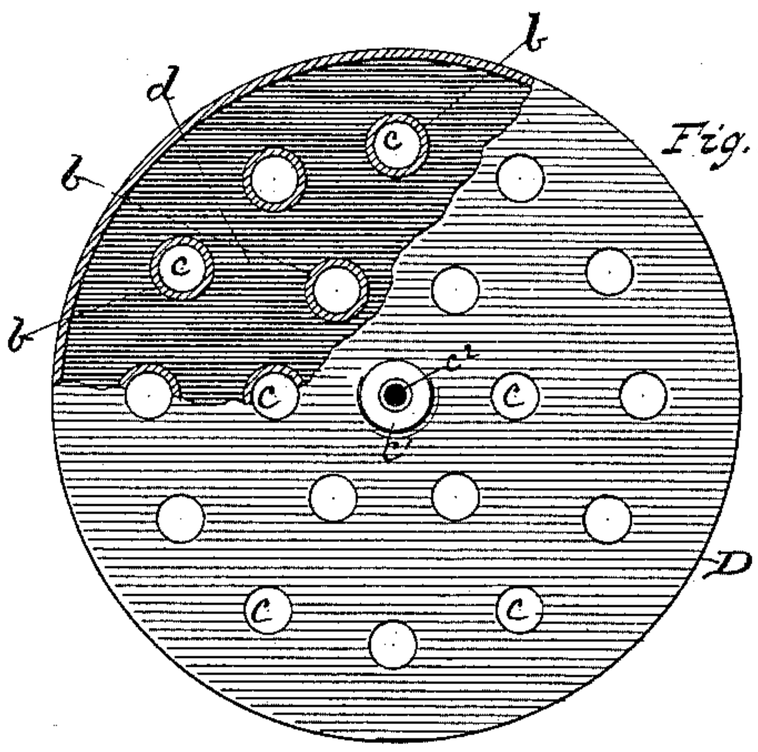


Fig. 3.

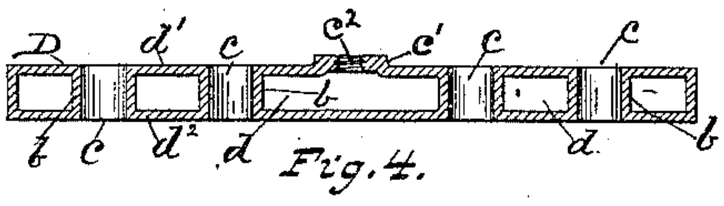


Fig. 4.

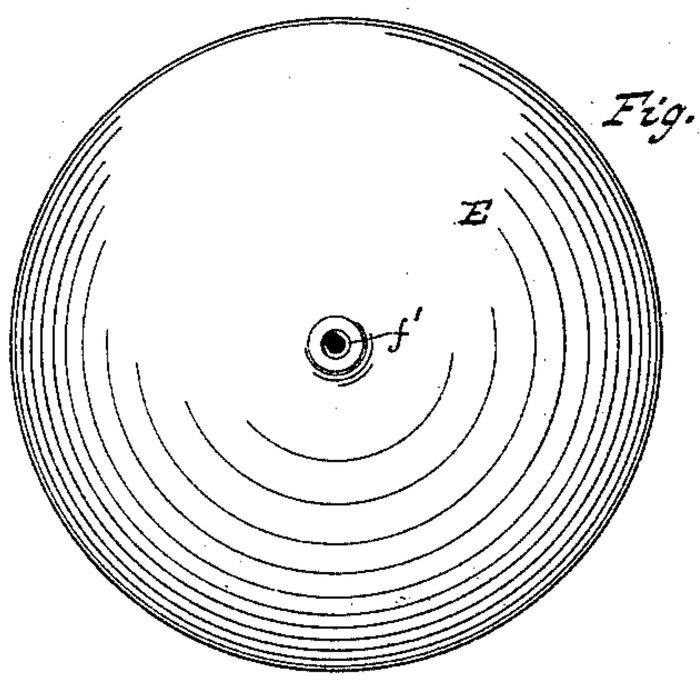


Fig. 5.

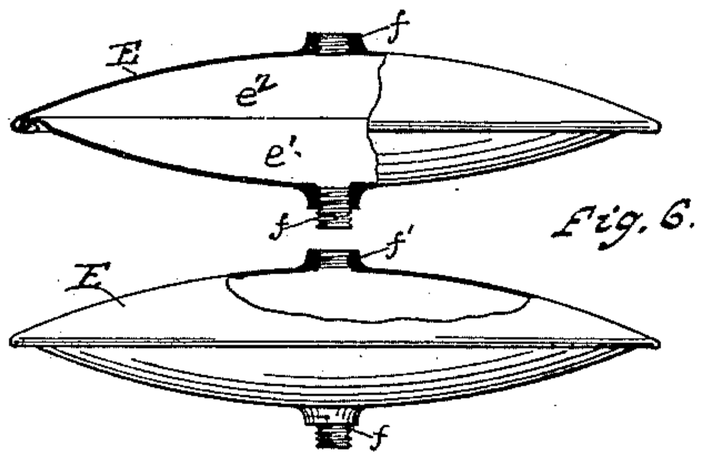


Fig. 6.

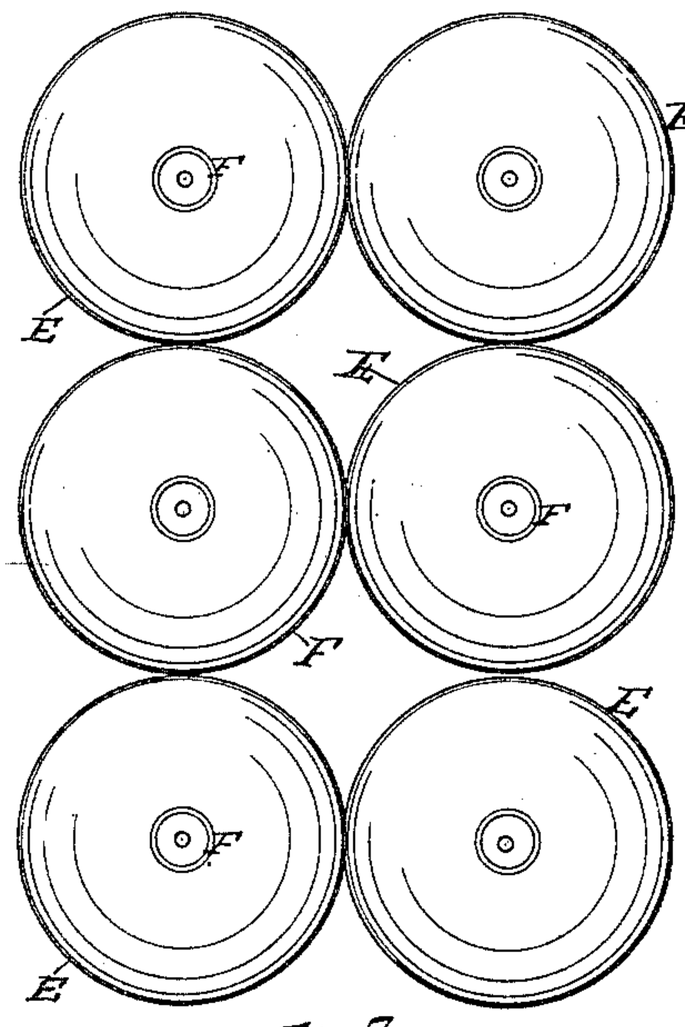


Fig. 7.

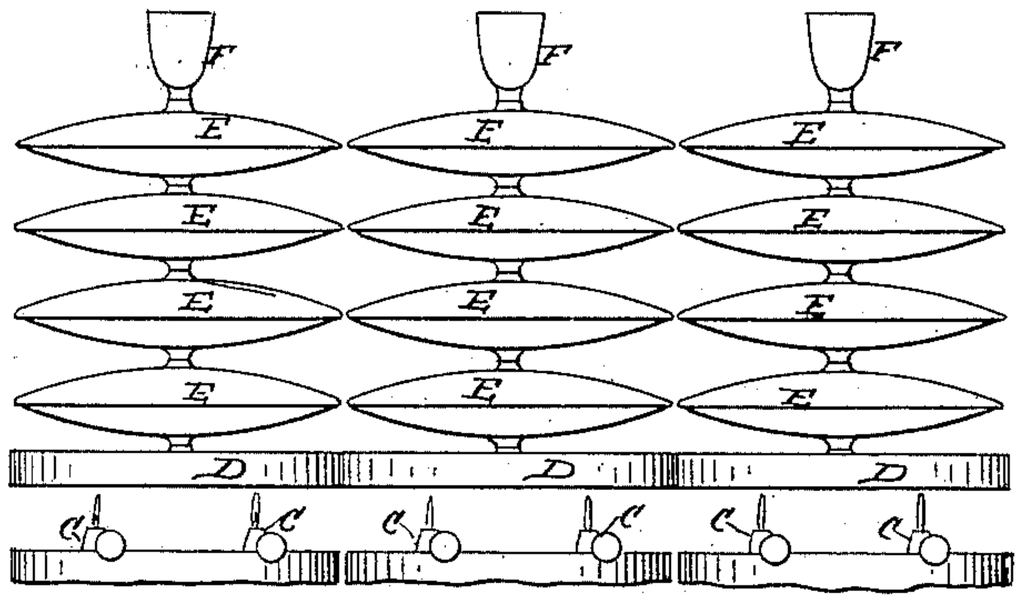


Fig. 8.

Witnesses:
Charles Seeger.
Edwin Shaffer

Robert G. Ferguson
Inventor.
by his Attorney
Alex Bell Kirk

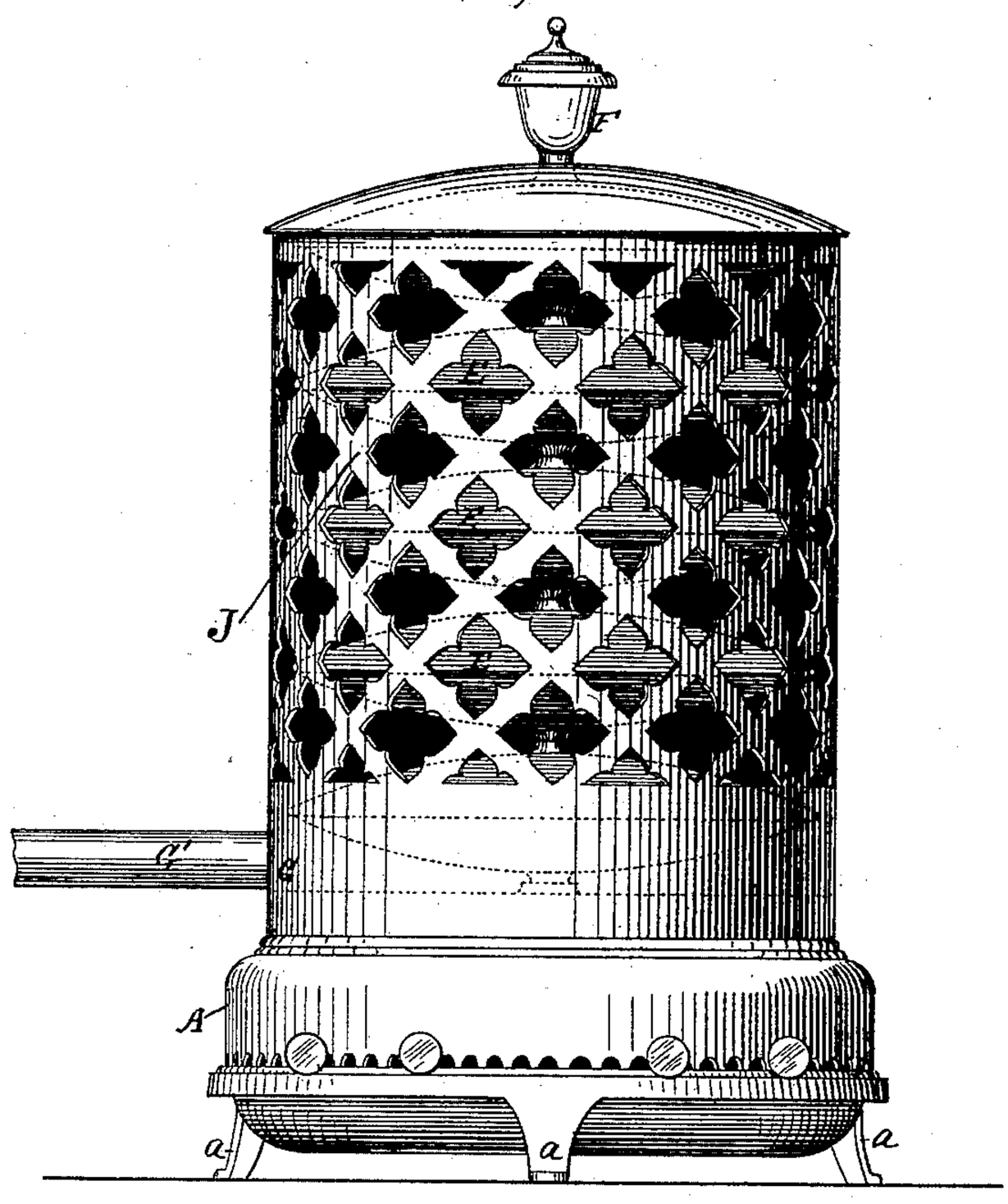
(No Model.) 3 Sheets—Sheet 3.

R. G. FERGUSON.

PORTABLE STEAM GENERATOR AND RADIATOR COMBINED.

No. 399,512. Patented Mar. 12, 1889.

Fig. 9.



Witnesses:
Chas. Seeker
Calvin Shaffer

Robert G. Ferguson
Inventor.
by his attorney
Alex. Gelbert

UNITED STATES PATENT OFFICE.

ROBERT G. FERGUSON, OF SARATOGA SPRINGS, NEW YORK, ASSIGNOR OF ONE-HALF TO OSCAR A. DAY, OF SAME PLACE.

PORTABLE STEAM GENERATOR AND RADIATOR COMBINED.

SPECIFICATION forming part of Letters Patent No. 399,512, dated March 12, 1889.

Application filed November 15, 1887. Serial No. 255,182. (No model.)

To all whom it may concern:

Be it known that I, ROBERT G. FERGUSON, a citizen of the United States, residing at Saratoga Springs, in the county of Saratoga and State of New York, have invented certain new and useful Improvements in Portable Steam Generators and Radiators Combined, of which the following is a specification.

My invention relates to a portable steam generator and radiator combined; and it consists of the devices and elements hereinafter particularly described, and specifically set forth in the claims.

The objects of my invention are, primarily, to produce portable heating apparatus which will be light in weight, cheap in construction, and can be conveniently moved from one room to another or from one part of a room to another part thereof, and will combine, with a heating device which can be regulated at will, a steam generator and radiators, two or more, which can have their numbers increased or lessened at will, as may be suited to the weather or as the comfort of the occupants of the room may require; and, second, to provide specific combinations of devices and elements whereby my invention can be embodied in portable combined steam generators and radiators, whereby the heating capacity of the fuel-burning devices, and also of that of both the steam-generator and the radiators, can be increased or lessened at will and the operating parts of the apparatus be so controlled that their operations can be adjusted for increasing or lessening the heating power of the apparatus, as the weather or comfort of occupants of the room may require. I attain these objects by the means illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a side elevation of my improved combined steam generator and radiator with portions of parts broken away to expose hidden or interior parts, portions, and elements. Fig. 2 is a plan view of the same. Fig. 3 is a view of the steam-generator with part broken away and illustrating its interior construction. Fig. 4 is a sectional elevation of the same. Fig. 5 is a view, from above, of a radiator having my improved form of construction. Fig. 6 is a side view of two radiators with parts broken away and illustrating their construction and means for uniting the same together and with the steam-generator. Fig. 7 is a plan view of a battery of steam-radiators. Fig. 8 is a sectional elevation of a battery of combined steam generators and radiators. Fig. 9 is a side elevation of my improved apparatus with its outer perforated casing in place.

The same letters of reference refer to like parts throughout the several views.

In the drawings, A represents any suitable base for supporting the heater, the generator, and the radiators. This base can be made of any suitable metal, either cast or sheet, and with any suitable form as will adapt it to support the several parts of the superstructure, and is provided with suitable legs, *a a*, by which it will have support from the floor.

B is a tank for holding any suitable liquid fuel for burning beneath the steam-generator.

C C are burners of any selected construction for burning with a heating-flame the liquid fuel in tank B.

D is the steam-generator, made preferably of cast metal, and having in it the shallow water-chamber *d*, of about one inch in vertical extension, and a series of tubular form of perforations, *c c*, extended from the lower side of the bottom shell of this generator to the upper side of the top wall of the same, as shown in Figs. 3 and 4. The walls *b* of these tubular perforations *c c* are preferably cast or made connected with the walls d' d^2 of the generator, and serve to stay the said walls and hold them from deflecting when under pressure from the steam within, and they also serve as flues for the passage of the heat and products of combustion from the fuel burning at the burners C C below said generator to and against the lower side wall of the lowermost radiator of the series employed, so as to highly heat said wall. Made at a point about central in the top wall, d', of this generator is a boss or projecting ring-form flange, c', which is provided with an internal screw-thread, c^2, for securing it to a radiator in a convenient manner, and with a steam-tight joint. This generator is seated in an annular

seat, a', made with the base A, as shown in Fig. 1, and can be readily placed in situation in said base or removed from the same. Although the drawings show this generator to be made with all of its parts above described in solid connection, as of cast metal, yet, if selected, the upper and lower walls and annular wall, together with the walls of the several tubular perforations, can be made of sheet metal and of iron or copper, with said walls united in a steam-tight manner.

E E are radiators made each of a pair of concavo-convex disks or plates, e' e^2, of metal, and preferably of sheet copper or brass, struck up in form under dies or by any other known means. These disks or plates e' e^2 can be circular, as shown, or be square, oval, or oblong, as may be preferred, and are each securely united to the other all around at their edges in a steam-tight manner, and preferably by means of double-seaming the edges of the two plates, as shown in Fig. 6. These radiators are made, preferably, from ten to twenty inches in diameter and with about from two to three inches extension of chamber in a vertical direction at their centers. When made with largest diameters, these plates e' e^2, composing the radiator, can be stayed from being distended at the centers by tubular form of stays e^3, secured to the two shells or plates, as indicated by dotted lines in Fig. 1, and when stayed I prefer to unite these tubular form of stays to said plates by means of suitable screw-threads made with each said disk or plate and the ends of the tube forming the stay; and I would perforate the wall of this tubular-form stay to permit steam to freely pass from the interior of the same to the chamber of the radiator. The lower plate, e', of one radiator E has made at about its center a the screw-threaded hollow nipple f, corresponding in size and screw-thread with the size and screw-thread of the central perforation of the ring-form flange or boss c' of the steam-generator, so that the said radiator can at will be securely attached to said generator in a steam-tight manner or be removed, as may be required. The upper plate, e^2, of each radiator E is provided with a ring-flange having a central screw-threaded opening, f', and each of the lower plates, e', of the radiators above the lowermost one of the series is provided with a hollow screw-threaded nipple, f, corresponding in size and screw-thread with the screw-threaded openings f' of the upper plates of the radiators, so that these radiators can be readily united with each other in a steam-tight manner with the lowermost one connected with the steam-generator below, all substantially as shown in Fig. 1, and, being thus connected or united, these radiators will be in situation one vertically over the other, with their radiating-surfaces relatively horizontal and in position in reference to each other to admit a circulation of the air to be warmed between the plates of neighboring radiators, so as to be effectively acted on by the heat from said plates. The plate forming the lower wall, e', of the lower one of the series of these horizontal radiators E is directly over the steam-generator D, and also directly over the walled vertical perforations c c provided in the said steam-generator, so that the products of combustion from the burners will, after heating the walls of said steam-generator and passing through the said perforations c, heat the said lower side wall, e', of the said lower heater E, and thereby contribute to increase the temperature of the steam contained within the chamber of said lower radiator, and also operate to reconvert the condensed water being constantly received on the upper side of the said lower side wall, e', of this lower radiator E from the radiator above into steam. By thus utilizing the heat from the burners after its passage through the walled perforations c c of the steam-generator by heating the lower side wall of the lower radiator I am enabled to make more effective for warming purposes all the other radiators above the lower one, as the steam from the latter will communicate with the other radiators and highly heat the walls of the same.

F is the water-measuring vessel, connected with the uppermost radiator in a water-tight manner. This vessel can be made with a size as will give it capacity for holding, when filled, the quantity of water required to charge the generator, or it can be made of size to require two fillings of water to make a single charge.

F′ is a tubular-form plug which has its upper end tightly closed, while its lower end is open, and has made on its periphery a screw-thread, s, by which it will be screwed into the bottom of said vessel and into the screw-threaded opening in the radiator. The lower end of this tube has made in its wall one or more perforations or outlets, s'. When this tube is screwed into place in the radiator and the bottom of the vessel F to a distance sufficient to carry the outlet-openings s' below the surface of the bottom of vessel F, as shown in Fig. 1, that vessel can be filled with water, and the water will be held from escaping; and when filled with water the operator will screw this plugging-tube downwardly until one or more of the outlet-openings s' is uncovered, when the water will readily run out of said vessel into the radiator or radiators below and thence into the generator below. When a sufficient quantity of water has been introduced into the radiators and generator, the tubular plug F′ will be screwed upwardly again into place, so as to effectually close the opening of the vessel F to the radiator, when the apparatus will be ready for operation.

G is an inclosing-wall between the upper side of the generator and the lower side of the lowest radiator, and G′ is a tube or pipe leading from the chamber H contained within this wall G to a fire-place or to any flue or pipe in the wall or room, and through which the gases from the burners will be drawn from the ap-

paratus. By means of this wall G and pipe G′ the products of combustion, after heating the lower side wall, *e′*, of the lower radiator E, will be drawn to a suitable exit, and this draft, produced by means of the pipe G′ drawing from the chamber II, between the lower radiator and the steam-generator, will stimulate the combustion of the fuel, which will burn with the best character of flame, and burn without any escape of gas or smell in the apartment where this apparatus is located.

J is an open-work inclosure or jacket which incloses the several radiators to prevent persons from touching the same, and at the same time permit the air to have ready passage to and from the radiating surfaces of the several radiators. This jacket can be made plain or ornamental, and preferably of thin sheet metal.

In large-sized steam generators and radiators I use (to increase the capacity of the apparatus) groups or batteries of two or more, as shown in Figs. 7 and 8. These batteries can be made to have their several generators and radiators supported by a suitable base, and each generator in the battery will have its own set of burners C, and each steam-generator and its connected radiator in the battery will be made to be without communication with the others in the same, so that in a battery of, say, six steam-generators, D, and radiators E E, belonging to each generator, any one or more of the number of generators, or all of them, can be used at a time. In milder weather one or two of the generators can be heated by the burners operating with them, and in cooler weather some one or more additional generators can be heated, while in very cold weather all of the generators can be operated with. It will therefore be readily understood that with several generators D and their respective sets of radiators E E arranged in batteries of two or more, with each generator having its own burners and having no communication with the other generators, and the radiators of one set having no communication with those of another set in the battery or with any other generator than the one they are attached to, the operations of the apparatus can be nicely regulated to suit all weathers and conditions of temperature, and the heat from the apparatus can be increased or lessened at will.

When the burners C are lighted, the heat from the same will act on the shell of the generator D and on the walls of the tubular openings *c c* and highly heat the same and the small quantity of water within, which water will be rapidly converted into steam, and this steam will rise and fill each one of the several radiators E with a greater or less degree of pressure, as the operator or attendant will adjust the flame of the burner to produce, and consequently the heat from the radiators will be increased or lessened correspondingly. As fast as the steam is condensed by reason of its contact with the cooler surfaces of the radiator, the water from this condensed steam will run down from one radiator to another by gravity toward or into the generator below, where the heat from the burners will at once operate to reconvert this water into steam, which will replace the steam condensing within the radiators above.

As a rule, one filling of water into the generator at the beginning of the cold season will suffice to the end thereof.

I have found that by ascertaining the amount of water which will be sufficient for a charge with the burners regulated to give the hottest flames for producing the greatest possible degree of pressure of the steam from this ascertained charge of water with the burners giving the greatest amount of heat I can dispense with steam-gage and safety-valve, so that the cost of the apparatus will be considerably reduced to the user, as well as to the manufacturer.

The several parts of this apparatus can be made of sheet metal, if selected, and when so made it will be very light, so as to be readily handled and moved from one place to the other.

If preferred, combustible vapors or gases can be used in lieu of liquid fuel when the burners are fitted for their use, as the same advantageous results in respect of cleanliness and control of the heating-flame will be secured by such use.

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

1. In a portable combined steam generator and radiator, the combination, with the steam-generator D, having its water-chamber of small vertical extension and provided with a series of vertical walled perforations, *c c*, all as described, of the burners C, situated directly beneath the said steam-generator, and the horizontal radiator E, having its lower side wall, *e′*, directly over the series of vertical perforations in said steam-generator and its chamber communicating directly with the chamber of the latter, substantially as and for the purposes set forth.

2. In a portable combined steam generator and radiator, the combination, with the steam-generator D, having its water-chamber of small vertical extension and provided with a series of vertical walled perforations, *c c*, all as described, and a series of two or more horizontal radiators, E E, having free communication with each other and with the steam-generator, of burners C C, situated beneath the said steam-generator, and the inclosed chamber II, situated between the latter and the horizontal wall *e′* of the said radiator, substantially as and for the purposes set forth.

3. In a portable combined steam generator and radiator, the combination, with the steam-generator D, having its water-chamber *d* of small vertical extension and provided with a series of vertical walled perforations, *c c*, all as described, and the burners C C, operating

below the said steam-generator, of a series of connected horizontal radiators, E E, composed each of concavo-convex walls e' e^2, as described, and situated one above the other and having free communication with each other, the lowermost radiator of the series being connected with the said steam-generator and having its lower side wall, e', heated by the products of combustion passing upwardly through the walled perforations in the said steam-generator, all substantially as and for the purposes set forth.

4. In a portable combined steam generator and radiator, the combination, with the steam-generator D, having its water-chamber of small vertical extension and provided with a series of vertical walled perforations, a combustion-chamber below the said steam-chamber and containing burners C, and the radiator E above said generator and communicating with it, of the chamber H between said radiator and generator, with the lower side wall, e', of the former forming the upper wall of said chamber H, and the pipe G′, leading from the said chamber to an exit, substantially as and for the purposes set forth.

5. In a portable combined steam generator and radiator, the combination, with the series of horizontal radiators E E, having each the horizontal concavo-convex walls e' e^2, and the chambers of which communicate each with the other, and the steam-generator D, having its water-chamber of small vertical extension and provided with a series of vertical walled perforations, c c, of a series of burners contained within an inclosed chamber situated underneath the said steam-generator, and heating through the walled perforations of the latter the lower side wall of the lowermost radiator of the series, and a liquid-fuel tank supplying the said burners with fuel, and the chamber H between the said steam-generator and the lower radiator and provided with an exit for escape of the products of combustion, substantially as and for the purposes set forth.

6. In a portable combined steam generator and radiator, the combination, with the uppermost one of the series of radiators E of the measuring-vessel F and the tubular plug F′, having its lower end screw-threaded and working in a screw-threaded opening in the bottom of the said vessel and communicating with the chamber of the radiator and having one or more openings, s, communicating with the chamber of said measuring-vessel, substantially as and for the purposes set forth.

7. The combination, with the portable combined steam generator and radiator above described, and consisting of a series of horizontal radiators, E E, formed each by concavo-convex walls e' e^2, and having their chambers communicating with each other, and a steam-generator, D, having its water-chamber d of small vertical extension and communicating with the lowermost one of the series of radiators, and having through it a series of vertical walled perforations, c c, which communicate above with the chamber H between this generator and the lower radiator and below with the combustion-chamber provided with a series of burners, of the open-work or perforated jackets K, inclosing the steam-generator and the several radiators of the series and supported from the base which supports the burners and steam-generators, all substantially as and for the purposes set forth.

ROBERT G. FERGUSON.

Witnesses:
L. R. RICH,
CLARENCE L. R. KAIN.