(No Model.) 3 Sheets—Sheet 1.

L. GUTMANN.

ELECTRIC HEATER.

No. 467,538. Patented Jan. 26, 1892.

Fig. 1.

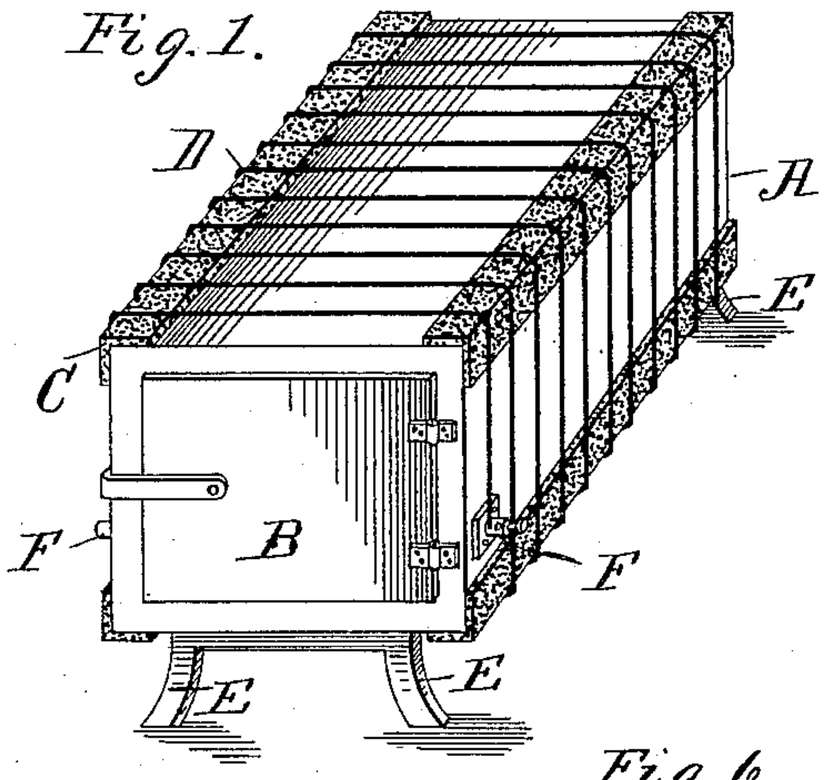


Fig. 2.

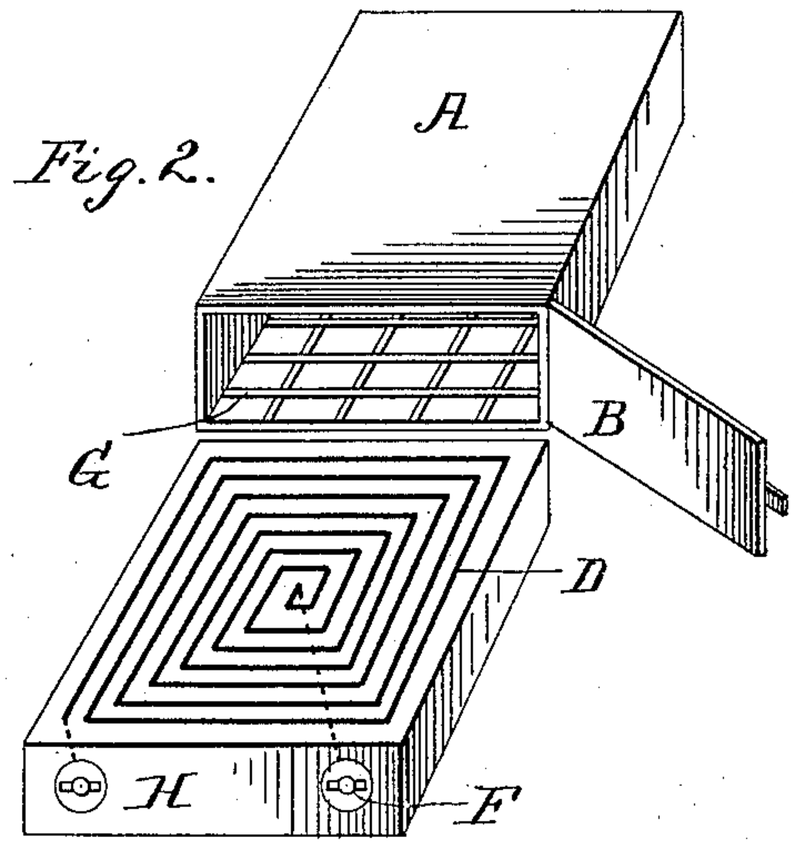


Fig. 6.

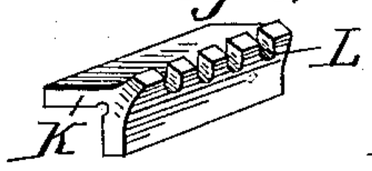


Fig. 3. H'''

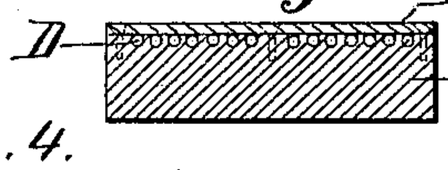


Fig. 5.

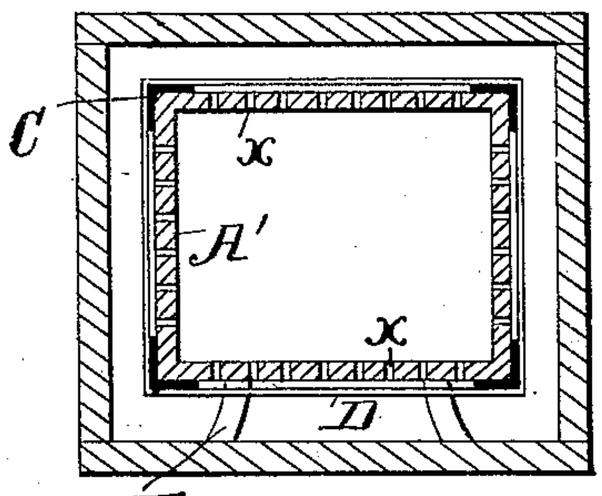


Fig. 4.

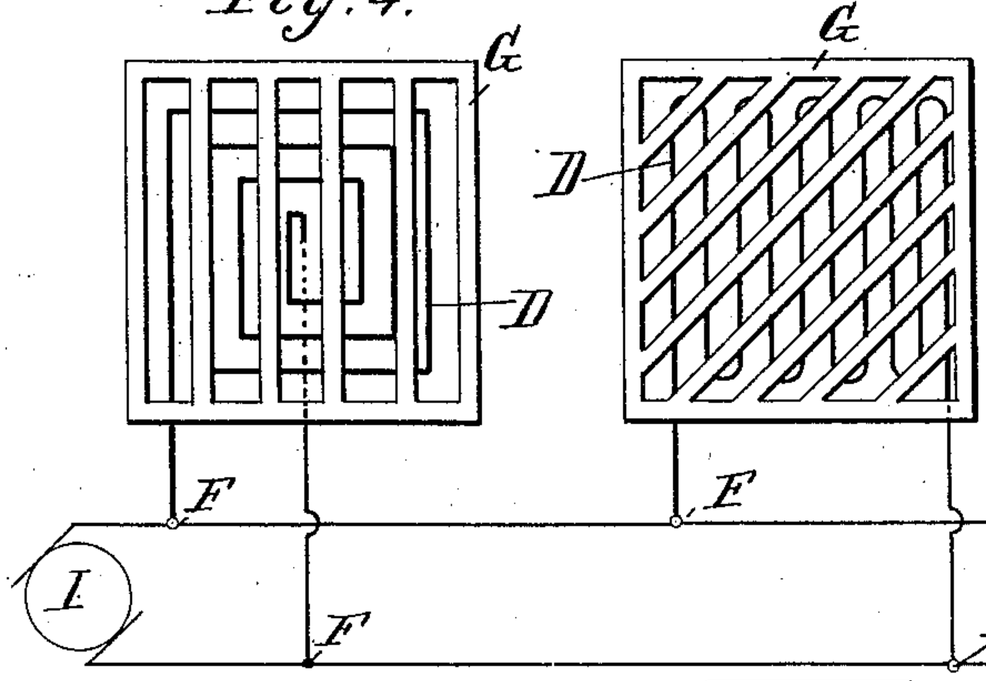


Fig. 7.

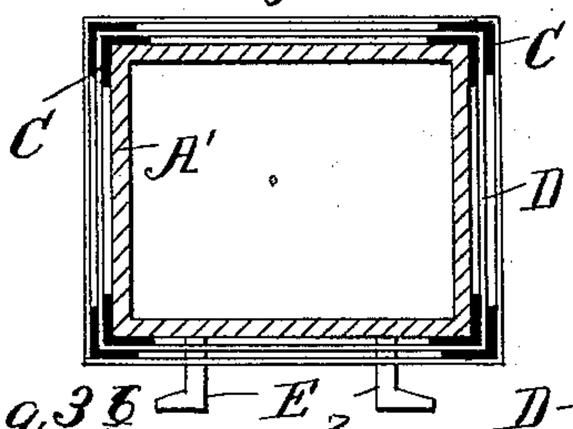


Fig. 3 a.

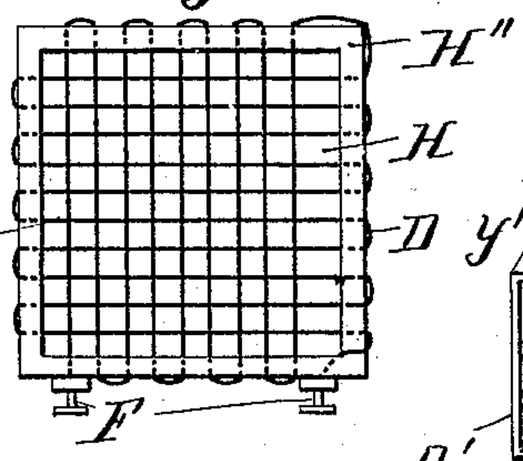


Fig. 3 b.

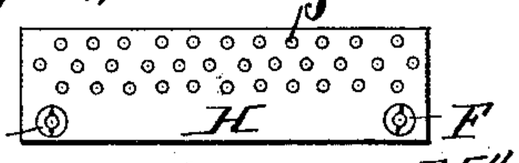


Fig. 3 c.

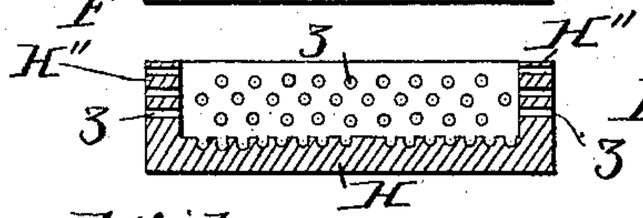
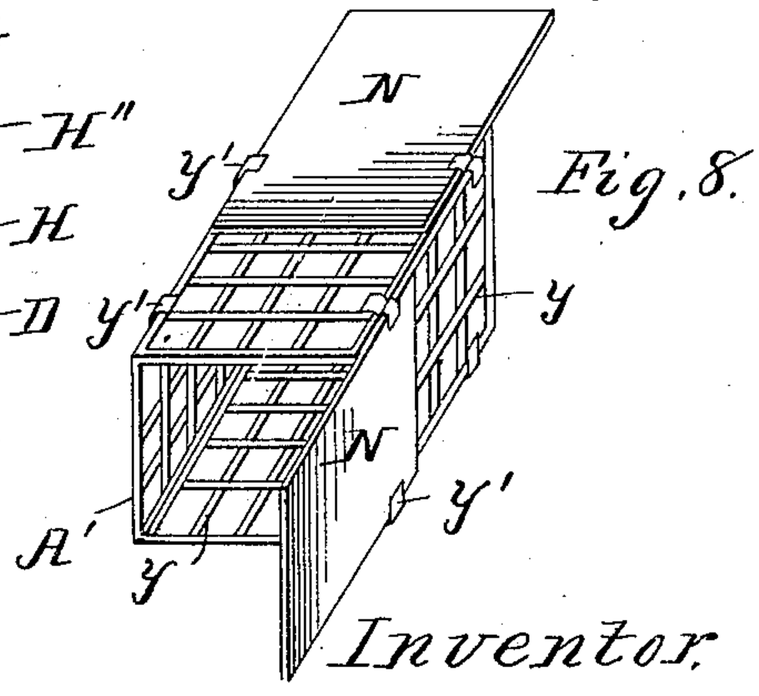


Fig. 8.



Witnesses

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BY HIS ATTORNEY.

Edward P. Thompson

(No Model.) 3 Sheets—Sheet 2.

L. GUTMANN.

ELECTRIC HEATER.

No. 467,538. Patented Jan. 26, 1892.

Fig. 9.

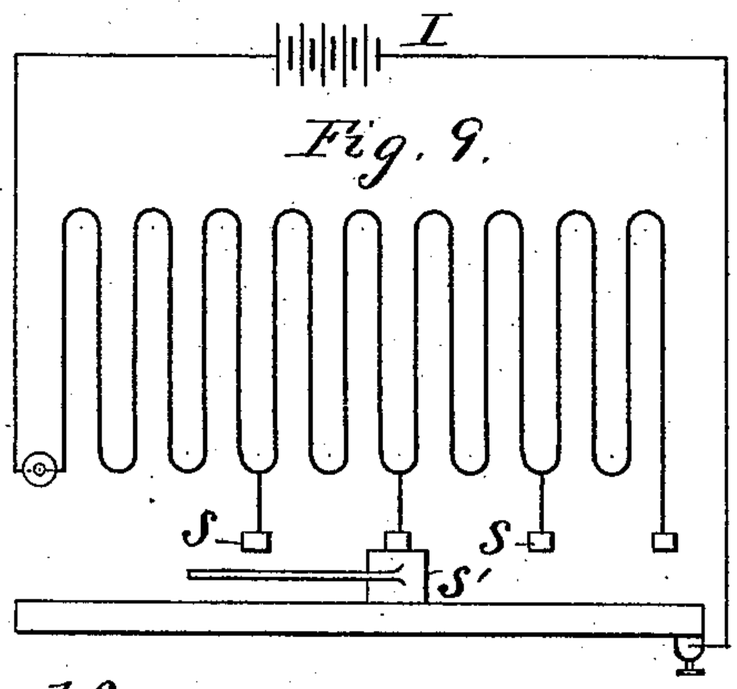


Fig. 10.

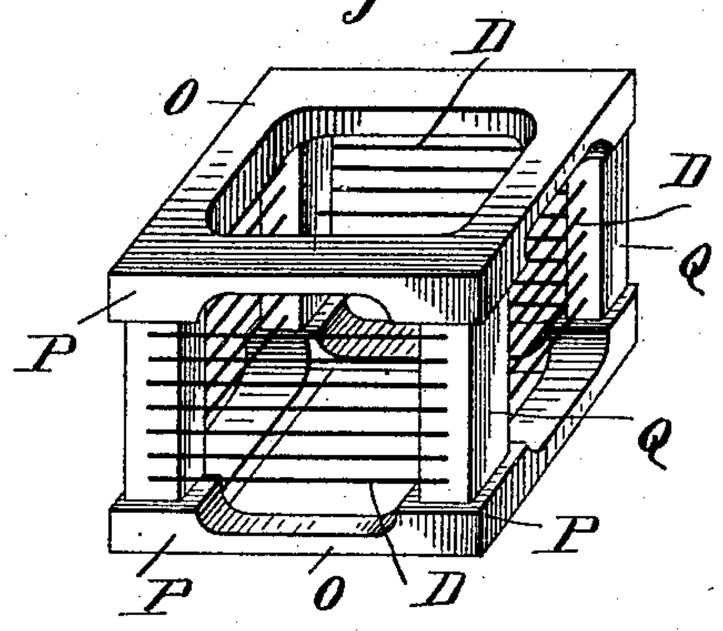


Fig. 12.

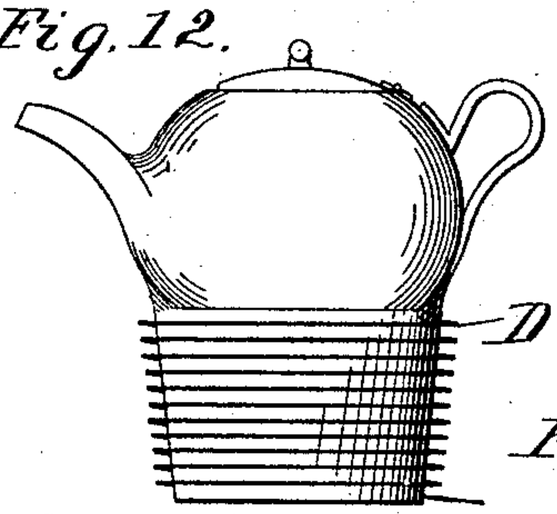


Fig. 13. a

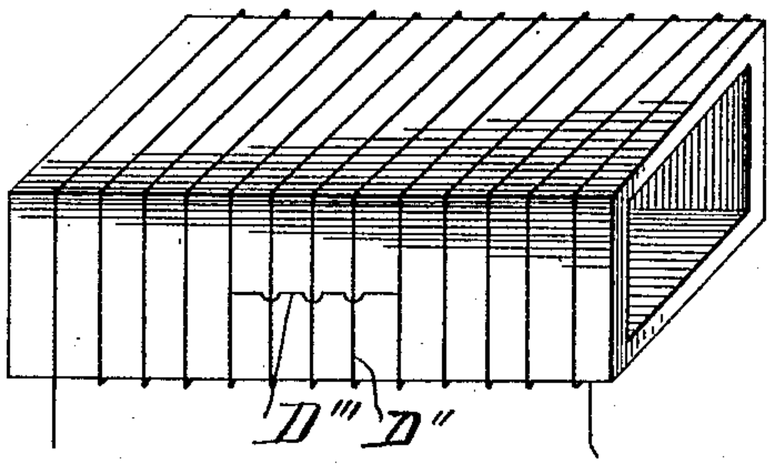


Fig. 11.

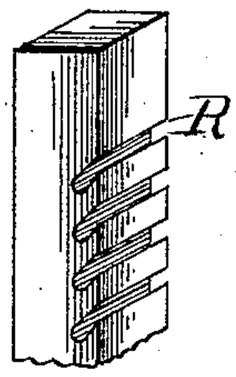


Fig. 16.

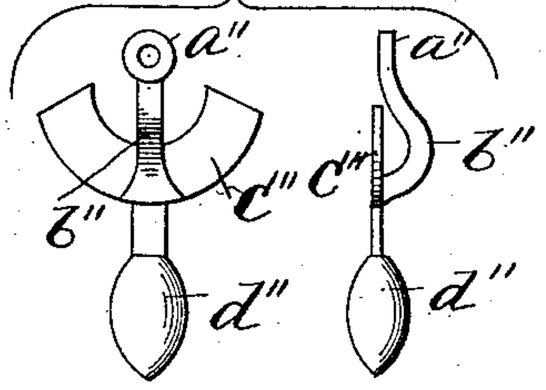
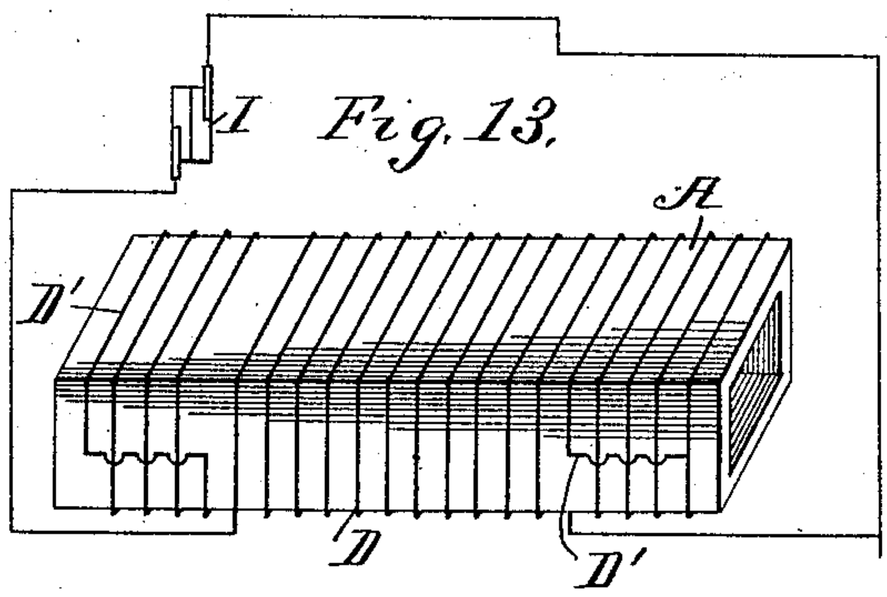


Fig. 13.



Witnesses
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(No Model.) 3 Sheets—Sheet 3.

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ELECTRIC HEATER.

No. 467,538. Patented Jan. 26, 1892.

Fig. 14.

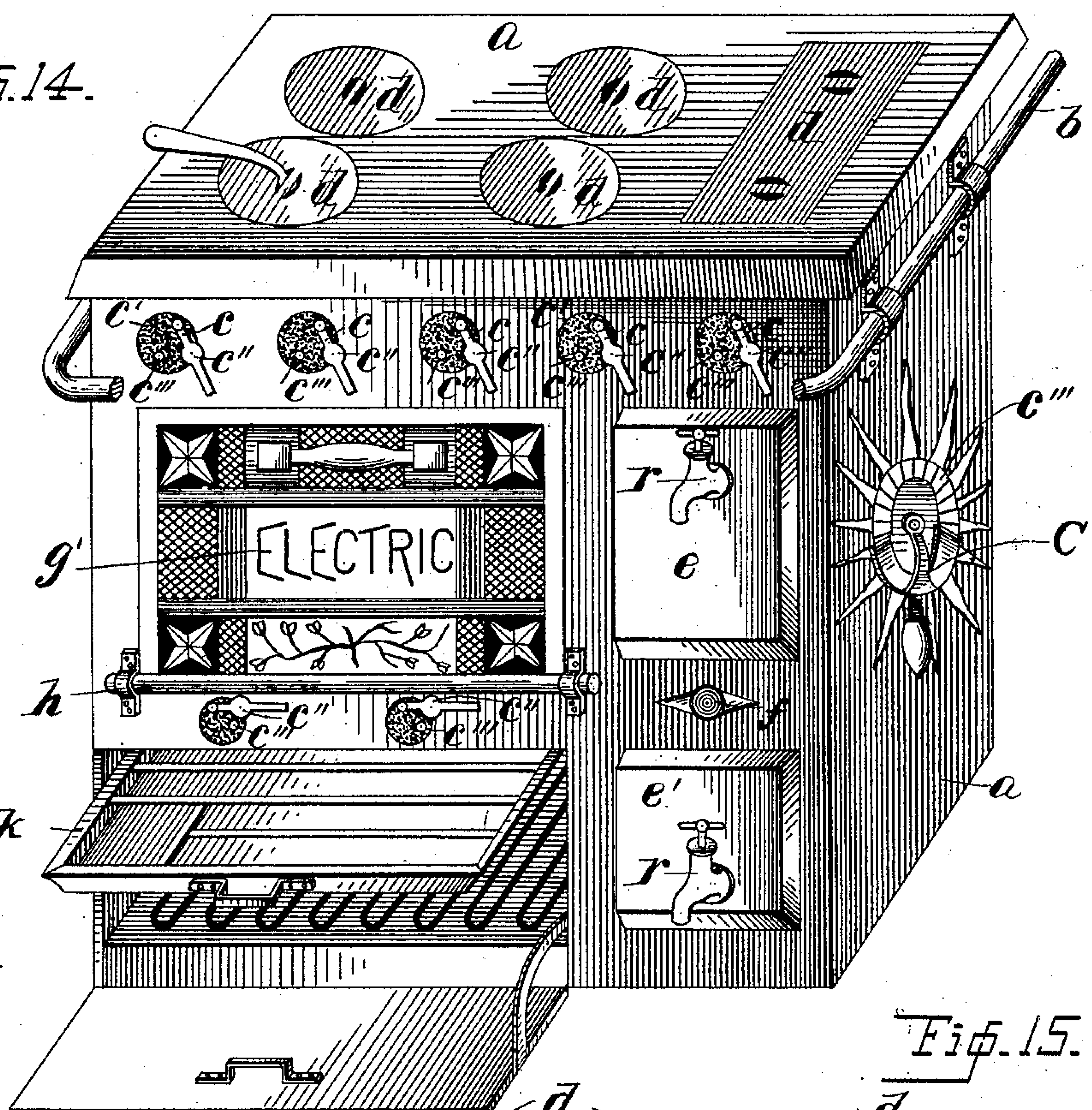
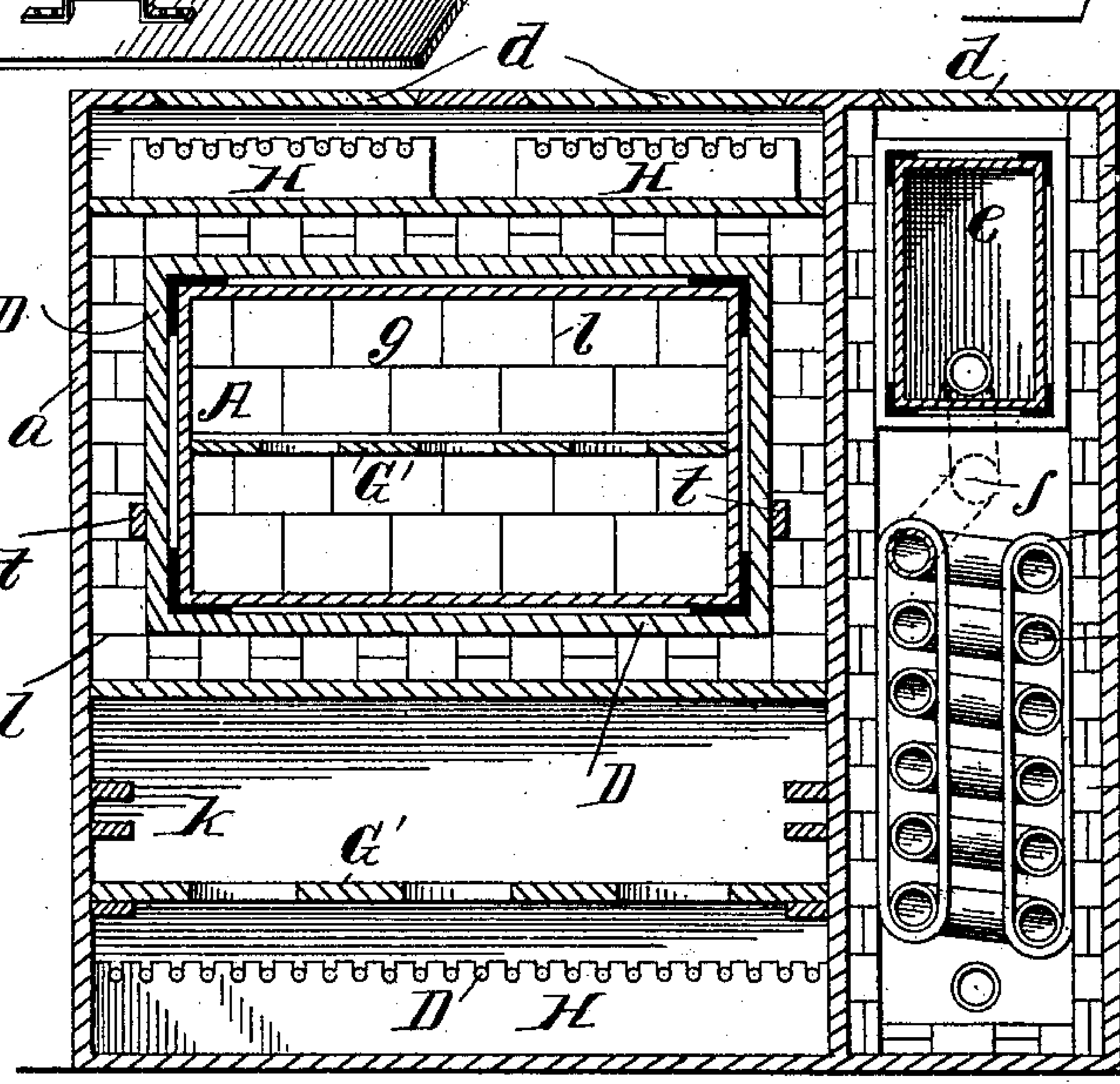


Fig. 15.



Witnesses
W. A. Courtland
Nellie L. Pope.

Inventor.
Ludwig Gutmann
by his Attorney
Edward P. Thompson

UNITED STATES PATENT OFFICE.

LUDWIG GUTMANN, OF PITTSBURG, PENNSYLVANIA.

ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 467,538, dated January 26, 1892.

Application filed November 12, 1890. Serial No. 371,155. (No model.)

To all whom it may concern:

Be it known that I, LUDWIG GUTMANN, a subject of the Emperor of Germany, and a resident of Pittsburg, county of Allegheny, and State of Pennsylvania, have invented certain new and useful Improvements in Electric Heaters, (Case 49,) of which the following is a specification.

My invention has for its purpose to provide an apparatus to be operated by the direct application of continuous, pulsating, alternating, or intermittent electric currents to an electric or magnetic conductor, which in turn by direct radiation or by the magnetic field established is used for practical purposes.

In the accompanying drawings, Figures 1 and 2 show single forms of electric heaters in perspective. Figs. 3 3^c show in section, 3^b in elevation, 3^a in plan and a modification of Fig. 2 for a grate or radiator for chimneys. Fig. 4 shows different forms of grates in plan in an electric circuit. Figs. 5 and 7 show in section and Fig. 8 in perspective different constructions of a compartment forming part of a stove. Fig. 6 shows an insulating-piece for supporting the heating-conductor in perspective. Fig. 9 shows a system in diagram of regulation. Fig. 10 is a perspective view of a special form of a grate. Fig. 11 shows a modified construction of support for the heating-conductor in perspective. Fig. 12 is partially a diagram of the grate shown in Fig. 10. Figs. 13 and 13^a show different ways in diagram and perspective of winding the heating-conductors, especially when used with alternating or intermittent currents. Fig. 14 represents the invention in perspective in its complete state. Fig. 15 is a sectional view of Fig. 14. Fig. 16 shows details of Fig. 14.

Fig. 1 shows the simplest, but not the preferred, construction of my invention. A is preferably a metallic shell, box, or receptacle of any suitable material—such as cast or sheet iron, copper, steel, &c.—preferably closed on all sides, except at the front or door B, which side is hinged to the remaining box or shell to enable it to be opened or closed at will. C are insulating and fire-proof corner-pieces, such as asbestus, fire-clay, &c., around which the conductors are wound spirally and whose ends are attached to the binding-posts F for conveniently inclosing or connecting the apparatus in circuit with a suitable generator. E are stands or feet to prevent the box from resting on the bare conducting-wires. The wire D may be either iron, steel, copper, German silver, brass, aluminium, or any other metal, and is of such a size that the current which is used for operating the device will cause the conductor to become heated, the heat being directly transmitted to the box A, which in turn tends to raise the temperature of all articles placed inside it. It is evident that the apparatus in this exposed form is uneconomical on account of the great amount of waste radiation that would take place.

Fig. 2 shows a modification of Fig. 1. In this case the box A is similar to that in Fig. 1, except that the bottom plate is replaced by a grate or perforated plate G, or else it may consist of a number of thin flat strips interlaced with one another. The winding D is removed from the box in Fig. 2 and placed underneath the box in a fire-proof hollowed or solid block or box H, which is provided with grooves of spiral or other suitable form, in which the winding D is embedded and supported. Its ends are conducted to the two binding-posts F on one side of the block H, which may consist of brick, fire-clay, earthenware, china, or other suitable material.

In Fig. 2 the box A is shown with the door B open and elevated above the block H, so as to enable the winding D to be visible and its position with regard to the box or oven A represented. The advantages of this disposition are apparent—namely, by placing the conductor in a bad heat-conductor little power is lost. The heat generated is reflected and radiated, so as to act on the box A above it. The non-conducting block H serves as a screen from the outside atmosphere and as a reflection toward the oven A. The perforations of the bottom plate G permit an easy heating of the air inside the box while this air is retained therein, as the other sides of the oven A are closed.

Fig. 3 shows a cross-section of block H of Fig. 2. It may be made of any non-conductor that can withstand the heat to which it is exposed. As an example, I may mention earthenware or fire brick. To prevent the

conductor from leaving its place, a cleat H''' may be applied, as indicated by dotted lines.

In Figs. 2 and 3 the heating-conductor D is shown to consist of but one layer. Figs. 3ª, 3ᵇ, and 3ᶜ show a modification in which several layers may be superposed without touching one another and without needing the cleat H'''. (Indicated in Fig. 3.) Fig. 3ª gives a top view of the heater, showing several layers of conductor D wound or mounted on block H. Fig. 3ᵇ gives a front view showing the terminals F of the heating-conductor D, as in Fig. 2; but besides these a number of holes *z* are provided for the purpose of retaining other layers of conductor D and to enable the block to be placed in any convenient position without allowing the conductor D or any convolutions thereof to become misplaced. This is clearly shown in Fig. 3ᶜ, which represents a section of Fig. 3ª or Fig. 3ᵇ. In this case the block H is provided with a frame or extension H'', which leaves a central cavity above the block H. The frame or extension H'' is provided with several rows of holes *z* for retaining heating-conductors D. It will be easily understood that nearly all the heat caused by the conductor D, Fig. 3ª, will be reflected by the block H and the frame H''. This form may be adapted for cooking purposes, instead of the simple form shown in Figs. 2 and 3, or may also be used simply as a radiator in chimneys or firesides, where it may be placed in vertical or, preferably, in an inclined position, so as to reflect the heat properly into the room. The frame H'' may be in one piece with block H, and consists, also, of a non-conductor, or it may be mounted on a block H and consist of a conductor or a non-conductor of heat or electricity. The block H may consist of the same conducting or non-conducting material, the vital point in construction being that the holes *z*, supporting the heating-wire, should be in a non-conducting material. If, therefore, the frame H'' or the whole frame or box H H'' would be made of metal, the perforations in the frame would have to contain non-conducting bushings, as shown in Fig. 19, adapted to retain the wire D.

Fig. 4 shows two diagrams of a grate G and the heating-conductor D, placed below either in spiral or zigzag form and provided with suitable terminals F for their introduction in circuit with the generator I in multiple arc with one another.

Fig. 5 shows a modification over Figs. 1 and 2 and is a vertical section through the modified heater. In Fig. 5 the heating-wire is mounted internally and not externally, as in Fig. 1. The receptacle A', which is used to support cooking utensils, may consist of any suitable material. It is provided with perforations *x* in the various sides to allow the heat generated by the surrounding conductor D to penetrate quickly to the interior. By placing the conductor D in the interior of the shell or box A, which may consist of sheet or cast iron or other suitable material, the heat remains concentrated around the support A', and there can be but little waste. For commercial reasons, the support A' may be made of metal. As shown in Fig. 5, to prevent the support from coming in contact with the conductor D the separating insulating angle-pieces C are interposed, which may have the form shown in Fig. 6. The non-conducting corner-piece K is provided with a number of notches or grooves L for retaining the convolutions of the conductor D.

Fig. 7 shows a sectional view of an oven with two layers of conductor D in position and properly insulated from one another by insulating corner-pieces C. The conductor D, mounted in insulation, is a modified radiator, which, surrounding the support A' and both inclosed by a heat-screen, as in Fig. 5, is preferably termed "concentrator."

Fig. 8 shows a method of regulation of heat. It consists of a support or box A'—that is, a receptacle—the sides of which are composed of perforated plates formed of strips *y*, while cast or sheet metal plates N, adjustable and also removable in slides *y'*, are provided to completely or partially inclose the box to regulate the intercommunication of the hot air.

The construction and support of the heater-coils D can be varied considerably and will depend on the shape of the apparatus or utensils to be heated, as shown for circular vessel in diagram in Fig. 12 and also in Fig. 10. For boiling water (see Fig. 12) or other fluids a grate like that of Fig. 4 would not be economical in combination with a kettle shown in Fig. 12. In this latter case it is desirable to have as great a heating-surface applied near to the fluid as possible. For this reason the winding D is mounted on the non-conducting columns Q, so that all convolutions are placed in the same vertical plane around the kettle to form a heater of a similar shape to a portion thereof and to be adapted to closely surround it. The columns Q are provided with holes for receiving and retaining the winding D, or else they may be provided with recesses or grooves R, as shown in Fig. 11. To give the winding D and columns Q stability, frames O are mounted on both top and bottom and are provided with suitable projections P, having cavities in which the columns are permanently retained. These heaters are operative with any current—such as continuous, pulsating, or alternating; but it offers especially advantages in combination with alternating or intermittent currents, because the field surrounding the heating-coils D will cause secondary currents to flow in the low-resistance and closed circuits of the perforated plates or grates G and eddy-current in the plates N, which both assist in heating the receptacle. Further, if the box or receptacle A is made of iron or other magnetic conductor the increased number of lines of force will not leak away, but are concentrated around the box or shell, which constitutes an open-core magnet which may be quickly raised

to saturation, and in this manner hysteresis may be also used to combine with the other factors to intensify the heating.

In making the cell, box, or shell A A′ N of magnetic material the effect may be modified still further, as given in diagram in Fig. 13. This diagram shows that the shell A has several separate circuits, one of which D is in circuit with the terminals I of a suitable generator, while several windings D′, which constitute closed secondary demagnetizing-circuits, surround the common magnet core or shell A.

It is well to state at this point that any of the forms or modifications mentioned may replace the radiator A′ D of Fig. 5, so that for economical reasons as much heat as possible is retained in the ovens or cells thereof by applying a suitable non-conductor of heat partially around, as in Fig. 2, or completely around, as in Fig. 5.

Fig. 13ª shows another diagram, in which all the winding D forms part of the energizing-circuit; but a portion of it D″ is shown closed on itself by the conductor D‴.

The commercial article for domestic purposes is shown in Figs. 14 and 15. The oven, stove, or range is shown to consist of an outside frame or shell *a* of suitable material—such as sheet or cast iron, steel, brass, and the like. *b* is a guard-rail around the same. (Shown partly broken away.) *c* are controlling-switches for the various grates or compartments, the terminals of the conductor being *c′ c″ c‴*. C′ is a grouping-switch, or such switch adapted to control simultaneously all grates or compartments and their circuits. *d* are grate-cover plates. *e e′* are water-heaters. *f* is a controlling-valve for the water. *g* is a baking or roasting oven. *g′* is the door. *h* are hinges for the door. *k* is a broiler. *l* is a non-inflammable wall for screening and retaining the heat and of slow heat-conducting capacity. *m* is a special form of water-heater. *n′* and *o* are communicating tubes for hot and cold water. *p p′* are central heating and ventilating holes. *r* are valves for controlling the different water-compartments. *s* are contact-blocks, and *s′* a sliding contact-block.

In Fig. 14, on the top surface of the shell *a* of the oven there are shown five removable grate-cover plates *d*, arrayed in the same way as in coal-stoves; but in this case under each plate *d* is fixed a heater-box H, which is shown in Figs. 2, 3, 3ª, 3ᵇ, and 3ᶜ and in section in Fig. 15. Each grate is preferably independent of the other and each is controlled by a switch *c*, one of which is shown per each cover-plate *d*. The heating-conductors D of the various separate compartments are connected in parallel with one another to the source, as shown in Fig. 4, while the conductor of each grate or for each compartment may be subdivided, (see Fig. 9,) the subdivisions being connected in series with one another and provided with contact-terminals *s s* and slide *s′* to enable a variable length to be placed in circuit with the source I. The stove, which is a combination of a number of grates and compartments, of which nine are shown in Figs. 14 and 15, are all controlled by a single switch C′ on the right-hand side of the stove, while each single compartment or grate can be cut out of circuit by a special switch *c*. The bake-oven *g* consists here of a concentrator, as in Figs. 1, 5, 7, 8, or 13. To prevent quick radiation for the sake of economy, the grate, shell, or receptacle A′, with the heating-conductor D, are together surrounded by a non-inflammable material of slow heat-conducting capacity, such as asbestus, mica, slate, earthenware, fire-clay, brick, &c., as indicated by *l*, which represents panes or tiles, some of which appear in front view, others in section. This compartment is controlled by a switch below, while the second switch *c* shown controls the grate of the broiler *k* below it. In both compartments *g* and *k* the food to be heated is placed on perforated supports or grates G′ or surrounded by compartments whose sides and bottom are perforated, so as to allow a quick communication of the hot air surrounding the food, while at the same time the local retaining of the heat is effected by the heat-screen *l*, which prevents an easy diffusion of the heat developed through the frame *a*, as is usually the case with coal or gas stoves. Where economy is a secondary consideration, the stove can evidently be used without the screening material *l*, as shown by the compartment *k*, in which the same is omitted. The terminals of the heating-conductor D, if a fixture, are connected to the switches *c* and C′, passing through the casing *a* in an insulated manner by using insulating-bushings. On the other hand, if the grate or compartment is removable—as, for instance, A′ of the oven *g*—then special terminals *t* are mounted in the insulating material *l* or in an insulated manner, and on introducing the frame or support A′, with its conductor D, the heater makes contact with the terminals *t*, including the heating winding in the circuit. In the broiler *k* the heating-conductors D are shown mounted on a non-inflammable block or substance adapted to radiate or reflect the heat upward, while almost no heat will penetrate the block H to find its way through the frame *a*. *e e′* are boilers in connection with the stove. The compartment *e* having a comparatively small heating-surface, the water contained therein will take a longer time to become heated than that in the spiral *e′* below *e*. Both heating-chambers are connected by a valve *f*, which is adapted to keep the water separate or to allow the quickly-heated water in the tube or spiral *e′* to rise and the cooler water of box *e* to descend, and in this manner to hasten the heating of the whole quantity of water, while for quickly obtaining a quantity of hot water the spiral *e′* alone would be used. Both water-heaters are inclosed by a heat-screen *l*, as shown in section.

In Fig. 15 the spiral heater *e'* as a whole is shown to be surrounded by the conductor D.

Fig. 16 gives the grouping-switch of Fig. 14 in detail. In Fig. 14 the commutator-like contact-pieces *c'''* are the terminals of the conductors D of the various heaters. The switch-lever C'', as shown in Fig. 18, is pivoted centrally to those terminals at the point *a''*, around which the slide C'' is movable by its arm B'' and operated by the handle *d''*.

I claim as my invention—

1. In an electric heater, the combination of a box provided with a door normally closed and an electric conductor wound around and insulated from said box.

2. In an electric heater, the combination of a hollow mass of any suitable material, an electric conductor surrounding the same and separated therefrom, and means, such as a door, by which articles to be heated may be entered into said mass.

3. In an electric heater, a box having parallel sides, insulating and fire-proof angular strips placed upon the corners and lapping over the said sides, and bare metallic wire forming an electric conductor wound around the same and upon the insulating-strips, leaving air-spaces between said box and said wire, a door being provided in one end of the box.

4. In an electric heater, a box having parallel sides, insulating and fire-proof angular strips placed upon it and lapping over the sides, bare metallic wire forming an electric conductor wound around the same and upon the insulating-strips, leaving air-spaces between said box and said wire, a door being provided in one end of the box, and a casing of fire-brick or similar poor conductor of heat surrounding the above-named elements.

5. An electric heater consisting of the combination of a perforated box provided with a door normally closed, an electric conductor wound around said box, and a non-heat-conducting substance surrounding the above elements.

6. An electric heater consisting of the combination of a perforated box, an electric conductor wound around the same, a non-heat-conducting substance surrounding the two above-named elements, and a door adapted to close said box as well as that formed by said non-conducting substance.

7. In an electric heater, the combination of an external frame, partitions dividing the internal space into several compartments, a heating-conductor located in some or all of said compartments, a poor heat-conducting substance lining the walls of one or more of said compartments, supports in close proximity to one or more of said heating-conductors, and means, such as doors, lids, or openings, for access to the compartments.

8. An electric heater consisting of the combination of a perforated box open at one end, an electric conductor wound around the same, a non-heat-conducting substance surrounding the two above-named elements except at said open side, and a door adapted to close the space surrounded by said non-heat conductor.

9. In an electric heater, the combination of a metallic box, a primary electric conductor surrounding said box and insulated therefrom, and an independent or secondary conductor closed upon itself and surrounding and insulated from said box.

10. In an electric heater, the combination of a metallic box and an electric conductor surrounding and insulated therefrom and short-circuited as to a portion of the length of said conductor.

11. In an electric heater, a box having parallel sides, insulating-strips placed upon said box, bare metallic wire forming an electric conductor wound around the box and said insulating-strips, leaving air-spaces between itself and the said box, a door being provided in one end of the box, and a casing of fire-brick or similar poor conductor of heat surrounding the above-named elements.

12. In an electric heater, the combination of an external frame *a*, partitions dividing the internal space into several compartments, a support for cooking utensils, and a heating-conductor located in proximity to said support, and the last two elements being inclosed in one or more of said compartments.

13. In an electric heater, the combination of a perforated support, a metallic conductor surrounding the same, and a hollow box with means, such as a door, for temporarily opening or closing the same, the said box surrounding the above-named elements.

14. In an electric heater, the combination of a perforated receptacle, a metallic conductor surrounding the same, a suitable casing for inclosing the above-named elements, and means, such as a door or cover, for admitting access to said receptacle.

15. An electric heater consisting of the combination of a perforated receptacle, a metallic conductor surrounding the same, a casing surrounding the above elements and separated from said conductor by an air-chamber, and a door or cover, for the purpose described.

16. In an electric heater, the combination, with a perforated oven or support, of adjustable plates adapted to cover more or less of the sides of said perforated oven or support.

17. In a heater for alternating, pulsating, or intermittent electric currents, the combination of a conductor carrying the said current supplied from any suitable source and a metallic or magnetic hollow core adapted to allow air circulation through its body in inductive distance to said conductor.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 15th day of October, 1890.

LUDWIG GUTMANN.

Witnesses:

SAMUEL WALLACE,

JAS. J. MCAFEE.