(No Model.) 4 Sheets—Sheet 1.

L. GUTMANN.

ALTERNATING ELECTRIC CURRENT HEATER.

No. 458,163. Patented Aug. 25. 1891.

Fig. 1.

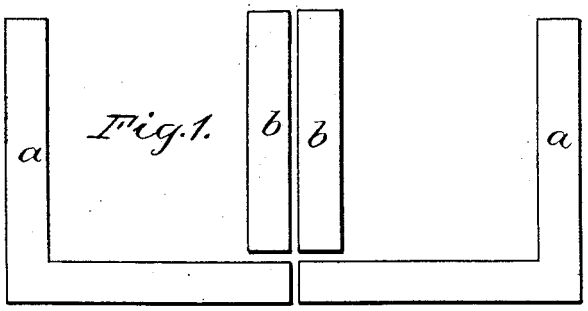


Fig. 1a

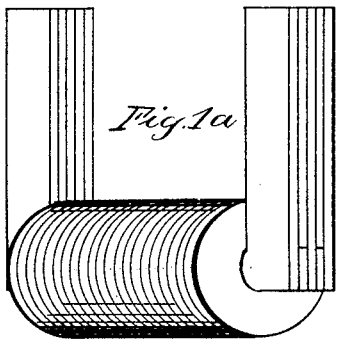


Fig. 2.

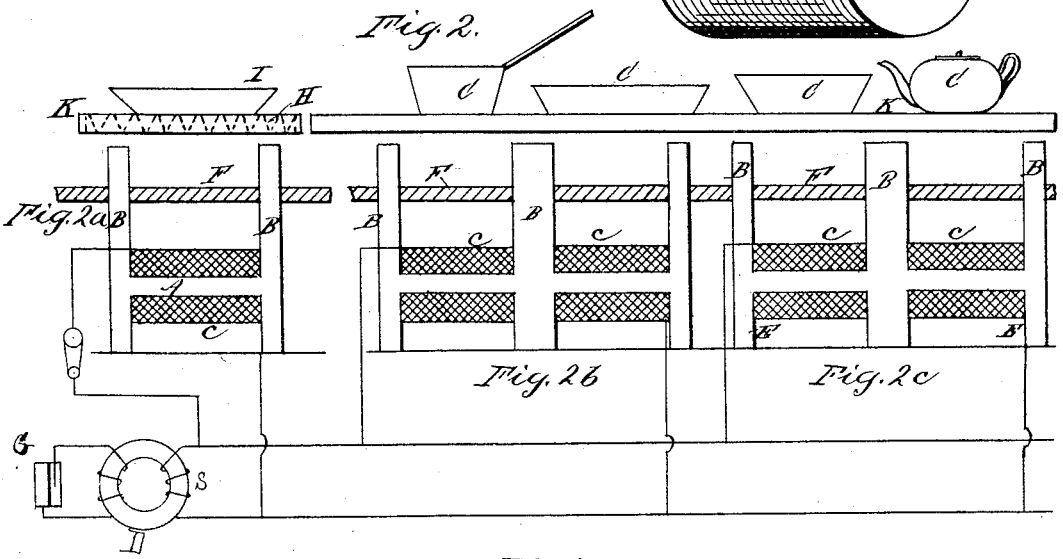
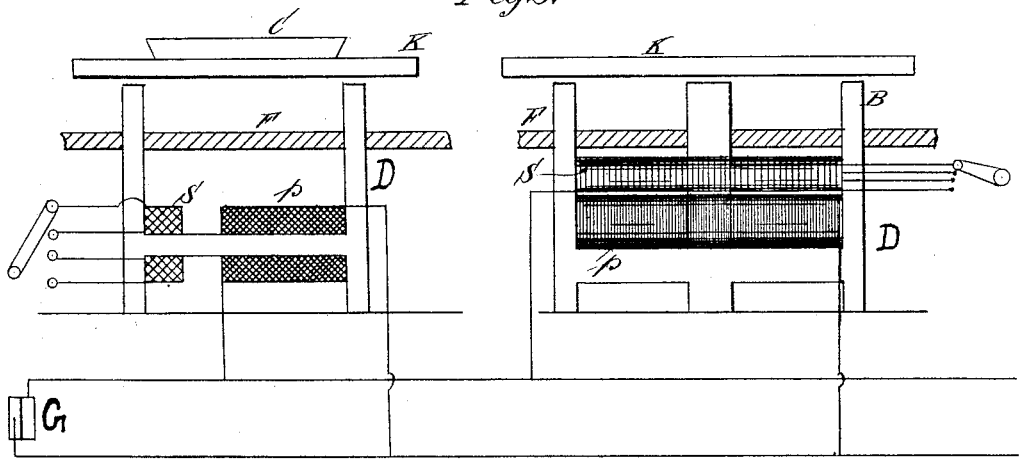


Fig. 2a

Fig. 2b

Fig. 2c

Fig. 3.



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(No Model.) 4 Sheets—Sheet 2.

L. GUTMANN.

ALTERNATING ELECTRIC CURRENT HEATER.

No. 458,163. Patented Aug. 25, 1891.

Fig. 4.

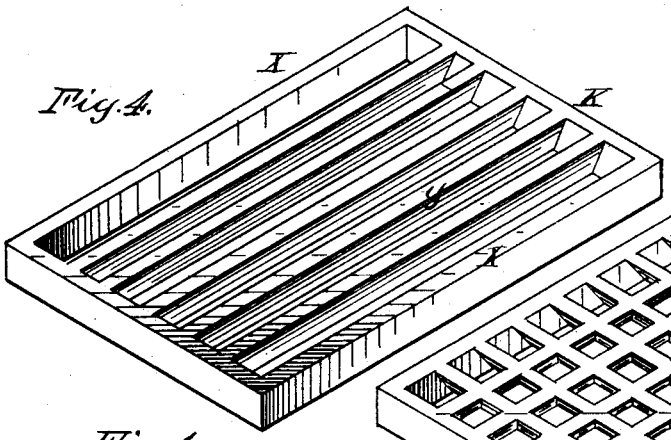


Fig. 5.

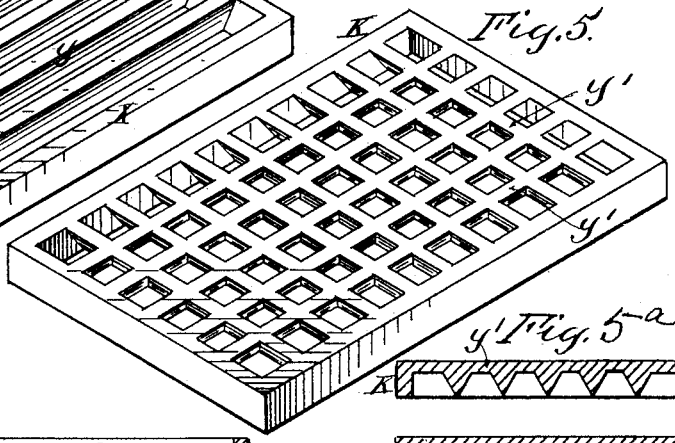


Fig. 4a

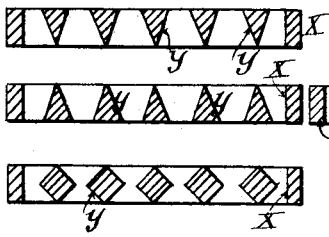


Fig. 5a

Fig. 8.

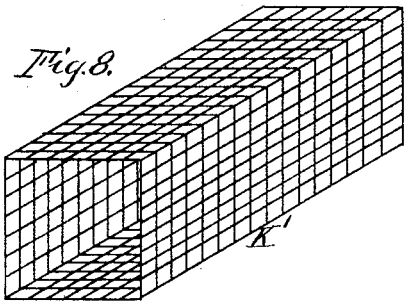


Fig. 7.

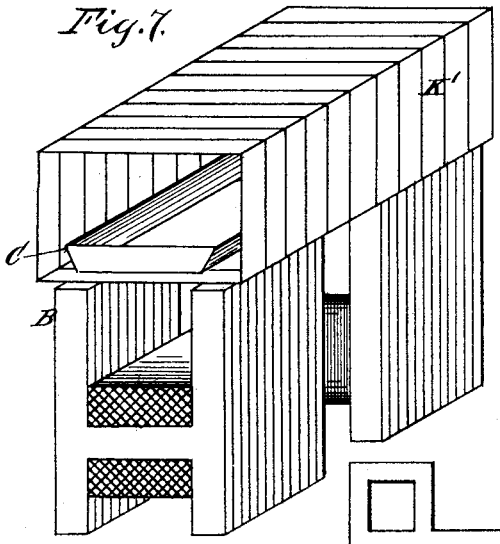


Fig. 9.

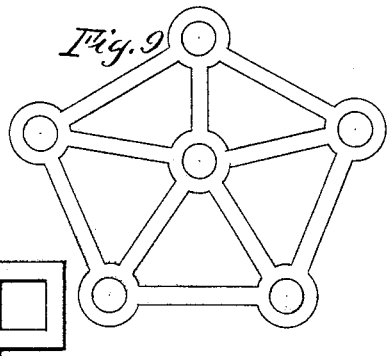
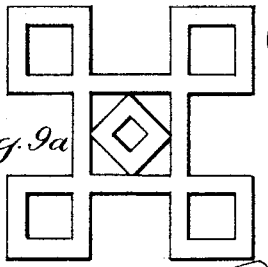


Fig. 9a



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(No Model.) 4 Sheets—Sheet 3.

L. GUTMANN.

ALTERNATING ELECTRIC CURRENT HEATER.

No. 458,163. Patented Aug. 25, 1891.

Fig. 6.

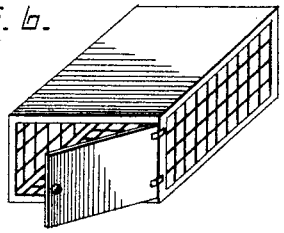


Fig. 6. a

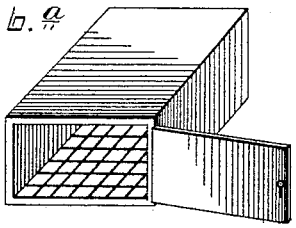
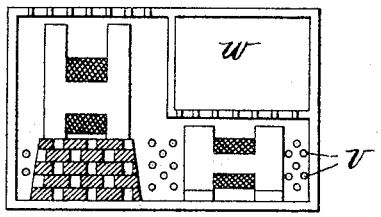


Fig. 14. a



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(No Model.) 4 Sheets—Sheet 4.

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ALTERNATING ELECTRIC CURRENT HEATER.

No. 458,163. Patented Aug. 25, 1891.

Fig. 12.

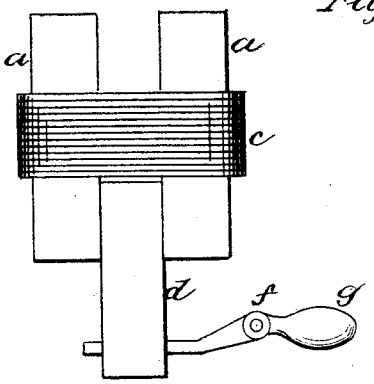


Fig. 11.

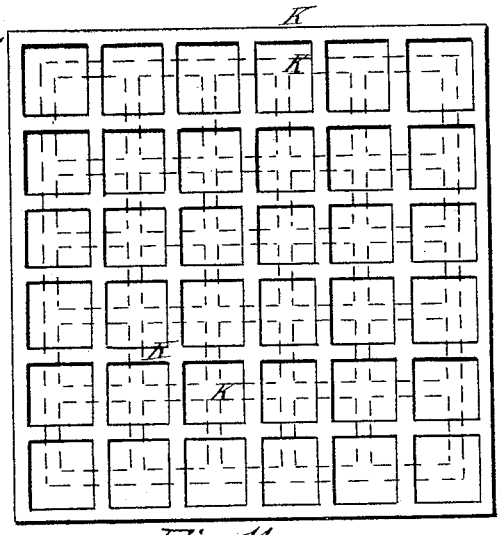


Fig. 11b

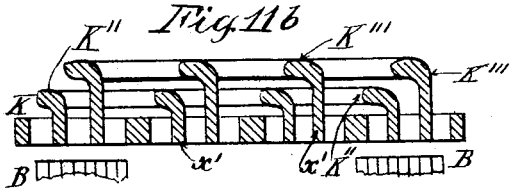


Fig. 11a

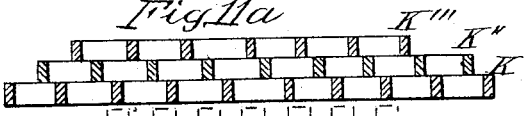


Fig. 10.

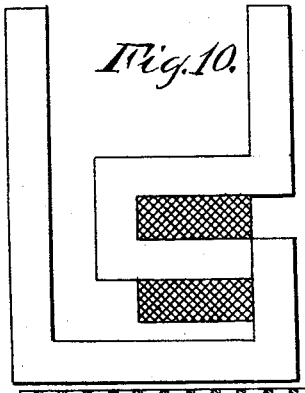


Fig. 13

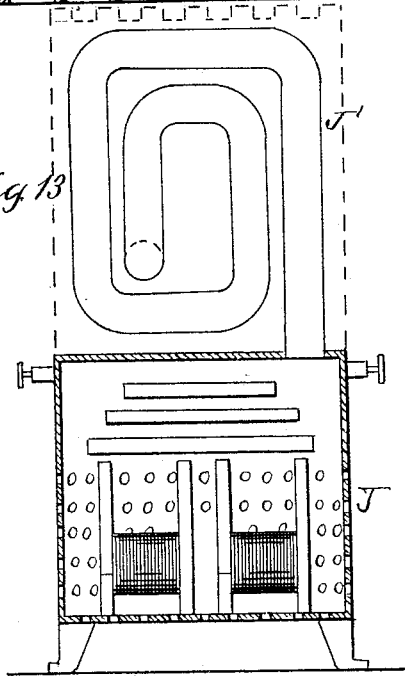
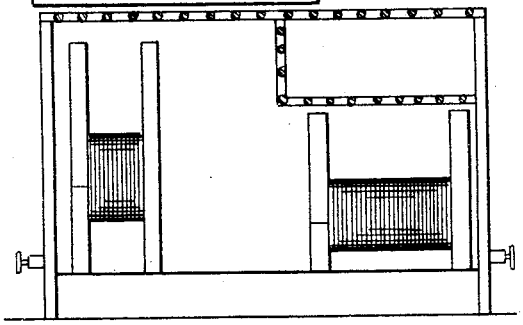


Fig. 14



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Inventor:
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Edward P. Thompson

UNITED STATES PATENT OFFICE.

LUDWIG GUTMANN, OF PITTSBURG, PENNSYLVANIA.

ALTERNATING-ELECTRIC-CURRENT HEATER.

SPECIFICATION forming part of Letters Patent No. 458,163, dated August 25, 1891.

Application filed December 9, 1889. Serial No. 333,144. (No model.)

To all whom it may concern:

Be it known that I, LUDWIG GUTMANN, a subject of the German Emperor, and a resident of Pittsburg, county of Allegheny, and State of Pennsylvania, have invented certain new and useful Improvements in Alternating-Electric-Current Heaters, (Case 33,) of which the following is a specification.

My invention relates particularly to the construction and regulation of electric heating apparatus for domestic services, as operated by alternating, pulsating, or intermittent currents.

This electric heater has for its purpose to generate and distribute heat in an economical, simple, and safe manner. In apparatus of this class I find a great difficulty which is not found in apparatus for distributing light and power. While in the latter I can locate the light or motor when and where I want by placing them at any distant point and providing them with suitable cut-outs at those places, it is not so easy to locate heat devices in a similar manner, inasmuch as the apparatus itself is customarily exposed to the heat it generates, the consequence being the rapid rise in temperature of the exciting-coils by the surrounding radiated heat. It is evident that under such conditions the insulation is quickly destroyed and the magnetic property of the electro-magnet reduced. To overcome this difficulty various ways may be adopted, of which several methods will be described below.

Figures 1 and 1ª are illustrative constructions of the core of the magnet used in my invention. Figs. 2, 2ª, 2ᵇ, and 2ᶜ are views in cross-section of the invention in its simplest form. The several devices are shown connected in circuit with a single dynamo. Fig. 3 shows similar views to the above of heating devices in which two coils are mounted on the core of the apparatus, the one for energizing and the second for regulation. Fig. 4 is a perspective view of a part of the device, while Fig. 4ª shows a sectional view thereof and of three modifications of the same. Figs. 5 and 5ª are perspective and sectional views of a still further modification of grate. Figs. 6, 6ª, 7, and 8 show a cage or oven formed of a grate. Figs. 9 and 9ª show modifications of a grate for producing an ornamental effect. Fig. 10 is a modified electro-magnet to protect the exciting-coils. Figs. 11, 11ª, and 11ᵇ are plan and sectional views of means for heating comparatively large spaces. Fig. 12 shows means of regulation. Fig. 13 shows a stove or radiator for heating rooms, &c. Figs. 14 and 14ª show cooking-stoves, the one being a modification of the other.

The magnets may be built up, as shown in Fig. 1, by the superposition of L or angle shaped laminæ *a*, placed alternately with the vertical part at the left and then at the right side. By this means I am enabled to wind the exciting-coil *c* independently from the core, which can easily afterward be introduced, as shown in Fig. 1ª. To make the core as small and powerful as possible the open space naturally formed by the overlapping laminæ is filled up by straight pieces *b*.

To adapt the apparatus for domestic services it is necessary, as a matter of safety, to use low-tension alternating currents, and, accordingly, Figs. 2, 2ª, 2ᵇ, and 2ᶜ show a converter D in circuit with the generator G, having its secondary low-tension current in coil S closed through heaters, preferably in parallel arc. To prevent the destruction of the exciting-coils C by heat they are placed as far as practicable from the object to be heated. For this reason the coils *c* are wound on a part corresponding to the yoke or cross-piece A of the magnet. In Figs. 2ª, 2ᵇ, and 2ᶜ the coil *c* is placed around the yoke, while in Fig. 3 the exciting-coil is shown as near as possible to the yoke. Besides, the magnet-poles are made to form long extensions or pole-pieces B, as clearly shown in Figs. 2, 2ª, 2ᵇ, and 2ᶜ. In Figs. 2ᵇ and 2ᶜ are three extensions B. It is convenient to provide small extensions E as legs at the lower part of the plate for resting or supporting the apparatus.

To further prevent self-destruction of the apparatus by radiation it is provided at its upper end near the poles with a screen F, preferably made of a poor conductor of heat and electricity, such as slate, fire-brick, glass, hollow porcelain, box filled with ashes, or any other suitable protecting device.

An important feature exhibited in the construction of this heater is the grate K, which

is either made of iron bars, as customarily employed with coal-stoves, and shown in Fig. 4, or of bars, concentric rings, or corrugated plates of any other magnetic or electric conductor. In its simple and preferred form it consists of a frame X, into which are laid, screwed, riveted, or welded or otherwise secured the bars y, the cross-section of which at line X can have any suitable form, as shown in Fig. 4^a, where circular, rectangular, triangular, and inverted triangular cross-sections are exhibited. Another form of grate is shown in Fig. 5, in which bars y' are laid across one another and are preferably at all cross-points in good metallic contact; or instead of building up the grate shown in Fig. 5, it may be cast in one piece and represent a perforated plate. The main objects for these forms and the preferred construction of wrought or cast iron are the following: Iron is preferred for its cheapness and for most suitably reducing the resistance of the magnetic circuit, and, secondly, for its combined qualities of a good electric as well as magnetic conductor. The secondary currents generated are given by the form of the grate defined ways for their circulation, which are of low electric resistance, owing to their comparatively short length. In addition to these secondary currents of great volume eddy currents are created, owing to the large surface of the bars, and both kinds of currents assist in this case to produce heat. The air-spaces between the bars y or in the perforated plates cause all heated air to rise and heat the articles placed on top of the grate, while the coil c, placed below, is kept away from the hot air and receives a constant supply of cool air from below as a natural consequence of circulation of air, for which special holes below and around the magnet are provided. Another advantage not to underrate is that when metal basins or kettles are placed on the grate they will be directly influenced by the magnets, which cause induced currents to circulate in the bottom, so that these metal basins are not altogether dependent on the heat they derive from the grate, but are in part themselves their own source. It will be evident that with such a disposition of parts heating can be effected very much quicker than by direct transmission of heat. For ordinary cooking-ranges the heating of the grate on which the object is placed may suffice; but for baking and other purposes which require uniform heat all around another form is preferred. It is shown in Figs. 6, 6^a, 7, and 8. This stove, represented partly in diagram, consists of one or more energizing-magnets having the usual extension B, above which is fixed in close proximity to their poles and preferably without actual contact a grate or oven K', in form of a cage, of which five sides may be permanently closed and in good metallic contact, while the sixth side either remains permanently open or is removable, so as to be easily applied and to serve as a door, Fig. 6. Either all six sides of the oven are made of bars or corrugated plates, as shown, or else some of the sides, and preferably those farthest removed from the magnet—such as the door or back or the uppermost surface—may be replaced by a solid plate for inclosing the heat in the said oven for a longer time. The bottom should be a grate always for good effects, Fig. 6^a. It is of course self-evident that the space left open on the inside of the cage is left for the purpose to place therein the article C to be heated, Fig. 7. Further, that the shape given to this oven can be of any suitable form, and the perforations need not be rectangular holes, but can be quite ornamental, as shown in Figs. 9 and 9^a. Fig. 10 represents another form of magnet, where the screen F seems to be omitted; but the fact is that a portion of the core itself forms a screen for the coil, which is removed to a considerable distance from the grate. These various forms are especially well adapted for cooking purposes, while the preferred form for heating of rooms and large apartments is shown in Fig. 11. Two grates K are shown superposed, of which the lower one is indicated by dotted lines.

Fig. 11^a shows a cross-section of a combination of three grates K K'' K''', which are of such a form that the openings or perforations of the second, third, &c., grate are smaller and smaller, or else the grates are so placed in space that the closed conductors, or in this case squares, do not cover each other in a vertical plane, thereby diminishing loss of magnetic action. In this manner all lines of force will act upon one or more grates which have a considerable surface for radiation. The superposed grates may, but need not be, in metallic contact with one another.

In Fig. 11^a the sections of the rods show that each subsequent grate is further removed from the energizing-magnet, while Fig. 11^b shows another section of grate K, in which the extensions or projections x' afford large heating-surface for the air, which place all superposed grates equally far from the magnet.

For very large installations it may be necessary to use medium or high pressure currents for the energizing-coils; but as the direct contact or any regulation of high-tension circuits would be altogether objectionable, I have adopted a regulation by secondary currents, as shown in Fig. 3, where the electro-magnet is provided with a primary energizing-coil p and a subdivided regulating-coil S, the subdivisions of which have different inductive resistances and can be closed or short-circuited singly or several of them to form a closed circuit by a switch shown at the left of the figure. By closing one or more of said secondary windings upon themselves or in circuit with one another a secondary current is generated therein, which tends to demagnetize the electro-magnet and to increase the energizing-current. These secondary currents

can be easily kept at a low pressure and afford a convenient and safe means for regulation.

The whole organization by open-coil converters is shown in Fig. 3.

Fig. 12 shows another safe method of regulation, which consists in making a part of the core movable. The core *a a* is surrounded by the energizing-coil *c* and has its center part *d* adapted to slide between two outside portions *a*. This movable part or section *d* is provided with a handle *g*, pivoted at the point *f*. The introduction of the iron section *d* to its normal position will reduce the exciting-current, while its extraction will cause a current of increased quantity to flow through the coil *c*. While for cooking purposes I prefer metal cooking-ranges, which quickly heat and quickly get cold, as shown in Fig. 11, the heating-stoves are preferably constructed in two parts, the lower metal part or stove J proper containing all the electrical appliances and grates, as shown in Fig. 13, which quickly rise in temperature, while the upper preferably non-metallic part J′ contains an inner air-chamber or tubular channels for guiding the heated air over a comparatively long distance. The air-chamber or tubular channels penetrate this non-metallic heat-retaining part of the stove at one or more points, so as to be in connection with the room in which the stove is located. The heat-retaining part is preferably built up of plates, pans, disks, &c., of earthenware, china, glass, or other suitable material, the said plates or parts being properly joined or cemented together.

For the sake of economy and maximum power the horseshoe, U, or W type of magnets are preferred as being the simplest and easiest to replace, and instead of making them in two or more parts, as shown in Fig. 1, they may be made of a single piece, as shown in Fig. 3. This is especially advantageous if the coils are mounted on the limbs or pole-arms of the converter.

It is of course self-understood that the stove represented in Fig. 13 may be completely of metal, as also the tubular channel, or else this channel and the upper part can be completely omitted, and in this case the heater can easily be used to replace the present fireplace in dwelling-rooms. It will be noticed, further, that the magnets are surrounded by perforated plates, and also that perforations are provided in the bottom of the stove. The purpose is that it is desired to remove the hot air as quickly as possible and preserve the magnet cool. By this arrangement of providing air-circulation from below and around the energizing-magnets the latter are kept cool; but this circulation is considerably increased by the employment of grates, cages, or corrugated plates, contrary to present custom, inasmuch as the hot air is forced from the inner side of the apparatus through said perforations into the room. The result I obtain is great air-circulation, quick radiation of heat, and preservation of good magnetic condition at the generating-magnet, and consequently normal current in the exciting-coils.

Figs. 14 and 14ª represent views of cooking-stoves, of which the front plate is removed, exposing the energizing-magnets. In Fig. 14 the place for heating is shown corrugated or perforated everywhere, while in Fig. 14ª the compartment *w* for baking has closed sides. The arrangement will cause the heat to go through the grate, but will prevent it from escaping rapidly, and so causing a uniform heat inside said compartment. Also, perforations *v* are shown for the circulation of air.

I claim as my invention—

1. In an electric heater, the combination, with an alternating, pulsating, or intermittent current generator and circuit connections, of an electro-magnet in circuit with said generator, a magnetic or electric substance serving as a platform for supporting cooking utensils, located within inductive relation to said electro-magnet, and means, such as perforations in said magnetic or electric substance, for the passage of the heated air.

2. In an electric heater, the combination of an electro-magnet, polar extensions thereto, a non-conductor of heat mounted on said extensions, and a mass of iron within inductive relation to said extensions.

3. In an electric heater, the combination of an electro-magnet, a suitable frame or box inclosing it and provided with holes for admitting air to the said electro-magnet, a support for cooking utensils in inductive relation to said electro-magnet, and means for allowing the inclosed hot air to rise or escape.

4. In an electric heating apparatus, the combination of one or more energizing electro-magnets, a suitable frame or box inclosing them and provided with means to admit air to said electro-magnets, a support for cooking utensils in inductive distance to said magnets, and means for the passage of the heated air generated on the surface near the magnet to that on the opposite side of said support.

5. In an electric heater, the combination of one or more energizing electro-magnets, a suitable frame or box inclosing them and provided with means for permitting air-circulation from the outside of the apparatus to the inside and from the inside again to the outside, one or more supports for cooking utensils in inductive distance to said magnets, and one or more divisional compartments in said frame or box having other additional supports for cooking implements in proximity to one or more additional electro-magnets.

6. In an alternating-current electric heater, the combination, with a horseshoe electro-magnet energized by a suitable generator, of a grate consisting of one or more closed metallic circuits in proximity to the poles of said field electro-magnet, and a non-conductor-of-heat screen, for the purpose described.

7. In an alternating-current electric heater,

the combination, with horseshoe electro-magnets energized by a suitable generator, of a metal platform consisting of several superposed grates, each consisting of one or more closed metallic conductors in proximity to the poles of the said field electro-magnets and a heat-screen, as and for the purpose described.

8. In a system for the distribution of heat, the combination, with a source of alternating, pulsating, or intermittent electric currents, of converters or electro-magnets having a laminated core whose magnetic circuit is open, a single magnetic or electric conductor in close proximity to both the poles of the said converter or electro-magnet, and means, such as perforations, in said conductor, for the purpose described.

9. In a system of distribution of heat, the combination, with an alternating, pulsating, or intermittent generator, of converters or electro-magnets the exciting-coils of which are in circuit with said generator, open cores for said converters or electro-magnets, magnetic or electric conductors in close proximity to the ends of the said open cores, and a screen located between the said magnetic or electric conductor and the said exciting-coils.

10. In an electric heater, the combination of a frame, case, or box provided with means, such as binding-posts, for the connection with a source of alternating, pulsating, or intermittent electric currents of one or more supports, grates, or receptacles for supporting or inclosing cooking implements, and means, such as openings, holes, or perforations, in the said frame, case, or box, and other openings, holes, or perforations in said supports, grates, or receptacles, for the purpose described.

11. In an electric heater, the combination of one or more magnetic cores, each surrounded with one or more coils, a frame, case, or receptacle for said magnets retaining the terminals of said one or more coils, one or more grates or partitions in inductive distance to said magnets, a screen interposed between said grates or partitions and the magnets, and ventilating-openings, for the purpose described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 2d day of December, 1889.

LUDWIG GUTMANN.

Witnesses:
J. W. SMITH,
JAMES N. BARR.