Oct. 11, 1927. 1,645,029

J. P. SUNDERLAND

ELECTRIC HEATING APPARATUS

Filed Nov. 22, 1926 3 Sheets-Sheet 1

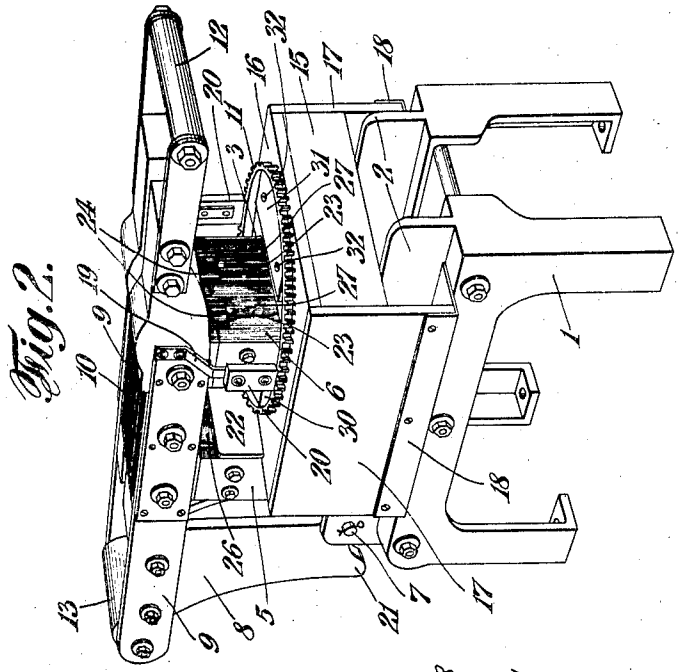


Fig. 2.

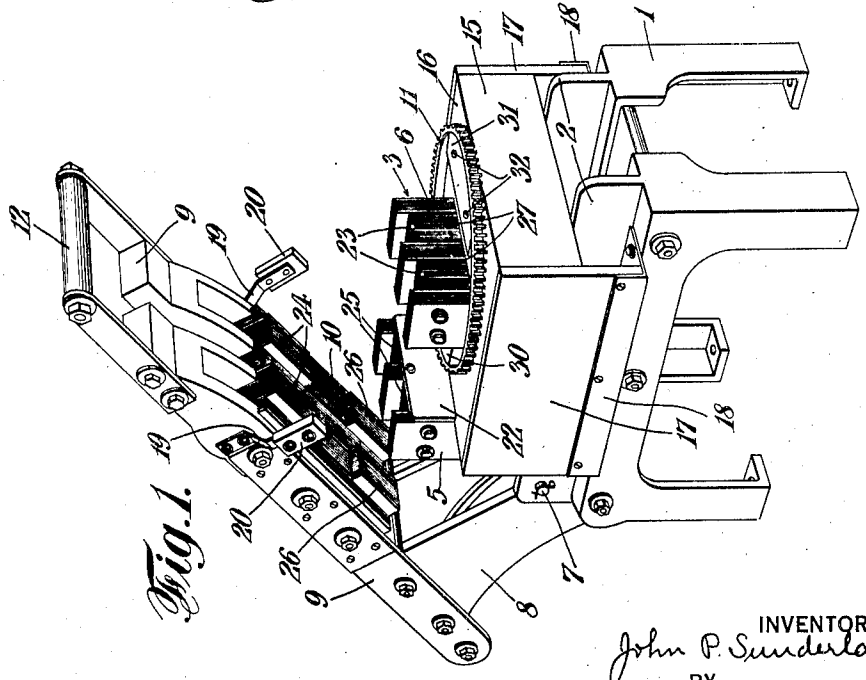


Fig. 1.

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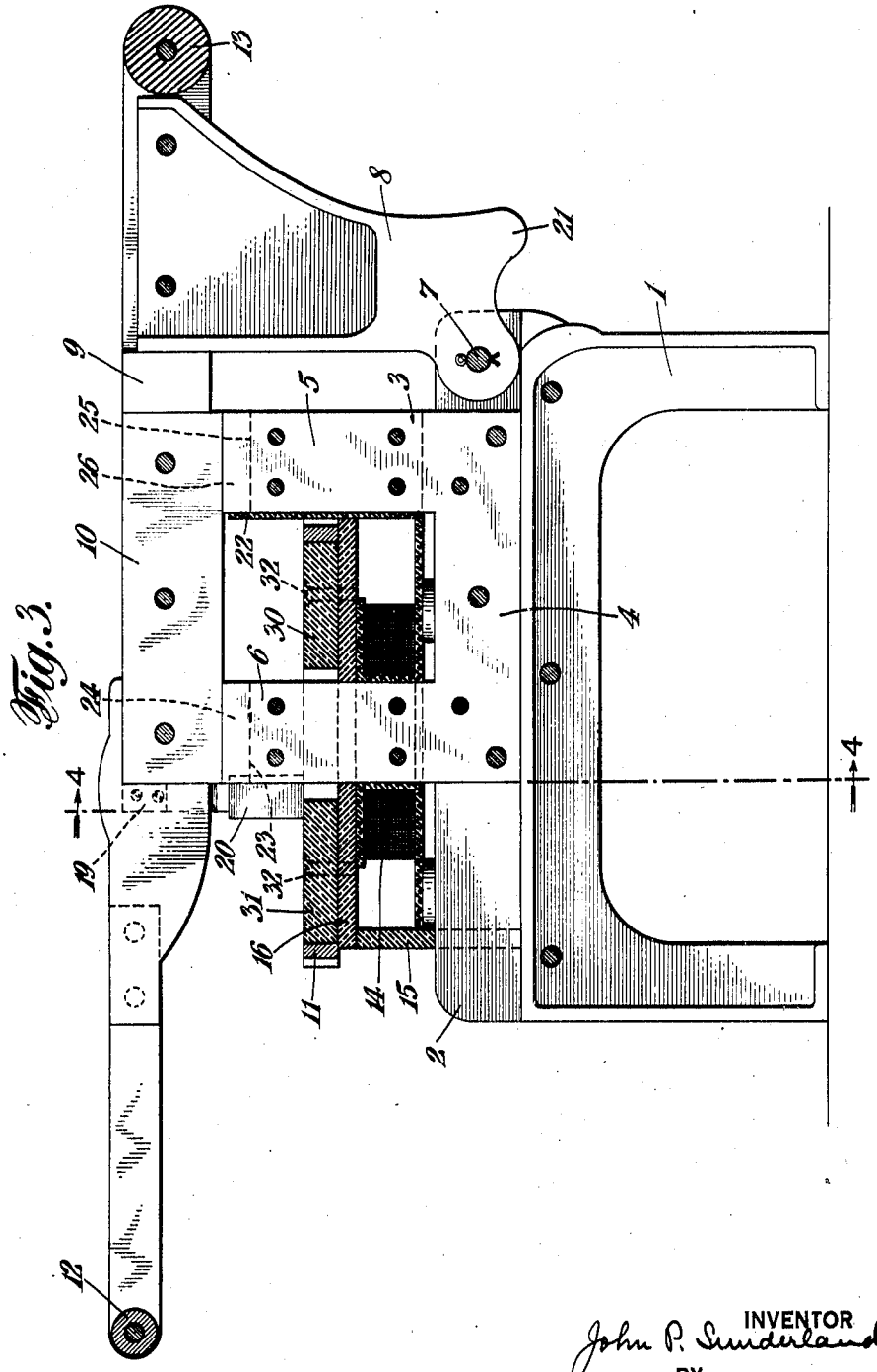


Fig. 3.

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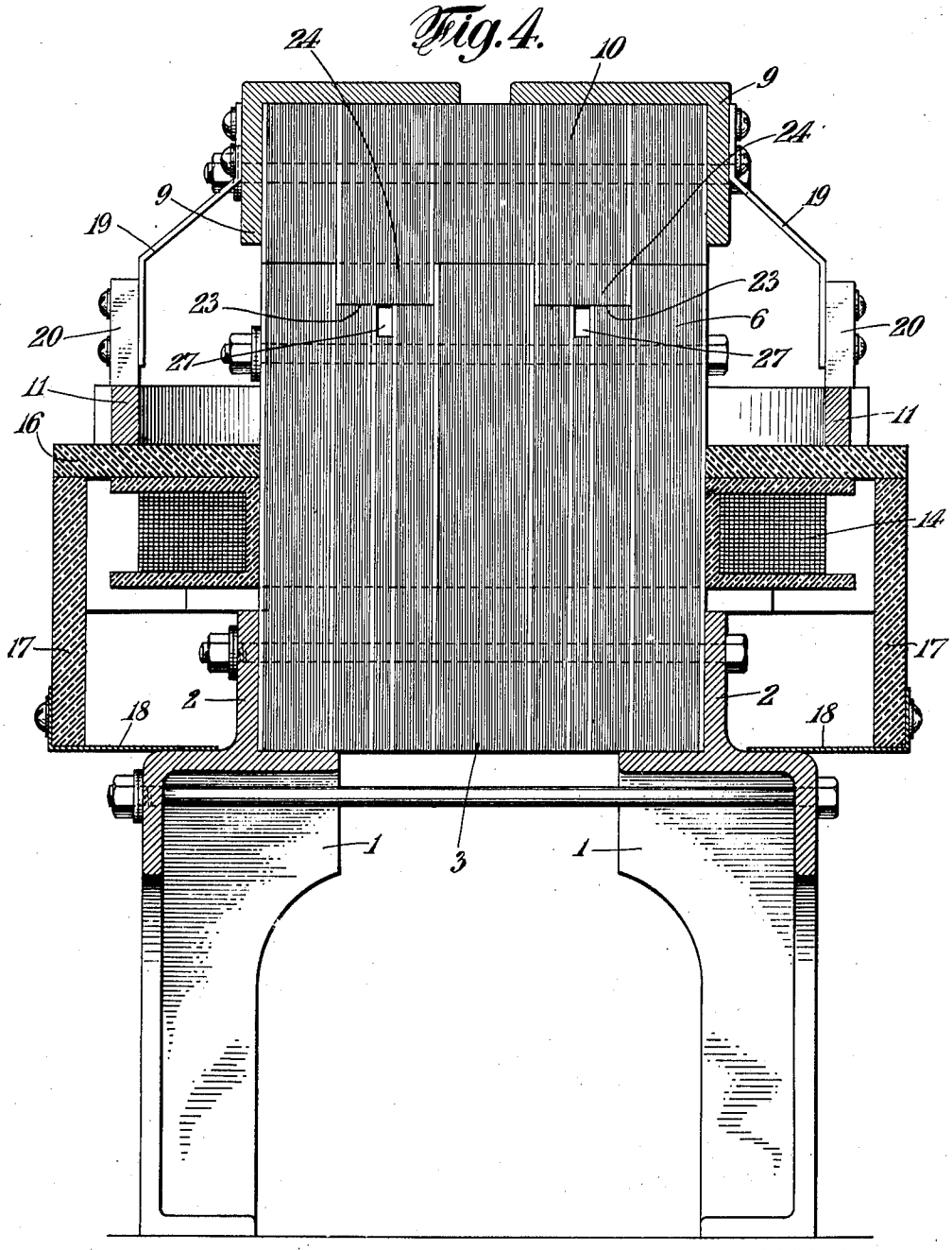
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Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN P. SUNDERLAND, OF PORT CHESTER, NEW YORK, ASSIGNOR TO THE CALORAC ELECTRIC CORPORATION, A CORPORATION OF NEW YORK.

ELECTRIC HEATING APPARATUS.

Application filed November 22, 1926. Serial No. 149,846.

My invention relates to improvements in electric heating apparatus and more particularly to electric heating apparatus wherein the device to be heated forms the secondary of a transformer. The main object of the invention is to provide an apparatus of this class which is not only easily and cheaply constructed, but which is also simple to handle and efficient in operation.

Further and more specific objects, features and advantages will more clearly appear from the detail description given below taken in connection with the accompanying drawings which form a part of this specification.

In the drawings Fig. 1 is a perspective of an apparatus embodying my improvements in a preferred form thereof and showing the apparatus open. Fig. 2 is a similar view showing the apparatus closed. Fig. 3 is a vertical section of the apparatus closed. Fig. 4 is a transverse section taken on the line 4—4 of Fig. 3.

Referring to the drawings, 1 represents a suitable frame or frame work adapted to be bolted to the floor and provided on its top with longitudinal ribs 2, 2. Securely bolted between the ribs 2, 2 is one part of a substantially closed magnetic circuit transformer core 3, so that the part 3 forms a fixed part of a magnetic transformer core. This fixed part 3 is made up of laminations having horizontal portions 4 and upright portions 5 and 6. (See Fig. 2.)

Pivoted to the frame 1 at 7 is a second frame 8 having longitudinal members 9 between which is bolted the other part 10 of the magnetic core, the part 10 also being laminated vertically. Thus the transformer core is formed of a bottom portion having two upright legs 5 and 6 and a top portion which is removable therefrom by tilting the frame 8, 9 about pivot 7 so that the device to be heated such as a ring gear 11 may be linked with the transformer core and properly associated therewith to form a secondary circuit thereof. For the purpose of lifting or tilting the frame 8, 9 the same is provided with a handle member 12 by which it may be manually rocked about the axis at 7. The frame 8, 9 is provided with a suitable counter-weight at 13 so that the frame is pivoted and weighted such that when tilted so that the core parts are separated a predetermined distance the frame tends to move by gravity in a direction to further separate the core parts and when the pivoted frame is tilted in a direction to bring the core parts toward one another to a predetermined extent, the frame member tends to move by gravity in a direction to bring the core parts together. Arranged around the leg 6 of the transformer core is an alternating current primary winding 14. 15 represents a cover of insulating material, such as asbestos board, having a top member 16 and side members 17 secured to the frame 1 by angle irons 18.

Thus the device is provided with a covering of insulated material secured to the first frame and covering the alternating current winding and part of the core and on which the device to be heated such as the ring 11 is adapted to rest. Blocks 30 and 31 may be fastened to the top 16 by screws 32 for the purpose of serving as guides for suitably locating or centering the ring member gear 11 on the top 16 about the core leg 6.

Secured to the side members 9 of the frame 8 are brackets 19, one on either side of the frame, and to the free ends of the brackets 19 are secured blocks 20 respectively which, when the two parts of the transformer core are brought together, are adapted to resiliently engage and press upon the ring member 11 in order to hold it in place while it is being heated.

When a device to be heated such as the ring member 11, is thus inserted in the apparatus so that it is linked with the core member and the two parts of the core brought together as shown in Figs. 2, 3 and 4, and the primary 14 is suitably energized by an alternating current, a heavy secondary electric current will be set up in the device 11 and heat the same in a rapid, even and efficient manner. By pivotally mounting the removable part of the core member 10 with respect to the fixed part of the core 4 the removable part of the core is easily tilted back to permit of the ready insertion of the device to be heated and easily closed again, manually or otherwise, the frame 8, 9 remaining in either of its extreme positions due to the action of gravity. The movement of the frame 8, 9 with the core part 10 in a direction to bring the core parts together is arrested by core parts coming together while the movement of the frame 8, 9 in the opposite direction is arrested by projections 21 on the frame 8 coming in contact with

portions on the fixed frame 1. 22 represents a sheet of insulating material in front of the leg 5 of the core and serves to prevent the device to be heated from coming in contact with the leg 5 of the core.

I find that if the adjacent faces of the two core parts, that is, the faces which come together, be perfectly plain or lie in a single plane that, in operation, a serious chattering of the apparatus was produced. It appears that every time there was a reversal of the electric current in the primary thereby producing a reversal of the flux in the magnetic core, there was a tendency for the core parts to separate or jump apart causing a more or less severe pounding which not only tended to injure the apparatus but also to cause injury to the foundations on which the apparatus is placed and also produce a disadvantageous noise, so that in order to avoid same it was necessary, after bringing the two core parts together, to in some way bolt the two frames together in order to prevent this serious chattering.

The bolting of the two frames together, however, introduced another disadvantage in that it was necessary to bolt and unbolt the two frames every time that a device to be heated was inserted and removed, and this necessitated considerable loss of time and labor.

I have discovered, however, that by changing the adjacent faces of the core parts (i. e., the faces which come together) as shown in the drawings, this chattering could be substantially if not wholly avoided and without bolting the two frames together in order to hold the core parts together by such mechanical means. Thus it will be seen that the upper face of the leg 6 of the core is cut away to provide grooves as at 23, these grooves being rectangular in cross-section, while the corresponding face of the core part 10 is provided with corresponding tongues or projections 24, which when the core parts are brought together substantially fit the grooves 23. In the same way the upper face of the leg 5 of the core is cut away to provide recesses or grooves 25 and the core part 10 is provided with interlocking tongues or projections 26 also rectangular in cross section and adapted to substantially fit into the grooves or depressions 25 when the core parts are brought together. It will be understood that in making the core of two separable parts there is necessarily a thin air-gap where the adjacent faces of the two parts substantially meet, but by breaking up the plane of the adjacent substantially engaging faces of the core parts as above described so that the said air-gap is provided with off-sets, I find that the parts of said core, when the apparatus is in operation, will be held against substantial chattering by electro-magnetic action. That is, the parts of the core are held together by magnetization produced in the core by the alternating current in the primary winding. I find that this result is even more effectually attained if small air-gaps of greater widths than the average width between said adjacent faces are provided in the core structure. Thus I have shown further cutaway grooves in the legs 5 and 6 at 27, which grooves are not engaged by any corresponding tongues or projections on the part 10 so that they are left entirely as air-gaps during the operation of the device.

The arrangement described seems to provide a plurality of lagging magnetic circuits in the core so that at all times during the operation there is a sufficient pull or attraction between the core parts to hold them together sufficiently to prevent any substantial chattering. While the correct theory according to which the chattering is thus substantially reduced or prevented is perhaps uncertain, I believe that by thus varying the air-gaps in the core structure and producing lagging magnetic circuits, a result is produced similar to the action of a direct current, but in any event I find that the arrangement permits the core parts to be held in position by magnetic pull thereby eliminating the necessity of applying special bolts or other mechanical means to hold them together. The exact shape of the tongues and grooves in the faces of the core parts does not appear to be particularly important and the variation or variations in the plane of contact between the core parts or the breaking up of the substantially engaging faces of the core parts may be widely varied, and indeed the electro-magnetic action which holds the core parts against substantial chattering may be accomplished by various other arrangements.

Thus while I have described my improvements in detail and with respect to a preferred form thereof, I do not desire to be limited to such details or form since many changes and modifications may be made and the invention embodied in widely different forms without departing from the spirit and scope thereof in its broader aspects and I desire to cover all forms, modifications and improvements coming within the language or scope of any one or more of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. Electric heating apparatus comprising a magnetic transformer core with an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, part of said core being removable from the rest of the core to permit of the insertion and removal of the device to be heated, and the said parts of said core being

held against substantial chattering by electro-magnetic action.

2. Electric heating apparatus comprising a magnetic transformer core with an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, part of said core being removable from the rest of the core to permit of the insertion and removal of the device to be heated, and the said parts of said core being held against substantial chattering by magnetization produced in the core by the alternating current in the primary winding.

3. Electric heating apparatus comprising a magnetic transformer core with an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, part of said core being removable from the rest of the core to permit of the insertion and removal of the device to be heated, the adjacent faces of said core parts having interengaging tongue and groove parts respectively, whereby the said parts of said core are held against substantial chattering by electro-magnetic action.

4. Electric heating apparatus comprising a magnetic transformer core with an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, part of said core being removable from the rest of the core to permit of the insertion and removal of the device to be heated, and whereby there is formed in the magnetic circuit of said core a thin air gap where the adjacent faces of said core parts substantially meet, said air gap being provided with offsets whereby the said parts of said core are held against substantial chattering by electro-magnetic action.

5. Electric heating apparatus comprising a magnetic transformer core with an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, part of said core being removable from the rest of the core to permit of the insertion and removal of the device to be heated, and whereby there is formed in the magnetic circuit of said core a thin air gap where the adjacent faces of said core parts substantially meet, said air gap being provided with offsets and air gaps of greater width than the average width between said adjacent faces, whereby the said parts of said core are held against substantial chattering by electro-magnetic action.

6. Electric heating apparatus comprising a substantially closed magnetic circuit transformer core and an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, said core being formed in two parts, one of which is relatively stationary and the other of which is pivotally mounted with respect thereto so that the second part is removable from the first part to permit of the insertion and removal of the device to be heated, the plane of the adjacent substantially engaging faces of said core parts being broken, whereby the said parts of said core are held against substantial chattering by electro-magnetic action.

7. Electric heating apparatus comprising a magnetic transformer core with an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, part of said core being removable from the rest of the core to permit of the insertion and removal of the device to be heated, said core being constructed to provide a plurality of lagging magnetic circuits, whereby the said parts of said core are held against substantial chattering by electro-magnetic action.

8. Electric heating apparatus comprising a substantially closed magnetic circuit transformer core and an alternating current primary winding associated therewith, the device to be heated being linked with said core to form a secondary circuit, said core being formed in two parts, one of which is relatively stationary and the other of which is pivotally mounted with respect thereto so that the second part is removable from the first part to permit of the insertion and removal of the device to be heated.

9. Electrical heating apparatus comprising a relatively fixed frame, a relatively movable frame pivotally mounted on the first frame, a substantially closed magnetic circuit transformer core, an alternating current primary winding associated with said core, the device to be heated being linked with said core to form a secondary circuit, and said core being formed in two parts, one part of which is secured to the first frame and the other part of which is carried by the second frame, whereby the second part is removable from the first part by tilting the second frame about its axis on the first frame to permit of the insertion and removal of the device to be heated.

10. Electrical heating apparatus comprising a relatively fixed frame, a relatively movable frame pivotally mounted on the first frame, a substantially closed magnetic circuit transformer core, an alternating current primary winding associated with said core, the device to be heated being linked with said core to form a secondary circuit, and said core being formed in two parts, one part of which is secured to the first frame and the other part of which is carried by the second frame, whereby the second part is removable from the first part by

tilting the second frame about its axis on the first frame to permit of the insertion and removal of the device to be heated, means on the first frame on which the device to be heated may rest and means on the second frame adapted to engage and hold the device to be heated in place when the two parts of the core are brought together.

11. Electrical heating apparatus comprising a relatively fixed frame, a relatively movable frame pivotally mounted on the first frame, a substantially closed magnetic circuit transformer core, an alternating current primary winding associated with said core, the device to be heated being linked with said core to form a secondary circuit, and said core being formed in two parts, one part of which is secured to the first frame and the other part of which is carried by the second frame, whereby the second part is removable from the first part by tilting the second frame about its axis on the first frame to permit of the insertion and removal of the device to be heated, said second frame being so pivoted and weighted that when tilted so that the core parts are separated a predetermined distance the frame tends to move by gravity in a direction to further separate the core parts, and when the second frame is tilted in a direction to bring the core parts toward one another to a predetermined extent the frame tends to move by gravity in a direction to bring said core parts together.

12. Electrical heating apparatus comprising a relatively fixed frame, a relatively movable frame pivotally mounted on the first frame, a substantially closed magnetic circuit transformer core, an alternating current primary winding associated with said core, the device to be heated being linked with said core to form a secondary circuit, and said core being formed in two parts, one part of which is secured to the first frame and the other part of which is carried by the second frame, whereby the second part is removable from the first part by tilting the second frame about its axis on the first frame to permit of the insertion and removal of the device to be heated, and a covering of insulating material secured to the first frame and covering said alternating current winding and on which the device to be heated is adapted to rest.

In testimony whereof I have signed my name to this specification.

JOHN P. SUNDERLAND.