May 4, 1943. F. S. DENNEEN ET AL 2,318,468

ADJUSTABLE HEATING APPARATUS

Filed Aug. 6, 1941 3 Sheets-Sheet 1

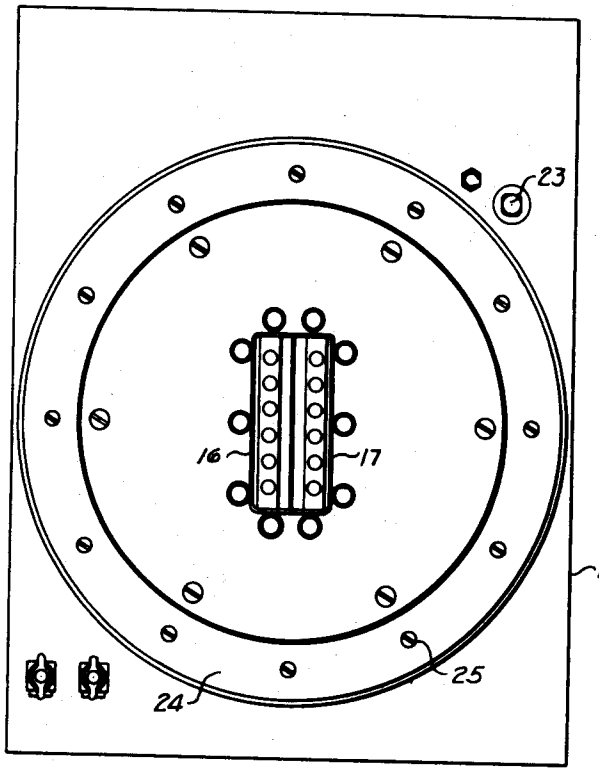


Fig. 1

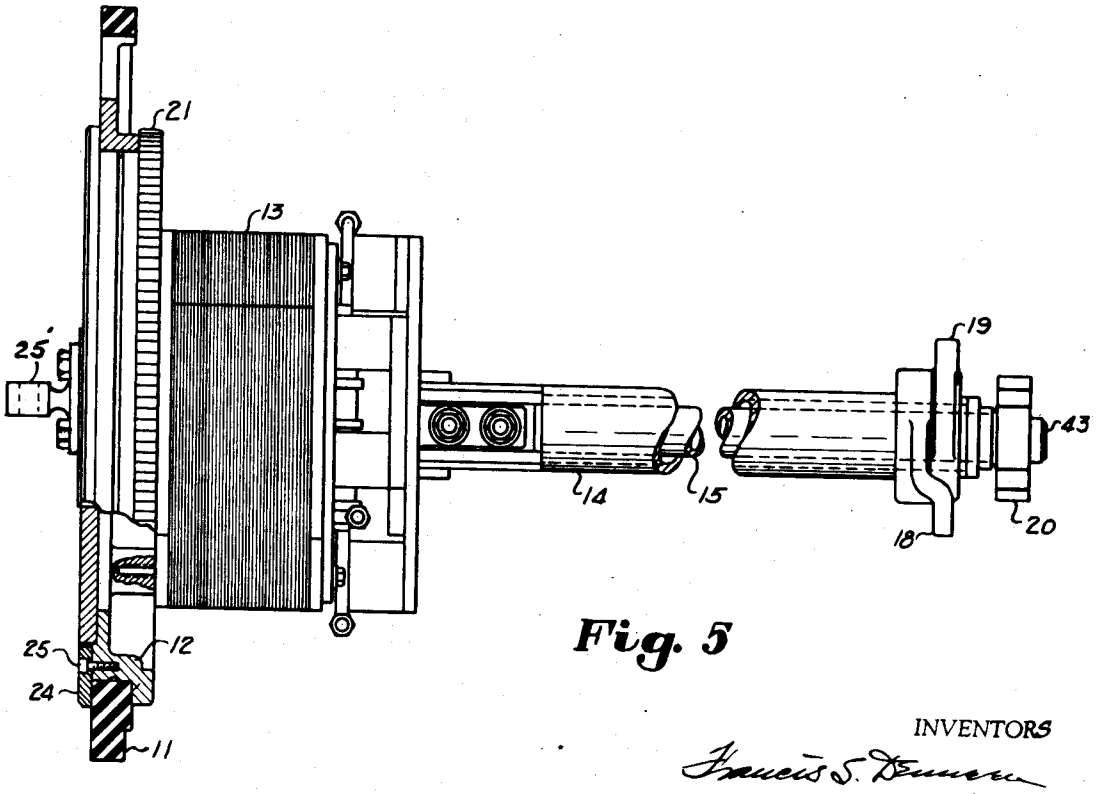


Fig. 5

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ADJUSTABLE HEATING APPARATUS

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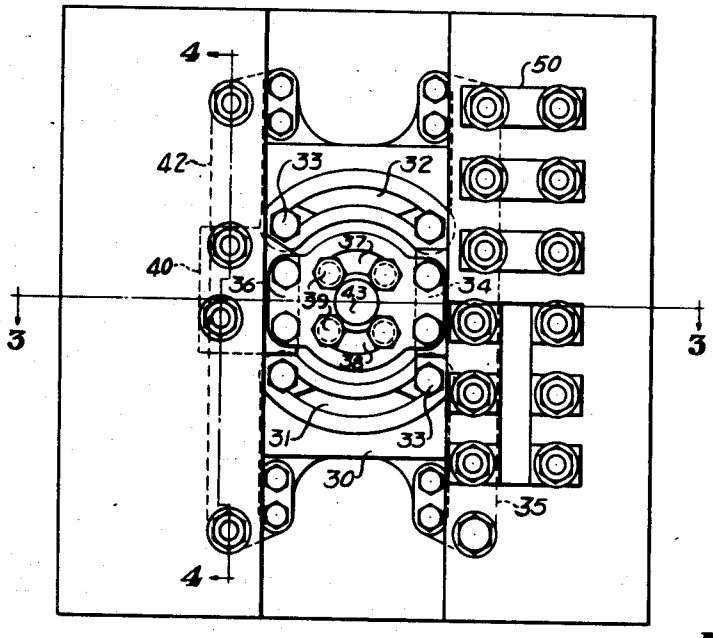


Fig. 2

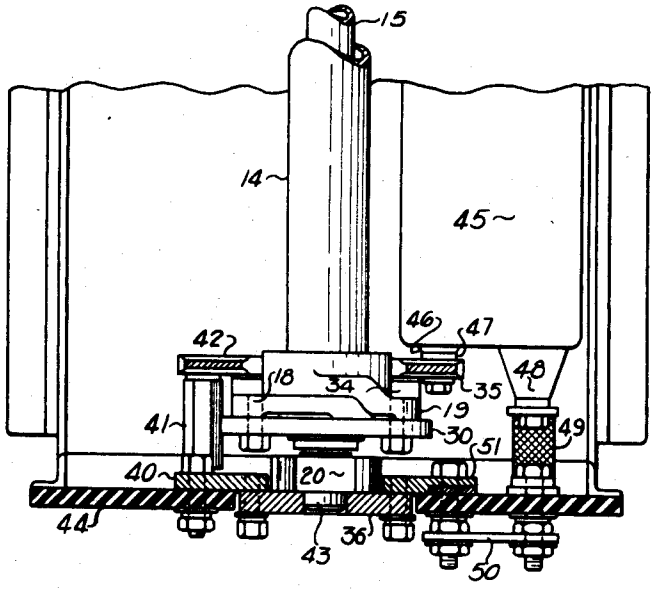


Fig. 3

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ADJUSTABLE HEATING APPARATUS

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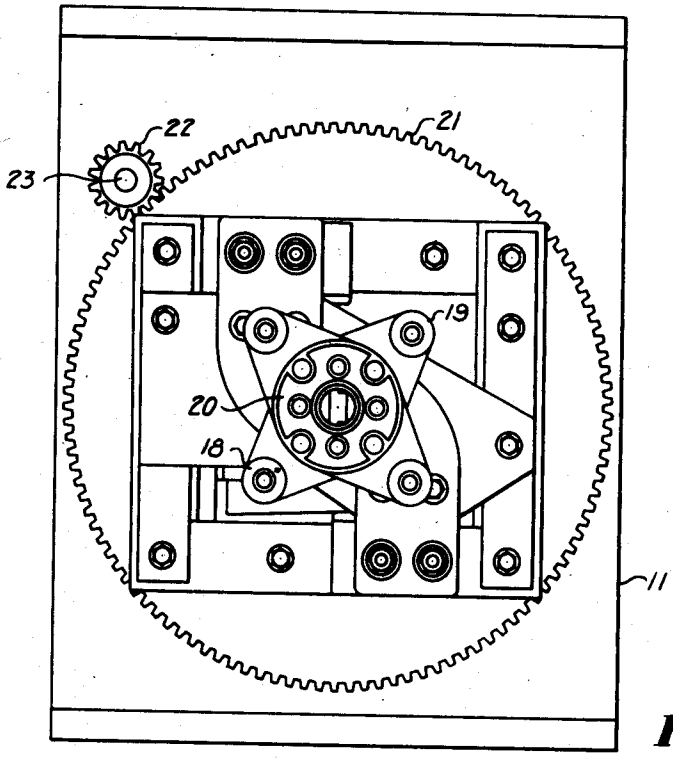


Fig. 6

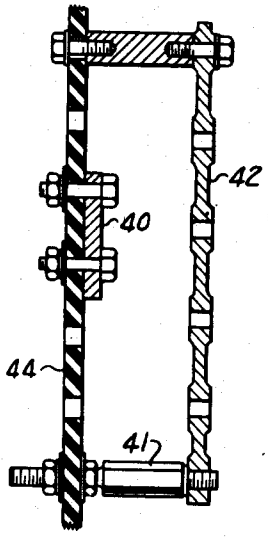


Fig. 4

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2,318,468

UNITED STATES PATENT OFFICE

2,318,468

ADJUSTABLE HEATING APPARATUS

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Application August 6, 1941, Serial No. 405,595

11 Claims. (Cl. 219—13)

The present invention as an improvement on that shown and described in our co-pending application Serial No. 304,986, filed November 17, 1939, relates to mechanism for rendering more convenient and universal the apparatus contained in the said pending application. Apparatus of this general character is applicable to the heat treatment of many articles which vary in size and form and which, as a result, require to be handled in a variety of ways. In the former application, the general arrangement of the apparatus is shown and described, and one simple way of bringing out the power leads from the transformer within the upper part of the apparatus to supply power to an inductor placed in the quench collecting basin is shown.

Frequently it is not advantageous to place the inductor in one fixed position as shown in that application, but is often found necessary to move this inductor into various other locations and to rotate it into various positions, especially when progressive or continuous operations are required, such as are described in our co-pending application Serial No. 307,394 filed December 4, 1939. If it were desired to use the apparatus of this last named application to progressively heat treat elongated parts which were too long to pass vertically through the inductor, it would then be necessary to turn the inductor and the feeding mechanism so as to pass the articles therethru in a horizontal direction or in an intermediate direction.

This invention thus relates to apparatus for adjusting the positions of operative elements, particularly elements for delivering power for heating, such as inductors or resistors for electric heating, and nozzles for combustion heaters or for the transfer of power for a variety of other purposes including the heat treating of articles. It is adapted also to controlling the direction of flow of cooling or quenching fluid for such heat treating or for other purposes. It is particularly well adapted to use in cases where a variety of articles are to be heated or otherwise operated upon which require a modification in the apparatus in changing over from one article to another. One of its chief uses as above indicated has been found in the mounting of inductors used in the heat treatment of articles such as the inductors of the above stated applications and of such inductor as is shown in our Patent No. 2,170,130.

In heating articles of varying form and size by electric means, a variety of heating elements or inductors is required, each being adapted to the particular item being operated upon and each is often required to be adjusted to a particular position. For instance, if an inductor for progressively heating a series of articles is employed, it may be necessary that the inductor be arranged to let the various articles pass thru or adjacent to the inductor in many different directions. To this end, the conductors to which the inductors or other elements are connected are arranged so as to be rotated or otherwise moved into numerous positions to provide the greatest possible convenience in changing over from operating on one part to operating on another.

The chief object of our invention has been to provide apparatus of a universal character for supplying power to elements for heating or other purposes. Another object has been to provide means for conveniently changing the positions of these elements to adapt them to a variety of uses. A further object has been to provide means of this general character which is compact, easily installed and efficient in operation. Other objects will appear in the following description.

With the above and related objects in view, the said invention consists of the means hereinafter described together with the steps employed in using this or similar means, which means and steps are particularly pointed out in the claims. The annexed drawings and the following description set forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In the annexed drawings:

Fig. 1 is a front elevation of the preferred form of our apparatus.

Fig. 2 is a rear elevation of this apparatus.

Fig. 3 is a section substantially at 3—3 of Fig. 2.

Fig. 4 is a section substantially at 4—4 of Fig. 2 showing the bus bars only.

Fig. 5 is a side elevation showing the rotatable mechanism attached to its front support.

Fig. 6 is a rear elevation of the mechanism shown in Fig. 5.

Referring now to the drawings, 11 represents the front member of an enclosure for our improved mechanism, this front member serving as the chief supporting element of this mechanism. This front member is provided with a bore into which is inserted the rotatable support 12. This support 12 carries the transformer 13 to whose primary current is supplied by concentric tubular primary conductors 14 and 15. The secondary

of this transformer is connected to deliver secondary current, usually of high amperage, to the terminals 16 and 17. The outer conductor 14 has terminals 18 and 19 and the inner conductor is provided with terminal 20. This entire mechanism comprising the transformer and the secondary and primary conductors with their terminals is rotatable on the supporting front member 11, which member is usually made of non-metallic material. This rotatable support 12 is provided with the gear 21 either attached to or integral therewith. Meshing with this gear is pinion 22, which pinion is carried by shaft 23, this shaft having a bearing in the front support member 11. The end of the shaft 23 is provided with a square or other form to engage a crank or a wrench whereby the shaft and pinion can be conveniently rotated. A plate 24 is provided on the face of support member 11 and is attached to support 12 by means of screws such as 25 and is so arranged that when the screws are tightened the front member 11 is clamped between this plate and support 12 thus holding this support and the transformer 13 to which conductors 14 and 15 are attached, all in firmly secured relation with the front member. It will be apparent that after loosening the screws 25, a wrench or crank can be applied to shaft 23 and the transformer with its primary leads 14 and 15 and its secondary terminals 16 and 17 to which an inductor or other heating member 25' is attached, can be rotated to any desired position after which the screws are tightened to hold the mechanism securely in its new position. It will be observed that the terminals 16 and 17 are elongated and have numerous holes for screws so that the inductor 25' or other heater can be moved into selected locations along these terminals. By adjusting the position of the heater along the terminals and by rotating the terminals, a substantially universal adjustment of the heater is provided.

Since the primary conductors 14 and 15 usually carry heavy currents and are required to be rotated whenever the transformer is turned their connections to the supplying bus bars do not comprise the flexible cables which are often employed in such cases but have heavy copper terminals which are securely clamped to the bus bars. To permit rotation, the clamping means must be loosened and again tightened after the conductors have been brought into the desired positions. To accomplish this adjustable clamping the terminals are arranged as shown more clearly in Figs. 2, 3 and 4. The terminals 18 and 19 which are secured to the outer conductor 14 are in substantially sliding contact with plate 30 which plate is provided with arcuate slots 31 and 32 to receive clamp screws 33. The plate 30 by means of connector 34 is joined with bus bar 35 to which power is supplied from some outside source, such as a high frequency generator or tube set. The terminal 20 which is secured to the inner conductor 15 is in sliding contact with plate 36, which plate is provided with arcuate slots 37 and 38 to receive clamp screws 39. This plate 36 by means of connector 40 and extension 41 is connected to bus bar 42 to which the above mentioned source of power is also connected. Connector 40 is supported by the insulating frame member 44. Terminal 20 is provided with a piloting end 43 which has a bearing in a bore in plate 36 which being concentric with the bore in support member 11 helps to hold the entire mechanism in alignment.

To obtain resonance in the primary circuits, capacitors such as 45 are employed. These capacitors are connected between bus bars 35 and 42. One terminal such as 46 of each capacitor is connected directly to one bus bar 35 as at 47 and the other terminal, such as 48 is connected to the other bus bar 42 by means of the lead 49 and by connector 50 and plate 51 which plate is secured to plate 36 as shown.

Operation

When it is desired to rotate the secondary terminals 16 and 17 to bring the inductor 25' or other heating member attached to them into some desired angular position, screws 33 and 39, holding the terminals 18 and 19 and 20 of conductor tubes 14 and 15 respectively, are loosened to permit these terminals to slide in substantial contact with the plates 30 and 36 respectively. Screws 25 in the clamp ring 24 on the front of the apparatus are also loosened to release the clamping effect of this clamp ring and to permit support 12 to be rotated. A crank or wrench is then applied to the end of shaft 23 carrying pinion 22 and this pinion is rotated in the desired direction and thru a sufficient number of turns to turn gear 21 and support 12 to the desired angular position. During this movement, terminals 18 and 19 rotate substantially in contact with plate 30 and terminal 20 rotates in substantial contact with plate 36, the piloting end 43 secured to terminal 20 rotating centrally in the bore in plate 36 during this rotation to hold the entire moving mechanism in alignment while being turned. In some cases where the desired angular movement is large, screws 33 and 39 are removed entirely from the holes in the terminals and inserted in other holes which are uncovered by the arcuate slots as the terminals rotate.

It will be understood that the tubular conductors 14 and 15 are suitably insulated from each other and that these conductors are firmly attached to the transformer 13 so as to form a unit of the necessary structural strength. Tubes for supplying cooling fluid to the coils of the transformer are provided and are made of material sufficiently flexible to permit the required angular movements of the transformer.

It will be observed that space is provided within the confines of the structure to insert all necessary capacitors.

This general arrangement is not intended to be limited to apparatus for heating by induction, but as pointed out heretofore it may be employed for resistance heating, or for holding burners or other mechanism in combustion heating, or it may be employed in apparatus intended for purposes other than that of heating.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the means herein disclosed, provided those stated by any of the following claims or their equivalents be employed.

We, therefore, particularly point out and distinctly claim as our invention:

1. In apparatus of the character described, a transformer having a substantially tubular conductor secured thereto to form a substantially rigid power supply unit, the transformer and the conductor having a common axis of rotation, a support for the transformer and a support for the conductor, the said supports being spaced from each other, means for rotating the said unit on the supports to angularly adjust an inductor

being carried by the unit, a bus bar for delivering current to the conductor, and means to secure the conductor to the bus bar to hold the aforesaid power supply unit in adjusted position.

2. In apparatus of the character described, a transformer having a conductor secured thereto to form a substantially rigid power supply unit, a heating member being attached to the unit, a support for said unit, means for rotating the unit on the support to adjust the heating member, a bus bar for supplying current to the conductor, and means to release the conductor from the bus bar to permit the conductor to be rotated to a new position, the last named means being adapted to again attach the conductor to the bus bar in a new position on the bus bar.

3. In apparatus of the character described, a power supply unit comprising a rotatable transformer having an axis, an inductor being attached to the transformer, a conductor for supplying power to the transformer, said conductor being rotatable with the transformer on the axis, a fixed conductor for supplying periodically varying current to the rotatable conductor, means for rotating the transformer and rotatable conductor to angularly adjust the inductor, and means to fasten the rotatable conductor to the fixed conductor to hold the rotatable conductor when the inductor has been adjusted.

4. In apparatus of the character described, an enclosure, a transformer having an axis passing thru a part of the enclosure, an inductor being attached to the transformer and projecting exteriorly from a wall of the enclosure and substantially along the axis, a conductor for supplying current to the transformer, the transformer and conductor being rotatable on the said axis to angularly adjust the inductor, locking means associated with a wall of the enclosure for holding the inductor in adjusted position, and means for supplying periodically varying current to the conductor.

5. In apparatus of the character described, a power supply unit comprising a transformer having an axis, conductors for supplying power to the transformer, the conductors extending axially from a side of the transformer and serving as a support for the transformer, an inductor being connected to the transformer and lying substantially along the axis thereof, means for rotating the transformer and the supporting conductors on the said axis to rotatably adjust the inductor, clamping means for holding the transformer and conductors to maintain the inductor in an adjusted position, and means for supplying periodically varying current to the conductors.

6. In apparatus of the character described, a power unit comprising an inductor and a terminal for delivering periodically varying current to the inductor, the terminal being elongated to provide space to selectively position the inductor on the terminal, means fastening the inductor to the terminal, means for rotating the power unit on an axis to rotate the terminal and to move the inductor into a preselected position, and means to hold the inductor in the preselected position.

7. In apparatus of the character described, a power unit comprising an inductor and a terminal for delivering periodically varying current to the inductor, the unit being rotatable on an axis in a supporting member, the terminal being elongated and extending transversely of the axis to provide space to selectively position the inductor on the terminal radially from the axis, means fastening the inductor to the terminal in a selected position, means for rotating the power unit on the axis to rotate the terminal and to move the inductor along an arc into a preselected position, and means for holding the inductor in the preselected position.

8. In apparatus of the character described, a power unit comprising an inductor and a terminal for delivering periodically varying current to the inductor, the inductor having a bore to receive an article to be heated, the power unit being rotatable on an axis in a supporting member, the terminal being elongated and extending transversely of the axis to provide space to selectively position the inductor on the terminal substantially radially from the axis, means fastening the inductor to the terminal in a selected position, means for rotating the power unit on the axis to rotate the terminal and to move the inductor along an arc into a preselected position to change the elevation of the bore relative to the axis and to change the angle of the bore relative to the aforesaid support, and means for holding the inductor in the preselected position.

9. In apparatus of the character described, a power unit comprising an inductor and terminals for delivering inducing current to the inductor, the inductor being attached to the said terminals at selected positions, a bus bar for delivering current to the power unit, means for angularly adjusting the power unit to selectively position the inductor, and means for fastening the power unit to the bus bar in adjusted position.

10. In apparatus of the character described, a power unit comprising an inductor and power transforming means for delivering inducing current to the inductor, a conductor for delivering current to the said power transforming means, spaced supports for said power unit, the supports having coaxial bores, one of the bores engaging a part of said power transforming means for supporting one part of the unit, the other bore engaging a part of the aforesaid conductor to support another part of the unit, means for angularly adjusting the unit in the bores to angularly adjust the inductor, and means to secure the unit in adjusted position.

11. In apparatus of the character described, a power supply unit comprising a transformer and an inductor, the transformer and inductor having an axis of rotation, said inductor having a bore, an axis of the bore having a direction making a substantial angle with the said axis of rotation, means for rotating the transformer and inductor about the axis to change the direction of the axis of the bore of the inductor, and means for supplying periodically varying current to the transformer said last named means being adapted to be secured in selected positions to deliver said current to the transformer at substantially all selected positions of the inductor.

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