Oct. 25, 1949. A. J. PINKNEY 2,485,843

HIGH-FREQUENCY HEATING ARRANGEMENT

Filed Dec. 17, 1947 2 Sheets-Sheet 1

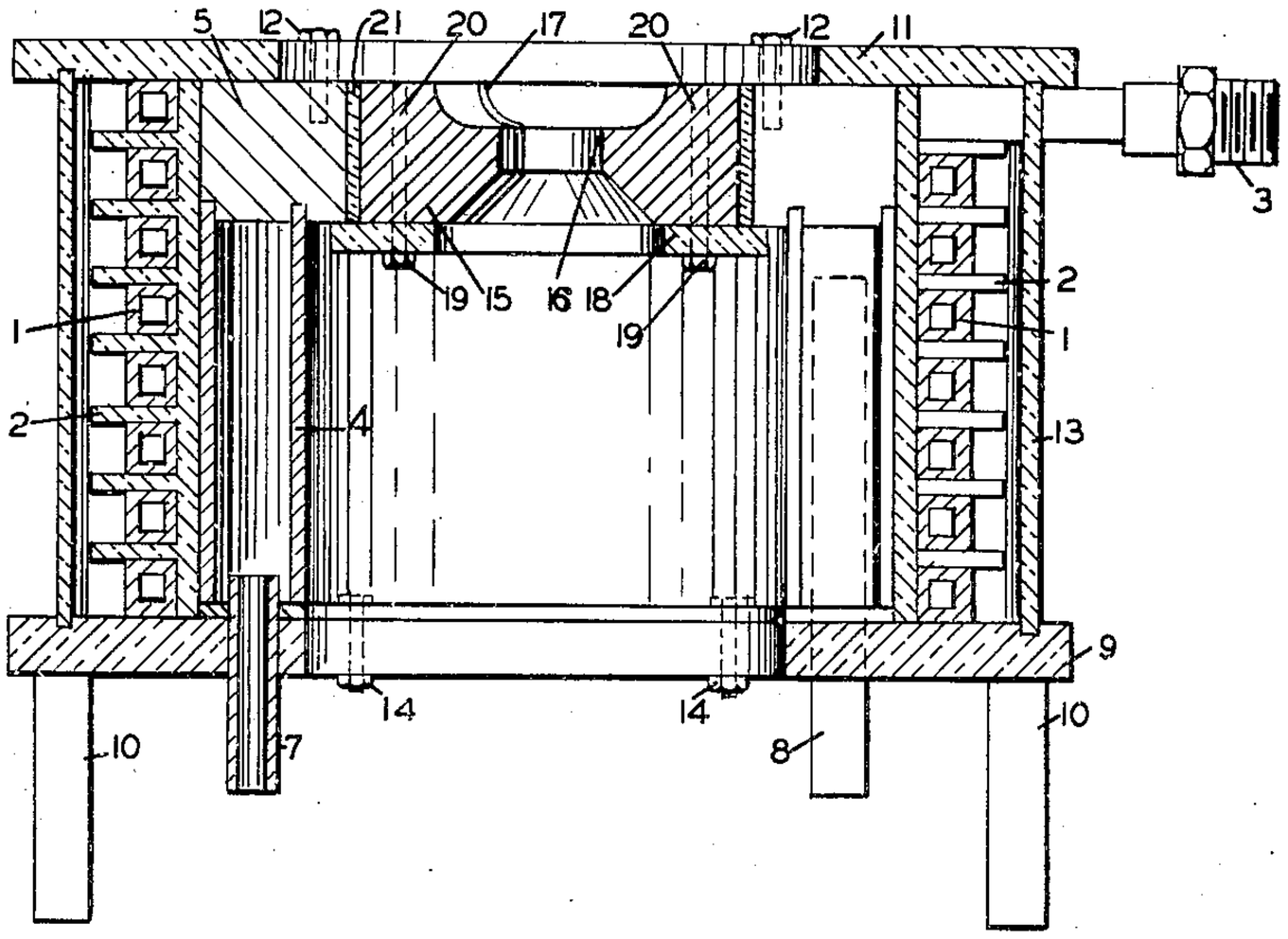

FIG. 1

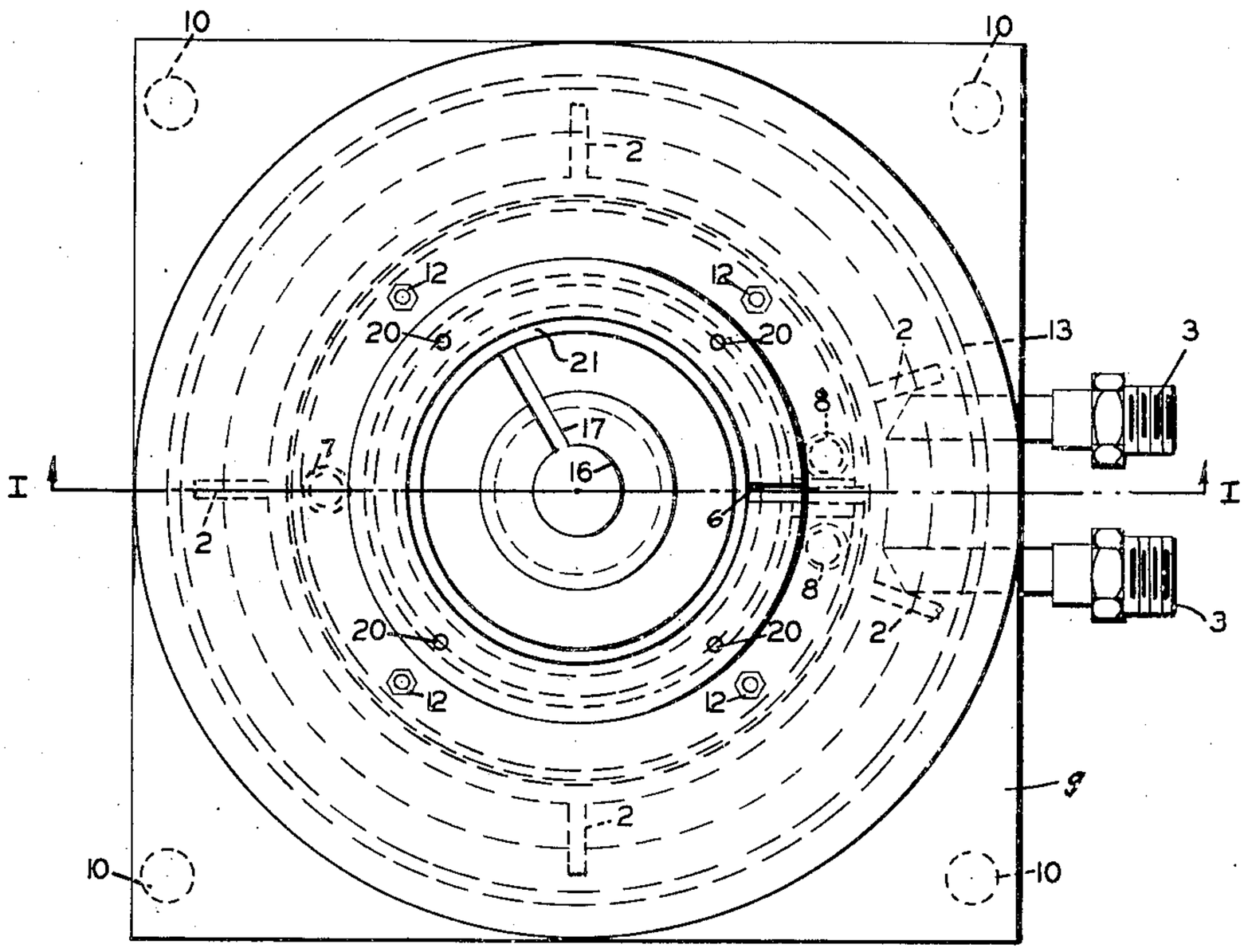

FIG. 2

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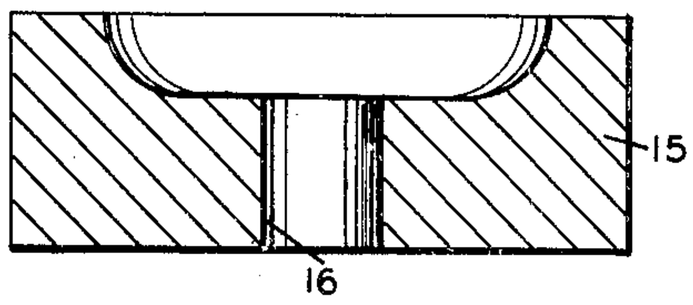

FIG. 3

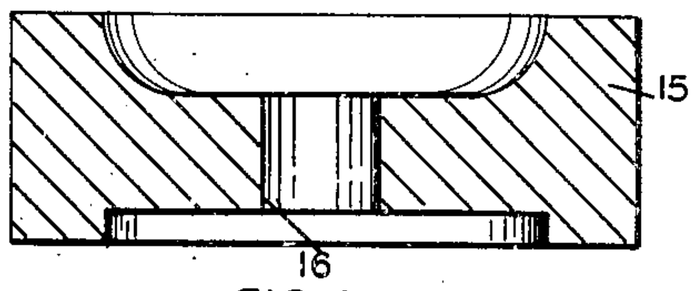

FIG. 4

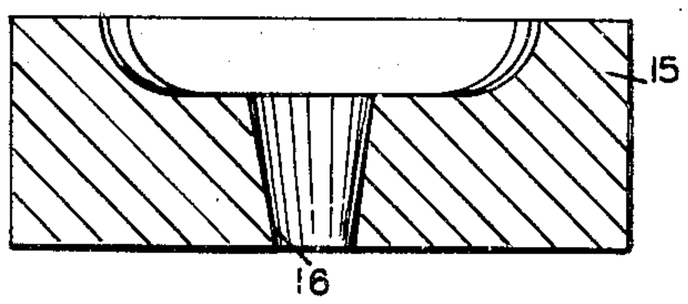

FIG. 5

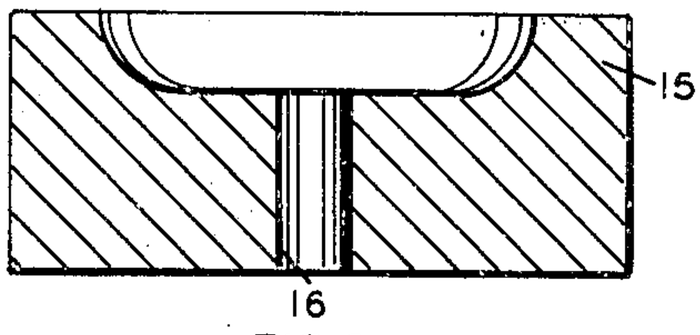

FIG. 6

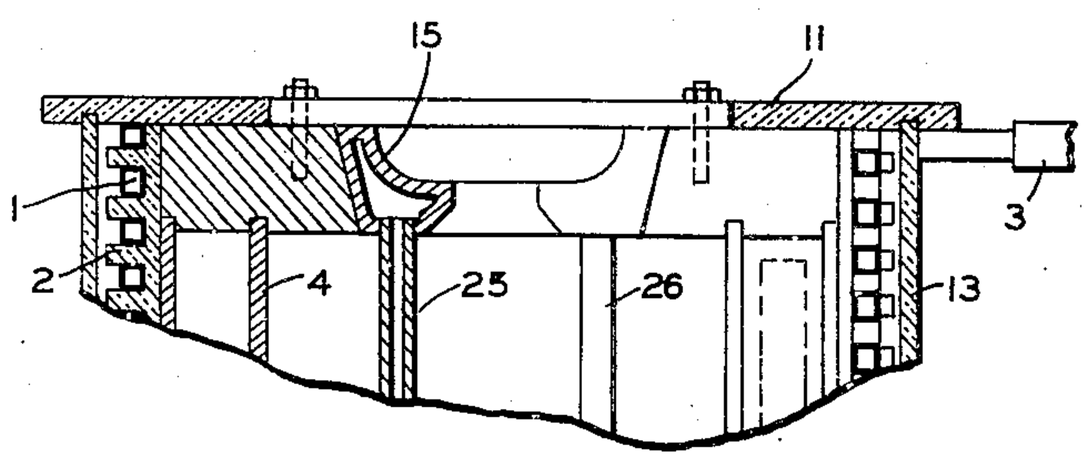

FIG. 7

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UNITED STATES PATENT OFFICE

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HIGH-FREQUENCY HEATING ARRANGEMENT

Arthur Jack Pinkney, London, England, assignor to The Hartford National Bank and Trust Company, Hartford, Conn., as trustee

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In Great Britain October 18, 1944

Section 1, Public Law 690, August 8, 1946
Patent expires October 18, 1964

6 Claims. (Cl. 219—47)

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This invention relates to high frequency heating arrangements incorporating a concentrator of the kind consisting of a hollow cylinder of copper or similar highly conducting material provided at one end with a block of like material which is attached to the cylinder and has an aperture for the passage of the work; the block and the cylinder are slotted so that a closed circuit does not exist about the aperture. The high frequency current is supplied to a coil surrounding the cylinder.

With such concentrators it is desirable that the end block should surround the work as closely as possible, and the present invention has for its object to enable this desideratum to be achieved quickly and simply.

According to the present invention the end block is provided with an aperture greater than or at least not smaller than the maximum desired aperture, the walls of the aperture being so shaped as to form a seating for an adaptor ring which is inserted in the aperture in the end block and is itself provided with an aperture appropriate to the work. The adaptor ring is slotted in the same way as the end block and cylinder and consists of similar material. To avoid the production of a closed circuit about the aperture, the slots in the adaptor ring and the remainder of the concentrator may be aligned, but preferably the adaptor is insulated from the remainder by the interposing of a layer of mica for example.

In practice, a number of interchangeable adaptor rings forming a series can be provided for use with a single concentrator. When changing to work of different diameter, it is only necessary to substitute an adaptor ring having an aperture of the appropriate size. If the concentrator cylinder is arranged with its axis vertical and with the block at its upper end, the adaptor rings can simply rest on the seating provided and no securing means are required.

Certain embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a central vertical section through a high frequency heating arrangement according to the invention, the section being taken substantially along the line I—I of Figure 2.

Figure 2 is a top plan view of Figure 1.

Figures 3 to 6 show central sections through alternative forms of concentrator rings for use in the arrangement according to Figures 1 and 2, Figures 3 to 6 being on a somewhat larger scale than Figures 1 and 2.

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Figure 7 illustrates a further embodiment according to the invention.

Referring first to Figures 1 and 2, the main inductor 1 consists of a number of turns of square section copper tubing, the consecutive turns being supported at the desired spacing by a number of insulating spacing members 2. The two ends 3 of the main inductor coil 1 are provided with connections for water or other cooling fluid and are also electrically connected to the high frequency source (not shown). Arranged within the inductor coil 1 is a concentrator unit consisting of a cylindrical body 4 and an annular top member 5 constituting the end block, the inner diameter of the annular member being smaller than the inner diameter of the cylindrical body 4. As best seen from Figure 2, the concentrator is provided with a radial slot 6 extending through the annular top member 5 and along the length of the cylindrical body 4. The cylindrical body 4 is hollow and is provided with water inlet and outlet connections 7 and 8 respectively. The arrangement so far described is supported on an insulating base plate 9 provided with legs 10, the concentrator body being secured to the base plate 9 by a number of bolts 14 (Figure 1). The upper face of the annular concentrator member 5 is covered by a cover plate 11 of insulating material which also covers the top of the main inductor coil 1. The cover plate 11 is secured by means of bolts 12 which are embedded in the concentrator member 5 and which receive nuts engaging the outer surface of the cover plate 11. The peripheral surface of the main inductor coil is enclosed within a cylindrical surround 13 of insulating material which extends between the base plate 9 and the cover plate 11.

The annular top member 5 of the concentrator has a central aperture considerably in excess of the diameter of the work which it is desired to heat. To adapt the concentrator to the work an adaptor ring 15 is inserted in the central aperture in the annulus 5 and is provided with a central aperture 16 corresponding to the size of the work to be heated. This inserted concentrator ring 15 is provided with a radial slot 17. If the inserted ring 15 is insulated from the annulus 5 by an interposed layer of mica or equivalent insulating material capable of withstanding an elevated temperature the slot 17 need not be aligned with the slot 6 in the annulus 5, but if there is metallic contact between the inserted ring 15 and the annulus 5 the slots 17 and 6 must be in registration. In the construction illustrated a layer 21 of mica is interposed between

the inserted concentrator ring 15 and the annulus 5. The inserted ring 15 is supported in the desired position by means of an annular member 18 of insulating material which is secured to the underface of the annulus 5 by means of bolts 19 engaging in tapped holes 20 passing through the annulus 5. The concentrator ring 15 is thus removably supported in the annulus 5 and can consequently be replaced by a ring exhibiting an aperture of different size or shape to suit the particular work which is to be treated. Typical alternatives to the form of inserted ring shown in Figure 1 are illustrated in Figures 3 to 6. Figures 3 to 6 show a cross-section through the ring 15 with the work aperture 16, but the cross-section has been taken on such a line that the radial slot 17 (Figures 1 and 2) does not appear.

As an alternative to the arrangements shown for supporting the ring 15 within the annulus 5, the supporting ring 18 could be dispensed with, the ring 15 being made of conical form tapering downwardly and the inner surface of the annulus 5 forming a corresponding conical seat. Such a construction is shown in Fig. 7. In this case the slot in the inserted ring must register with the slot 6 in the annulus 5.

If desired, provision can be made for cooling the inserted ring 15 by making it hollow and passing a cooling fluid through it, as shown in Fig. 7 wherein a hollow ring 15 is supplied with a cooling fluid through the conduits 25 and 26.

Moreover the insulating supporting 18 (Figure 1) may comprise or carry a jig for the accurate location of the work in the aperture 16 in the ring 15.

I claim:

1. High frequency heating apparatus comprising a coil member for generating a high frequency heating field, a first electrically conductive tubular member fixedly secured within an end portion of said coil and provided with a slot longitudinally extending through a wall portion thereof, and a second electrically conductive tubular member positioned within said first tubular member and provided with a slot extending through a wall portion thereof.

2. High frequency heating apparatus comprising a helical coil member for generating a high frequency heating field, a first electrically conductive cylindrical member fixedly secured within said coil, a second electrically conductive tubular member fixedly secured within an end portion of said coil in abutting relationship to one end of said first member, said first and second member being provided with aligned slots extending through a wall portion thereof, and a third electrically conductive tubular member positioned within said second tubular member and provided with a slot extending through a wall portion thereof.

3. High frequency heating apparatus comprising a helical coil member for generating a high frequency heating field, a first electrically conductive cylindrical member fixedly secured within said coil, a second electrically conductive annular member fixedly secured within an end portion of said coil in abutting relationship to one end of said first member, said first and second members being provided with aligned radial slots, and a third electrically conductive ring member positioned within said annular member and provided with a radial slot.

4. High frequency heating apparatus comprising a helical coil member for generating a high frequency heating field, a first electrically conductive cylindrical member fixedly secured within said coil, a second electrically conductive annular member fixedly secured within an end portion of said coil in abutting relationship to one end of said cylindrical member, said first and second members being electrically interconnected, being provided with aligned radial slots and being electrically insulated from said helical coil, a third electrically conductive ring member positioned within said annular member and provided with a radial slot, and means to electrically insulate said ring member from said annular member.

5. High frequency heating apparatus comprising a helical coil member for generating a high frequency heating field, a first electrically conductive cylindrical member fixedly secured within said coil and comprising spaced concentric wall portions, a second electrically conductive annular member fixedly secured within an end portion of said coil in abutting relationship to one end of said cylindrical member, said first and second members being electrically interconnected, being provided with aligned radial slots and being electrically insulated from said helical coil, a third electrically conductive ring member positioned within said annular member and provided with a radial slot, and means to supply a cooling fluid to the space between said concentric wall portions.

6. High frequency heating apparatus comprising a helical coil member for generating a high frequency heating field, a first electrically conductive cylindrical member fixedly secured within said coil, a second electrically conductive annular member fixedly secured within an end portion of said coil in abutting relationship to one end of said cylindrical member and being provided with a conical aperture, said first and second members being electrically interconnected, being provided with aligned radial slots and being electrically insulated from said helical coil, and a third electrically conductive ring member provided with a conical outer surface and with a radial slot and positioned within said annular member.

ARTHUR JACK PINKNEY.

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