Oct. 4, 1949. H. A. STRICKLAND, JR 2,483,444

INDUCTION HEATING HEAD AND ARBOR THEREFOR

Filed July 17, 1945

2 Sheets-Sheet 1

Fig. 1.

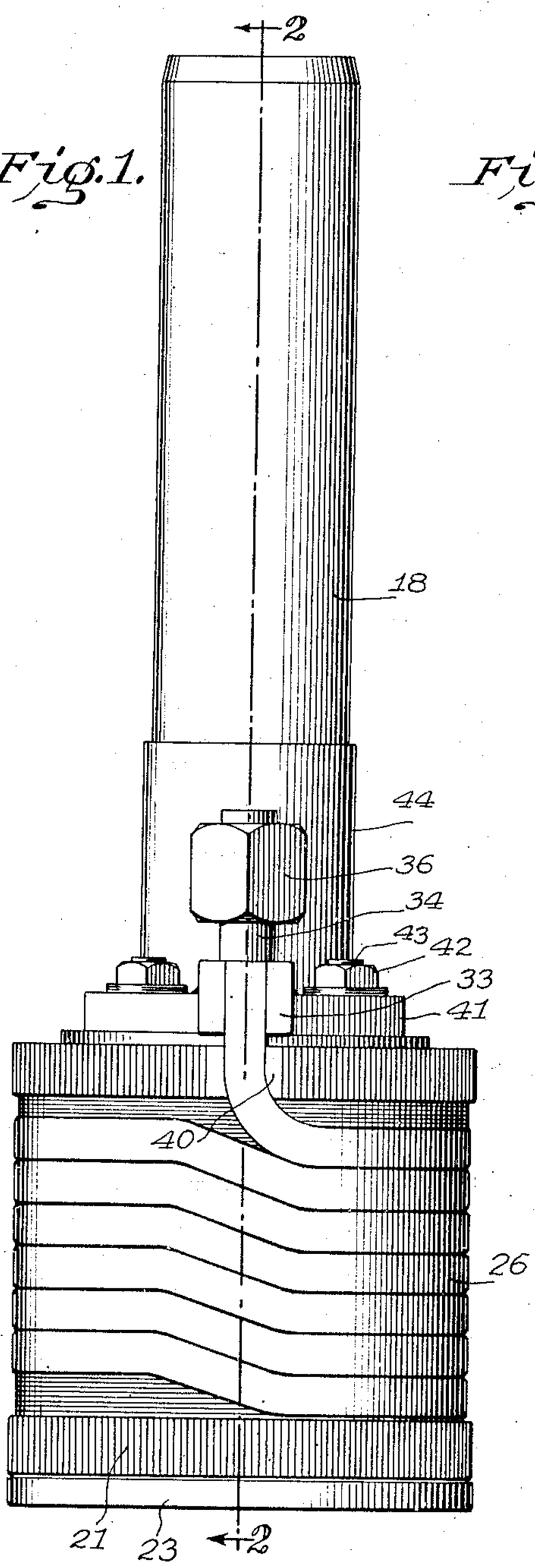
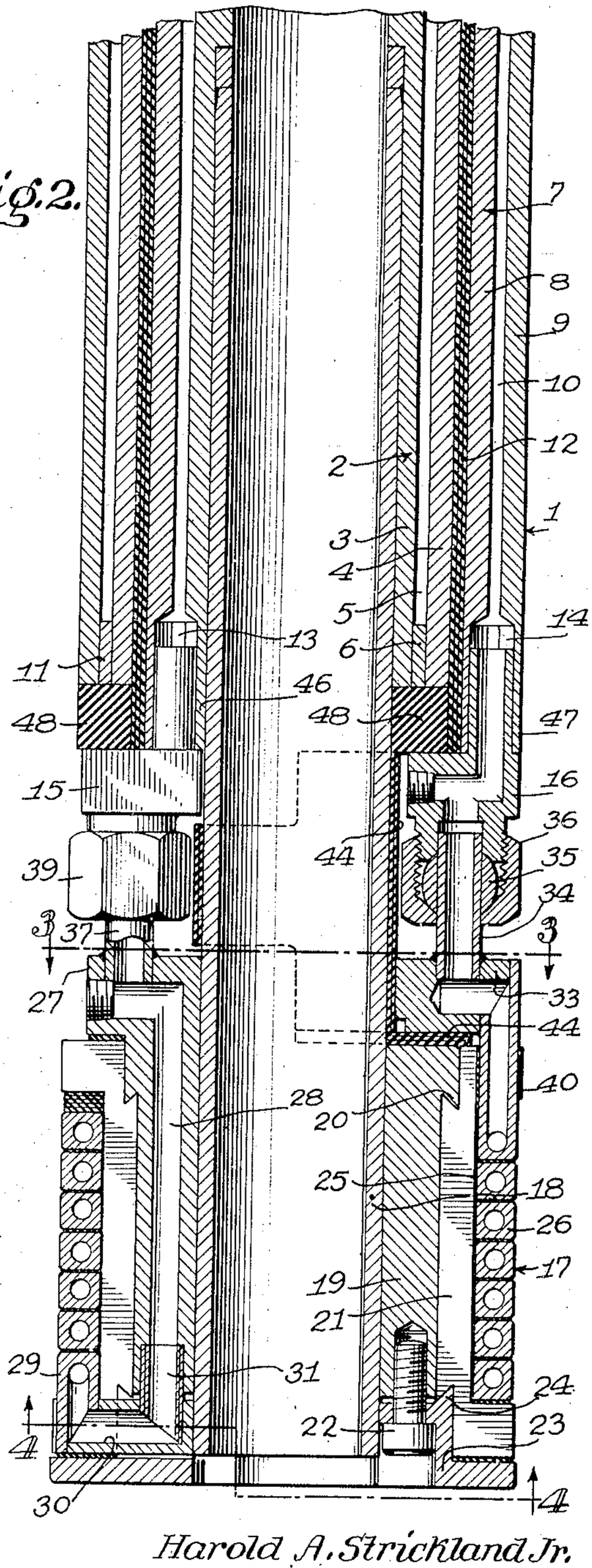


Fig. 2.



Harold A. Strickland Jr.

INVENTOR

BY Horace B. Waite

ATTORNEY

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Fig. 3.

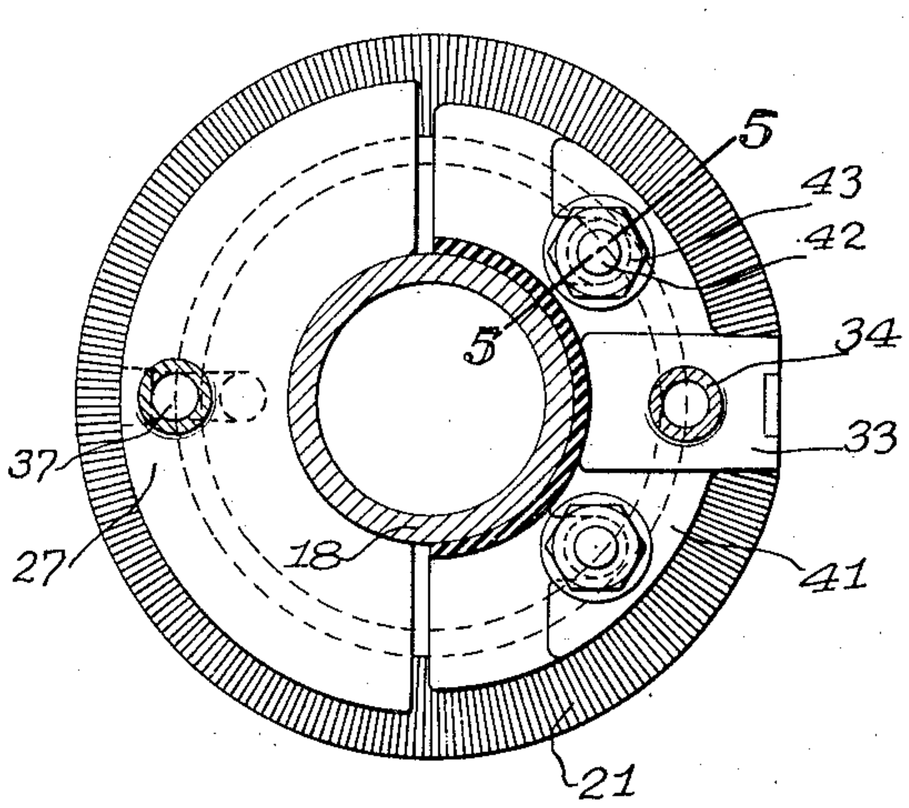


Fig. 4.

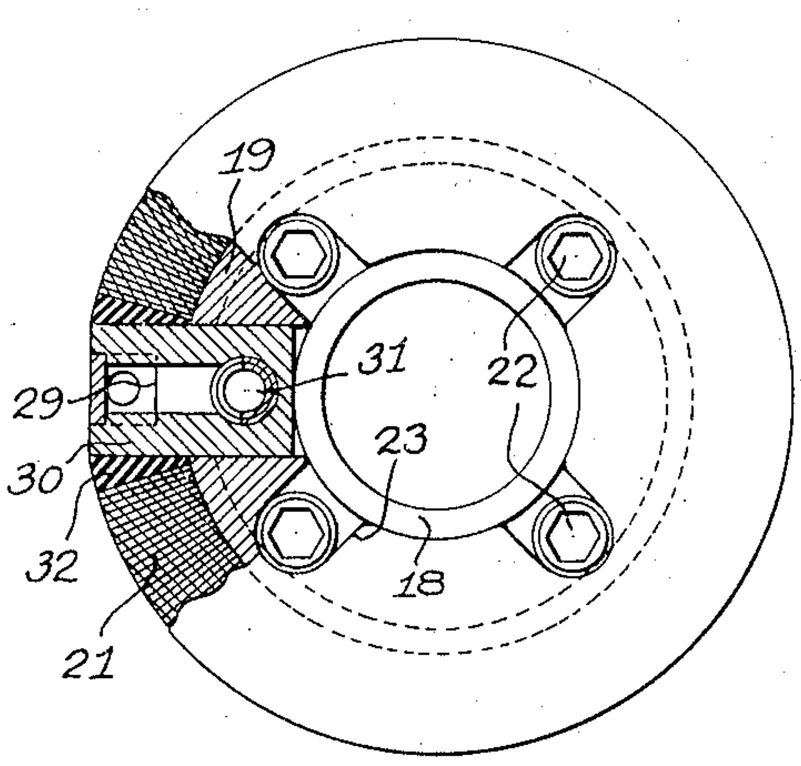


Fig. 5.

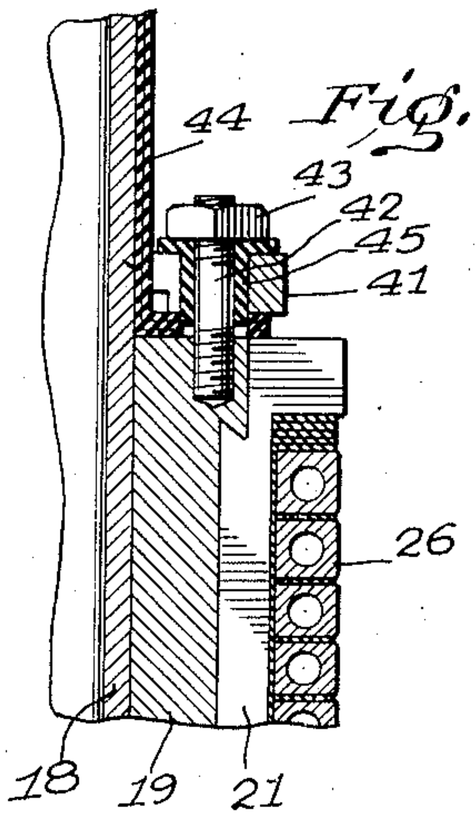
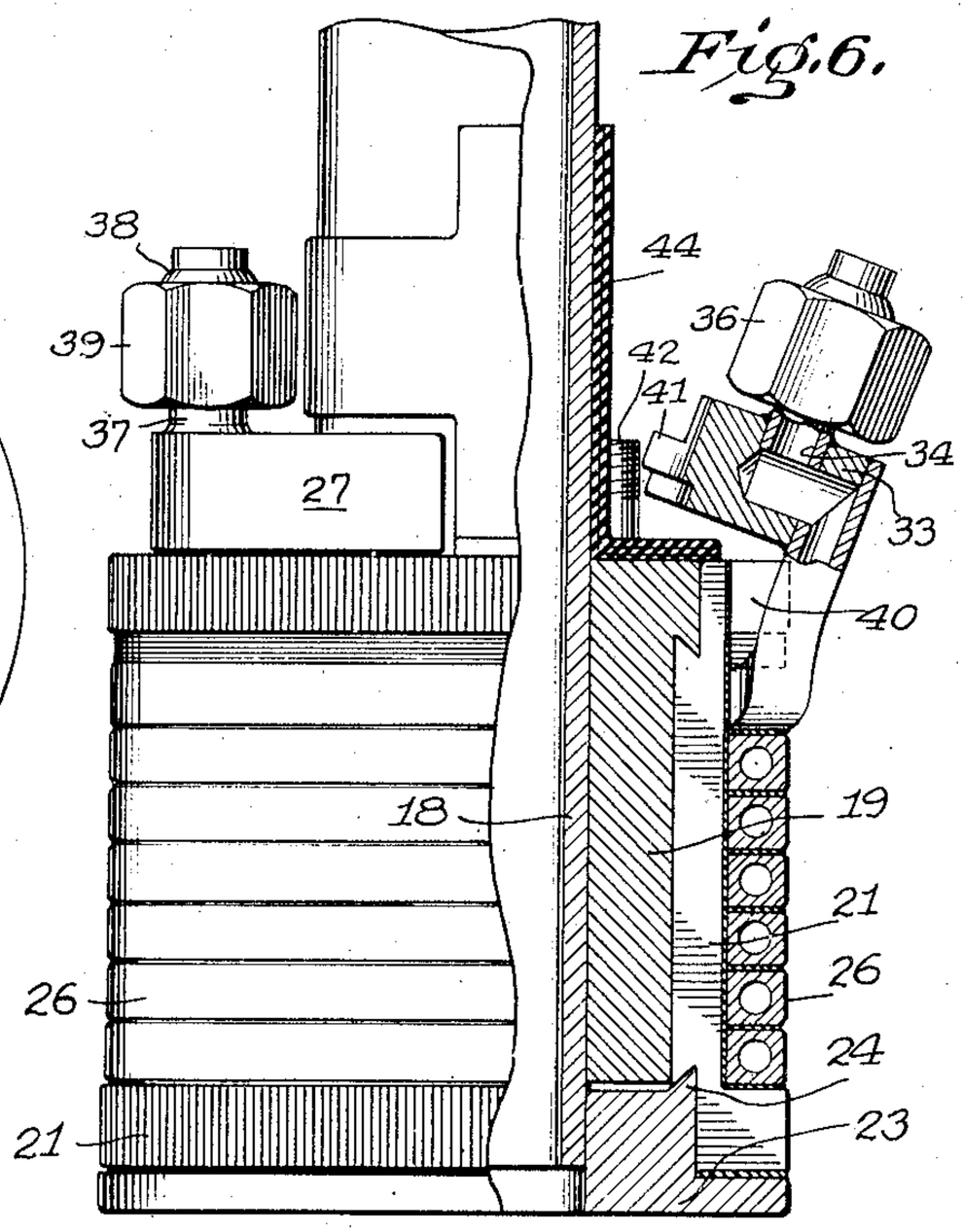


Fig. 6.



Harold A. Strickland Jr.

INVENTOR

BY Donald B White

ATTORNEY

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INDUCTION HEATING HEAD AND ARBOR THEREFOR

Harold A. Strickland, Jr., Detroit, Mich., assignor, by mesne assignments, to The Ohio Crankshaft Company, Cleveland, Ohio, a corporation of Ohio

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6 Claims. (Cl. 219—13)

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This invention relates to an electro-magnetic induction heating head and supporting arbor for conducting current thereto, particularly to the manner of supporting the head from the arbor.

Heretofore, it has been the practice in induction heating equipment utilizing an arbor having concentric current conductors and a head member having an inductor coil to provide various means for threadably or otherwise supporting the head from the arbor which means added considerably to the cost of the equipment and required considerable time for assembly and disassembly of the parts when it was desired to replace the heating head.

The primary object of the present invention is to provide a simple and economical expedient for removably supporting the induction heating head from a current-conducting arbor.

A further object is to provide a simple arrangement whereby the connections between the terminals of the inductor coil and the current conductors of the arbor constitute the sole means for supporting the head from the arbor.

With the above and other objects in view, which will be apparent to those skilled in the art to which the invention appertains, the present invention consists in certain features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed.

In the drawings which illustrate a suitable embodiment of the invention for the purpose of description;

Figure 1 is an elevation of the induction heating head;

Figure 2 is a vertical section of the heating head taken substantially on the line 2—2 of Figure 1 and showing the same assembled to the current-conducting arbor;

Figure 3 is a transverse section taken substantially on line 3—3 of Figure 2;

Figure 4 is a transverse section taken substantially on line 4—4 of Figure 2;

Figure 5 is a transverse section taken substantially on line 5—5 of Figure 3; and

Figure 6 is an elevation, partially in section, of the heating head, showing the initial step in the process of removing the inductor coil from the head.

Referring to the accompanying drawings in which like numerals refer to like parts throughout the several views, the current conducting arbor 1 is comprised of an inner current conductor 2 formed of concentric tubular members 3 and 4 having a fluid passage 5 therebetween,

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the ends of the passage 5 being sealed by a closure sleeve 6, and an outer current conductor 7 similarly formed of concentric tubular members 8 and 9 having a fluid passage 10 therebetween, the end of which is sealed by a closure sleeve 11.

The conductors 2 and 7 are separated from each other by an insulating sleeve 12 and are each drilled through their ends to provide bores 13 and 14, respectively opening into the passages 5 and 10, which bores receive the shanks of passaged fitting 15 and 16, respectively, the shanks thereof being brazed or otherwise secured in water tight connection with the bores. The ends of the passaged fittings are externally threaded as shown.

The induction heating head 17 includes a tubular mandrel 18 to one end of which an annular coil supporting element 19 is suitably secured, such as by shrink fitting or brazing. The upper end of the element 19 is provided with an annular undercut shoulder 20 and surrounding the element 19 in interlocking relation with the shoulder 20 is an annular magnetic circuit member 21 of low magnetic reluctance which is comprised of a series of tapered laminations. Secured to the element 19 by screws 22 is an annular end plate 23 having a shoulder 24 which interlocks with the laminated member 21 and together with shoulder 20 locks the laminations in position about the element 19.

The laminated member 21 is provided with a circumferential window 25 and disposed in this window is a helical, hollow inductor coil 26.

The annular element 19 is formed with a longitudinally extending boss portion 27 at its upper end and with a through-running passageway 28 which extends through the boss portion 27. The lower terminal end 29 of the inductor coil 26 is provided with a downwardly, thence inwardly extending portion 30 which is provided with a tubular upwardly extending sleeve 31 which extends within and is brazed to the wall of the passage 28 at the lower end thereof, the laminations being cut out to receive the coil terminal portion 30 and being insulated from this portion as indicated at 32 in Figure 4.

The upper upwardly extending terminal end of the coil 26 is provided with a hollow fitting 33 which is provided with an upwardly extending sleeve 34 surrounded by a spherical element 35 and internally threaded nut 36. The portion 27 of element 19 is provided with a similar sleeve 37, spherical element 38 and nut 39. The laminations are provided with a recess 40 for the reception of the upwardly extending portion of upper ter-

minal end of the coil as shown in Figures 1 and 6.

The coil 26 is wound about the laminated magnetic circuit member 21 from its lower end upwardly and the upper end thereof is finally bent inwardly from the position shown in Figure 6 to overlie the end of element 19. The fitting 33 is provided with arms 41 which by means of bolts 42 and nuts 43 clamp the fitting 33 to element 19 with the upwardly extending portion of the coil disposed in recess 40.

As shown in Figure 2, the fitting 33 including its arms 41 is insulated by insulation 44 from the annular element 19, which insulation preferably surrounds the mandrel 18. Also the arms 41 are insulated by insulation 45 from the bolts 42 and nuts 43.

Referring back to the mandrel 18 shown in Figure 2, it is to be noted that the portion of 46 of the inner conductor 2 and the portion 47 of the outer conductor 9 which houses the longitudinally extending portions of the fittings 15 and 16, respectively, extend beyond the remainder portions of the ends of these conductors and that insulation 48 is provided to insulate fittings 15 and 16 from conductors 2 and 7, respectively.

In order to assemble the head 17 to the arbor 1, it is only necessary to position the mandrel 18 within the tube 3 of the inner conductor 2 with the fitting sleeves 34 and 37 properly aligned with the passaged fittings 16 and 15 respectively and move the head longitudinally of the arbor to enter sleeves 34 and 37 within the passages of fittings 16 and 15, after which the nuts 36 and 39 are threaded on the fittings 16 and 15, respectively, and tightened. Due to the ball seating of the ball-like elements 35 and 38 on the fittings and nuts, the balls are clamped about the sleeves to provide a fluid-tight connection.

The nuts 35 and 39 which secure the head coil-terminals to the conductor fittings 16 and 15, respectively, thus provide the sole mechanical supporting connection between the heating head 17 and arbor 1.

In the operation of the head and arbor, cooling fluid circulates downwardly through passage 5 of the inner conductor 2, through fittings 15 and 27 and passage 28, thence upwardly through the hollow coil and back through fitings 33 and 16 and passage 10 of the outer conductor 7, thus cooling the coil and both conductors. The current for the coil flows through the inner conductor 2 and annular element 19 to the lower coil terminal, and, thence, through the coil and back through the outer conductor 7, suitable insulation, as described and shown, being provided to insure against short circuiting.

The heating head and arbor described are of the type for use in inductively heating the bores of articles wherein the heating head has close coupling with the bore surface. To this end it is essential that the connections between the head be maintained within the circumferential limits of the head.

It is to be understood that various changes may be made in the detailed construction and arrangement of the parts described without departing from the spirit and substance of the invention, the scope of which is defined by the appended claims.

What is claimed is:

1. In an induction heating apparatus, an arbor including a pair of parallel current conductors insulated from each other, each having a terminal fitting at one end thereof, an inducing head having a coil support and an inductor coil carried by said support, terminal connector fittings for said coil, said last-mentioned fittings being rigidly carried by said coil support, and means rigidly and removably securing said last-mentioned fittings to said first-mentioned fittings and providing with said fittings attachment connections for said head from said arbor, said fittings being in spaced relationship to form an air-space insulation between the arbor and head whereby electrical creepage current losses at said connections are substantially reduced.

2. In an induction heating apparatus, an arbor including a pair of parallel current conductors insulated from each other, each having a terminal fitting at one end thereof, an inducing head having a coil support and an inductor coil carried by said support, terminal connector fittings for said coil, said last-mentioned fittings being rigidly carried by said coil support, and means rigidly and removably securing said last-mentioned fittings to said first-mentioned fittings and providing with said fittings attachment connections for said head from said arbor, one of said conductors having a longitudinal bore and said coil support having a longitudinal mandrel projecting therefrom and closely fitting with said longitudinal bore in slidable relationship thereto.

3. In an induction heating apparatus, an arbor including a pair of parallel current conductors insulated from each other, each conductor having a longitudinally extending connector fitting extending from one end thereof, an inducing head including a coil support having longitudinally extending connector fittings rigidly carried thereby for alignment with said first-mentioned fittings, an inductor coil carried by said support and having its ends electrically connected with said second-mentioned fittings, and nut means removably connecting said first and second mentioned fittings and constituting with said fittings an attachment connection between said head and arbor, said fittings being in spaced relationship to form an air-space insulation between the arbor and head whereby electrical creepage current losses at said connections are substantially reduced.

4. In an induction heating apparatus, an arbor including concentric current conductors insulated from each other, an induction heating head including a support and an inductor coil carried thereby, said support and the innermost of said conductors having interfitting longitudinal portions holding said arbor and conductor against relative transverse movement only, a pair of rigid current connectors at one end of said support electrically connected with said coil, a pair of rigid current connectors at the adjacent end of said arbor electrically connected with said current conductors, and means rigidly and removably securing the first-mentioned connectors to the second-mentioned connectors, said means constituting a supporting connection between said head and arbor.

5. In an induction heating apparatus, an arbor including concentric current conductors insulated from each other, an induction heating head including a support and an inductor coil carried thereby, said support and the innermost of said conductors having interfitting longitudinal portions holding said arbor and conductor against relative transverse movement only, a pair of rigid current connectors at one end of said support electrically connected with said coil, a pair of rigid current connectors at the adjacent end of

said arbor electrically connected with said current conductors, and means rigidly and removably securing the first-mentioned connectors to the second-mentioned connectors, said means constituting a supporting connection between said head and arbor, the connected connectors of said pairs being substantially diametrically opposite the connected connectors of the others of said pairs and being arranged with the circumferential limits of said head.

6. An induction heating head comprising a support constituting an electrical conductor, an inductor coil surrounding said support and having one end electrically connected to one end of said support and its other end extending longitudinally beyond the other end of said support, a rigid electrical connector rigidly secured to said projecting coil end extending radially inwardly of said other end of said support, electrical in-

sulation between said connector and other support end, means rigidly and removably securing said connector to said other support end, and insulation between the turns of said coil and between said coil and support.

HAROLD A. STRICKLAND, JR.

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