July 6, 1948. H. E. SOMES 2,444,475

COIL AND CORE ARRANGEMENT

Filed Oct. 7, 1944

2 Sheets-Sheet 1

Fig. 1.

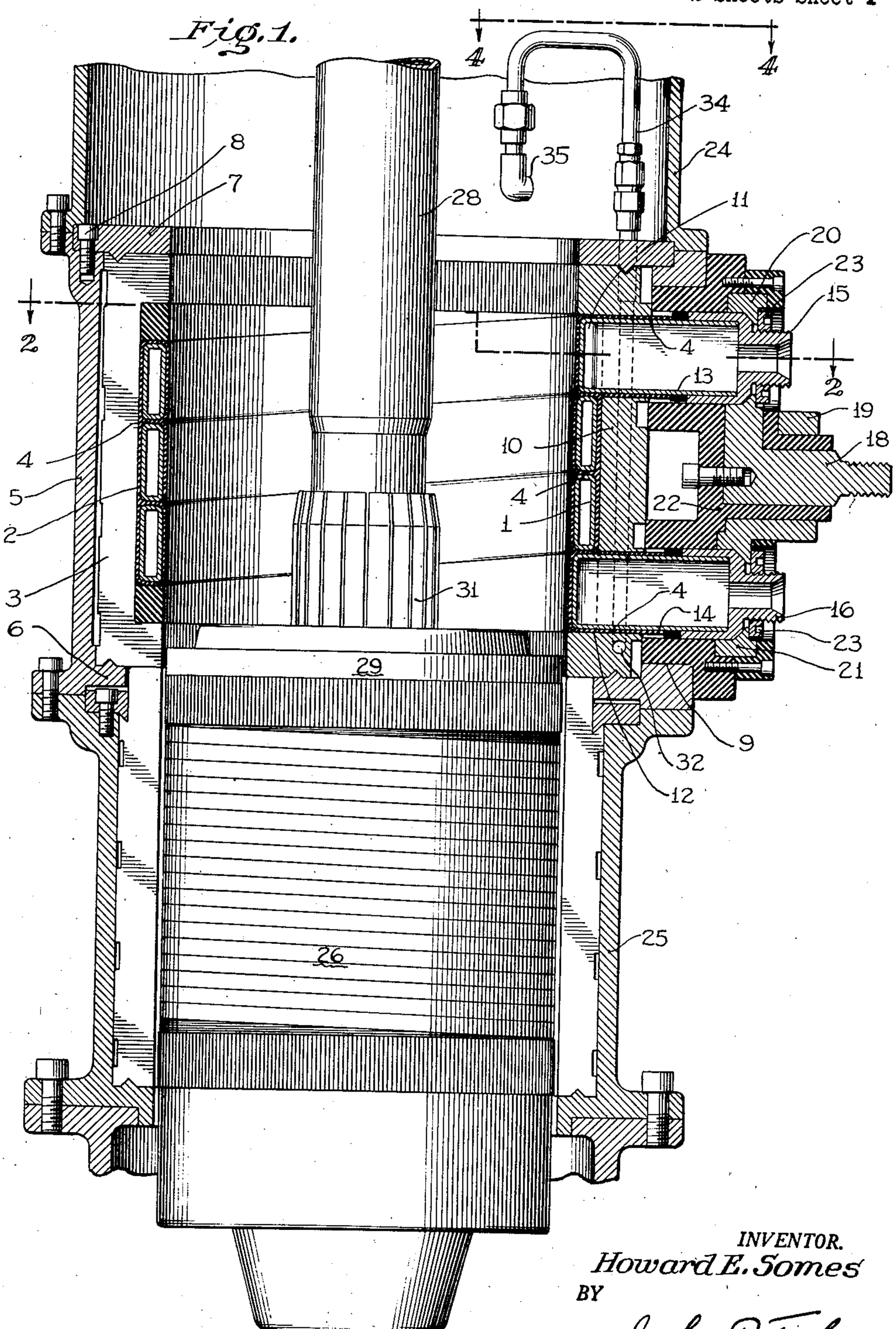

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Fig. 2.

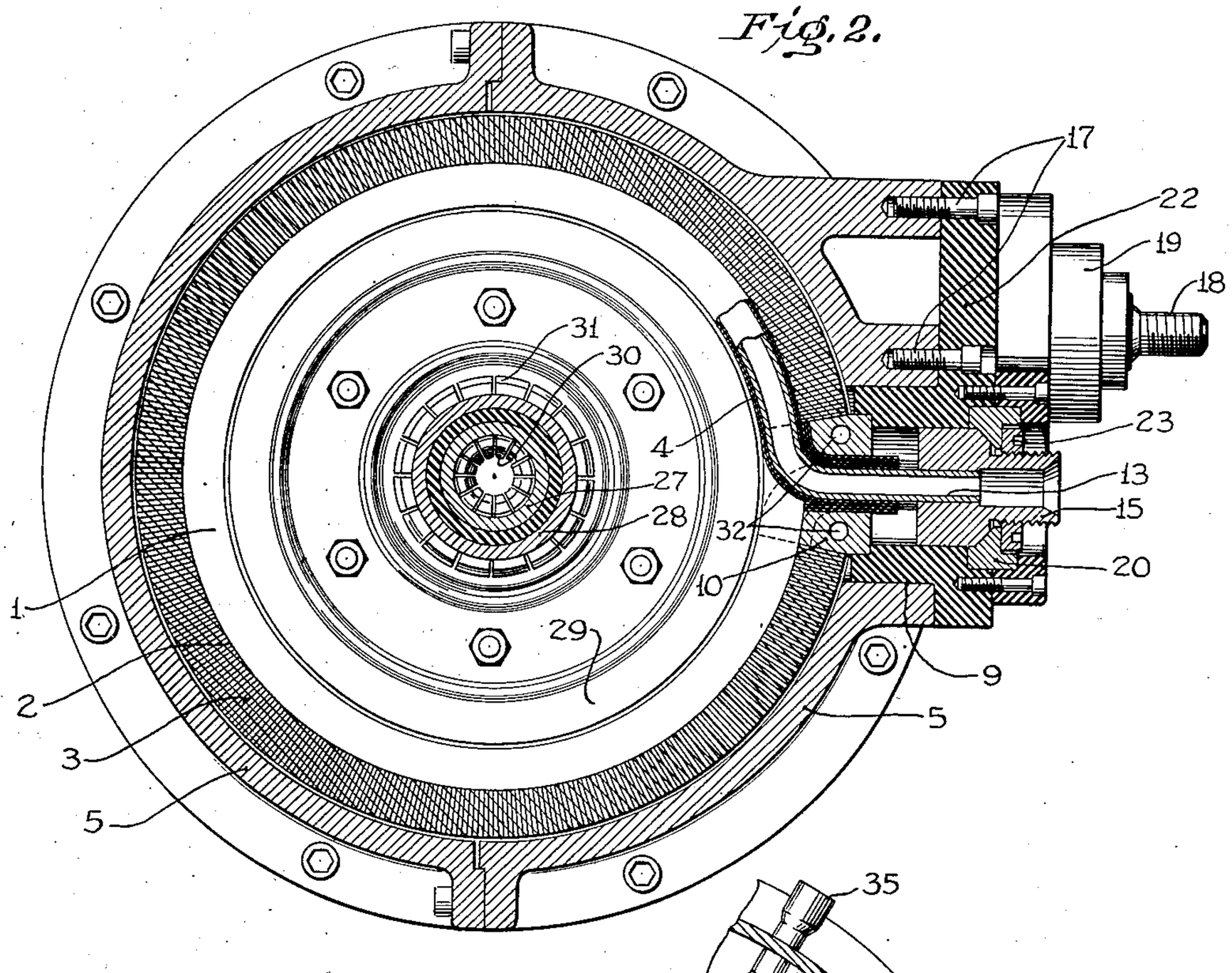


Fig. 3.

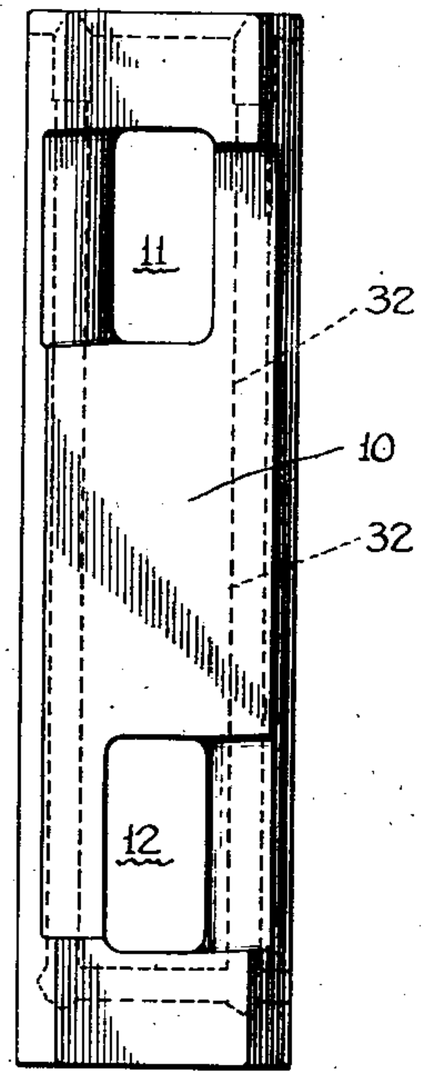
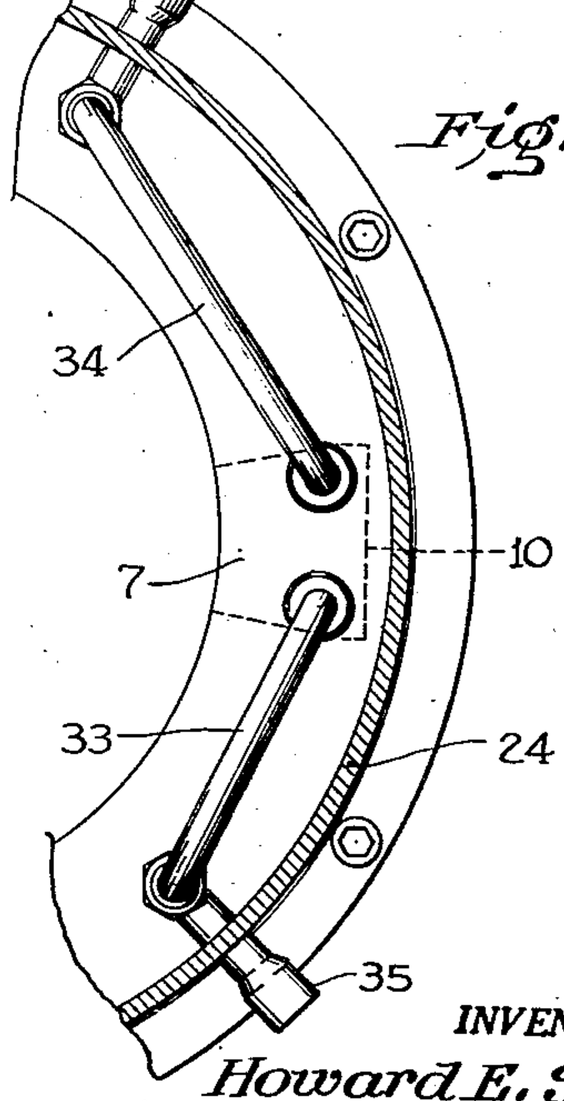


Fig. 4.



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UNITED STATES PATENT OFFICE

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COIL AND CORE ARRANGEMENT

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6 Claims. (Cl. 175—356)

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This invention relates to electrical apparatus, particularly to coils and the like associated with a core of transformer iron.

In many instances of coils used in transformers and electromagnetic inducing heads, a core of transformer iron is concentrically associated with the coil and the coil ends are turned to extend through the core. In such cases, there is a tendency due to the change in direction of the flux path incident to the coil end turn-out, for the portions of the core adjacent the turned-out coil ends to become highly heated to an undesirable degree.

The primary object of the present invention is to provide in a coil and core arrangement having the coil ends extending through the core, improved means for shielding the portions of the core through which the coil ends extend from the detrimental heating effect of the coil.

Another object is to provide improved means for reducing the reactance in those portions of a coil core which lie adjacent the turned-out ends of the coil.

A further object is to provide an annular coil core of laminated material with a portion thereof in the form of a block of non-magnetic and high electrical conductivity through which the coil ends extend.

With the above and other objects in view which will be apparent from the following description 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:

Figure 1 is a vertical section through a transformer arrangement having the present invention incorporated therein;

Figure 2 is a transverse section taken substantially on line 2—2 of Figure 1;

Figure 3 is an enlarged elevation of the shielding device; and

Figure 4 is a fragmentary view taken substantially on line 4—4 of Figure 1.

Referring to the accompanying drawings in which like numerals refer to like parts throughout the several views, the invention is shown for the purpose of illustration as applied to a secondary winding or coil of a switching type transformer. It is to be understood however that the invention is applicable to any coil and core arrangement, whether the coil is of the type to induce currents or have currents induced therein.

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The secondary winding or coil 1 shown in the drawings is of the multi-turn type and is carried within a recess 2 formed in the inner face of an annulus 3 comprised of a plurality of taper ground laminations of magnetic material. The coil turns are separated from each other and from the walls of the recess 2 by suitable electric insulation 4.

The core or annulus 3 is encased within an annular casing 5 having an end flange 6 against which one end of the annulus 3 abuts and an annular ring 7 secured to its opposite end by screws 8, which ring abuts the other end of the annulus 3 in clamping relation.

The casing 5 is provided at one side with an opening 9.

In accordance with the present invention, the annular continuity of the core 3 is interrupted by a wedge block 10 extending the full axial extent thereof. The wedge block 10 is provided with spaced upper and lower openings 11 and 12, respectively which are aligned with the opening 9 of the casing 5.

The coil ends 13 and 14 are turned outwardly through the openings 11 and 12, respectively, and are provided with terminal connectors 15 and 16, respectively, to extend through the casing opening 9. The body of the coil 1 and the ends 13 and 14 thereof are insulated from the block 10 by the insulation 4.

Secured to the casing 5 over the opening 9 by screws 17 is a terminal unit which, although forming no part of the present invention, comprises concentric terminal posts 18 and 19 having laterally extending arms 20 and 21, respectively, each terminal post and its arm being electrically insulated from the other post and its arm by insulation 22 which also insulates the terminal unit from the casing 5. The arms 20 and 21 are provided with openings through which the terminal connectors 15 and 16, respectively, extend, the connectors 15 and 16 being secured to these arms by nuts 23 threaded thereon. The terminal posts 18 and 19 provide means for the attachment of suitable bus bars, cables, conductors and the like (not shown).

Secured to the casing 5 is an upper casing 24.

Secured to the lower end of the casing 5 is a casing 25 which in the uncoupled position shown in Figure 1 houses the transformer primary coil 26 which forms no part of the present invention. The primary coil 26, although no actuating means is shown in the drawings, is movable upwardly

into coupled relation with the secondary coil 1, and in its coupled position is energized through the axially arranged concentric conductors 27 and 28 (Figure 2), the primary element support 29 being provided with annular resilient connectors 30 and 31 to effect connection with the conductors 27 and 28 respectively.

The wedge block 10 is constructed of a metal of non-magnetic high electrical and high heat conductivity as compared with iron such as for example, copper, aluminum and the like, and is provided with a U-shaped cooling passage 32, the ends of which open through the upper end of the block 10. Suitable conduits 33 and 34 are connected with the ends of the passage 32 and are provided with connectors 35 extending through the upper casing 24 for connection with suitable coolant supply and discharge conduits (not shown). A means is thus provided for circulating a cooling fluid through the wedge block 10 to maintain the same at a desired low temperature.

The wedge block 10 of high electrical conductivity reduces the reactance of the portions of the magnetic annulus 3 adjacent the turned-out coil ends 13 and 14 incident to the magnetic laminations and through its high conductivity in combination with the cooling passage 32 prevents excessive heating of the end laminations incident to the turned-out coil ends which in the absence of the wedge block 10 would otherwise occur.

The wedge block 10 thus provides an efficient means for shielding the laminations from detrimental heating effects incident to the coil.

While the invention has been described in connection with a coil having a surrounding core of magnetic material, it will be obvious to those skilled in the art that it is equally as applicable to a coil having an internal core.

It will also be obvious to those skilled in the art that various changes may be made in the detailed construction and arragnements of the 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 a device of the character described an iron core of annular formation having circumferentially spaced ends and a helical conductor concentrically disposed adjacent and insulated from said core, said conductor having radially extending ends disposed in the space between said spaced ends, and a metallic, non-magnetic member disposed in said space in engagement with said core ends, said conductor ends extending through and being insulated from said member.

2. In a device of the character described an iron core of annular formation having circumferentially spaced ends and a helical conductor concentrically disposed adjacent and insulated from said core, said conductor having radially extending ends disposed in the space between said ends, a metallic, non-magnetic member disposed in said space in engagement with said core ends, said conductor ends extending through said member and means for insulating said member, said member having passage means therein for the circulation of cooling fluid.

3. In a helical electrical conductor arrangement having substantially axially aligned, radially extending ends, an iron core of annular formation extending from a radial plane relatively closely spaced from one side of said ends concentrically adjacent to said conductor to a radial plane relatively closely spaced from the other side of said ends, a member of high heat conductivity, as compared to said core, disposed in the space between the ends of said core, said conductor ends extending through said member, and means insulating said conductor from said core and said member.

4. In a device of the character described, an annulus comprised of a rectangular block of non-magnetic metal and a plurality of abutting laminations of magnetic iron, the endmost laminations abutting opposite sides of said block, means for holding said laminations and block in annular formation, a helical conductor concentrically disposed adjacent and insulated from one circumferential side of said annulus, said conductor having radially extending end terminals extending through said block, and means for insulating said conductor from said block and laminations.

5. In a device of the character described, an annulus comprised of a rectangular block of non-magnetic metal of high electrical and heat conductivity, as compared with iron, and a plurality of abutting laminations of magnetic iron, the endmost laminations abutting opposite sides of said block, means for holding said laminations and block in annular formation, and a helical conductor concentrically disposed adjacent and insulated from one circumferential side of said annulus, said conductor having radially extending end terminals extending through and insulated from said block.

6. In a device of the character described, an annulus comprised of a rectangular block of metal of high electrical and heat conductivity, as compared with iron, and a plurality of abutting laminations of magnetic iron, the endmost laminations abutting opposite sides of said block, means for holding said laminations and block in annular formation, and a helical conductor concentrically disposed adjacent and insulated from one circumferential side of said annulus, said conductor having radially extending end terminals extending through and insulated from said block, said block having passage means therein closely adjacent the said side thereof for the circulation of cooling fluid.

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