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H. A. STRICKLAND, JR

2,325,810

HEATING COIL

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Fig. 2.

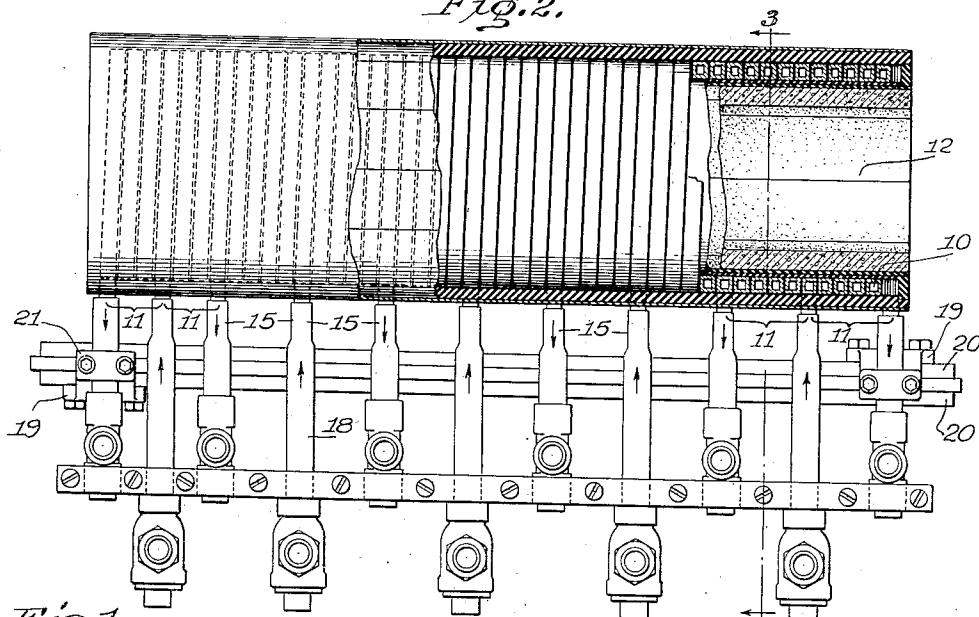


Fig. 1.

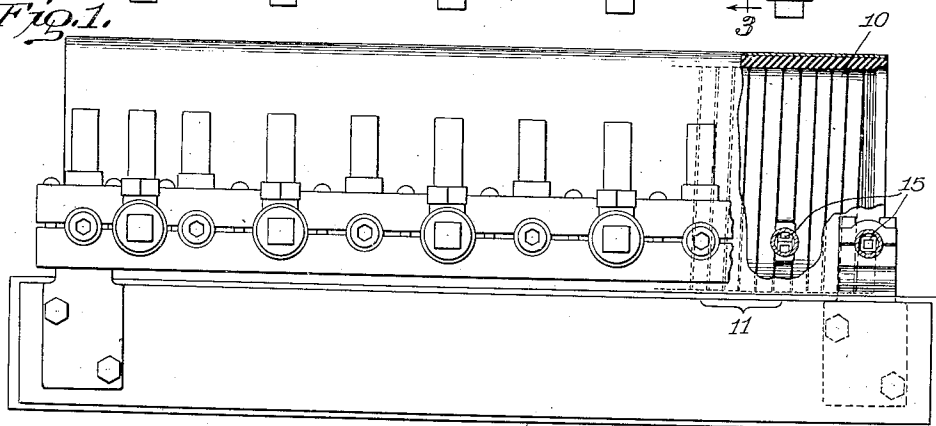


Fig. 3.

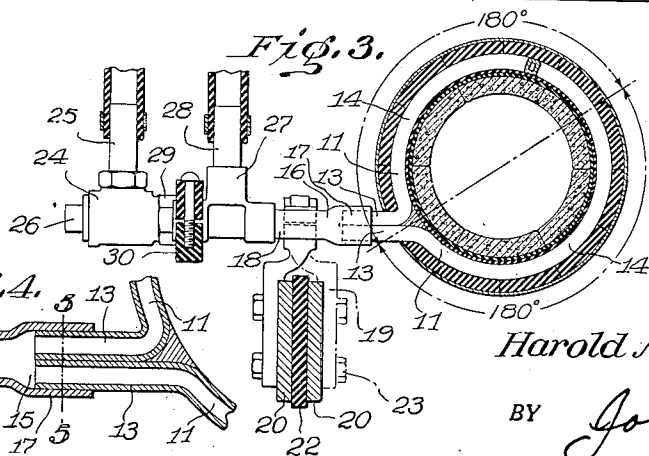


Fig. 5.

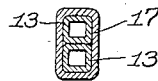
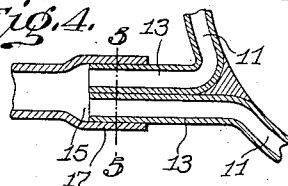


Fig. 4.



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HEATING COIL

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6 Claims. (Cl. 219-13)

My invention relates to electric coils of the type most commonly required for use in furnaces for the heating of metals by electromagnetic induction.

It is required that these coils be provided with high capacity means for removing heat from the coil itself and with convenient means for pairing the number of turns within the coil itself. The high capacity means for removing heat from the coil consists in many cases in forming the coil of a tubular conductor and passing water through different portions of the coil in a number of parallel water cooling circuits. This requires a number of different water taps to the tubular conductors. Changing the number of turns in the coil also requires a number of different taps.

The outstanding feature of my invention is the construction of these water taps in the electrical connections to render them more efficient and, at the same time, to render the construction of the coil itself simple, efficient and inexpensive.

This outstanding aim I have obtained by constructing the coil over all in a plurality of separate sections which, when placed end to end, constitute the coil as a whole, by diverting the ends of each section outwardly from the contour of the adjacent end turns of the section, by arranging these diverted ends to overlap each other in planes which substantially comprehend the portions of the turn from which they emanate, by matching the adjoining 180° of the endmost turns of adjoining or contiguous section ends in such manner that the two 180° turns together constitute a single turn of the same contour as complete turns of the respective sections, the taps so formed being thus at the midpoint of such turn, whereby the coil as a whole may be comprised of single turns throughout about a common axis, and by affording common water and electrical connections between and to the taps so formed. Other objects of my invention are the provision in connection with the taps themselves for cleansing the cooling water or other cooling medium circulated through the tubular conductors of the coil, the arrangement for convenient and quick cleansing of the taps and the coils, strong and quick electrical connections to the taps in orderly and simple fashion and staunch yet simple mounting for the water and electrical connections themselves. The same mounting may be used for the mounting of the coil but I prefer to use a supplemental mounting for the coil.

In the accompanying drawing is shown the embodiment of my invention best known to me but, of course, there are others which are possible and which should be comprehended in the claims which are annexed to this specification.

Of the drawing,

Figure 1 is a side elevation showing the right hand end of the structure broken away to reveal the insulating and coil structure more fully;

Figure 2 is a plan view with the portions of the heating unit embodying the coil broken away to a deeper depth to show different layers of insulation inside and out and to show the coil and the insulations in longitudinal cross-section;

Figure 3 is a longitudinal cross-section on line 3-3 of Figure 2;

Figure 4 is a vertical section through all of the taps and

Figure 5 is a transverse section in cross-section on line 5-5 of Figure 4.

The numeral 10 is the coil as a whole. The several separate conductor sections of which it is comprised are designated respectively by the numeral 11 applied to brackets in Figures 1 and 2 and to coil ends in Figures 3 and 4. These sections 11 are constructed of separate sections of tubular conductor, each of appropriate length to form its own portion of the coil 10 as a whole. The coil and sections are indicated as comprised of circular turns although they may be of any shape and together form a continuous helix about a common axis 12 of uniform diameter throughout, each turn being like each other turn of the helix.

The ends 13 of the endmost turns 14 of each section 11 are diverted from the main body of the turns 14, as clearly appears in each of Figures 1 to 4, and particularly in Figures 3 and 4, to form the taps 15. These ends 13 and the taps 15 which they together form immediately adjoin the contour of the endmost turns 14. The ends 13 are overlapped on each other in the plane of the endmost turns 14 from which they emanate, or substantially a plane since the plane is helical and is not a true plane. The arrangement is such that the adjoining 180° of the conductor section 11 immediately adjoining or contiguous to it forms a complete turn joined in its mid-section by the ends 13 constituting the taps 15, and having the same contour for the turn as all other turns of the sections and of the coil 10 as a whole, whereby there is uniformity of turns throughout the coil 10 as a whole.

The ends 13 which overlap substantially in the

plane of the turn are electrically connected together by soldering or otherwise in the overlapped portions, and are hydraulically connected together for the introduction and discharge of cooling fluid by pipe coupling members 16 as shown in the general form of pipe reducers having a large end 17 surrounding the overlapped ends 13 and soldered or otherwise connected thereto. The coupling members have their reduced ends 18 of greater or less length connected with the fittings through which the water or other cooling fluid is to be supplied. The reduced ends 18 are circular and serve as convenient, simple and sturdy terminals for the electrical connections 19 which are made thereto from the bus bars 20 located below them and parallel to the common plane in which the coupling members 16 lie. Members 19 are in the form of clamping lugs, their upper ends provided with circular portions clamped around the reduced ends 18 by horizontally split clamping sections 21 and their lower ends clamped to the bus bars 20 (separated by insulation 22) by bolts 23.

The longer of the reduced ends 18 are provided at their outer ends with housings having main bodies 24 in line with said reduced ends 18 and water-tube connecting nipples 25 at right angles to the main body 24. Removable plugs 26 confine removable strainers (not shown) in place in the strainer housings 24, whereby any strainer may be conveniently removed for cleansing merely by removing plug 26. The shorter reduced ends 18 enter pipe T 27 by their main bodies, and discharge cooling fluid through nipples 28 from the oppositely directed branch of the T. Removable plugs 29 close the opposite end of the main body from that connected with members 18 and through the removal of these plugs the fixtures and coil may be readily cleansed.

A through-running pair of clamping bars 30 binds all of the reduced ends 18 and the adjoining fittings 24, 27 together in an orderly spaced relation, which facilitates simple connection to cooling entrance and discharge manifolds the bars 30 engaging about the round outer ends of the T 27 and the rounded bodies of the longer reduced ends 18, the spacing laterally of the bars 30 of the fittings 27 on the one side and the fittings 24 on the other being such as to permit this engagement.

The bus bars 20 together with the clamping members 30 afford a structural unit of support for the electrical and cooling medium tap system described. These members 20 and 30 may also serve to assist in the mounting of the coil thereupon but, as aforesaid, I prefer to mount the coil otherwise (by means not shown since not a part of the instant invention).

The arrows applied to Figure 2 of the drawing show the direction of introduction and discharge, respectively, of the cooling medium through the reduced ends 18. It will be apparent, by noting these arrows, that every other tap 15 constitutes a means of introduction of cooling medium and the alternate taps constitute means of discharge. They are not necessarily across coil sections of an equal number of turns, the present illustration showing sections 11 of but three turns each on the left and sections 11 of five turns each on the right. Thus there are provided by the tap system multiple parallel paths for circulation of cooling medium through the tubular conductors of the coil as a whole. The electrical connections 19 are shown in this construction as but two, the

one at the extreme left and other at the extreme right, the entire number of turns of the coil being connected across the bus bars 20. Obviously, however, these connectors may be shifted from one tap 15 to another all the way along the coil.

The coil turn is shown as provided with various insulations inside and out, but, inasmuch as these insulations do not constitute a part of the instant invention, they have not been described herein. The water passage above the nipples 25 and 28 is shown as being of insulating material whereby the convolutions are substantially in series electrically.

What is claimed is:

1. In an electric furnace an electrical conductive tubular coil having multiple coil sections and formed of hollow conductors, the conductor ends of adjacent sections being diverted radially outward from the coil, the diverted ends lying in a common transaxial plane and the associated endmost turns of the coil sections forming together a turn of substantially the same pitch as the turns of the coil sections, whereby the sections together comprise a helical coil of uniform pitch.

2. In an electric furnace an electrical conductive tubular coil having multiple coil sections and formed of hollow conductors, the conductor ends of adjacent sections being diverted outwardly from the coil, the diverted ends being parallel to each other and contiguous, lying in a common plane and immediately adjoining the portions of helical turns of the same curvature as the remaining turns of each of the sections, whereby the taps do not distort the end turns of the sections from which they emanate and the 180° sections of the endmost turns which adjoin the taps form for each pair of taps a complete turn of the same form as the remaining turns of the sections.

3. In an electric furnace, an electrical conductive tubular coil formed of hollow tubing and having multiple sections, the adjacent ends of the hollow tubing of the respective sections being turned outwardly with reference to the coil axis and secured together to form taps for both electric and fluid transmission.

4. In a cooling coil system, a tubular coil formed of hollow conductors and having multiple coil sections with conductor ends of contiguous sections outwardly turned and interconnected for common transmission of a cooling medium, the adjacent half-end turns of adjacent coil sections forming a full turn of pitch uniform with the coil section turns.

5. In a cooling coil system, a tubular coil formed of hollow conductors and having multiple coil sections, the conductor ends of adjacent coil sections being outwardly turned and superimposed in a plane transverse to the coil axis whereby the contiguous section coil turns conform substantially in pitch to that of the other coil turns.

6. In an electric furnace, an electrically conductive tubular coil formed of hollow conductors and having plural coil sections, the conductor ends of adjacent sections being out-turned and superimposed in a common plane whereby the coil is formed of turns of substantially uniform pitch and continuity, means for uniting electrically and mechanically adjacent section ends and electrical circuit connections secured to at least one of said end uniting means.

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