This invention relates to the coils of furnaces heated by high frequency electric currents, the use of which is increasingly warranted in carrying out metallurgical processes. In these furnaces it is highly desirable to strengthen the primary coil itself and to fix it in so stable a manner that during tilting for the purpose of pouring no bending or displacing of the separate windings towards one another takes place. Reinforcements of this kind have hitherto been effected by placing, for example, a double bar on the inside and outside of the coil, or by arranging a comb-shaped bar on one side of the coil. In the first case a really stable support for each separate winding is not generally obtained, and in the second case there is a risk of the teeth of the bar breaking during operation and giving rise to the possibility of short-circuiting the winding. For the same reasons arrangements are also unsatisfactory in which the coil is embedded as a continuous spiral in concrete or in which the separate windings are insulated from one another by layers of asbestos placed between them. The walls of the concrete grooves can break and the asbestos crumbles in the course of time. Also supporting the coil on one side by wood or the like is not satisfactory.

According to the present invention the coil is strengthened by bars of electrically insulating material capable of withstanding temperatures which arise, and which are fixed by means of nuts or bolts onto bolts or nuts. These bolts or nuts are externally soldered onto the various turns of the coils and the bolts are arranged to pass through holes in the bars. In order that the invention may be clearly understood and readily carried into effect some constructions affording an extremely efficient reinforcing of the coil will be described with reference to the accompanying drawings in which:

Figure 1 is a cross-section through a number of coil windings strengthened according to the present invention.

Figure 2 is a similar cross-section showing a modified form of the supporting bars, Figure 3 is a side elevation showing the connection between two supporting bars.

Figure 4 is a central section on the line IV—IV, and Figure 5 is a central section on the line V—V of Figure 3, while Figure 6 is a detail view showing to an enlarged scale a special method of fixing the supporting bars.

As shown in Figure 1, headed screws or screw-threaded bolts b are soldered firmly to the outside of the separate coil windings a in a nearly radial direction. These screws can, for example, be made of brass. A bar c of an electrically insulating material capable of resisting the temperatures and mechanical stresses which arise, is pushed over the bolts and is fixed by means of nuts d. If the coil is made, for example, of copper tubes through which water flows, this bar can be made of Pertinax, an insulating material obtained by impregnating paper with artificial resin and pressing several sheets together with the application of heat, while for very high temperatures asbestos strip or mica is chosen. In this way the windings are rigidly connected one below the other and the connection remains fixed and serviceable despite the stresses due to the temperatures to which it is subjected.

If the reinforcing is to be made still firmer, a bar of brass or other metallic material e can be placed on the insulating bar as shown in Figure 2, and insulating tubes f can be arranged in the spaces between the metal bar and the bolts in order to prevent arcing across the coil winding. Preferably, a second bar of insulating material e' is then placed against the metal bar.

In some circumstances, for example, if large mechanical stresses arise in tilting, these vertically arranged insulating and metallic strips can with advantage be connected in pairs by a fastening plate g (see Figures 3, 4 and 5). These plates which need not extend over the whole length of the coil, can, for example, be made of brass. In many cases it is advisable to employ chrome nickel as the material for the plates and bars, as this has a high rigidity with small conductivity at high temperature.
Since the plates $g$ have no considerable dimensions at right angles to the direction of the stresses and do not completely surround the coil, but only extend over a given angle, the currents induced in these plates have no appreciable disturbing effect.

In order that a furnace furnished with such a coil can be tilted conveniently for the purpose of emptying, the plates $g$ are provided with trunnions $h$ and thus a rigid connection is obtained between the coil and the trunnions $h$ which rest in bearings in the furnace support. Thus it becomes possible to connect the trunnions $h$ absolutely rigidly with all the windings of the coil of the oven, so that in operation, and particularly in tilting, no undesirable stress or deformation is set up. The trunnions themselves are rotatably mounted in bearings fixed in the furnace supports and to this extent they are not completely rigid relatively to the furnace supports.

In the manufacture of the reinforcement described above it is preferable to push an iron template or former over the bolts, in place of the insulating bar, while the bolts are being soldered to the windings of the coil in order to fix the bolts in position. The band of insulating material can generally not be subjected without damage to the temperatures which arise in soldering. Now as the bolts are absolutely fixed in their right places by the soldering, it is occasionally difficult to withdraw the templates which had previously been placed in position. Because of this it may be advantageous to solder screw-threaded nuts $k$ to the coil windings in place of screw-threaded bolts, and the bolts which carry the insulating bar can be screwed into these as is shown in Figure 6. In this method of operation it is possible to screw out the bolts after the soldering has been effected and to withdraw the templates without further difficulty. Preferably, a material is chosen for the nuts such that it is not damaged by the heat during soldering, for example, a non-magnetic copper or nickel chrome alloy is suitable, while the bolts themselves can be made out of a metal or alloy, for example, brass, which has little resistance to heat, since in operation, generally very strong heating does not take place. If only the nuts and not the bolts are soldered a still further advantage is obtained which is particularly noticeable when very valuable materials capable of resisting heat are employed. Bolts or nuts are always produced from round material, and in the manufacture of nuts relatively little loss of material arises during turning and screw cutting in comparison with that in the production of a screw-threaded bolt. This saving in the lost material is of importance with alloys as for example, with non-magnetic nickel-copper or nickel-chrome.

I claim:

1. A strengthened coil for a furnace heated by high frequency electric currents in which bars of electrically insulating material capable of withstanding the temperatures which arise are fixed to the coil by means of a nut-and-bolt connection, one element of the nut-and-bolt connection being externally soldered onto the various turns of the coil, and the bolts being passed through holes in the bars.

2. A coil according to claim 1 in which nuts are soldered onto the turns of the coil and consist of a material which is not damaged by soldering, while the screw-threaded bolts are made from a material relatively incapable of withstanding high temperatures.

3. A coil according to claim 1 in which bars of a metallic material are employed between the insulating bars to reinforce them and insulating tubes are placed in the holes through the bars so as to prevent a conductive connection being set up between the bolts.

4. A coil according to claim 1 in which nuts are soldered on to the turns of the coil and consist of a material which is not damaged by soldering, while the screw-threaded bolts are made from a material relatively incapable of withstanding high temperatures, and bars of a metallic material are employed between the insulating bars to reinforce them and insulating tubes are placed in the holes through the bars so as to prevent a conductive connection being set up between the bolts.

5. A strengthened coil for a furnace heated by high frequency electric currents in which vertically arranged bars of electrically insulating material capable of withstanding the temperatures which arise are fixed to the coil by means of a nut-and-bolt connection, one element of the nut-and-bolt connection being externally soldered on to the various turns of the coil, and the bolts being passed through holes in the bars which are in pairs connected by cross-strips.

6. A strengthened coil for a furnace heated by high frequency electric currents in which vertically arranged bars of electrically insulating material capable of withstanding the temperatures which arise are fixed to the coil by means of a nut-and-bolt connection, one element of the nut-and-bolt connection being externally soldered on to the various turns of the coil, and the bolts being passed through holes in the bars which are in pairs connected by cross-strips, the opposite cross-strips being provided with trunnions adapted to rest in bearings in the furnace support.

7. A strengthened coil for a furnace heated by high frequency electric currents in
which bars of electrically insulating material capable of withstanding the temperatures which arise are fixed to the coil by means of nuts soldered on to the various turns of the coil and bolts passed through holes in the bars and screwed into the said nuts.

8. The method of constructing coils for electric furnaces heated by high frequency currents which comprises pushing an iron former over a number of screw threaded bolts, soldering the bolts to the various turns of the coil, and then replacing the iron former by an insulating bar.

In testimony whereof I affix my signature.

WILHELM ROHN.