June 5, 1945. M. R. SASLAW 2,377,378

COUPLINGS FOR COOLING CONDUITS OF HIGH FREQUENCY APPARATUS

Filed Nov. 25, 1943

Fig. 1.

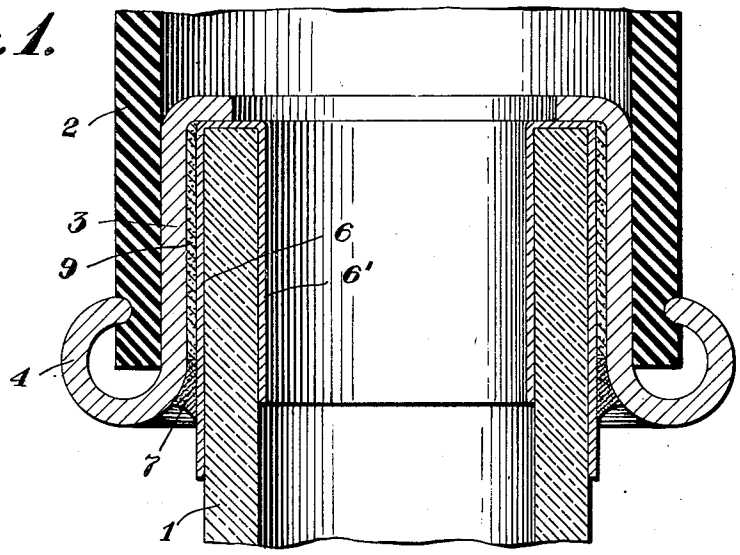


Fig. 2.

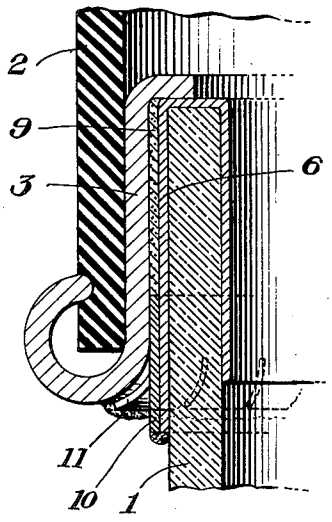
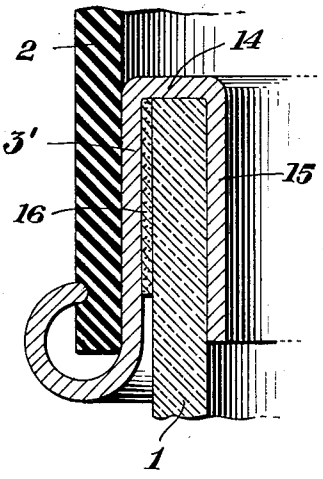


Fig. 3.



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COUPLING FOR COOLING CONDUITS OF HIGH-FREQUENCY APPARATUS

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5 Claims. (Cl. 285—161)

This invention relates to connecting or joint structures for the attaching of hollow tube inductor elements or other connecting conduits to the porcelain water cooling coils as employed in connection with high frequency induction heating apparatus and particularly of the type adapted for the surface hardening of metals by electromagnetic energy employing relatively high voltages and frequencies within the megacycle range.

In the employment of metal connectors or couplings as customarily used for this purpose considerable difficulty has been experienced heretofore in maintaining the proper connections or joinings as a result of excessive temperature rise of the metal fitting. This occurs by reason of the dielectric loss heating of the cement customarily employed to bond the fitting to the porcelain. As a result the excessive expansion of the metal by heat conduction, in addition to excessive heating of the cement, tends to disrupt the effective bond thereby causing considerable maintenance difficulties. The objectionable action as referred to, and as will be readily appreciated, is very substantial in its effect as associated with the use of high voltages and frequencies of the character referred to. The particular object of the present improvements is to provide a coupling or joint structure having special provision to overcome or eliminate the dielectric loss and resulting heating of the bonding material of the coupling to the coil in a manner to produce a more efficient and durable coupling connection.

In accordance with the present invention and for the purpose of overcomig the objections as referred to, I have devised an improved coupling arrangement or joint structure wherein special provision is made to avoid dielectric loss and heating of the bonding material by providing a suitable short circuiting of the current flow to the coupling member and thereby reducing the radio frequency voltage through the dielectric material and the dielectric heating loss resulting therefrom. In accordance with a preferred embodiment this is accomplished by applying to the surface of the porcelain coil to which the coupling member is to be bonded a coating of metal which may be applied thereto by spraying with hot metal in the well known Schooping operation. Thereafter the coupling member is secured by cement applied thereto with the incorporation of a copper resilient contact washer or soldered electrical connection from the coating to the coupling member. In further accordance with the invention the coupling member may desirably be formed with a flange extension entering the opening of the porcelain tube for a distance corresponding to the depth or width of the coupling member further to effect protection from dielectric loss in the end of the porcelain coil and from the heating as the result thereof.

The foregoing and other features and advantages of the present improvements will be more fully understood by reference to the accompanying drawing wherein like reference characters are applied to the corresponding parts in the several views.

In the drawing:

Fig. 1 is a central, vertical sectional view of a coupling or joined structure made in accordance with the invention.

Fig. 2 is a similar view showing a modification thereof, and

Fig. 3 is a similar sectional view showing a further modified form.

In the preferred embodiment of the present improvements as illustrated in Fig. 1 the porcelain water cooling coil is indicated at 1. To the marginal end portion of the coil is attached a separate conduit which may be in the form of a flexible hose connection 2, providing a continuing conduit to a hollow tubular heating inductor or, as employed at the opposite end of the porcelain coil, as a conduit connection to the usual tank for the cooling fluid. A coupling member 3, employed for attaching the hose 2, is formed of a cylindrical wall member having its lower marginal portion formed with outwardly and reversely turned plate flange portions or prongs 4, forced inwardly into clamping engagement with the hose 2, for securing it to the member 3. At this upper end the clamping member is formed with an inturned positioning flange for stop engagement with the end of the coil.

In accordance with the present invention the joint structure is completed in a manner so as to eliminate dielectric loss heating by applying to the surface of the marginal end of the porcelain coil a layer or coating of metal which is desirably applied by hot metal spraying or Schouping. The metal coating as indicated at 6, is applied to the external surface of the coil 1, inwardly from the end thereof, a distance slightly greater than the length of the parallel wall portion of the clamping member and is likewise extended over the end of the coil and over the internal surface at 6' for a distance substantially coextensive with the outer coating. Upon assembling of the coupling on the coil as indicated it is then permanently secured by means of a soldering connection as indicated at 7 between the inner surface of the coupling

and the metal coating 6. The joint structure so formed, as will be readily understood, provides a a rigid connection wherein the presence of the electrically conducting metal coating on the coil end and the connection with the coupling member 3 provide a closed path for the current flow short-circuiting the porcelain or dielectric material thereby to avoid excessive heating thereof and, by conduction, the excessive heating of the metallic coupling 3.

In the assembling of the structure as illustrated in Fig. 1 and prior to the soldering as indicated, a suitable porcelain cement 9 may if desired, be interposed between the metal coating 6 and the internal peripheral surface of the coupling member 3, to give added support thereto, in which case the short circuiting connection between the coating and the clamping member will afford protection against heating of the cement in similar manner by providing a conductive path for the current flow in shorting relation to the cement.

In the modified construction as shown in Fig. 2 the marginal end portion of the porcelain coil 1 is provided on its outer surface with a metallic coating 6, corresponding to the outer coating of Fig. 1, extending a distance thereover greater than the length of the coupling member 3, and between the latter and the coating 6 there is interposed the securing cement 9, as indicated. For the purpose of providing electrical connection from the coating 6 to the metal coupling member 3, an annular metallic connector ring 10 is positioned as shown extending within the space between the lower end of the coupling member and the coating and provided with resilient lugs or ears 11 engaging the inner curved surfaces of the coupling member. In this construction the electrical connection from the coating through the ring 10 engaging the coupling member short circuits the current flow which would otherwise cause heating of the cement and resultant heating of the coupling member such as might disrupt the proper bonding.

In Fig. 3, a further desirable modification is disclosed wherein the coupling member 3' is of a special form for by-passing or shorting the electrical current in its relation to the bonded cement without the employment of the metal coating on the porcelain coil. As shown the coupling member in addition to the external cylindrical wall is formed integrally with a connecting end wall 14 and an internal cylindrical wall or vertical flange 15, fitting within the opening of the coil. The coupling member of this form is proportioned to loosely fit over the end of the coil so as to receive between the outer wall thereof and the external surface of the coil the bonding cement as indicated at 16 and extended a distance desirably less than the depth of the internal flange 15. As will be readily appreciated the structure thus provided will materially reduce dielectric loss heating of the bonding cement and likewise the end portion of the coil by reason of the short-circuiting path provided by the coupling member.

While I have illustrated and described desirable embodiments of the features of the invention, it will be understood that various modifications thereof may be made without departing from the scope of the invention as defined in the appended claims. It is, therefore, intended that all matter herein shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, I claim:

1. A connecting structure for porcelain cooling coils of high frequency heating apparatus comprising in combination with the coil and a conduit for attachment thereto, a coupling member secured to the conduit and proportioned to slidably fit over the end of the coil, bonding cement interposed between the coupling member and the coil and a metallic element electrically connected with the coupling member and positioned inwardly of the bonding cement and coextensive therewith protectively to short circuit the current flow to eliminate dielectric hysteresis heating of the cement substantially as described.

2. A connecting structure for porcelain cooling coils of high frequency heating apparatus, comprising in combination with the coil and a conduit for attachment thereto, a coupling member formed for attachment to the conduit and proportioned to slidably fit on to the end of the coil, a metallic coating positioned on the marginal surface of the coil and substantially coextensive with the coupling member, cement interposed between the coating and the coupling member for the bonding thereof and means providing an electrical connection between the coating and the coupling member substantially as described.

3. A connection structure for porcelain cooling coils of high frequency heating apparatus comprising in combination with the coil and a conduit for attachment thereto, a coupling member secured to the conduit and proportioned to slidably fit over the end of the coil, an adherent coating of metal applied to the marginal end portion of the coil to extend longitudinally of the coil substantially coextensive with the coupling member and an electrical connection between the coating and the coupling member.

4. A connecting structure for porcelain cooling coils of high frequency heating apparatus comprising in combination with the coil and a conduit for attachment thereto, a coupling member formed for attachment to the conduit and to slidably fit over the end of the coil, an adherent metallic coating applied to the marginal end portion of the coil upon the external surface thereof and extending longitudinally thereof a distance greater than that of the coupling member, bonding cement interposed between the coupling member internal surface and the coating for bonding connection therebetween and means for electrically connecting the extended portion of the coating and the coupling member so as to short circuit the current flow about the cement to reduce molecular friction heating thereof.

5. A connecting structure for porcelain cooling coils of high frequency heating apparatus comprising in combination with the coil and a conduit for attachment thereto, of a coupling member secured to the conduit and proportioned to slidably fit over the end of the coil, a metallic coating sprayed upon the surface of the coil to be coextensive with the coupling member longitudinally thereof and to extend beyond said member, a bonding cement interposed between the coupling member and the coating for securing the coupling member in position and a metallic resilient contact member engaging the extended portion of the coating and the coupling member to provide electrical connection therebetween.

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