ACID-RESISTANT ELECTRICAL IMMERSION HEATER

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Fig. 1.

Fig. 2.

Fig. 3.

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ACID-RESISTANT ELECTRICAL IMMERSION HEATER

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3 Claims. (Cl. 219—41)

This invention deals with electrical heating apparatus, and has particular reference to an improved electrical immersion heater for acid-containing baths, such as acid baths of the type used in cleaning, pickling, or plating metals.

It is the primary object of this invention to provide an electrical immersion heater for use in acid-containing baths or solutions which is entirely resistant to chemical attack by acids of the type normally used in such baths, and which is capable of transmitting to such baths a relatively great amount of heat without being detrimentally affected thereby.

It is another object of this invention to provide an improved immersion heater which is formed with an outer covering or coating of synthetic resin which is acid-resistant and which is relatively inexpensive thereby resulting in economy of manufacture of such heaters.

For a further and more complete understanding of this invention and the additional objects and advantages realized thereof, reference is made to the following description and the accompanying drawing, wherein:

Fig. 1 is a side elevational view of an acid and heat-resistant electrical immersion heater formed in accordance with the present invention;

Fig. 2 is an enlarged transverse vertical sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary vertical sectional view similar to that of Fig. 2 on a relatively enlarged scale.

With reference to the drawing, it will be seen that the present invention makes use of an electrical heating element embodying a continuous flat coil of suitable resistance wire 5 which is preferably surrounded by a knitted, braided or woven glass fiber covering 6 which is heat-resistant, and functions to electrically insulate the resistance wire from other portions or elements of the present improved immersion heater.

The insulated heating element is secured in a zigzag fashion to one side of a flexible sheet or backing of heat-resistant woven glass fabric 7, as by stitching or sewing, as at 8.

Sewn to the upper edge of the glass fabric sheet 7 are a pair of enclosed loop members 9 which are preferably formed from strips of the glass fabric, and which serve to support the heater in a partially immersed position within an acid solution contained within a plating or pickling tank or vat. In operation, the loops normally receive a supporting rod or shaft which extends transversely across the open top of an associated bath-containing tank or vat, and rests upon the upper edges of the latter to support the present heater in a substantially stationary and vertical position within the associated acid solution.

Applied to and completely surrounding the outer surfaces of the heating element and the flexible backing 7, is an outer covering 10 of a suitable acid-resistant synthetic resin. The outer resin covering may be applied to the heating element and backing in any suitable manner, such as, by dipping the uncovered assembly into the resin when the same is in a liquid or uncured state, or by painting or spraying the resin in liquid form upon the uncovered assembly. One particular form of the heat-synthetic resin which has been found to possess extremely good acid-resistant qualities and which at the same time is capable of withstanding the operating temperatures of the present immersion heater, is a thermosetting composition consisting of a mixture of an unsaturated polyester resin with styrene. The unsaturated polyester portion which comprises 50% to 90% of the composition is produced by esterification of a mixture of maleic and/or fumaric acid and at least equal parts of a saturated dibasic acid having 6 to 12 carbon atoms with a glycol or polyglycol or a mixture thereof. Suitable plasticizers may be incorporated into the above mixed resin to control the color, tensile strength, and curing time of the composition. After curing, the synthetic resin is generally characterized by a high tensile strength, and provides a semi-rigid structure which is highly resistant to chemical attack by any of the dilute acids normally used in metal plating baths or the like.

In normal operation, the operating temperatures within the electrical resistance element range from 300° F. to 400° F. to normally maintain a plating bath temperature in the neighborhood of from 180° to 200° F. The outer synthetic resin covering of the heater is, therefore, cooled appreciably below the actual temperature of the resistance wire, due to its contact with the liquid plating bath. Preferably, the operating temperature of the resin covering is in the neighborhood of 250° to 300° F.

Operating current is supplied to the electrical resistance wire through two or more lead wires 11 which extend outwardly from the upper portion of the heater which is normally positioned slightly above the level of the acid bath solution. If desired, the lead wires 11 may be coated with the acid resistant resin, in order
to protect the same from chemical attack by fumes arising from the plating bath, or from the solution which might splash upwardly upon the lead wires.

Preferably, a number of the present immersion heaters may be used for a single tank or vat depending upon the volume of solution to be heated and the desired temperatures of operation. Such heaters may be conveniently positioned and supported within the solution by means of the aforementioned supporting rods, or may be clamped in proper locations within the solution by clamps affixed to the loops or straps and to stationary members of the tank or vat.

In view of the foregoing, it will be seen that the present invention provides an improved and mechanically efficient type of electrical immersion heater for acid-containing baths of the type used in plating, cleaning, or pickling metals. Heretofore, the general type of electrical immersion heater used in connection with such acid-containing baths embodied an outer metallic covering or casing which presented a relatively small heating surface in contradistinction to the relatively large flat surface obtained with the present improved heater. Further, such metallic heaters were in most instances subject to deterioration and chemical attack by the associated acid solution after a relatively short period of usage, and were therefore costly due to the necessity for constant replacement. Through the use of a suitable synthetic resin, the electrical heating element is entirely protected from chemical attack by corrosive acids or solutions of the type aforesaid.

While a single preferred form of this invention has been disclosed in detail, it will be manifest that various modifications with regard to constructional details may be accomplished without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. An electrical immersion heater comprising a continuous convoluted flat coil of electrical resistance wire providing a heating element and having an insulating covering of glass fibers; a flexible backing of glass fabric mounting said coil of resistance wire on one side thereof with the individual convolutions disposed in spaced non-shorting relation; lead wires electrically connected with the respective ends of said resistance wire and extending outwardly from said backing through which operating current may be supplied to said heating element; and an outer coating of an acid-resistant semi-rigid synthetic resin completely covering said heating element, the insulating covering therefor, said backing and at least a portion of said lead wires adjacent said backing.

2. An electrical immersion heater comprising a continuous convoluted flat coil of electrical resistance wire providing a heating element and having an insulating covering of glass fibers; a flexible backing of glass fabric mounting said coil of resistance wire on one side thereof with the individual convolutions disposed in spaced non-shorting relation; lead wires electrically connected with the respective ends of said resistance wire and extending outwardly from said backing through which operating current may be supplied to said heating element; an outer coating of an acid-resistant semi-rigid synthetic resin completely covering said heating element, the insulating covering therefor, said backing and at least a portion of said lead wires adjacent said backing; and means connected with said backing for supporting said heater in an immersed position within a liquid-containing vessel.

3. An electrical immersion heater for acid baths comprising a rectangular sheet of glass fabric; a continuous length of resistance wire secured to said sheet on one side thereof and disposed in a series of flat convolutions with the individual convolutions disposed in relatively spaced non-shorting relation, said resistance wire being provided throughout its length with an insulating covering of glass fibers and providing an electrical heating element for said heater; lead wires electrically connected with the respective ends of said resistance wire and extending outwardly beyond the edges of said sheet for conducting electrical operating current to said resistance wire; a plurality of supporting straps secured to and extending beyond an edge of said sheet and providing means for supporting said sheet and resistance wire in an immersed position within an acid-containing vessel; and a semi-rigid outer coating of an acid-resistant synthetic resin completely covering said sheet and said resistance wire and at least a portion of said lead wires for preventing direct contact of said sheet, said resistance wire and said lead wires with an acid solution into which said heater may be introduced.

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