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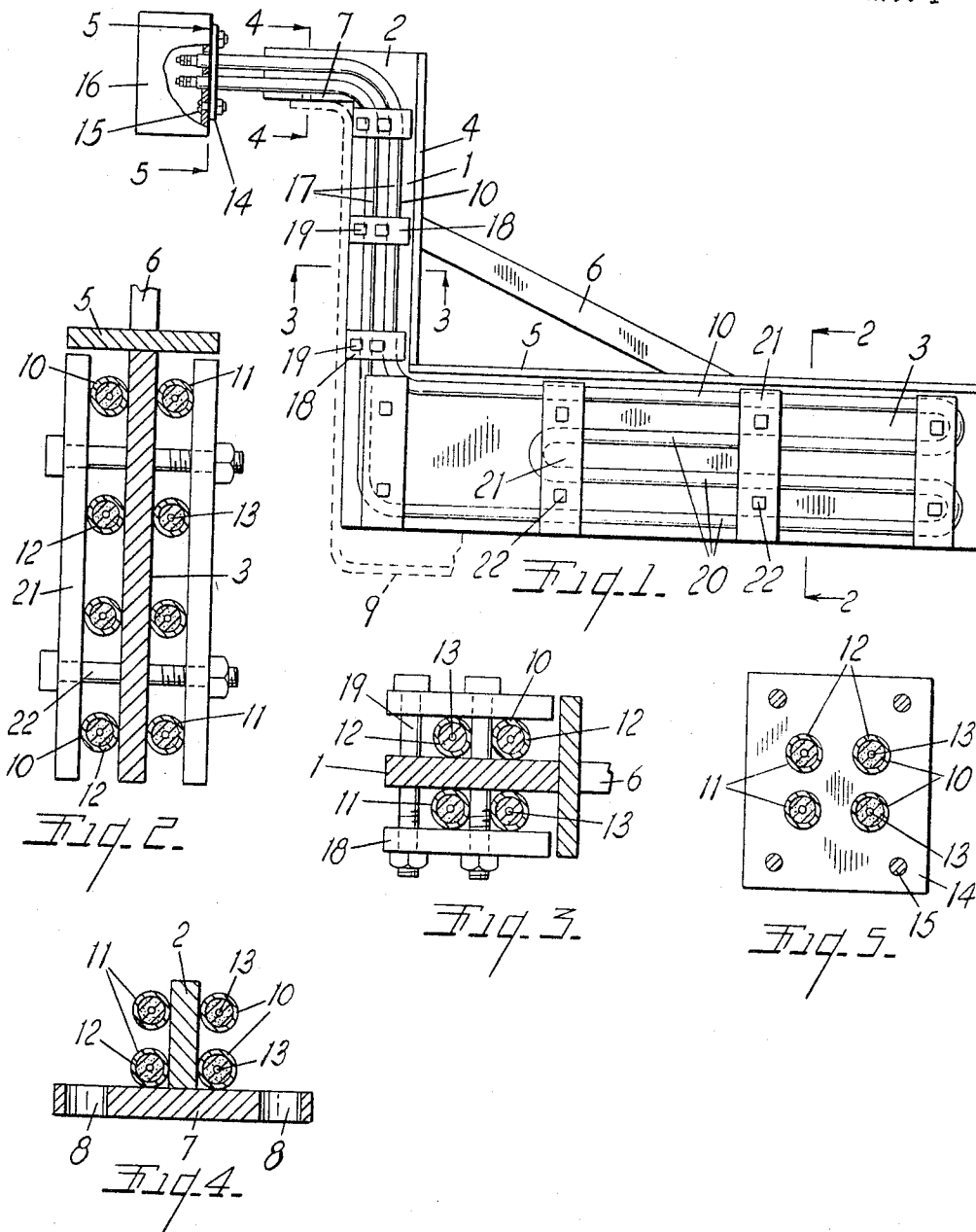
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3,280,307

HEATING UNIT FOR MELTING SOFT OR WHITE METAL

Filed Jan. 13, 1964

2 Sheets-Sheet 1



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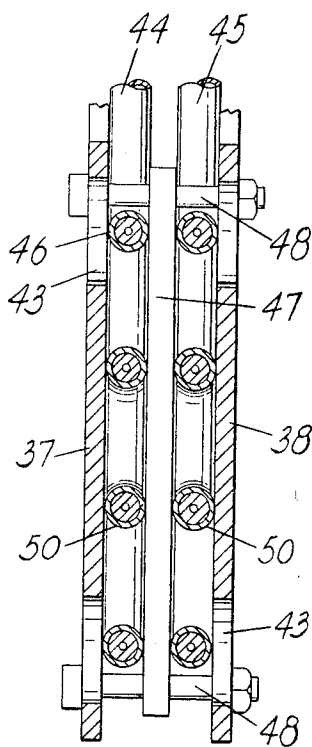
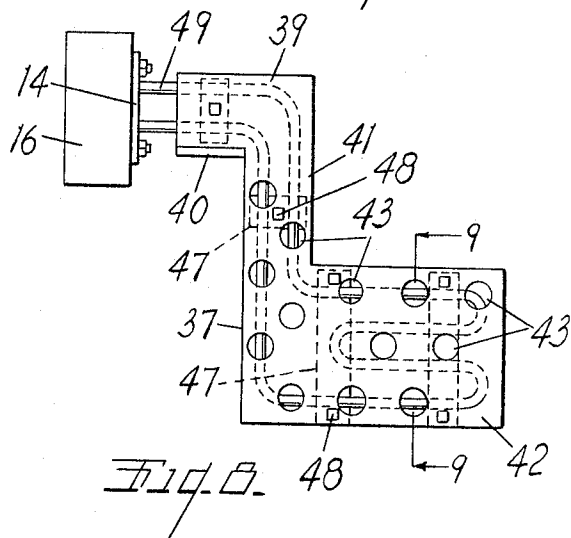
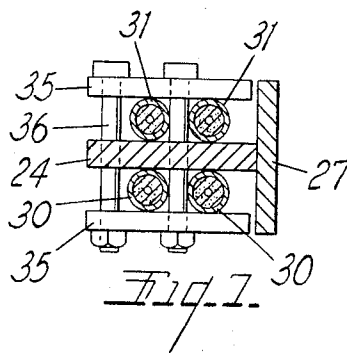
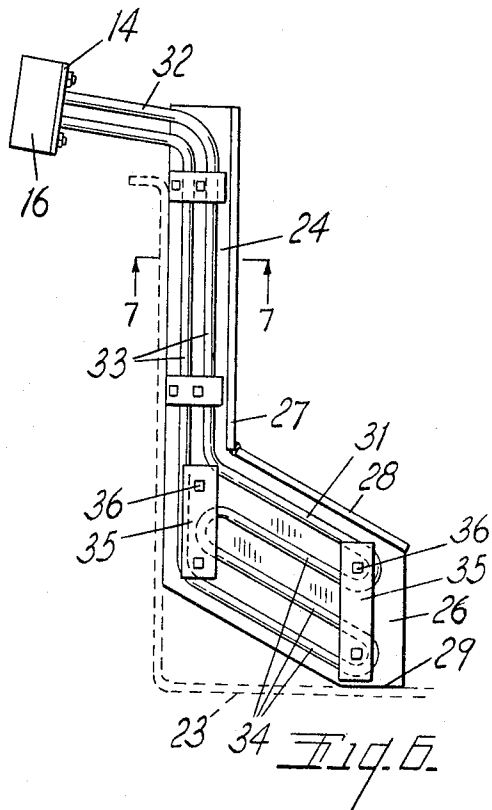
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HEATING UNIT FOR MELTING SOFT OR WHITE METAL

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2 Sheets-Sheet 2



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3,280,307

HEATING UNIT FOR MELTING SOFT OR WHITE METAL

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This invention relates to improvements in heating unit for melting soft or white metal such as type metal. The principal objects of this invention are:

First, to provide a heating unit for melting type metal and other low melting point metals which utilizes plural electrical resistance heating elements enclosed in tubular metal sheaths with the sheaths mounted in such a manner as to be protected from damage by pieces of metal dumped into the melting tank.

Second, to provide a heating unit embodying heating elements in tubular sheaths which is relatively light and which permits removal of individual heating elements for replacement as necessary.

Third, to provide a heating unit having one or more heating elements in sheaths with the heating elements having their metal sheaths secured in good heat conducting contact with supporting metal plates to radiate heat and protect the heating element from mechanical shock and scaling of the sheaths.

Fourth, to provide a mounting for plural resistance heating elements which separates the heating elements by a heat radiating plate to prevent one element from burning though the protective sheath of another heating element.

Fifth, to provide a heating unit of the type described which is easily mountable and demountable over the edge of a melting tank to be supported from the rim of the tank or from the inner side and bottom walls of the tank.

Other objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings of which there are two sheets, illustrate three highly practical forms of the heating unit of the invention.

FIG. 1 is a side elevational view of one form of the heating unit with a portion of the terminal connection box broken away in cross section and with a portion of a melting tank indicated in dotted lines in operative relation to the heating unit.

FIG. 2 is a fragmentary cross sectional view taken along the plane of the line 2—2 in FIG. 1.

FIG. 3 is a fragmentary cross sectional view taken along the plane of the line 3—3 in FIG. 1.

FIG. 4 is a cross sectional view taken along the plane of the line 4—4 in FIG. 1.

FIG. 5 is a fragmentary cross sectional view taken along the plane of the line 5—5 in FIG. 1 illustrating the connection of the resistance heating elements to the mounting plate of the heating unit.

FIG. 6 is a side elevational view of a first modified form of the heating unit with a portion of a melting tank illustrated in dotted lines in operative relation to the heating unit.

FIG. 7 is a cross sectional view taken along the plane of the line 7—7 in FIG. 6.

FIG. 8 is a side elevational view of a second modified form of the heating unit.

FIG. 9 is a fragmentary cross sectional view taken along the plane of the line 9—9 in FIG. 8.

Type casting and type setting machines in large printing establishments have a large requirement for molten type metal and this metal is commonly melted in tanks heated by electric resistance heating elements. The ele-

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ments are normally partially submerged to various levels in the molten metal and are subjected to the shock of fresh metal being added to the tank either in the form of old type plates or fresh metal pigs. In order to provide reliable heating units that are relatively light so as to permit their removal from the tank while at the same time protecting the heating elements from damage by pieces of metal dropped into the tank, the present invention mounts the electrical resistance heating elements on sheet metal plates that radiate the heat from the heating elements to the metal being melted. In the first form of the heating unit shown in FIGS. 1 to 5 the heating unit consists of a relatively narrow upright metal plate 1 having a laterally outwardly turned portion 2 at its upper end and a wider oppositely inwardly extending plate portion 3 at its lower end. The inner edge of the plate 1 has a stiffening and protective plate 4 welded across its inner edge while the top edge of the inwardly projecting portion 3 has a similar cross plate 5 welded thereto. Desirably a diagonal brace 6 is secured between the plates 4 and 5 to support the weight of the inwardly projecting portion of the unit and to resist the shock of solid metal pigs or pieces dropped into the tank. The outwardly projecting portion 2 of the plate has a horizontal mounting plate 7 welded thereto which may have holes 8 formed therein for securing the heating unit to the rim of a tank or to any other convenient support. The tank in which the heating unit is designed to operate is indicated by the dotted lines at 9.

The heating elements of the units consist of two electrical heating elements 10 and 11 each of which consists of a tubular metal sheath 12 with a resistance heating element 13 positioned within the sheath and surrounded by suitable electrical insulating material. Heating elements of this type are old and well known.

At their upper and outer ends the heating elements 10 and 11 have their sheaths passed through holes provided therefor in a mounting plate 14 and may be removably secured therein by brazing the ends of the sheath to the plate. The plate has holes receiving mounting bolts 15 which secure a terminal or connection box 16 to the mounting plate and the electrical connections to the heating elements 13 are made in the box in a manner well known in the trade. The tubular sheaths extend laterally inwardly and downwardly along the upright plate 1 in generally parallel reaches as at 17 and are held in place on opposite side of the plate by cross straps or plate 18 secured by bolts 19. The bolts and plates clamp the metal sheaths in heat conducting contact with opposite sides of the plate. Along the inwardly projecting lower portion 3 of the heat radiating plate the sheaths of the heating elements 10 and 11 are arranged in sinuously curved portions 20 secured in place and held against opposite sides of the plate by other cross straps or mounting plates 21 with bolts 22 which pass between adjacent curves of the sheaths of the heating elements. The heating unit shown in FIGS. 1 to 5 being supported externally of the tank 9 may be positioned above the bottom of the tank as illustrated. The protective plates 4 and 5 protect the heating elements from shock of metal dropped into the tank and the heating unit is relatively light and can be removed for replacement of one of the heating elements and its sheath should the element burn out after prolonged use.

The modified form of heating unit shown in FIGS. 6 and 7 is designed to be supported from the walls of the tank indicated by the dotted lines at 23. The unit has an upright narrow metal support plate 24 with a relatively wide and downwardly and inwardly inclined lower portion 26 at its lower end. Protective cross plates 27 and 28 are welded across the inner edges of the plates 24

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and 26 and the lower inner corner of the inclined portion 26 is flattened as at 29 to rest against the bottom of the tank while the outer edge of the upright plate 24 is supported against the inner sidewall of the tank.

The heating units 30 and 31 and their surrounding metal sheaths extend in self-supporting laterally outwardly projecting relation as at 32 and are connected to a mounting plate 14 which is the same as in FIGS. 1 to 5. The mounting plate supports the same terminal and connection box 16.

The heating elements 30 and 31 have their sheaths mounted on opposite sides of the plates 24 and 26 and extend in generally parallel downwardly directed portions 33 to downwardly and inwardly inclined and sinusously arranged portions 34.

The sheaths are secured in tight heat transfer relation to the plates by cross straps or plates 35 and bolts 36 which pass between adjacent reverse bends of the sheaths.

As in the first form of the heating unit the heating elements and their sheaths are protected from pieces of metal dropped into the tank by the plates 27 and 28. In addition the downwardly inclined portions 34 of the heating elements cause any slag or dirt which might collect on the surface of the molten metal to drain downwardly along the inclined reaches of the sheaths as the level of the metal in the tank is reduced. In this way the slag does not collect between the plate and the sheaths to act as an insulator and prevent good heat conduction between the sheaths of the heating elements and the heat radiating plates.

FIGS. 8 and 9 illustrate a second modified form of heating unit in which there are two L-shaped heat radiating plates 37 and 38 with laterally outwardly extending upper portions 39 having a cross support plate 40 welded across their lower edges. The plates have upright portions 41 connecting at the bottom to relatively wide inwardly projecting portions 42 and the plates are apertured as at 43 to permit flow of molten metal between the plates and around the heating elements.

There are two resistance heating elements 44 and 45 arranged in metal sheaths 46 as in other forms of the invention. The heating elements are positioned on the inner sides of the heat radiating plates 37 and 38 and are held in spaced apart relation by cross straps or strips 47 removably secured in place by cross bolts 48 which permit the heating unit to be dismantled for replacement of either of the heating elements.

At their upper ends the heating elements and their sheaths project laterally as at 49 for connection to the mounting plate 14 and terminal connection box 16 as in the other forms of the invention.

The third form of the heating unit shown in FIGS. 8 and 9 provides protection for the resistance heating elements by the spaced edges of the two heat radiating plates 37 and 38. It will be appreciated that the heating capacity of the heating units in any of the forms illustrated can be varied by varying the length of the sinusously arranged lower portions of the heating elements 20, 34 or 50 in FIGS. 8 and 9. All forms of the heating unit illustrated are approximately $\frac{1}{3}$ the weight of previously used heating units in which the resistance heating elements are cast into integral metal bodies and in addition the construction illustrated permits replacement of one heating element without discarding the entire heating unit.

What is claimed as new is:

1. A heating unit for melting soft metal comprising a pair of resistance heating elements enclosed in tubular metal sheaths with the ends of the sheaths connected in adjacent relation to a mounting plate, said sheaths being arranged in generally parallel spaced relation laterally from said mounting plate with downwardly extending portions connecting to further laterally off-set sinuous main heating portions, metallic heat radiating plate means contacting said sheaths along said main heating portions and the downwardly extending portions of the sheaths,

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said plate means projecting beyond the outline of said sheaths to protect the sheaths and support the unit from the walls of a melting tank,

and releasable clamp plates engaged with said sheaths and removably bolted to said plate means at spaced points to hold said sheaths in heat transmitting contact with said plate means.

2. A heating unit as defined in claim 1 in which said radiating plate means include a central plate between said sheaths,

and cross protective plates secured to the inner edge of the plate means along the downwardly and laterally inwardly extending main heating portions, said clamp plates being bolted to the outer sides of said sheaths by bolts passed between convolutions of the sheaths.

3. A heating unit as defined in claim 2 in which said radiating plate means projects laterally outwardly at the upper end to overlies the edge of a tank and support the unit from the top.

4. A heating unit as defined in claim 2 in which said sheaths are inclined downwardly and inwardly in said main heating portions.

5. A heating unit as defined in claim 1 in which said radiating plate means includes plural perforate plates on opposite sides of said sheaths with said clamp plates disposed between the sheaths.

6. A heating unit as defined in claim 5 in which said radiating plate means project laterally at the top to overlies the edge of a melting tank.

7. A heating unit as defined in claim 1 in which said main heating portions of said sheaths are inclined downwardly and inwardly,

and said radiating plate means have upright outer and inwardly projecting edges adapted to support the unit from the inner side and bottom of a melting tank.

8. A heating unit for melting type metal comprising a pair of resistance heating elements enclosed in tubular metal sheaths with the ends of the sheaths connected in adjacent relation to a mounting plate, a terminal and connection box for said elements connected to said plate,

said sheaths being arranged in generally parallel spaced relation laterally from said mounting plate and downwardly to further laterally off-set sinuous main heating portions,

metallic heat radiating plate means contacting said sheaths along said main heating portions and the extending portions of the sheaths and along the upper laterally extending portions of the sheaths,

said plate means projecting beyond the outline of said sheaths to protect the sheaths and support the unit from the walls of a melting tank,

and releasable clamp plates engaged with said sheaths and removably bolted to said plate means at spaced points to hold said sheaths in heat transmitting contact with said plate means.

9. A heating unit for melting metal comprising a resistance heating element enclosed in a tubular metal sheath with its ends connected in adjacent relation to a mounting plate,

said sheath being arranged in generally parallel downwardly extending portions connected to a laterally projecting, sinusously arranged main heating portion, a heat radiating plate disposed along said downwardly extending portions and said main heating portion and projecting therebeyond,

protective cross plates secured to the inner and upper edges of said radiating plate along said downwardly extending portion and over said main heating portion, and clamp plates arranged in crossing relation to said sheath removably clamping said sheath to said radiating plate by means of bolts passed through the clamp plate and the radiating plate between bends in said sheath.

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10. A heating unit as defined in claim 9 in which said radiating plate has a support projecting laterally from its upper end to overlie the edge of a tank.

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