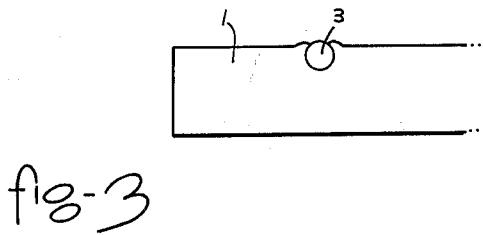
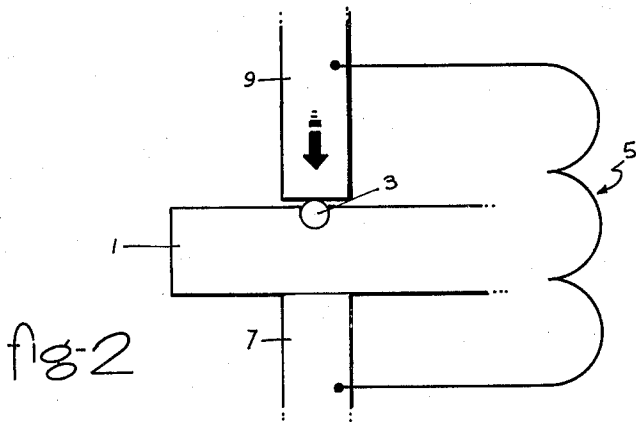
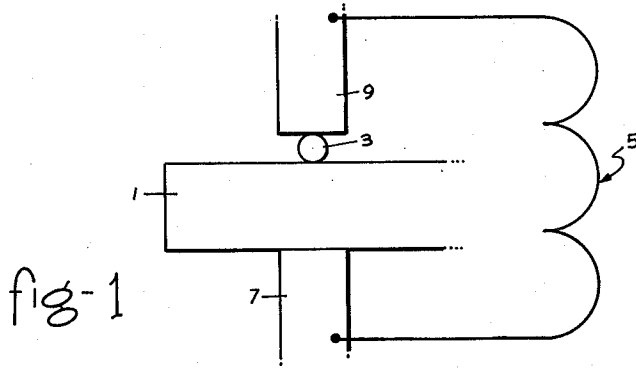


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R. E. PERKINS
WIRE FASTENING METHOD
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1

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WIRE FASTENING METHOD

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3 Claims. (Cl. 219-58)

This invention relates to the fastening of metal members to one another and more particularly to the fastening to one another of metal members, such as wires, of different materials having different melting temperatures.

One of the operations usually performed in the manufacture of electric lamps, electronic tubes, hermetically sealed circuit breakers, etc., is the fastening of a tungsten or other resistance wire filament or heater of relatively small diameter to lead-in wires or support wires of dumet, nickel-plated iron or other material of relatively large diameter. Heretofore, several different techniques, all well known in the art, have been employed. For example, one of these techniques is spot welding, a technique in which both the resistance wire and the support wire are melted and an alloy formed at the interface or contact surface. Another technique is clamping, in which the resistance wire is positioned in a hook formed from a flattened end section of the support wire and the hook is closed on the resistance wire. Still another technique is cold swaging of the harder resistance wire into the softer support wire.

Although each of these techniques has certain advantages which commend their use in a number of applications, there are also certain disadvantages associated therewith. For example, in certain applications where spot welding is employed, it is quite difficult to control the electrode temperatures sufficiently to prevent a reduction of the cross section area of the resistance wire and the resultant shortened life of the filament or heater. In the manufacture of incandescent lamps for example, if the cross section area of the tungsten filament is reduced substantially, this weak spot will run hotter than the rest of the filament and shorten the life of the lamp.

One of the problems associated with the clamping technique is the tendency of the closed hooks to open due to the springiness of the material of which the support wires or lead-in wires are made. Cold swaging is difficult to control without distorting the support wires or lead-in wires and/or accidentally changing the lead tip spacing. In the manufacture of electric lamps for example, uniform lead tip spacing is important because even slight variations thereof affect the effective electrical length of the filament and consequently the electrical characteristics of the finished lamp. In the manufacture of hermetically sealed circuit breakers for example, lead-in wire spacing is important because it affects the control of trip time.

In view of the foregoing, one of the principal objects of this invention is to fasten to one another two metal members having different melting temperatures in such a manner that advantage is taken of the difference in melting temperatures to effect an embedding of the member having the higher melting temperature in the member having the lower melting temperature without distortion of the former.

A more particular object of this invention is to fasten a tungsten or other resistance wire filament or heater coil to support wires or lead-in wires without distorting the resistance wire.

These and other objects, advantages and features are attained, in accordance with the principles of this invention, by what may be termed a hot swaging technique or method.

In the specific embodiment of the invention illustrated

2

in the accompanying drawing, FIGURE 1 is a schematic illustration of a welding unit with a pair of wires disposed in contact with one another and in position to be secured to one another by the welding unit.

FIGURE 2 is a schematic illustration similar to FIGURE 1 showing the state of the work at an intermediate stage of the wire fastening operation.

FIGURE 3 is a fragmentary detail of the work showing the work components after they have been secured to one another.

In accordance with the principles of this invention, lead-in wire 1 and resistance wire 3 are firmly attached to one another by a combination of heat and mechanical pressure. Heating of wires 1 and 3 is effected by a welder 5 through electrodes 7 and 9, electrode 7 being connected to lead-in wire 1 and electrode 9 being in firm frictional contact with resistance wire 3. Mechanical pressure is applied by electrode 9 on resistance wire 3. In the operation of this arrangement, the lead-in wire 1 and the resistance wire 3 are positioned in contact with one another at the locus where it is desired to effect a joining of these two members to one another as shown in FIGURE 1. The electrodes 7 and 9 of the welder 5 are brought into firm frictional contact with the wires 1 and 3 respectively as shown in FIGURE 1. The welder 5 is then energized to effect a flow of current through the electrodes 7 and 9 and the wires 1 and 3, the amount of current being regulated to insure the application of sufficient heat to the work pieces to effect a softening of lead-in wire 1 but not enough to so affect the resistance wire 3. With the work pieces in this state, the electrodes 7 and 9 are displaced with reference to one another and toward one another, preferably by the downward movement of electrode 9 as shown in FIGURE 2. The force exerted by this downward movement of the electrode 9 pushes the resistance wire 3 into the softened lead-in wire 1. The softened lead-in wire material flows closely around the resistance wire which becomes firmly embedded therein as shown in FIGURE 3 when the welder has been deenergized and the electrode 9 has been removed from engagement with the resistance wire.

The work components of the specific embodiment of the invention illustrated in the accompanying drawing are greatly enlarged in size. For example, the resistance wire 3 may be of tungsten and be about one mil in diameter. The lead-in wire 1 to which the wire 3 is secured may be nickel-plated iron and be about 30 mils in diameter. With work components of this nature and size, it has been found that good results may be obtained with a 50 mfd. capacitor discharge welding unit operated from a 100 volt D.C. supply, discharging through a 20:1 welding transformer. However, it will be readily apparent to those skilled in the art that other types of welding units may be employed and work components of other materials, natures and sizes may be secured to one another without departing from the spirit or principles of this invention.

Furthermore, a number of advantages of this hot swaging technique will also be apparent to those skilled in the art. For example, less heat need be generated and more mechanical pressure may be applied than is conducive to the attainment of good results when conventional welding techniques are employed. More heat may be generated and less mechanical pressure need be applied than is conducive to the attainment of good results when swaging is employed. This hot swaging technique may be employed in many applications which do not readily lend themselves to the hook forming and clamping technique. It is also much simpler and more effective than notching and peening.

3

What I claim is:

1. The method of fastening to one another two symmetrical metal members having different melting temperatures, said method comprising: placing said members in engagement with one another; heating said member having the lower melting temperature sufficiently to effect a softening thereof; and effecting relative movement between said engaged members toward one another whereby said member having the higher melting temperature is embedded in said softened member having the lower melting temperature without substantial distortion of said member having the higher melting temperature.

2. The method of fastening to one another two symmetrical metal members having different melting temperatures, said method comprising: placing said members in engagement with one another; passing an electric current through said engaged members sufficient to effect a softening of the member having the lower melting temperature only; and effecting relative movement between said engaged members toward one another whereby said member having the higher melting temperature is embedded in said softened member having the lower melting temperature without substantial distortion of said member having the higher melting temperature.

4

3. The method of fastening to one another two symmetrical wires having different melting temperatures, said method comprising: placing said wires in engagement with one another; placing one electrode of a welding unit in engagement with one of said wires; placing the other electrode of said welding unit in engagement with the other of said wires, said electrodes when so placed being substantially in register with one another; energizing said welding unit to cause a flow of electric current through said electrodes and said wires sufficient to effect a softening of said wire having the lower melting temperature only; and effecting relative movement between said electrodes toward one another whereby said wire having the higher melting temperature is embedded in said softened wire having the lower melting temperature without substantial distortion of said member having the higher temperature.

References Cited in the file of this patent

UNITED STATES PATENTS

910,434	Thompson	Jan. 19, 1909
2,179,545	Edge et al.	Mar. 14, 1939
2,734,118	Patten	Feb. 7, 1956