May 8, 1951 T. H. LENNOX 2,552,193

HEATING DEVICE

Original Filed April 23, 1949

Fig. 1.

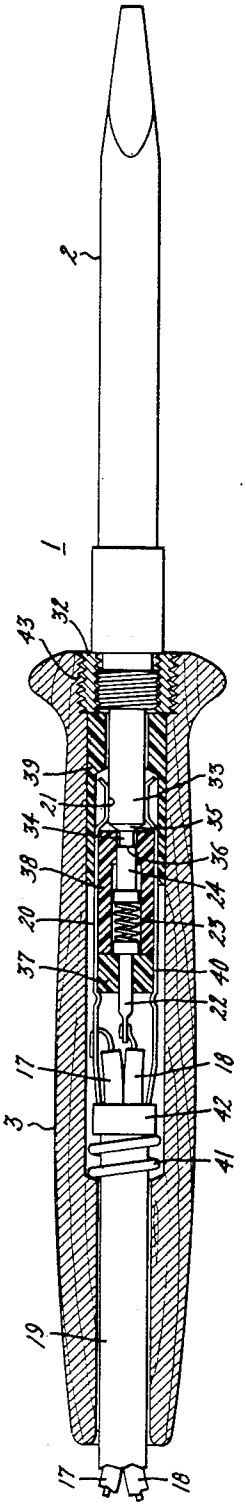
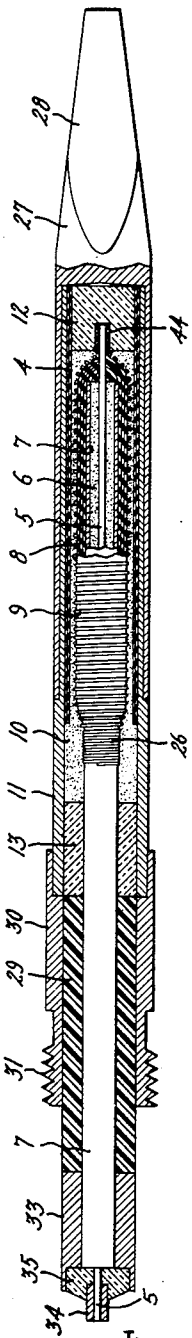


Fig. 2.



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2,552,193

HEATING DEVICE

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3 Claims. (Cl. 219—26)

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This invention relates to electric heating devices, and more particularly to electric heating devices utilizing heating units which have concentric terminals for making electrical connections thereto. This invention relates also to connection means for heating units having concentric terminals.

This application is a division of my application Serial No. 89,284, filed April 23, 1949, now Patent No. 2,515,781, issued July 18, 1950, which is assigned to the same assignee as the present application.

An object of the present invention is the provision of an improved construction for electric heating devices which incorporate heating units having concentrically disposed terminals.

Another object of the invention is to provide improved connection means for heating units having concentrically disposed terminals for making electrical connections thereto.

Still another object of my invention is to provide an improved combined handle and connection apparatus which is readily connectible to and removable from a heating unit having concentrically disposed terminals.

A more specific object of the invention is the provision of an improved construction for soldering irons.

Other objects and advantages of the invention will become apparent as the description proceeds, and the new and distinguishing features thereof will be pointed out in the appended claims.

In carrying out my invention in one form, I provide an elongated heating unit having a threaded portion near one end and a pair of concentrically disposed terminals on that end. A hollow handle and connector apparatus is provided having an internally threaded portion for screw connection to the threads on the heating unit. Within this apparatus are resilient means for releasably connecting an electrical conductor to the outer of the concentric terminals and means including a spring and slidable contact member for releasably connecting a second electrical conductor to the inner of the concentric terminals.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is an enlarged view, partially in section, of a soldering iron in which is incorporated a combined handle and connector apparatus embodying my invention; while Fig. 2 is an enlarged sectional view of the soldering tip end of the soldering iron showing in detail the construction of the heating unit.

Referring to Fig. 1 of the drawing, there is

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shown a soldering iron, designated generally by the numeral 1, which is composed of two principal parts: a heating unit 2 having a soldering tip on one end and a pair of concentrically disposed terminals on the other, and a handle 3 which encloses the electrical connections to the heating unit.

The heating unit, which is illustrated in detail in Fig. 2, comprises a center electrical conductor 5 which may, for example, be made of iron wire. Surrounding wire 5 is a layer 6 of electrical insulating material which is preferably compacted magnesium oxide powder. Concentrically located around the insulation layer 6 is a tubular electrical conductor 7 of a heat resistant material which may, for example, be an alloy containing iron, cobalt and nickel. In one typical heating unit embodying my invention, tube 7 has an outside diameter of approximately .130 inch.

Around the outer surface of tubular member 7 along a portion thereof adjacent the extremity opposite the handle is a layer 8 of electrically insulating material. Layer 8 may, for example, comprise several thicknesses of insulating paper wrapped around member 7 with additional thicknesses over the extremities of member 7 and insulating layer 6 in the manner illustrated in Fig. 2. On the outside of insulation layer 8 is located a helical coil 9 of resistance heating wire which is preferably made of an alloy of nickel and chromium. At one end 26 of the heating coil, there are several turns of wire wound on to the outside surface of member 7, while at the other end 44 several turns are coiled about center wire 5.

Immediately surrounding metal tube 7 and heating coil 9 is a layer of electrically insulating heat conductive material 10 such as compacted magnesium oxide powder. Around insulating layer 10 and enclosing all the foregoing component parts is an outer tubular metal sheath 11, preferably made of an alloy of iron, cobalt and nickel. If desired, a liner 4 of mica may be provided inside sheath 11 along the portion adjacent the heating coil. At the ends of sheath 11 are retaining members 12 and 13, which may be of baked lava, whose primary purpose is to retain insulating material 10 during and after the swaging operation, which is explained below.

At the end of the heating unit opposite the handle end, the soldering iron 1 is equipped with a copper tip portion 27 having a tapered wedge-shaped extremity. On this tapered wedge-shaped extremity are provided the actual soldering surfaces, such as the area designated by the numeral 28, for example. All, or a part

of the outer surface of copper tip 27 may be iron-plated, if desired, to reduce the corrosive effect on the tip of the tin which is contained in solder.

At the end of the heating unit adjacent the handle, the soldering iron 1 is provided with means for affixing the heating unit to handle 3 and for connecting the heating unit to a source of electrical energy. A cylindrical layer 29 of electrical insulation, which may, for example, be of ceramic material, surrounds tubular conductor 7 at this end of the heating unit. A cylindrically-shaped member 30, having a threaded portion 31, is positioned outside layer 29 overlapping the end of sheath 11. The threaded portion 31 engages corresponding threads on the inner surface of a bushing member 32 at the extremity of handle 3 and thereby joins the heating unit to the handle. At the inner extremity of insulator 29, there is a cylindrical member 33 of electrically conducting material, the outer surface of which provides a contact for electrical connections to tubular conductor 7. Another smaller cylindrical contact member 34 is provided at the inner extremity of center conductor 5 to provide for electrical connections thereto, with contacts 33 and 34 being separated by a suitable insulator 35 which is preferably of glass.

Referring to Fig. 1, the heating unit in this typical soldering iron is connected to a source of electrical energy (not shown) by two insulated conductors 17 and 18 which are located within a protective outer sheath 19. Conductor 17 is joined to a conductive flatly disposed prong member 20, of resilient material, which is in contact with member 33 at location 21 when the heating unit is in the handle, thus completing an electrical connection to conductor 7 of the heating unit. Conductor 18 is joined to a conductive member 22 from which an electrical connection is completed to center conductor 5 of the heating unit through an electrically conductive coil spring 23 and a conductive slidable contact member 24. This electrical connection is made at point 36 on member 34 at the end of the heating unit when the heating unit is screwed into the handle.

There are provided within the handle three cylindrically shaped insulators 37, 38 and 39 which are preferably of plastic material. These coaxially disposed insulators separate the two sides of the electrical circuit from each other and from the handle, as shown in Fig. 1. A resilient member 40, which is similar to member 20, and other like resilient members (not shown) are provided around the outer periphery of insulators 37 and 38 to maintain the parts within the handle in the proper concentric relation. A coil spring 41 coacts with a flange projection 42 at the inner extremity of sheath 19 to absorb a portion of the strain on the electrical connections within the handle caused by tension on the cable made up of sheath 19 and conductors 17 and 18. Bushing member 32, which joins the heating unit to the handle, may be secured within the handle 3 by means of threads 43. In addition to joining the heating unit and the handle, member 32 also serves as a retainer for the insulators and other parts within handle 3.

It will be understood that the heating unit is readily removable and replaceable in the handle merely by unscrewing threaded portion 31 from its mating member 32. Unscrewing the heating unit from the handle breaks the electrical connections between members 20 and 33 and members 24 and 34. Screwing the same or another similar heating unit into the handle causes both connections automatically to be made again due to the resiliency of member 20 and spring 23 which acts on member 24.

To construct a heating unit in accordance with my invention, I first provide a suitable length of preformed concentric electrical conductor comprising center wire 5, insulation layer 6 and outer conductor 7. The first step in the manufacturing operation is to remove a portion of outer conductor 7 and insulation layer 6 at each end of center conductor 5. Several thicknesses of insulating paper are then wound around the outside surface of member 7 and down over one extremity of member 7 on to conductor 5, as illustrated in Fig. 2. Heating coil 9 is then wound on the outer surface of insulation layer 8 with several turns wound off on member 7 at one end 26 and several turns on to member 5 at the other end 44 of the heating coil. Following the winding of the heating coil the end turns of the coil lying on members 7 and 5, respectively, are staked in order to form good electrical and mechanical connections between the coil and these members.

The assembled components described in the preceding paragraph are then placed concentrically inside outer sheath 11 and the intervening space is filled with magnesium oxide powder. Retainers 12 and 13 are inserted at the ends of sheath 11 to prevent the magnesium oxide powder from coming out during the subsequent swaging operation. Member 12 has a centered opening on the inner side to admit portion 44 of the heating coil assembly, and the aperture through member 13 is also at the center so that members 12 and 13 serve to maintain the heating coil assembly on the center line of sheath 11.

After assembly in the manner described, the heating unit is swaged to compact the layer 10 of magnesium oxide powder and reduce the diameter of sheath 11 to a predetermined value which may, for example, be .285". Sheath 11 is then machined at one extremity to provide for the addition of soldering tip 27 if the heating unit is to be used in a soldering iron, and the soldering tip is installed. At the other end of the heating unit, members 29 and 30 are installed in this order, after which cylindrical contact 33 is placed on tubular conductor 7 and secured thereto. Then center contact member 34 is added and a glass seal 35 is provided between contact members 33 and 34 by the use of high frequency current to heat the glass. The heating unit is then ready to be screwed into handle 3, after which electrical current may be circulated through the heating coil 9 to cause it to dissipate heat. The circuit which the current follows through the soldering iron 1, in which this typical heating unit is incorporated, may be traced as follows, assuming that conductor 17 is the forward conductor and conductor 18 the return conductor: conductor 17, member 20, contact member 33, tubular conductor 17, member 20, contact member 33, tubular conductor 7, heating coil 9, center conductor 5, contact member 34, member 24, spring 23, member 22, and conductor 18.

While I have illustrated and described my invention in a preferred form for use in a soldering iron, it will be readily apparent that it may be used for other purposes, such as liquid immersion heaters, for example. Also, the invention may be used in conjunction with other heating units having concentric terminals and is not limited to the specific heating unit construction described. Therefore, while I have illustrated and described one preferred embodiment of my invention, many

modifications may be made and, accordingly, it should be understood that I intend to cover, by the appended claims, all modifications which fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric soldering iron comprising a concentrically disposed heating unit having a center electrical conductor, a coaxial layer of insulating material around said center conductor, a second electrical conductor coaxially positioned around said layer of insulating material, a second layer of insulating material coaxially positioned on the outside surface of said second electrical conductor, a resistance heating coil positioned on the outside of said second layer of insulating material having one end of said coil connected to said second conductor and the other end connected to said center conductor at one extremity thereof, a layer of compacted powdered electrically insulating heat conductive material around all of the foregoing heating unit components embedding them within an outer metal sheath, a pair of concentrically disposed terminals projecting from the end of said sheath opposite said extremity, the center one of said terminals being connected to said center conductor and the outer of said terminals being connected to said second conductor, and a threaded portion on said sheath near the terminal end of said heating unit, a soldering tip having a cavity therein for receiving one end of the heating unit positioned on the end of said heating unit opposite said terminals, and a hollow handle having an internally threaded portion for engaging the threaded portion of said heating unit to affix said heating unit to said handle, said handle having therein means for terminating a two-conductor insulated electrical cable and connecting the two conductors to said heating unit, said means including a resilient prong member for connecting one of said cable conductors to the outer of said concentric terminals, and means including an electrically conductive coil spring and a slidable contact member for connecting the second of said cable conductors to the center one of said concentric terminals.

2. A handle and connector apparatus for an elongated electric heating device having a pair of concentric terminals at one end and a threaded portion near said end, said handle and connector member comprising an elongated enclosing member having an opening longitudinally therethrough, an internally threaded bushing near one end of said opening for receiving the threaded portion of said heating unit, said bushing being removably secured to said enclosing member, the end of said heating unit which includes the terminals extending into said enclosing member beyond said threaded portion, a portion of reduced diameter at the end of said opening opposite said bushing, means including a coil spring for terminating a two-conductor insulated electrical cable entering the reduced diameter end of said opening, said cable having an outer sheath provided with a flanged portion near the inner extremity thereof, said coil spring being positioned between said flange portion and said reduced diameter portion of said opening, a plurality of flatly disposed resilient members connected to said flanged portion and positioned longitudinally in said enclosing member in engagement with the outer terminal of said electric heating unit, at least one of said resilient members being connected to one of said conductors whereby an electrical connection is provided to said outer terminal, a conductive member connected to the other of said conductors, a second coil spring, a slidable member, said conductive member, said spring and said slidable member being consecutively positioned in abutting relation substantially centrally of said opening and providing an electrical connection from said second conductor to said inner terminal, and a plurality of coaxially disposed insulating members positioned in said opening, said insulating members insulating said conductive member, said spring and said slidable member from said resilient members and insulating said resilient members from said enclosing member, said bushing retaining said insulating members within said enclosing member whereby the internal elements of said apparatus are retained in position within said enclosing member.

3. A handle and connector apparatus for an elongated electric heating device having a pair of concentrically disposed terminals at one end and threaded portion near said end, said handle and connector member comprising an elongated enclosing member having an opening longitudinally therethrough, an internally threaded bushing removably secured to said enclosing member near one end thereof for receiving the threaded portion of said heating unit, the end of said heating unit which includes said terminals extending into said enclosing member beyond said threaded portion, yieldable terminating means within said enclosing member for terminating a two conductor insulated electrical cable entering the opposite end of the opening in said enclosing member, at least one flatly disposed electrically conductive resilient member connected to one of said conductors and positioned longitudinally within said enclosing member in engagement with the outer terminal of said electric heating device whereby an electrical connection is provided between said one conductor and said outer terminal, a spring electrically connected to the other of said conductors, a slidable member, said spring and said slidable member being positioned in abutting relation and providing an electrical connection from said second conductor to the inner terminal of said electric heating device, insulating means longitudinally disposed within said opening separating said resilient conductive member electrically from said spring and said slidable member and supporting said latter two elements substantially centrally of said opening, said bushing retaining said insulating means within said enclosing member whereby the internal elements of said apparatus are retained in position within said enclosing member.

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