

Nov. 18, 1941.

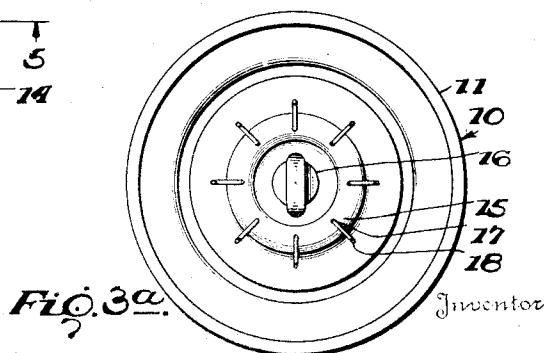
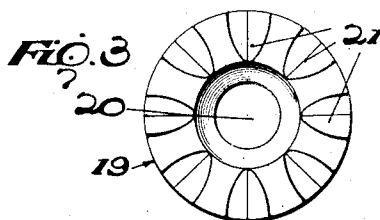
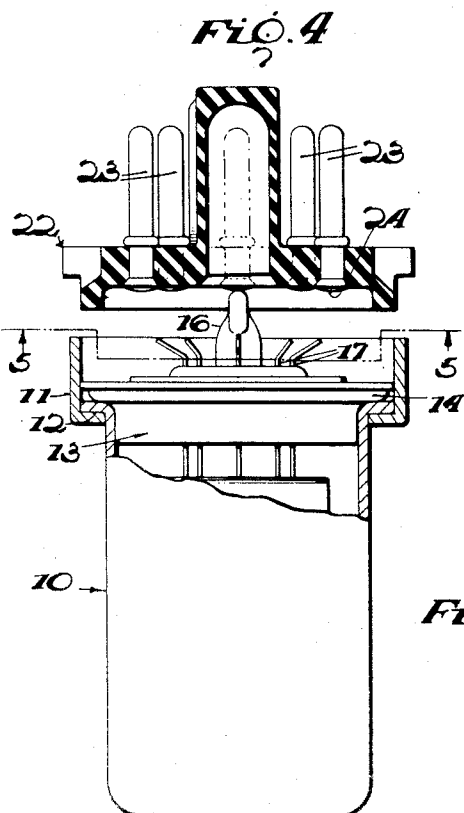
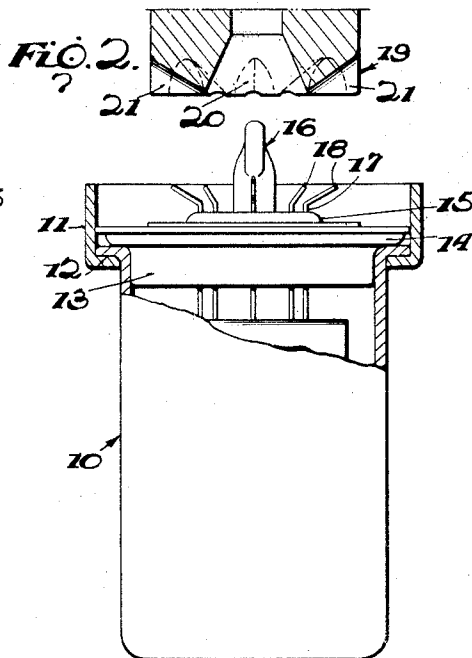
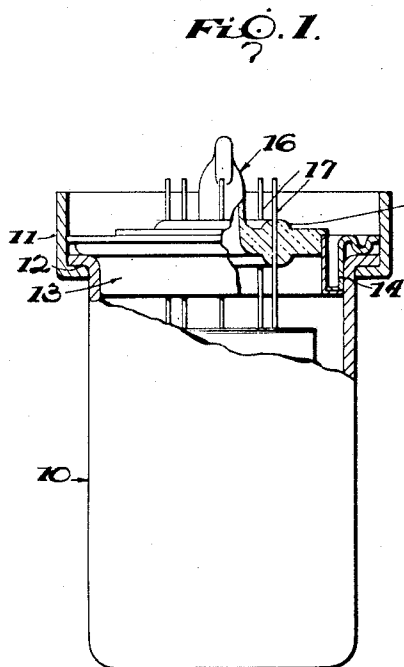
E. R. MURPHY.

2,262,901

METHOD OF CONNECTING LEAD WIRES AND TERMINALS

Filed June 10, 1941

2 Sheets-Sheet 1



Edward R. Murphy.

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By B.P. Johnson

Attorney

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E. R. MURPHY

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Sheets-Sheet 2

FIG. 5.

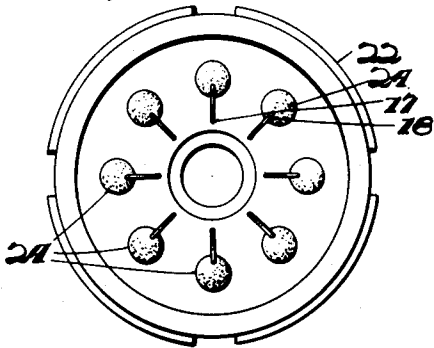


FIG. 6.

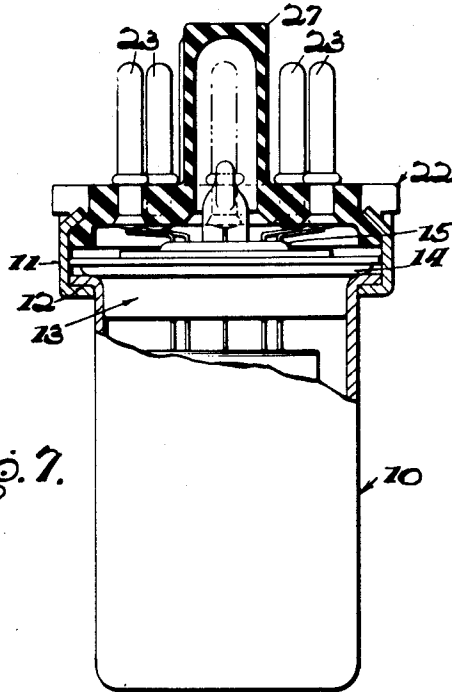


FIG. 7.

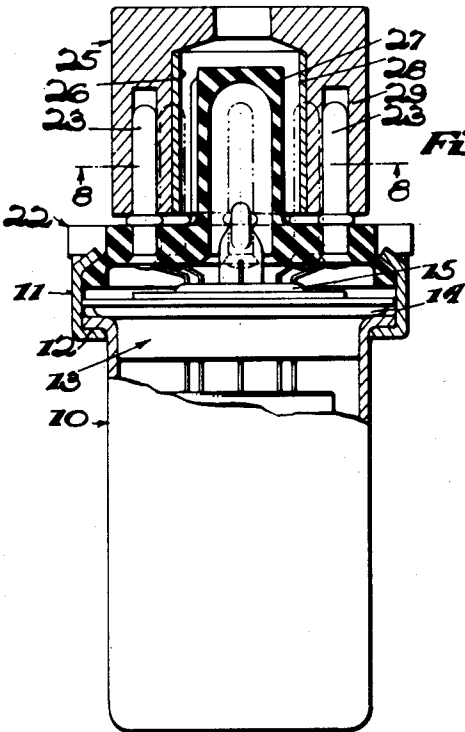


FIG. 9.

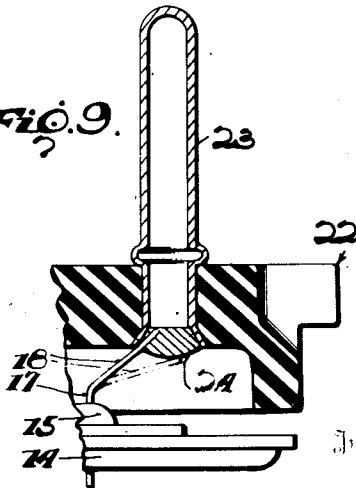
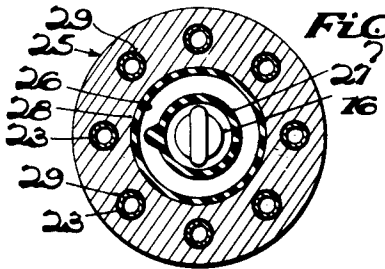


FIG. 8.



Edward R. Murphy.

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Attorney

UNITED STATES PATENT OFFICE

2,262,901

METHOD OF CONNECTING LEAD WIRES
AND TERMINALSEdward R. Murphy, Elizabeth, N. J., assignor of
one-half to Jack Slavitt, Newark, N. J.

Application June 10, 1941, Serial No. 397,479

17 Claims. (Cl. 250—27.5)

My invention relates to electrical translating devices such as radio tubes, gaseous discharge lamps, or the like, and has particular reference to a method of attaching the wires of such devices with their terminals.

In the production of the conventional radio tubes, a case or tube is provided and a head is attached to one end of the tube. This head carries a plurality of wires which are embedded in the insulating material of the head and lead to the interior of the tube for connection with the operating elements and extend to the exterior of the tube for connection with the terminals. It is the practice to embed tubular terminals in a base formed of insulating material, such as "Bakelite." These tubular terminals are open at both ends and the wires carried by the head are relatively long and are threaded through and beyond the tubular terminals. The insulating base is brought to the closed position and the tube is locked to the base by staking or other means. The wires now extend outwardly beyond the tubular terminals and these wires are now cut off so that they terminate near the outer ends of the terminals. The assembled unit is inverted and the outer ends of the terminals are dipped into molten solder whereby the wires are soldered to the tubular terminals at their outer ends. This method is time consuming and expensive inasmuch as it involves a number of steps including the straightening out of the wires, the threading of the wires through the tubular terminals, and the cutting off of the wires prior to soldering.

In accordance with my method, the wires are secured to the head or end of the radio tube, lamp, or the like in the conventional manner and extend into the tube for connection with the operating elements and also extend to the exterior of the tube. However, my wires extend to the exterior of the tube for only a relatively short distance and this enables them to remain vertical and straight until bent, if desired. It is preferred that these wires be originally short, to eliminate cutting, but of course they could be longer and subsequently cut off, after being embedded in the head. These relatively short wires are brought into engagement with solder carried by the inner ends of the terminals which are carried by or embedded in an insulating base, and after the insulating base is placed upon the tube, the solder at the inner ends of the terminals is heated so that it melts and forms proper electrical connections between the wires and the terminals. By my method considerable time and expense is saved as the length of the wires are reduced and the straightening and threading of the long wires eliminated and also the trimming of the long wires prior to soldering. A further advantage of my invention is that the various

steps of the method may be performed by automatic machinery.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same:

Figure 1 is a side elevation, parts in vertical section, showing a radio tube having the wires attached thereto in accordance with my method.

Figure 2 is a similar view, showing the tool raised after being shifted downwardly to bend the short wires outwardly,

Figure 3 is an end elevation of the tool,

Figure 3^a is a similar view of the tube,

Figure 4 is a side elevation of the tube, parts in central vertical section, showing the terminal carrying base arranged near the tube so that the wires will contact with the solder of the terminals, upon the downward movement of the base,

Figure 5 is a transverse section taken on line 5—5 of Figure 4,

Figure 6 is a view similar to Figure 4 with the terminal carrying base completely lowered with respect to the tube and attached thereto by staking,

Figure 7 is a view similar to Figure 6, showing a heating element applied to the terminals to heat the terminals and the solder secured to their inner ends,

Figure 8 is a horizontal section taken on line 8—8 of Figure 7,

Figure 9 is an enlarged detailed section through one of the terminals showing the melted solder at its inner end and forming the electrical connection between the terminal and the wire.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 10 designates a tube of a radio tube. The tube 10 may be of metal as is the case with so-called metal tubes. The tube 10 contains the operating elements of the radio tube. At one end of the tube 10 it is provided with a flange 11 and a shoulder 12 for receiving and supporting a head 13. The flange 11 extends longitudinally beyond the tube 10 and forms with the tube 10 a tube or casing. This head may be formed of an outer metal portion 14 carrying an inner glass portion 15 provided with the usual tube 16 to evacuate the tube and the tube 16 is then closed by pinching. This is the conventional construction. Embedded in the glass portion 15 are wires 17, which extend into the interior of the tube 10 for connection with the operating parts of the device. The wires 17 also extend to the exterior of the tube 10 upon the outer side of the head 13. The wires 17 are formed in sections having different coefficients of expansion, as is well known. The wires 17 extend beyond the head 13, as stated, but are relatively short. The wires 17 are preferably originally cut

relatively short before being embedded in the head 13, whereby the trimming of the outer ends of the wires is eliminated. This not only effects a saving in the wire but the relatively short wires 17 readily remain vertical and straight until bent and do not become displaced. By the use of the short wires I eliminate the step of separating and straightening out the long wires prior to threading such long wires through the tubular electrodes. While the wires 17 are relatively short they do extend for a short distance beyond the flange 11.

I next bend the ends of the short wires 17 radially outwardly forming angularly disposed ends 18 which when bent will occupy predetermined circumferential and radial positions. The bending is effected by bringing a bending tool 19 downwardly upon the ends of the wires 17. This tool has a central opening 20 to receive the tube 16 and notches 21 corresponding in number and arrangement to the wires 17. These notches are V-shaped in circumferential cross-section and are inclined in radial cross-section, increasing in depth outwardly. When the tool 19 is brought downwardly toward the wires 17 the ends of the wires enter the notches 21 which produce the outwardly inclined ends 18 and these bent ends are properly located to assume correct circumferential and radial positions. It is preferred to bend the wires 17, but under certain circumstances bending may be eliminated.

The numeral 22 designates an insulating base, formed of "Bakelite" or the like, and this base has tubular terminals 23 embedded therein and extending to the inner and outer sides of the base. The tubular terminals 23 may have their outer ends closed while their inner ends are formed open and solder 24 is applied to the inner ends of the tubular terminals 23 after they are embedded in the base. In applying the solder to each tubular terminal 23, a drop of molten solder is applied to the open inner end of the tubular terminal, and this drop of solder is allowed to cool to produce a solid mass, before the solder mass is brought down into engagement with the bent wire 17. Since the terminals are tubular the molten solder will enter the inner ends of the same, and this aids in securing the solder to the terminals. It is preferred to use tubular terminals, for the reasons stated, but the invention is not restricted to this feature as satisfactory results can be obtained by using solid terminals. The terminals correspond in number and radial and circumferential arrangement to the bent ends 18 of the wires and the base 22 is now brought down over the flange 11 and the solder 24 at the inner ends of the terminals will engage the bent ends 18. The base 22 and flange 11 may have suitable markings so that the terminals 23 will align with the bent ends 18 of the wires. This arrangement is shown in Figure 4. The next step is to move the base 22 downwardly to the completely closed position so that its lower portion enters the flange 11 and the base is then locked to the flange by staking at points, as is well known. The bent wires 17, Figure 4, extend slightly above the flange 11, Figure 4, but these wires are flexible and somewhat resilient so they are further bent by engagement with the solid solder 24 when the base 22 is moved to the closed position, Figure 6, and due to the resilience of the wires they have firm contact with the solder 24. The resilient wires 17 are thus held under compression by the solid solder, and as the solder melts, the bent wires will expand or

straighten out and firmly embed themselves in the solder.

The next step in the method is to heat the solder to melt the same so that it will positively and securely attach itself to the terminal and to the wire thus effecting a secure electrical connection between these elements. To effect this heating of the solder upon the inner ends of the terminals, I provide a preferably metal heating element 25, which is preferably cylindrical and has a central opening 26 for the passage of the tubular extension 27 of the base 22. The opening 26 is preferably lined with an asbestos sleeve 28 so that the heat will not injure the extension 27 which is formed of "Bakelite" or the like. The heating element 25 has cylindrical openings 29 which receive the terminals 23 and have substantially a sliding fit therewith and hence contact with the same. The heating element 25 is heated and while hot is applied to the terminals 23 and this thermal contact heats the terminals 23 and this heat passes by conduction through the terminals to the solder 24 which instantly melts and attaches itself to the terminal and the wire. The heating element 25 is preferably heated to the temperature of that used in connection with the ordinary electrical soldering iron and the heating element is applied to the terminals 23 for only a few seconds, such as around 3 seconds, more or less. The heating element is moved longitudinally of the terminals to apply itself to the same and then longitudinally off the same in an opposite direction to remove it and this is ordinarily sufficient time to transmit sufficient heat to melt the solder. The invention is not restricted to the precise time element in the heating step as the same will vary somewhat depending upon the degree of heat of the heating element, the character of the solder, and the speed at which the heating element is applied to and removed from the terminals. This can be determined readily by tests.

While I have shown one method of heating the solder to melt the same the invention is not restricted to this precise method as I contemplate using other methods such as passing current through the solder or subjecting the terminal to the action of infra-red rays or high frequency current or the like to heat the same.

Figure 9 shows the solder 24 after it is melted and attached to the terminal 23 and to the wire 24. The solder mass was solid before melting, and upon melting the bent resilient wire 17, under compression, expands and forces its end into the molten solder to become securely embedded therein.

I also contemplate using a solder mass which is plastic while cold. This cold plastic solder mass never hardens until melted by heat. The cold plastic solder mass is introduced into the inner open ends of the tubular terminals, and remains plastic when brought into engagement with the bent wires 17, upon the downward movement of the head 22. The bent wires readily sink into the cold plastic solder mass and contact with the terminals. The cold plastic solder mass may consist of finely ground solder particles mixed with a commercial soldering flux such as "No-Korode." This flux is a sticky acid paste which keeps the parts to be soldered clean. After the bent wires have become embedded in the cold plastic solder mass the terminals may be heated by the heating element 25, as shown in Figure 7, and this heat will be transmitted by conductivity to the plastic solder mass, whereby the solder

particles are melted, and upon the removal of the heating element the solder mass will harden and become solid and thereby securely attach the wires to the terminals. All other steps of the method remain identical with those described in connection with the solid solder mass.

In the practice of the method, it is preferred to arrange the tube 10 vertically, and the relatively short lead wires 17 will then be vertical, before bending. The tube 10 will be supported in the vertical position by any suitable means. It is also preferred to arrange the bending tool 18 vertically, and to reciprocate the same vertically. It is preferred to arrange the head 22 horizontally with the solder masses 24 next to the bent lead wires 17, and to move the head 22 downwardly in a vertical line to bring the solder masses into engagement with the lead wires. However, the invention is in no sense restricted to the vertical arrangement of parts and to the vertical movements of elements, as the same may be changed to horizontal positions or angular positions.

If a cold solid solder or a cold plastic solder is used, the bent wires finally contact with the terminals and are placed or held under compression by such terminals.

It is not intended to limit the invention by the explanation of the same in the introductory portion of the specification, which is given solely for the purpose of adequately explaining the invention, in the beginning.

While I have shown and described my method as applied to the product of a radio tube, yet the invention is not restricted to this application as I contemplate using the same in producing other translating electrical devices having a plurality of wires to be connected with a plurality of terminals such as gaseous discharge lamps including fluorescent lamps and the like.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size, and arrangement of parts may be resorted to, and changes may be made in the order of the steps of the method without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, what I claim is:

1. The method comprising arranging lead wires of an electrical translating device in a selected position, bending the wires laterally, applying solder to the ends of terminals carried by an insulating base, arranging such ends carrying the solder next to the wires, effecting a relative closing movement between the base and the wires to bring the solder into engagement with the wires, attaching the base to the device, and then applying heat to the solder to melt the same.

2. The method comprising arranging lead wires of an electrical translating device in a selected position, bending the wires laterally, applying solid solder masses to the ends of terminals carried by an insulating base, arranging the solid solder masses next to the wires, effecting a relative closing movement between the base and the wires to bring the solid solder masses into engagement with the wires to place them under compression, and heating the solid solder masses to melt the same.

3. The method comprising arranging lead wires of an electrical translating device in a se-

lected position, applying solder masses to the ends of terminals carried by an insulating base, arranging the solder masses next to the wires, effecting a relative closing movement between the base and the wires to bring the solder masses into engagement with the wires, and heating the solder masses.

4. The method comprising forming relatively short lead wires upon an electrical translating device and rendering such lead wires accessible from the exterior of the device, arranging the relatively short lead wires in a selected position, applying solder masses to the ends of terminals carried by an insulating base, arranging the solder masses next to the wires, effecting a relative closing movement between the base and the wires to bring the solder masses into engagement with the wires, and heating the solder masses to melt the same.

5. The method comprising forming relatively short lead wires upon an electrical translating device and rendering such lead wires accessible from the exterior of the device, arranging the relatively short lead wires in a selected position, applying solder masses to the ends of terminals carried by an insulating base, arranging the solder masses next to the wires, effecting a relative closing movement between the base and the wires to bring the solder masses into engagement with the wires, and applying heat to the end portions of the terminals which are remote from the solder masses.

6. The method comprising forming relatively short resilient lead wires upon an electrical translating device and rendering such lead wires accessible from the exterior of the device, arranging the lead wires in a selected position, applying solid solder masses to the ends of terminals carried by an insulating base, arranging the solid solder masses next to the wires, effecting a relative closing movement between the base and the wires to bring the solid solder masses into engagement with the wires and thereby placing the resilient wires under compression, and applying heat to the terminals to melt the solder by the conduction of heat.

7. The method comprising forming relatively short lead wires upon an electrical translating device and rendering the lead wires accessible from the exterior of the device, the wires retaining their shape by virtue of their relative shortness, holding the device in a selected position, applying solder masses to the ends of terminals carried by an insulating base, arranging the solder masses next to the wires, effecting a relative closing movement between the base and the wires to bring the solder masses into engagement with the wires, securing the base to the device, and bringing a heated element into contact with the terminals to heat the same to melt the solder by the conduction of heat.

8. The method comprising the steps of supporting a resilient lead wire, applying a solder mass to a terminal, arranging the solder mass next to the resilient wire, effecting a relative closing movement between the terminal and the resilient wire to bring the solder mass into engagement with the resilient wire and place the same under compression, and melting the solder mass, the resilient compressed wire expanding and entering the molten solder mass.

9. The method comprising the steps of supporting a resilient lead wire, applying a solder mass to a terminal, arranging the solder mass

next to the resilient wire, effecting a relative closing movement between the terminal and the resilient wire to bring the solder mass into engagement with the resilient wire and place the wire under compression, and applying heat to the terminal to melt the solder mass by the conduction of heat through the terminal.

10. The method of basing an electrical translating device having a casing and lead wires extending into the casing and having outer ends which are accessible from the exterior of the casing, said method comprising the steps of arranging the lead wires substantially vertical, bending the outer ends of the lead wires laterally, moving an insulating base and terminals carried thereby which terminals extend to the inner and outer surfaces of the insulating base and have solid solder masses applied to their inner ends downwardly toward the lead wires so that the solid solder masses are brought into engagement with the lead wires and the lead wires placed under compression, and then applying heat to the terminals upon the outer side of the base to cause the solid solder masses to be melted by the conduction of heat through the terminals, the resilient compressed lead wires expanding and entering the molten solder.

11. The method of basing an electrical translating device having a casing provided with an open end and lead wires extending into the open end to be accessible from the exterior of the casing, said method comprising the steps of arranging the lead wires substantially vertical, bending the lead wires laterally, applying solder to the ends of terminals which are carried by an insulating base and which terminals extend upon opposite sides of the base, arranging the base above the lead wires and the solder next to the lead wires, effecting a relative closing movement between the base and the casing to bring the solder into engagement with the bent wires and the insulating base into the open end of the casing, and applying heat to the terminals upon the opposite side of the base with respect to the solder to cause the solder to be melted by the conduction of heat through the terminals.

12. The method of basing an electrical translating device having a casing provided with an opening and lead wires extending to the opening to be accessible from the exterior of the casing, said method comprising the steps of arranging the lead wires generally vertical, applying solder to the ends of terminals upon one side of an insulating base which carries the terminals and the terminals extending upon the opposite side of the insulating base, arranging the insulating base above the lead wires and the ends of the terminals carrying the solder beneath the base, effecting a relative closing movement between the base and the casing to bring the solder into engagement with the wires and the base into a position to cover the opening of the casing, securing the base in place, and then applying heat to the terminals above the base to melt the solder by the conduction of heat through the terminals.

13. The method of basing an electrical translating device having a casing, comprising the steps of forming relatively short lead wires upon the translating device and rendering the lead wires accessible from the exterior of the casing, effecting a relative closing movement between terminals having solder masses applied thereto and the short lead wires to bring the solder

masses into engagement with the short lead wires and covering the short lead wires when engaging the solder masses to render them inaccessible from the exterior of the casing, then securing the terminals in position upon the casing, and then heating the end portions of the terminals remote from the solder masses to melt the solder masses by the conduction of heat through the terminals.

14. The method of basing an electrical translating device having a casing, comprising the steps of forming relatively short lead wires upon the translating device and rendering the lead wires accessible from the exterior of the casing, applying a cold plastic solder mass to the ends of tubular terminals which are carried by an insulating base, effecting a relative closing movement between the terminals and base as a unit, and the short lead wires to bring the cold plastic solder masses into engagement with the short lead wires and covering the short lead wires when engaging the cold solder masses by the insulating base, securing the insulating base in place upon the casing, and then applying heat to the terminals upon the outer side of the insulating base.

15. The method of basing an electrical translating device having a casing and a lead wire which is accessible from the exterior of the casing, comprising the steps of effecting relative closing movement between a terminal having a solder mass applied thereto and carried by an insulating base, and the lead wire to bring the solder mass into contact with the lead wire and causing the insulating base to form with the casing a substantially inaccessible space housing the contacting lead wire and solder mass, and then applying heat to the terminal exteriorly of the inaccessible space to melt the solder mass by the conduction of heat through the terminal.

16. The method of basing a radio tube or the like having a casing open at one end and lead wires accessible from the exterior of the casing through the open end of the casing, comprising the steps of effecting a relative closing movement between terminals having solder masses applied thereto and carried by an insulating base, and the lead wires to bring the solder masses into engagement with the lead wires and the insulating base into the open end of the casing to form with the casing a substantially inaccessible space housing the contacting solder masses and lead wires, securing the base to the casing, and then applying heat to the terminals exteriorly of the substantially inaccessible space to melt the solder masses by the conduction of heat through the terminals.

17. The method of basing a radio tube or the like having a casing provided with an opening and lead wires accessible through the opening, comprising the steps of effecting a relative closing movement between terminals having solder masses applied thereto and carried by an insulating base, and the lead wires to bring the solder masses into engagement with the lead wires and the insulating base into a position to cover the opening to render the contacting lead wires and solder masses substantially inaccessible, securing the base in place upon the casing, and applying heat to the terminals exteriorly of the base to melt the solder masses by the conduction of heat through the terminals.

EDWARD R. MURPHY.