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2,749,528

WELDED FLUORESCENT LAMP BASE PINS

Filed July 1, 1953

3 Sheets-Sheet 1

Fig. 1

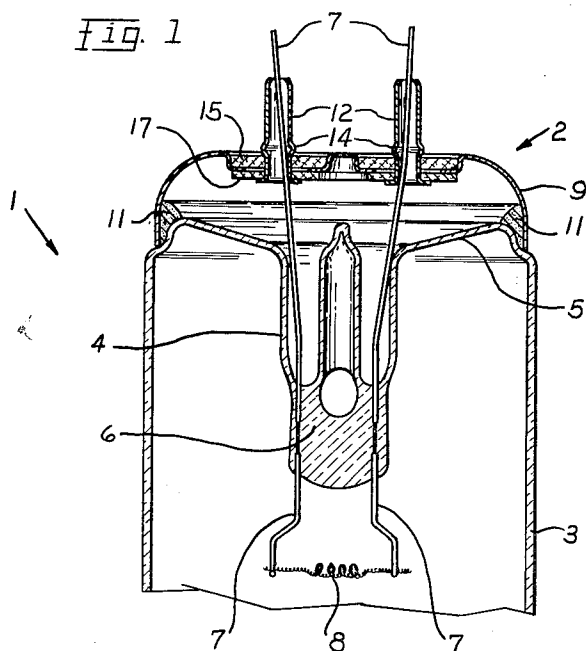


Fig. 2a

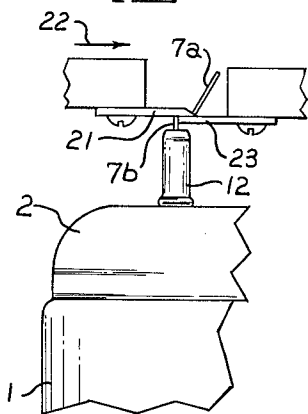


Fig. 2b

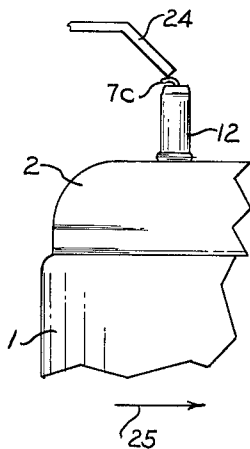
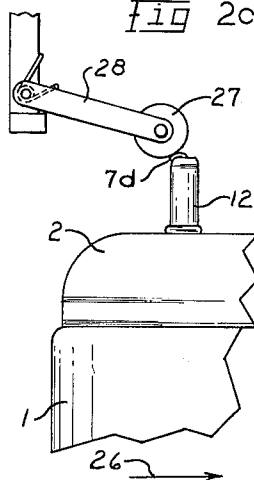


Fig. 2c



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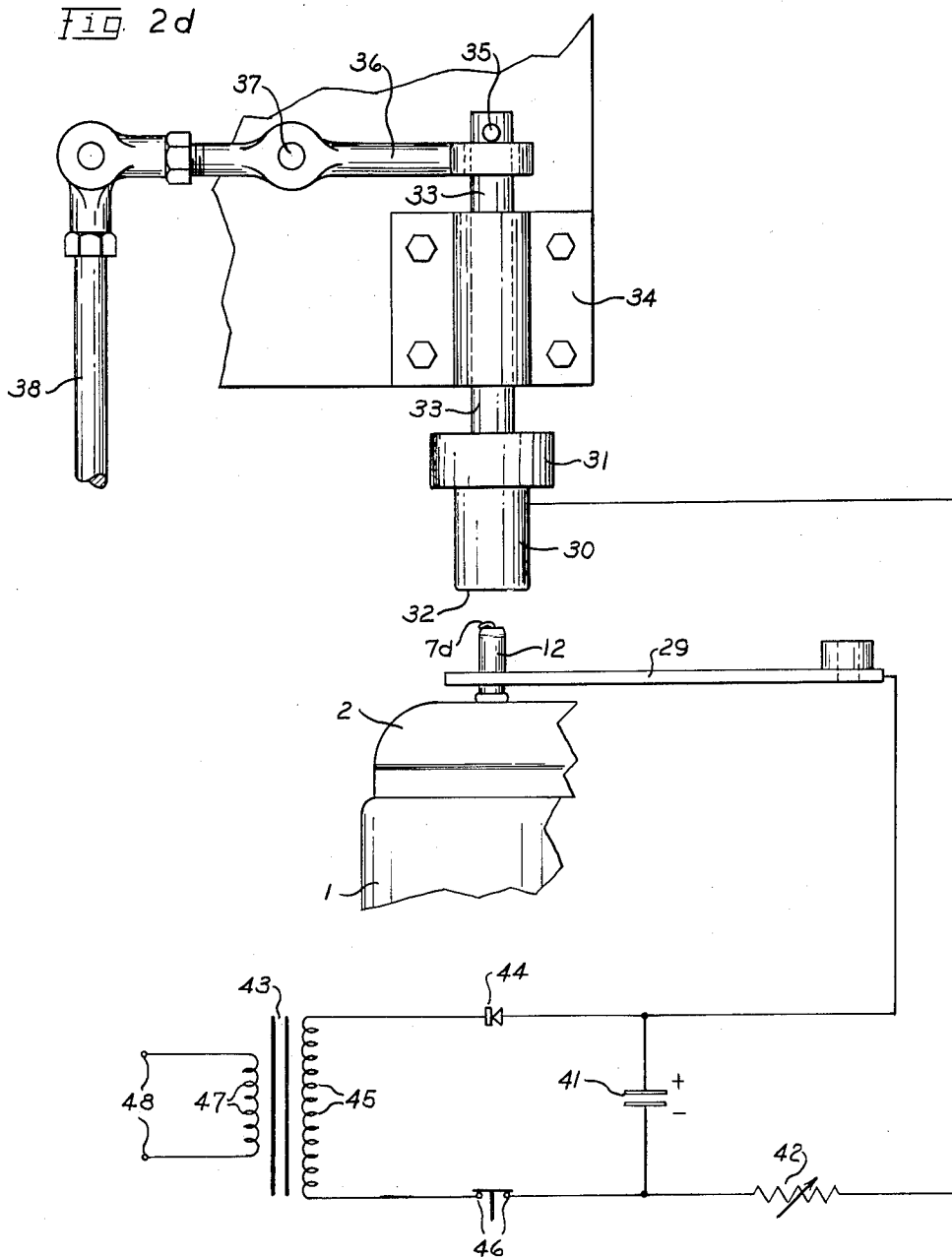
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WELDED FLUORESCENT LAMP BASE PINS

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WELDED FLUORESCENT LAMP BASE PINS

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Fig. 3a

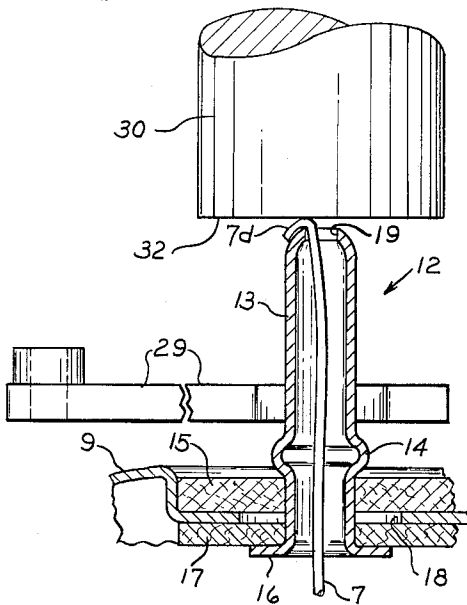


Fig. 3b

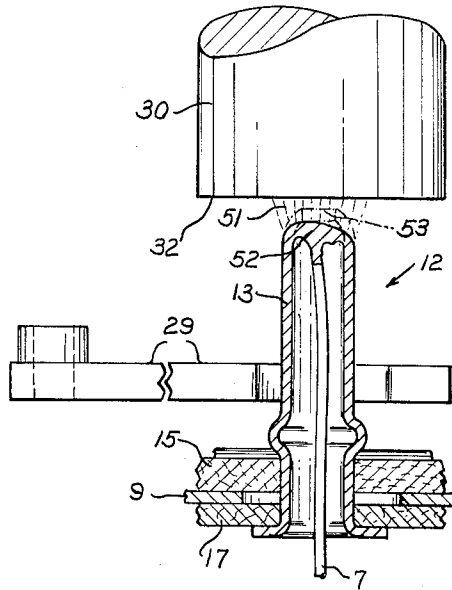


Fig. 4a

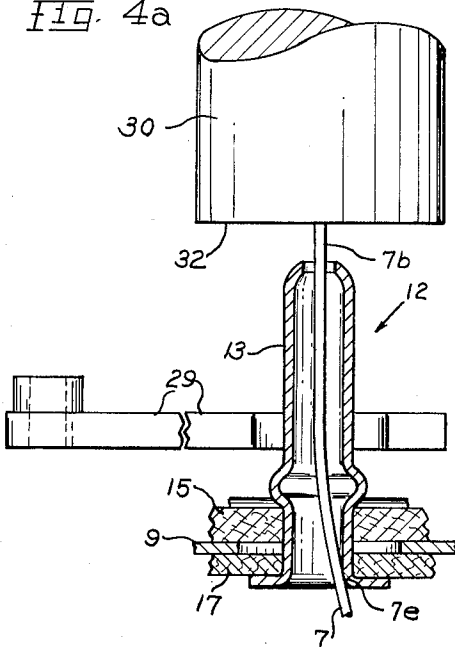
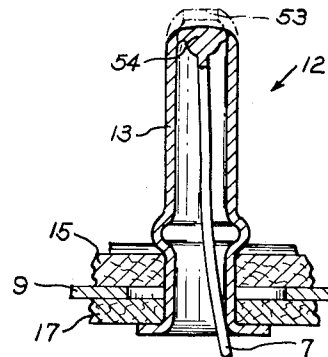


Fig. 4b



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WELDED FLUORESCENT LAMP BASE PINS

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4 Claims. (Cl. 339—145)

This invention relates to the basing of electric lamps of the type using elongated hollow pins or prongs for contact terminals. More particularly, it relates to the connection of the lead wires to the base pins of the common fluorescent lamp having a bi-pin base, by an electrically welded junction.

The object of the invention is to provide a new and improved welded connection between the lead wire and the tubular contact pin in electric lamps using pin type bases.

Another object of the invention is to provide a new and improved connection between the lead wire and the tubular pin of an electric lamp base, which connection is achieved by electric welding as a result of which the outer end of the pin is closed by metal resulting from the fusing of the end of the pin and of the wire into a solid mass and without any addition of metal thereto from an extraneous source.

In accordance with the invention, there is provided a welded connection of the lead wire to the tip of a hollow tubular contact pin which connection completely seals the open end of the pin. The welded connection consists of intermingled and fused metal from a short projecting stub of the lead wire and from the tip of the pin. The pin is foreshortened slightly as a result of the weld, and the weld itself is achieved by a welding current having a drooping characteristic. Preferably, it is achieved by discharging a capacitor between the pin and a massive electrode which is brought into contact with the projecting stub of the lead wire, the electrode being negative in polarity in the circuit.

For further objects and advantages and for a better understanding of the invention, attention is now directed to the following description and accompanying drawings. The features of the invention believed to be novel will be more particularly pointed out in the appended claims.

In the drawings,

Fig. 1 is a sectional view of one end of a fluorescent lamp provided with a bi-pin type base.

Figs. 2a to 2d illustrate diagrammatically the various steps followed in making a welded pin connection embodying the invention.

Figs. 3a and 3b are enlarged detail views, the former of a pin about to be welded, and the latter of a welded pin connection embodying the invention.

Figs. 4a and 4b are similar to Figs. 3a and 3b and illustrate a variant of the invention.

Referring to Fig. 1, there is shown in section an end of a fluorescent lamp 1 provided with a bi-pin base 2 of the type toward which the invention is specifically directed. The lamp comprises a vitreous tube 3 to which is united a mount 4 comprising a flare 5, the peripheral portion of which is united to the tube and a press 6 through which are sealed lead wires 7 for the support of a filamentary cathode 8. The base 2 which caps the end of the lamp comprises a shallow metal shell or cup 9 which is cemented at 11 to the end of the tube. The

lead wires 7 are threaded through hollow tubular contact pins 12 which are fastened to the end wall of the base shell 9 and insulated therefrom. Each pin 12 (seen more clearly in Fig. 3a) comprises a generally cylindrical tubular shank or body 13 which is outwardly expanded at 14 into an annular ridge. This ridge seats on an outer fiber washer 15 which fills a shallow well on the end wall of the base shell. The lower end of the pin is upset at 16 under an inner fiber washer 17 whereby the pin is securely staked to the base shell. It will be observed that the well in which the upper washer 15 is seated is provided with a central perforation 18 considerably larger in size than the diameter of the pin whereby the pin is insulated from the base shell. The upper end of the pin is rounded and the lead wire 7 emerges through an opening at 19 which is somewhat reduced in size with respect to the internal bore of the pin. As illustrated in the drawings, more particularly in Figs. 3a and 3b, the pin is relatively thin-walled and has a bore several times larger in diameter than the lead wire threaded through it.

In making a welded pin connection embodying my present invention, I use a method of welding sometimes known as spot-deposition welding. It is generally similar to that described and claimed in my copending application Serial No. 306,828, filed August 28, 1952, entitled "Lamp Base Welding," and assigned to the same assignee as the present invention, now Patent 2,708,702—Albrecht. The preparatory processing of the lamp and the welding itself may be carried out at successive stations of a rotary lamp finishing machine, such as disclosed for instance in U. S. Patent 1,708,756 Fagan. Such machines in general comprise a turret or turntable on the outer periphery of which the lamps are vertically supported in suitable chucks, and means for intermittently rotating the turret. While the lamps are stationary at the various stations, the required operations are performed by suitable mechanisms fixed in position around the periphery of the turret and synchronized to operate during the dwell intervals. The various operations now to be described are preferably performed on such a machine.

Figs. 2a to 2d illustrate the sequence of steps in making a welded connection such as illustrated in Fig. 3b. The first step involves cutting off the excess length of the lead wire so as to leave a relatively short stub, in general no longer than the diameter of the pin. This may be done in well-known fashion by means of reciprocating cutters such as illustrated in Fig. 2a. A knife-edged cutter 21, moving in the direction of the arrow 22, slides over a cooperating blade 23 and shears off the excess length 7a of the lead, leaving a short stub 7b upstanding through the opening in the upper end of the pin.

In the next operation, illustrated in Fig. 2b, the stub is bent over into the position 7c wherein it lies substantially horizontal. This operation may be effected during the rotary movement of the lamp on the finishing machine turret by means of a wiper 24 whose lower end is positioned to engage the wire while the lamp is moving in the direction indicated by the arrow 25. The projecting stub is then rolled down on the edge of the pin, as illustrated at 7d in Fig. 2c. This operation may also be accomplished while the lamp is in movement as indicated by the arrow 26, by means of a roller 27, carried on a spring-loaded arm 28 and positioned to engage the lead wire. The position of the projecting stub and its general configuration after the rolling operation are more clearly illustrated in Fig. 3a.

The welding operation may be carried out by means of a mechanism such as illustrated in Fig. 2d. The lamp is now stationary at a station of the machine where the shank of the pin is engaged near its lower end by a contact member 29. Positioned immediately above the pin is a massive cylindrical electrode 30 supported in an in-

insulating block 31. The electrode 30 may be cylindrical in form with a flat lower surface 32 and of a diameter considerably greater than that of the pin. It will be appreciated that the term massive, as applied to the electrode, is by comparison with the size of the pin. The object is to make the heat capacity of the electrode 30 much greater than that of the pin, so that the heat from the condenser discharge will fuse the lead wire and the tip of the pin without any substantial effect on the electrode itself. Also, the fact that the lower surface 32 of the electrode is flat and considerably greater in diameter than the pin, serves to reflect the heat of the electric discharge onto the pin. The electrode block 31 is carried on the lower end of a rod 33 which is slidably supported in a bushing 34. A transverse pin 35 in the upper end of the rod rests on the end of a rocker arm 36 pivoting at 37 and actuated by a connecting rod 38 in synchronism with the indexing of the finishing machine turret. It will be appreciated that connecting rod 38 is synchronized to the turret in such manner as to lower the electrode 30 during the dwell interval of the lamp at the welding station.

As the electrode 30 is lowered, it contacts the stub 7d of the lead wire and the welded connection then results almost instantaneously from the discharge of the capacitor 41. The welding current is exponential in waveform, that is, it has a drooping volt-ampere characteristic and starts off at a relatively high value, dropping off very quickly to a low value. Due to the rapidity with which the weld is made, the wattage or quantity of electricity required is relatively small. As illustrated schematically, condenser 41 is arranged to be discharged by reason of the direct connection from the positive side of the condenser to the contact finger 29 which engages the shank of the pin, and the connection from the negative side of the condenser through rheostat 42 to electrode 30. Capacitor 41 may have a value of approximately 5,000 microfarads and rheostat 42 may be adjustable between zero and 3 ohms. For welding the pins of the usual fluorescent lamp which extend above the base shell approximately one-third of an inch and wherein the lead wire consists of 16 mil copper wire, rheostat 42 may be set at approximately 1.5 ohms and capacitor 41 may be charged to approximately 400 volts at the beginning of the welding cycle.

Capacitor 41 may be recharged in between the welding operations through any conventional system. For instance as illustrated in the drawing, the recharging means may comprise a voltage step-up transformer 43 and a half wave rectifier 44. The rectifier 44 is connected in series with the secondary winding 45 of the transformer and a pair of relay contacts 46 across capacitor 41. Relay contacts 46 are normally closed and may be arranged to open just prior to the discharge of the capacitor in order to prevent short circuiting the rectifier 44 and transformer secondary 45 at the time when the weld is made. The primary winding 47 of the transformer may be energized at terminals 48 from the usual 115-120 volt 60 cycle supply mains.

At the instant when electrode 30 contacts the bent-over stub 7d of the lead wire, conditions are as illustrated in Fig. 3a. Capacitor 41 begins to discharge immediately with a heavy current, for instance 100 amperes through the lead wire. The maximum resistance in the circuit, exclusive of the control rheostat 42, occurs in the stub 7d of the lead wire and at the point where the stub is pressed against the lip of the opening 19 in the end of the pin. By reason of the low thermal mass of the wire stub, it melts almost immediately and part of it is vaporized. The metallic circuit is thereby broken, but the discharge of the capacitor, which is still charged nearly to its high initial value, continues through the metal vapor. The flat lower surface 32 of massive electrode 30 assists in concentrating the heat of the discharge on the end of the electrode, as indicated at 51 in Fig. 3b. By reason of the

exponential type of discharge obtained with a capacitor, the heat is developed very quickly and the lead wire stub and the tip of the pin liquify and drop back from the electrode more quickly than the electrode is lowered by the movement of the connecting rod 38. The capacitor is thus practically entirely discharged through the metal vapor and the molten metal fuses and closes the end of the pin, as indicated at 52, before the electrode contacts it again.

It is not necessary to cause the electrode to contact the pin a second time after the weld is made, but there is no objection to it. As a practical matter, the height of the pins may vary slightly as a result of dimensional variations and also as a result of slight misalignment of the lamp holders on the finishing machine turret. Accordingly, in order to prevent the possibility of the electrode failing to contact the pin at all, it is preferable to adjust the mechanism such that the electrode is lowered sufficiently to rest entirely on even the shortest pin after the weld is made. The possibility of missing some of the pins is thus avoided. At the second contact of the electrode with the pin, there is very little charge left in the capacitor and any spark that may occur is of very low intensity and has substantially no effect.

As illustrated in Fig. 3b, the weld junction 52 consists solely of intermingled metal from the lead wire and from the end of the pin. The major part of the fused weld metal comes from the end of the pin. The pin is foreshortened from its original configuration as illustrated in dot-dash lines at 53, and this feature provides enough metal to close the hole 19 in the end of the pin. In actual practice, the pin is foreshortened between .015 to .025 inch and this provides enough metal to achieve complete closure of the pin along with a satisfactory weld junction.

When the weld junction is made by first bending over the projecting stub of the lead wire as illustrated in Fig. 3a, the weld junction results in an externally smoothly contoured end wall on the pin, but slightly flattened and somewhat unsymmetrical, as illustrated in Fig. 3b. In accordance with a variant of my invention which is illustrated in Fig. 4b, I may provide a weld junction which results in a more rounded and symmetrical end on the pin. To achieve it, the projecting end of the lead wire is cut off to leave a short projecting stub 7b as previously described with reference to Fig. 2a. The stub 7b is left in straight upstanding position, that is it is neither bent nor rolled over. It will be appreciated that in order for the discharge of the capacitor to start, there must initially be circuit continuity between the lead wire and the pin. Generally, there will be contact somewhere within the bore of the pin between the lead wire and the pin, even though no special provision is made to assure the occurrence of such contact. However, as an additional safeguard to insure a positive contact, the base may be rotated with respect to the lamp during the basing operation so as to cause the lead 7 to enter the bore of the pin at an angle. This insures that a contact connection is present at the point where the lead is bent to enter the bore of the pin, as illustrated at 7e in Fig. 4a. Alternatively, the wire may be kinked before it is threaded through the pin and a contact connection will then be present where the wire presses against the pin wall.

The method followed in making the weld thereafter is generally the same as what has already been described. The electrode 30 is lowered into engagement with the end of the lead wire stub 7b, and the initial circuit continuity occurs through the lead down to the junction point 7e and then back through the shank of the pin to the contact 29. The projecting stub 7b is vaporized almost instantaneously, and the discharge then occurs through the metal vapor from the surface 32 of electrode 30 to the tip of the pin 12. It will be appreciated that following the vaporization of the stub 7b, the current flow is diverted from the lead wire to the shank of the pin so that there is no danger of melting and burning off the

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lead within the bore of the pin. The resulting weld connection is illustrated at 54 in Fig. 4b. The foreshortening of the pin from its original length, indicated at 53, is about the same as previously described, but the end of the pin is more rounded and symmetrical. This feature is somewhat advantageous from the point of view of appearance and marketability of the product.

It will be appreciated that in view of the fore-shortening of the pin which occurs upon the making of a weld junction embodying my invention, it may be desirable to provide initially a somewhat longer pin than where soldered connections are made. The resultant welded pin will then be of the same length as the soldered pins which were formerly used.

While certain specific embodiments of the invention have been shown and described, it will be appreciated that these are intended as illustrative of the invention only. The invention may readily be embodied in pins of a different size and configuration, and suitable modifications in the method and in the apparatus for achieving the weld connection will readily occur to those skilled in the art. The appended claims are intended to cover any modifications in the structure and features of the weld junction coming within the true spirit and scope of the invention.

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

1. An electric device including a lead wire and having a base including an elongated tubular contact pin, said lead wire being threaded through the bore of said pin and being welded into the end of said pin in a weld junction forming an end wall completely closing the end of said pin and consisting solely of intermingled metals of the lead wire and of the end of said pin and resulting from the foreshortening of said pin, the major part of the fused metal in said weld junction consisting of metal from said pin.

2. An electric device including a lead wire and having a base including an elongated tubular contact pin, said lead wire being threaded through the bore of said pin and being welded into the end of said pin in a weld junction

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forming an externally smoothly contoured and completely closed end wall for said pin, said junction consisting solely of intermingled metals of the lead wire and of the end of said pin and resulting from the foreshortening of said pin by an electric capacitor discharge on said end, the major part of the fused metal in said weld junction consisting of metal from said pin.

3. An electric device including a lead wire and having a base including an elongated tubular contact pin, the pin being thin-walled and having a bore several times larger in diameter than the lead wire, said lead wire being threaded through said pin to its outer end and welded to the pin at said end in a weld junction forming an externally smoothly contoured and completely closed end wall for said pin, said junction consisting solely of intermingled metal of the lead wire and of the pin, said weld junction consisting in major part of metal obtained from said end of the pin by foreshortening it.

4. An electric device including a lead wire and having a base including an elongated tubular contact pin, the pin being thin-walled and having a bore several times larger in diameter than the lead wire, said lead wire being threaded through said pin to its outer end and welded to the pin at said end in a weld junction forming an externally smoothly contoured and completely closed end wall for said pin, said junction consisting solely of intermingled metal of the lead wire and of the pin, said weld junction consisting in major part of metal obtained from said end of the pin by foreshortening it as a result of an electric capacitor discharge on said outer end of the pin, the major part of the fused metal in said weld junction consisting of metal from said pin.

References Cited in the file of this patent

UNITED STATES PATENTS

1,685,382	Stuart	Sept. 25, 1928
2,136,005	Dixon	Nov. 8, 1938
2,200,954	Glassberg	May 14, 1940
2,325,817	Watrous	Aug. 3, 1943