Aug. 20, 1935. E. C. ECHLIN 2,012,226

METHOD OF SECURING MEMBERS

Filed April 15, 1932 2 Sheets-Sheet 1

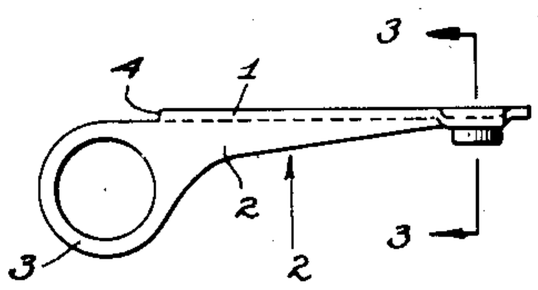

Fig - 1 -

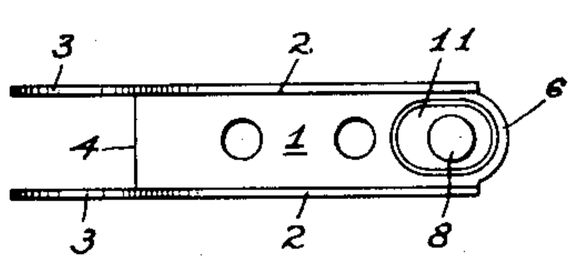

Fig - 4 -

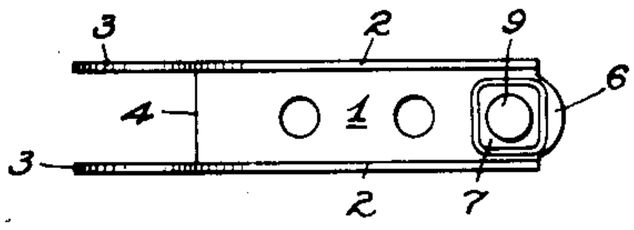

Fig - 2 -

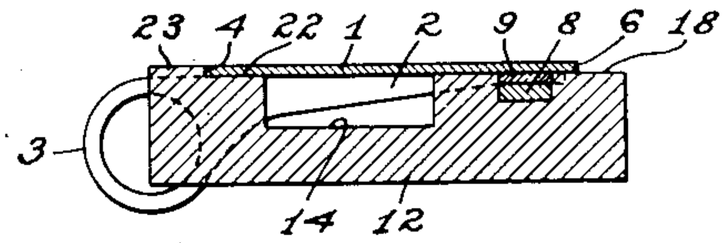

Fig - 5 -

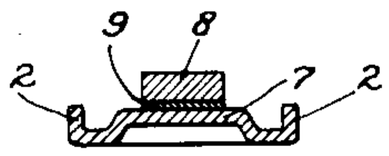

Fig - 3 -

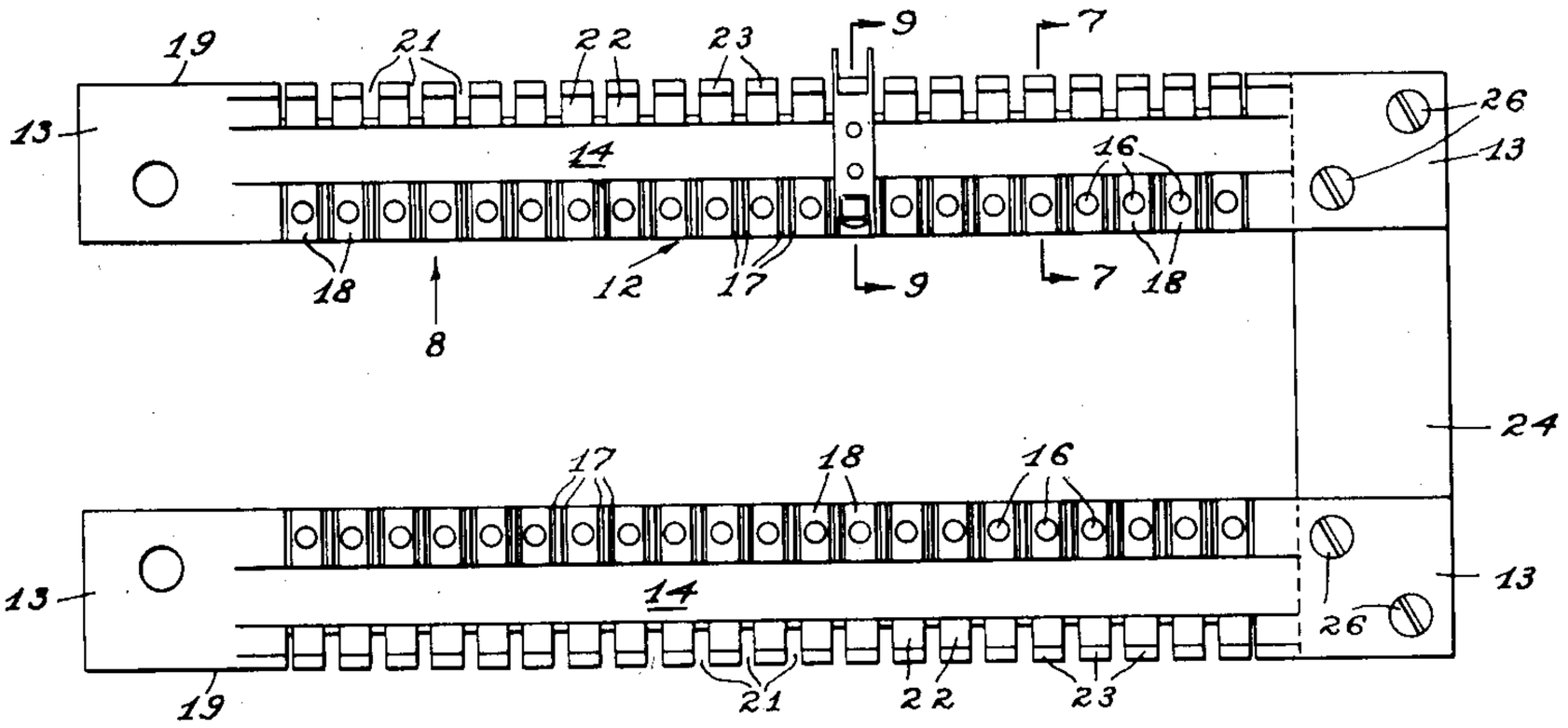

Fig - 6 -

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METHOD OF SECURING MEMBERS

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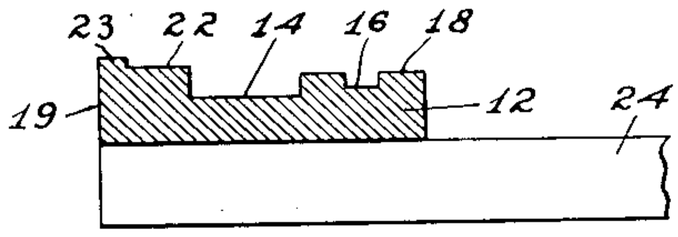

Fig - 7 -

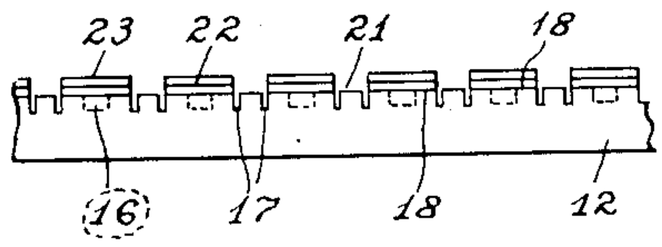

Fig - 8 -

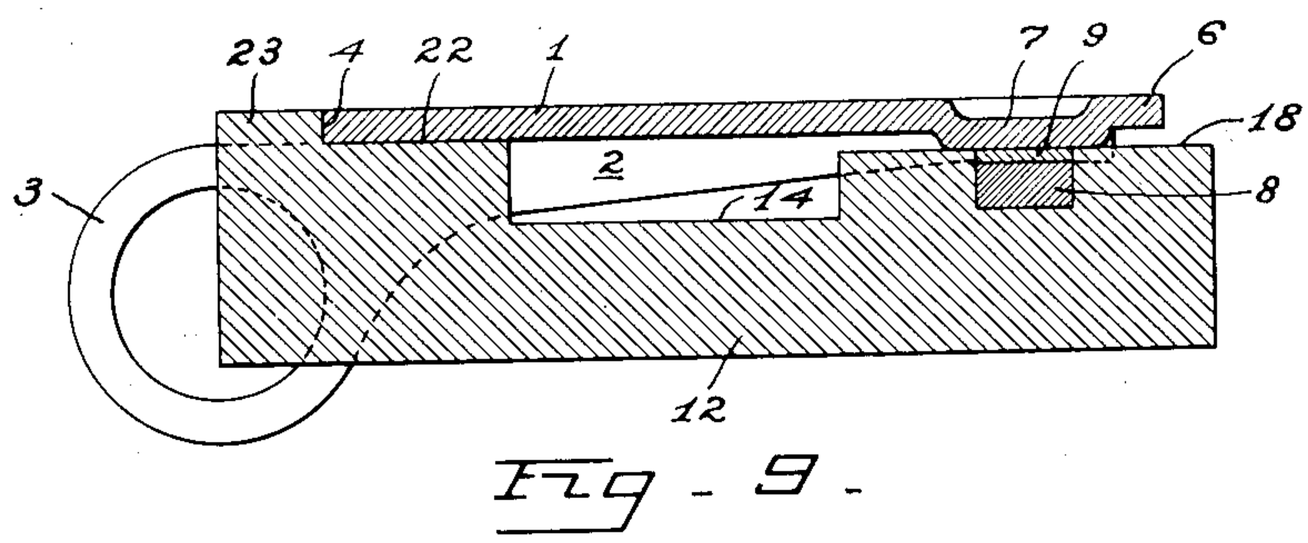

Fig - 9 -

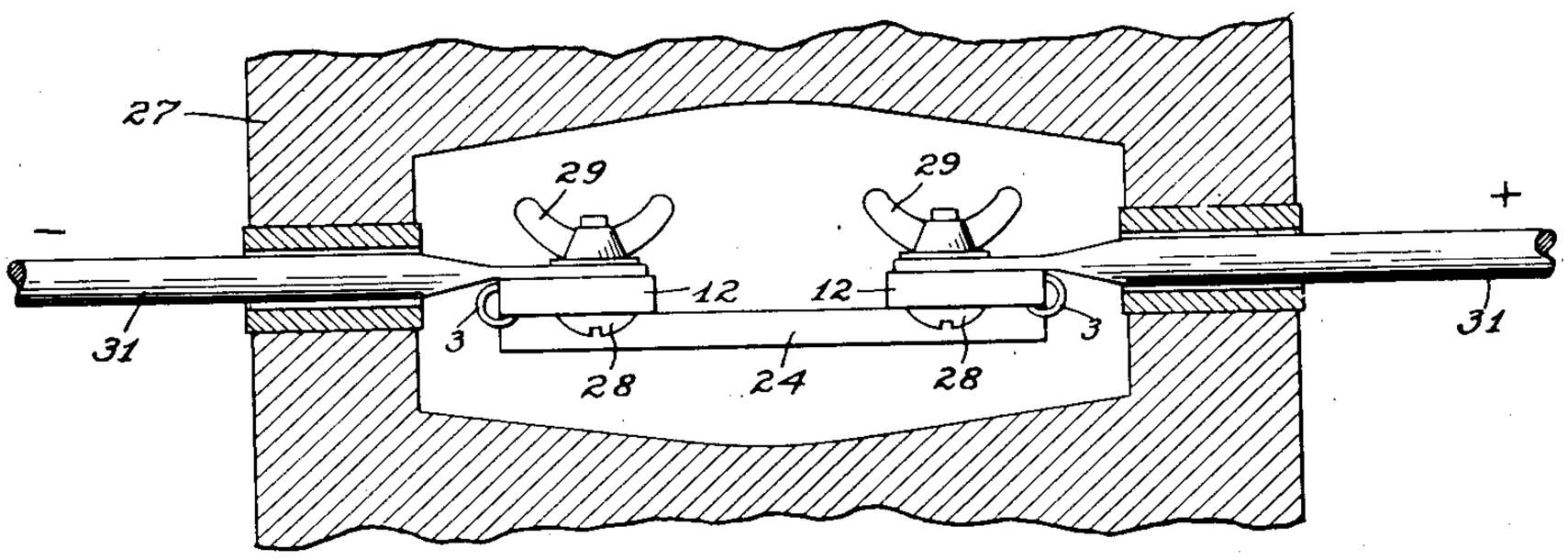

Fig - 10 -

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METHOD OF SECURING MEMBERS

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Application April 15, 1932, Serial No. 605,525

19 Claims. (Cl. 219—12)

My invention relates to a method of positioning and/or securing two members in predetermined relationship, and particularly to the securing of a contact element in definite position to a contact arm for the purpose of providing devices adapted to make and break electric circuits with precision and minimum sparking.

With respect to automobile ignition and similar systems, wherein distributor arms provided with contacts of high melting point, such as tungsten, are employed, and wherein the contact arm is positioned to vibrate about one end as a pivot for the purpose of making and breaking a circuit, by causing periodic engagement of the contact point thereon with a similar but stationary contact point, it is important that the contact points engage with great accuracy to reduce sparking to a minimum. For this reason, it is extremely desirable that the contact point be precisely positioned on the contact arm to afford the degree of accurate engagement with the stationary contact, necessary for an efficient distributor system. Heretofore, numerous methods have been tried, with little success, in an effort to obtain the desirable precise engagement between the contact points. Some have been directed to the positioning of the stationary contact point, while others have been directed to the positioning of the contact point on the contact arm.

An example of the latter is disclosed in the patent of Liebmann, No. 1,650,897, dated November 29, 1927. In the patent referred to, it is attempted to secure precise positioning of the contact point on the contact arm, by providing a struck-up circular portion on the contact arm of exactly the same size as that of the contact element or point, and securing the portion and point together by melting a layer of copper positioned therebetween. In such method the melted copper is supposed to function to bring the contact into proper position upon the struck-up portion. By experiments, however, I have found that this method is unsuccessful and does not function to properly position the contact on the arm. Furthermore, the copper will frequently creep up the sides of the contact element, and thereby cause an off-centering thereof with respect to the struck-up portion. Consequently the contact will not assume the proper position. My invention is designed to obviate difficulties heretofore encountered in securing the exact and precise positioning of a contact element on a contact arm. Therefore, one of the important objects of my invention is the provision of a method whereby precise securing of a contact element on a contact arm can be obtained.

Another object of my invention is the provision of a method which is generally applicable for positioning one member precisely with respect to another member, whereby the members can be secured in a predetermined and definite position.

Another object of my invention is the provision of a method, of the character described, wherein numerous members can be simultaneously positioned in predetermined relationship, with consequent economy of time and expense.

Another object of the invention is the provision of a method, wherein a permanent and molecular union can be obtained between the members to be positioned and secured, thus precluding displacement thereof after being once united together.

An additional object of my invention is the provison of a novel apparatus, comprising a jig, adapted to carry and properly position the members to be united upon employment of the method of my invention.

A further object of my invention is the provision of a jig, of the character described, of such shape as to concentrate heat, which is employed in the preferred method of my invention, at a desired point.

My invention possesses additional objects which will become apparent from a perusal of the following description, forming part of the specification.

Referring to the drawings:

Figure 1 is a side elevational view of a contact arm and element secured thereto, constructed in accordance with the teachings of my invention.

Figure 2 is a plan view of the device, looking in the direction of arrow 2 of Figure 1.

Figure 3 is a sectional view taken in a plane indicated by line 3—3 of Figure 1.

Figure 4 is a plan view of a modified form of the device.

Figure 5 is a sectional elevation of another modified form of the device and a jig therefor.

Figure 6 is a plan view of the jig assembly employed in the method of my invention, illustrating the position of a distributor contact arm thereon.

Figure 7 is an enlarged fragmentary sectional view of the jig, taken in a plane indicated by line 7—7 of Figure 6.

Figure 8 is an edge elevational view of the jig looking in the direction of arrow 8 of Figure 6.

Figure 9 is an enlarged sectional view, taken in a plane indicated by line 9—9 of Figure 6.

Figure 10 is a more or less diagrammatic view, illustrating the manner in which heat is applied to the jig assembly.

In broadly descriptive terms, the process of my invention comprises effecting change in dimensions of one member relative to another member, by a change in temperature, so as to bring the two members to a predetermined position in which they may be secured. Preferably, I accomplish this by holding one of the members in a relatively fixed position and supporting the other member in such manner that upon expansion thereof, by application of heat, a predetermined portion on said latter member is brought into a position of proper registry with the relatively fixed member. The size of the members is so chosen and they are of such material, that when the position of proper registry is obtained, a molecular union is effected by the heat causing said expansion. When the members are united, the application of heat is terminated.

In carrying out this method, I preferably employ a jig for holding one of the members in the relatively fixed position. The other member is supported by the jig in such manner that it can expand in the direction of or toward the fixed member; and means is provided on the jig for compelling expansive movement in the desired direction by preventing said expansive movement in a direction away from the fixed member. The jig is preferably an electric resistor, so that, when connected in an electric circuit, it will heat up to supply the necessary heat, and it is of such construction that the heat is concentrated at the point where the members are brought to a position of proper registry.

The method of my invention finds great applicability in the manufacture of distributor arms for automobile ignition and similar systems; and I, therefore, have chosen for detailed description and explanation of the principle of the invention, the manufacture of such distributor arm. As illustrated by Figures 1 through 3 of the drawings, I preferably construct a distributor arm which is stamped from sheet metal, such as sheet steel. The arm is channel shaped having the relatively flat web portion 1, and integral stiffening flanges 2 which are parallel. Flanges 2 terminate in apertured ears 3 projecting beyond the inner end 4 of the web, which ears may be journaled on a pin (not shown) to allow customary vibratory motion of the arm about the pin as a pivot. At a suitable distance from the inner end 4 and adjacent the outer end 6, a relatively flat and square table portion 7 is preferably formed, integral with the web 1, by being struck-up from the web. To the table portion, I preferably unite by molecular union a contact element 8, of tungsten or other suitable high melting metal. Preferably, the union is effected by means of a linking layer 9 of a metal adapted to fuse at a temperature below the melting point of either the contact element or the arm, and thus adhesively unite these members. I usually employ copper as the linking metal, although silver or any other suitable metal is adapted for the purpose. Although it is preferred to employ a table portion on the arm, to which portion contact element 8 can be secured, such table portion may be omitted. When omitted, the contact element may be secured directly to the arm.

In Figure 4 is shown a distributor arm which, in all respects, is the same as that previously described, except that it has a somewhat oblong-shaped struck-up table portion 11. It is to be noted that in both forms of the device described, the table portions are not of the same size and shape as the contact element, because the method of my invention does not require this. Therefore, when arms with table portions are utilized, I preferably construct such arms with table portions of greater size and of different shape than that of the contact element secured thereto.

Figure 5 illustrates a distributor arm, which is similar to the arms previously described. However, a table portion is not formed on the arm; and the contact element 8 is secured directly to the arm.

It is important that the contact element 8 be precisely positioned on the arm, so that its axis is a definite distance from the pivotal axis about which the arm is adapted to vibrate. It is, therefore, apparent that the contact element 8 must be accurately secured in a predetermined position to the contact arm. In the practice of my invention, I employ a jig for allowing this exact positioning, upon application of heat to cause expansion of the contact arm.

As illustrated by Figures 6 through 9, the jig 12, for the arms having table portions, is preferably an elongated rectangularly shaped bar, having the flat surfaced end portions 13, and a longitudinal channel 14 formed in the upper part between the side edges of the bar. Adjacent one side edge are formed a plurality of alined recesses 16 equi-spaced from each other; and between the recesses are formed transversely extending pairs of parallel slots 17. The recesses are each of a size just sufficient to allow seating of the contact element 8 therein, and are of such depth as to bring the adhesive layer 9 of metal, when resting on the contact element as illustrated by Figure 9, substantially flush with the surface of bar 12. Slots 17 are of a distance apart sufficient to allow seating therein of the contact arm flanges 2, when the outer end portion 6 of the contact arm is positioned over a recess. As illustrated best by Figure 9, the upper surface of bar 12, adjacent the recesses 16, is flat, so that all the top surfaces 18 between slots 17 lie in the same plane.

The upper surface of bar 12, adjacent the edge 19 opposite recesses 16 and on the other side of channel 14, is also flat, and is parallel to the surface adjacent recesses 16. However, the former surface is higher than the latter surface a distance substantially equal to that between the surface of table portion 7 and web 1 of the contact arm. If contact arms without table portions are employed, both the surfaces of bar 12 adjacent the recesses 16 and the edge 19 may be the same height as shown in Figure 5. Edge 19 is serrated to form parallel notches 21, the sides of which are in alinement with slots 17, and thus provide table portions 22 in alinement with the respective surfaces 18; and the edge 19 terminates above the plane of tables 22, to form shoulders 23 adjacent thereto.

From the preceding description, it is seen that the jig is so shaped as to accommodate and carry a plurality of the contact arms, with the inner edges 4 of webs 1 adapted to engage, at normal temperature, against the shoulders 23; and the table portions 7 of the contact arms are adapted to overlie the recesses 16. The jig is of such preselected width that at normal temperature the predetermined portion of the contact arm to which the contact element is to be secured is out

of registry with the contact element; so that when sufficient heat has been applied to effect adhesive union between the arm and the contact element, by means of fusion of the metal layer 9, the parts are expanded by the heat into proper registry. When this occurs, the weight of the contact arm causes it to bear down on the contact element to provide the necessary contact for fusion of the contact element to the contact arm.

In employing the jig for the purposes described, the contact elements are first placed in the recesses 16 and the metal adhesive layers placed thereover, as illustrated by Figure 9, so as to be held in fixed position. The contact arms are then properly seated. Upon application of heat, the contact arms will expand in the direction of the contact elements, because shoulders 23, engaging edges 4 of the contact arms, will not only prevent expansion in a direction away from the contact elements but will compel expansion in the desired direction. It is apparent that by knowing the coefficients of expansion of the contact arm and jig, the relative position of the parts at normal temperature may be so predetermined as to allow for the proper registry of the contact element and contact arm, upon application of heat necessary to effect the molecular union. When the molecular union is obtained (which can be readily determined by a skilled operator by observing the color of the contact arms and their downward movement caused by settling through the molten metallic adhesive layer 9), the application of heat is terminated. Upon cooling, contraction of the arm will be directed toward the contact element united thereto, because the contact element is held in relatively fixed position. After cooling, the contact arms may be then removed from the jig.

Any suitable method of heating the members on the jig may be employed. However, I prefer to make the jig of an electrical resistant material, so that upon connection in an electric circuit heating thereof is obtained by internal resistance. A suitable material out of which the jig may be made is carbon. It is to be noted that during such heating of the jig, the serrated edge thereof and the channel 14 provide the important function of allowing cooling at thcse portions of the jig and consequently concentration of the heat where the contact elements are supported. One method of effecting heating in an economical and rapid manner is to connect two parallel positioned jigs at their ends by means of a suitable conductor bar 24 and conductor bolts 26, placing the jigs in a suitable furnace 27, and connecting the free ends of the jigs, by means of conductor bolts 28 and wing nuts 29, to conductors 31. Preferably, the heating in furnace 27 is performed in an atmosphere of hydrogen or other reducing gas to prevent oxidation of the metals, which might impair their molecular uniting.

Although in the preferred method of my invention I employ the metallic layer 9 of copper or similar relatively low melting metal for adhesively uniting the contact arm and the contact element, it may be omitted without departing from the principle of my invention. This is so, because when omitted, the union of the contact arm and the contact element may be cbtained by application of heat sufficient to cause incipient fusion of the steel contact arm. From the preceding description it is apparent that my invention may be employed for uniting and positioning other members than those which I have chosen for the purposes of illustrating such invention.

I claim:

1. A method of securing a contact element to a predetermined portion of a contact arm, comprising causing expansive movement of the contact arm with respect to the contact element by the application of heat to bring the portion to a position of proper registry with the element, and utilizing the heat to effect union of said portion and element in said position.

2. A method of securing a contact element to a predetermined portion of a contact arm by molecular union, comprising holding the contact element in a relatively fixed position, supporting the contact arm for expansive movement thereof with respect to the element upon application of heat, applying heat to effect said expansion and thereby cause registry of the portion and element in proper position, and utilizing the heat to effect the molecular union in said position.

3. In a method of securing one member to a predetermined portion of a second member, the steps of holding the first member in relatively fixed position, supporting the second member for expansive movement thereof with respect to the first member upon application of heat, holding the second member in such manner as to prevent movement thereof in a direction away from the first member, and applying heat to effect said expansion and thereby cause registry of the members in the position desired.

4. A jig for carrying a contact arm and a contact element to be united to a predetermined portion of the contact arm upon application of heat, and having a recess adjacent one edge in which the contact element is adapted to seat, a table portion adjacent the opposite edge upon which an end portion of the contact arm is adapted to rest, whereby the arm is supported for expansive movement relative to the contact element upon application of heat, and means adjacent said table portion adapted to engage the contact arm for compelling expansive movement of the contact arm in the direction of the recess.

5. A jig for carrying a plurality of contact arms and a complementary number of contact elements to be respectively united, each element to a predetermined portion of a contact arm, and having a plurality of alined recesses adjacent one edge in which the contact elements are adapted to seat, means including table portions adjacent the opposite edge for supporting the contact arms for expansive movement relative to the contact elements upon application of heat, and means adjacent said table portions adapted to engage the contact arms for compelling expansive movement thereof in the direction of the recesses, the jig being formed with a channel between said edges and the edge adjacent said table portions being serrated to allow cooling of such portions and to concentrate the heat at the edge adjacent the recesses.

6. In the method of uniting in predetermined position a contact element on a contact arm, the steps comprising employing a jig capable of holding a contact element in a relatively fixed position and also capable of supporting a contact arm to compel expansion thereof with respect to the contact element upon application of heat, placing the contact arm and the contact element on the jig, and applying heat to cause expansion of the contact arm to bring it in the proper position with respect to the contact element.

7. A method of uniting a member to a second

member at a predetermined location on a surface of the second member and intermediate ends thereof, comprising holding said member in a relatively fixed position, supporting said second member in overlapping relationship with respect to said member with said location out of registry with said member, applying heat to effect expansive movement of said second member toward said member to bring said location into registry with said member, and utilizing said heat to effect molecular union between said members.

8. A method of uniting a member to a second member at a predetermined location on a surface of the second member and intermediate ends thereof, comprising holding said member in a relatively fixed position, supporting said second member with said surface above said member in overlapping relationship with respect to said member and with said location out of registry with said member, applying heat to effect expansive movement of said second member toward said member to bring said location into registry with said member, and allowing the weight of said second member to bring said members into contact for molecular union by the heat.

9. A method of securing a contact element to an elongated contact arm at a predetermined location between the ends of said contact arm, comprising holding the contact element in a relatively fixed position, supporting the contact arm over and above said contact element with said location out of registry with said element applying heat to cause expansive movement of the arm to effect proper registry of the element with said arm at said location, and allowing the weight of said arm to bring said arm and said element into contact for molecular union by the heat.

10. A method of securing a member to a predetermined portion of an elongated member, comprising holding said member in a relatively fixed position, freely supporting said elongated member adjacent opposite ends thereof and in overlapping relationship with respect to said member so that said predetermined portion is out of registry with said member, providing an abutment for an end of said elongated member, applying heat to compel expansive movement of said elongated member in a direction away from said abutment and to bring said portion into registry with said member, and utilizing the heat to effect molecular union between said members.

11. A jig for supporting a contact arm and a contact element to be united to a predetermined portion of the contact arm upon application of heat, comprising a member having a table portion adjacent one edge thereof for freely supporting said arm adjacent an end of said arm, and a shoulder adjacent said table portion against which said end of said arm can abut, the portion of said member adjacent an opposite edge thereof being formed with a recess of a size to seat and hold said contact element.

12. In the method of securing one member to a predetermined portion of a second member, the steps of holding the first member in a relatively fixed position, supporting the second member with said predetermined portion out of registry with said first member, and effecting a change in temperature to change the dimensions of the second member and bring said predetermined portion to a position of registry with said first member.

13. A method of securing by molecular union one member to a predetermined portion of a surface located between the ends of a second member comprising holding the first member in a relatively fixed position; supporting the second member with said surface above said first member and with said predetermined portion out of registry with said first member; and applying heat to expand said second member to a position wherein said predetermined portion and said first member register, and to cause said union at said position, the weight of said second member maintaining contact between said predetermined portion and said first member.

14. A method of securing by molecular union one member to a predetermined portion of a surface located between the ends of a second member comprising holding the first member in a relatively fixed position; supporting the second member with said surface above said first member and with said predetermined portion out of registry with said first member; preventing expansion of said second member in a direction toward one end thereof when heat is applied; and applying heat to thereby cause expansion of said second member in the opposite direction to a position wherein said predetermined portion and said first member register, and to cause said union at said position, the weight of said second member maintaining contact between said predetermined portion and said first member.

15. In the method of securing one member to a predetermined portion of a second member the steps of holding the first member in a relatively fixed position and in a manner to limit expansion thereof by heat in any direction along a predetermined plane, supporting the second member substantially parallel to said plane with said predetermined portion out of registry with said first member, and applying heat to expand said second member in a direction substantially parallel to said plane and to bring said predetermined portion to a position of registry with said first member.

16. In the method of securing one member to a predetermined portion of a second member, the steps comprising employing a jig device capable of holding the first member in a relatively fixed position and in a manner to limit expansion thereof by heat in any direction along a predetermined plane, and also capable of supporting the second member to compel expansion thereof by heat in a direction substantially parallel to said plane; placing said members on said jig device; and applying heat to cause expansion of the second member in said direction to bring said predetermined portion to a position of registry with said first member.

17. In the method of securing one member to a predetermined portion of a second member, the steps comprising employing a jig device having a recess for holding the first member in a relatively fixed position, and also having means for supporting the second member at spaced positions in unattached engagement with said jig device and to compel expansion of the second member with respect to the first member upon application of heat; placing said members on the jig device; and applying heat to cause expansion of the second member to bring it in the proper position with respect to the first member.

18. A jig device for supporting a member and an elongated member adapted to be secured at a predetermined portion thereof to said first member upon application of heat, comprising a table portion for supporting the elongated member adjacent an end thereof, and means adjacent said table portion for preventing expan-

sive movement of said elongated member in one direction upon application of heat, said jig device having a recess of a size to seat and hold said first member in a relatively fixed position.

19. A jig device for supporting a member and an elongated member adapted to be secured at a predetermined portion thereof to said first member upon application of heat, comprising spaced parts for freely supporting said elongated member adjacent each end thereof in unattached engagement with said jig device, and means adjacent one of said parts for preventing expansive movement of said elongated member in one direction upon application of heat, the other part having a recess of a size to seat and hold said first member in a relatively fixed position.

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