T. E. MURRAY, JR.

ELECTRIC WELDING.

APPLICATION FILED OCT. 4, 1917.

1,259,271.

Patented Mar. 12, 1918.

2 SHEETS—SHEET 1.

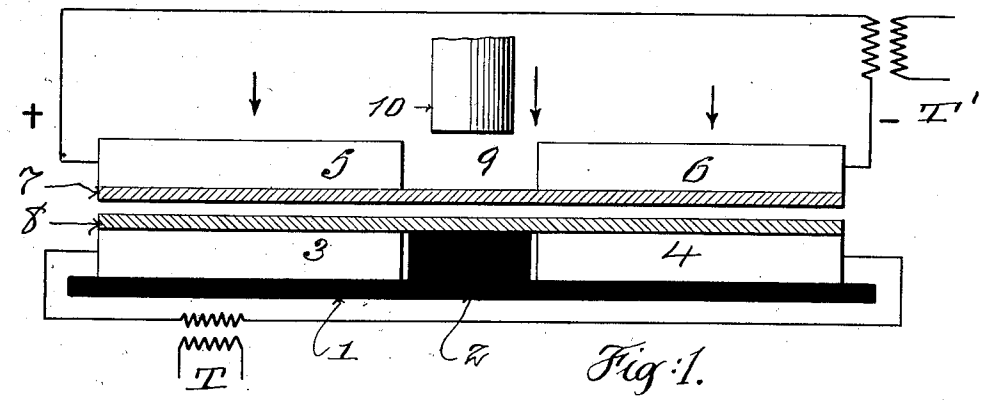

Fig. 1.

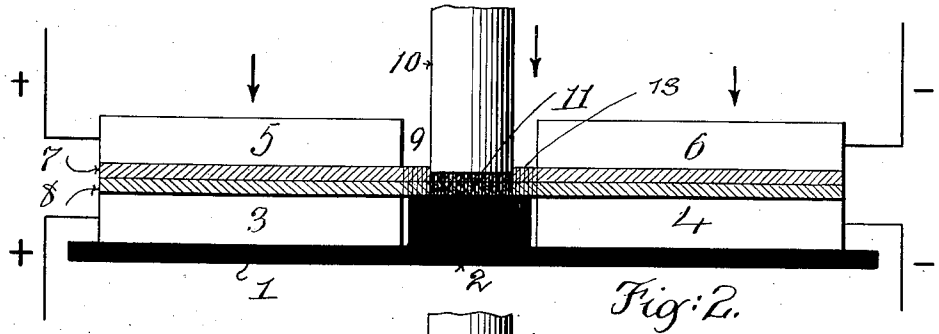

Fig. 2.

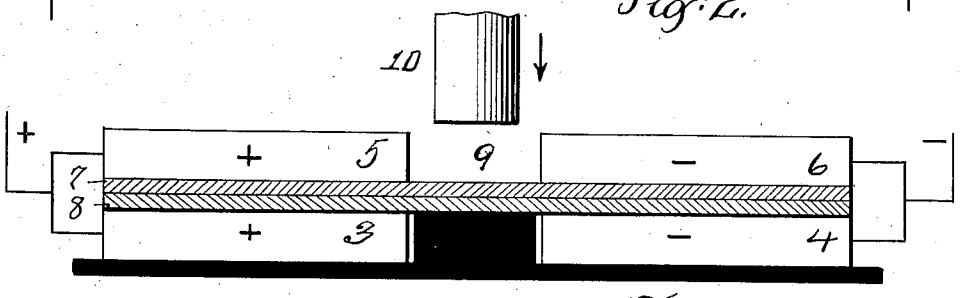

Fig. 3.

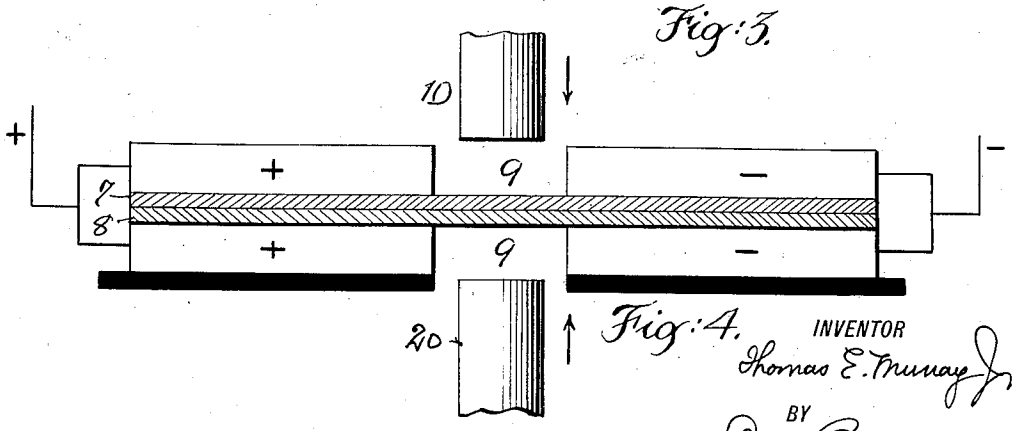

Fig. 4.

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2 SHEETS—SHEET 2.

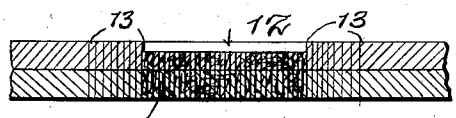

Fig: 5.

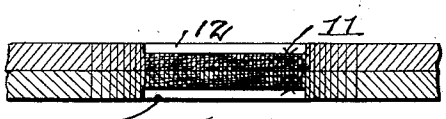

Fig: 6.

Fig: 7.

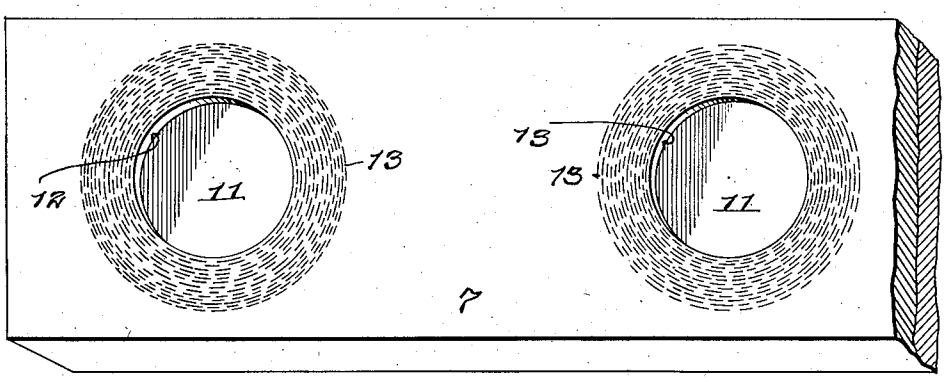

Fig: 8.

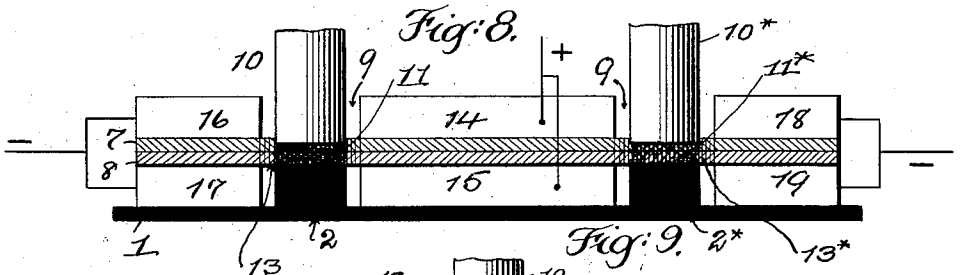

Fig: 9.

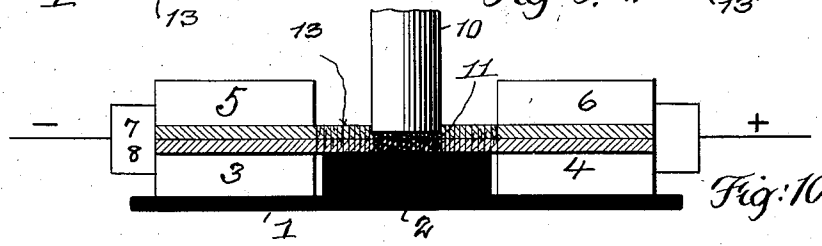

Fig: 10.

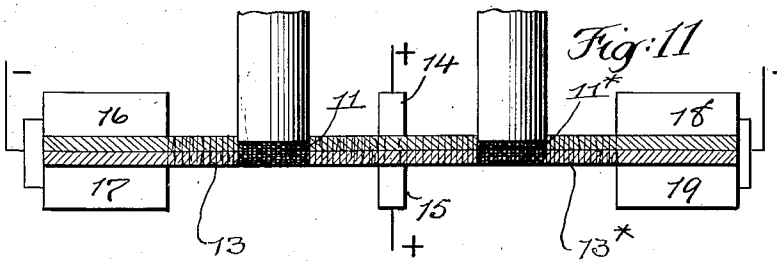

Fig: 11.

INVENTOR
Thomas E. Murray Jr
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UNITED STATES PATENT OFFICE.

THOMAS E. MURRAY, JR., OF BROOKLYN, NEW YORK.

ELECTRIC WELDING.

1,259,271. Specification of Letters Patent. Patented Mar. 12, 1918.

Application filed October 4, 1917. Serial No. 194,684.

To all whom it may concern:

Be it known that I, THOMAS E. MURRAY, Jr., a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Electric Welding, of which the following is a specification.

The invention relates to electric welding, and consists in a method whereby the objects are united by a circumscribed area, or circumscribed areas, of condensed and compressed metal, which metal thus differs in physical qualities from the remaining metal of said objects. Surrounding each spot, or intervening between said spots, may also be produced areas of metal in a less compressed or condensed state than the metal of said spots, said metal also differing in physical qualities from the remaining metal of said objects. Between said areas of less compression may be areas of non-union between said objects. In this way I am enabled to produce welded objects having joints which may be of great strength, which strength I may vary to suit circumstances.

In the accompanying drawings—

Figure 1 is a vertical section through the two plates to be united, the electrodes and supporting base of insulating material being shown in elevation. The two plates are here shown juxtaposed and separated, and the presser tool in raised position. Fig. 2 is a view similar to Fig. 1, the presser tool being in lowered position to compress the heated, and hence plastic, portion of the plates between the end of said tool and the upward projection on the base. In these figures the members of each pair of electrodes are connected to separate sources of current. Fig. 3 is a similar sectional view to Fig. 2, the tool being in raised position, and the plates in contact. Fig. 4 is a similar sectional view to Fig. 3, the plates being in contact, and the two tools being shown for compressing the metal of the plates between them. In Figs. 3 and 4, the members of the two plus electrodes are connected in branch to the plus supply lead, and the members of the two minus electrodes are connected in branch to the minus supply lead. Fig. 5 is a vertical section through the two plates after the weld is made in the manner illustrated in Fig. 2. Fig. 6 is a similar section through the two plates after a weld is made in the manner shown in Fig. 4. Fig. 7 is a similar section through the two plates after a plurality of welds are made in the manner shown in Fig. 4. Fig. 8 is a perspective view, showing the depressions made by the presser tool on the back of one of the plates. Fig. 9 is a sectional view, showing an arrangement for making two welds simultaneously, and also exhibiting the said welds at a distance apart, so that unwelded areas of said plates will intervene between said welds. Fig. 10 is a sectional view, showing the space between the electrodes of much greater width than the diameter of the presser tool, so that the welded areas are correspondingly increased. Fig. 11 is a sectional view, showing two welded areas closely approximated, so that practically there are no unwelded portions of the plates between said areas.

Similar numbers of reference indicate like parts.

Referring first to Figs. 1 and 2, 1 is a base or table of refractory insulating material, having an upward projection at 2. Upon said base and on opposite sides of said projection are placed the members 3, 4 of a pair of fixed electrodes—preferably copper blocks—here shown respectively connected to the terminals of a transformer T in a supply circuit. Above the fixed electrodes 3, 4 are supported in any suitable manner so as to be vertically movable, a pair of similar electrodes 5, 6. The stationary objects to be welded—here metal plates—are shown at 7 and 8, the lower plate 8 being supported upon the electrodes 3, 4 and projection 2, and the upper plate 7 being supported on the under side of the electrodes 5, 6, so as to bridge the space 9 between said last-named electrodes. The members 5, 6 of the upper or movable electrodes are respectively connected to the terminals of a transformer T′ in another supply circuit, here shown independent of the supply circuit to the terminals of which the electrodes 3, 4 are connected. As shown in Fig. 1, the plate 7 is supported a short distance above the plate 8, so that initially said plates are separated. Directly above the space 9 is arranged a vertically movable presser tool 10, which may be of cylindrical shape.

The positions of the aforesaid parts being as shown in Fig. 1, the two circuits are established. So much of plate 7 as lies be-

tween electrodes 3, 4 and the like area of plate 8 lying between electrodes 5, 6 become highly heated and plastic. That is to say, the noted area of plate 7 is in this instance heated by the current on one circuit independently of the similar noted area of plate 8 which is heated by the current on the other circuit. The upper electrodes now descend, bringing the plates 7, 8 into contact, and, at substantially the same time, the presser tool 10 comes down forcibly upon the upper plate 7, thus compressing the softened or plastic metal of the two plates between the lower face of said tool and the upper face of projection 2. By reason of this forcible compression of said heated metal, the tool enters for a short distance into the upper plate 7, as shown in Fig. 2, thus producing a recess or cavity 12, as shown in Figs. 5 and 8. During the passage of the currents through the juxtaposed plates 7 and 8 separately, the areas of said plates bridging the space 9 become, as already stated, highly heated and plastic, while the remainder of said plates remain comparatively cool by reason of their contact with the electrodes 3, 4, 5, 6, which to that end are preferably made of copper or other metal of high heat conducting capacity.

Attention is now especially directed to the following facts.

Each of the plates 7, 8 to be united is electrically heated independently of the other plate. In the arrangement shown in Figs. 1 and 2, this fact is emphasized by the actual separation of the two juxtaposed plates 7, 8. Hence there is no current path from one plate to the other, but, on the contrary, the current path in one plate, as 7, from electrode 5 to electrode 6 is parallel to the current path in the opposite plate 8 from electrode 3 to electrode 4. It is also obvious that inasmuch as there is no passage of the current in a transverse direction across a joint between the meeting surfaces of the plates, the resistance of such a joint is not a factor in any wise affecting the electrical heating of said plates; and it is further obvious that even if the plates be electrically heated, a weld between them is not produced solely for that reason, but something else must be done, namely, the forcing of the plates together by the descending presser tool 10 at the place where their union is desired.

As has already been pointed out, the portions of the plates which extend across the space 9 between the separated electrodes are the portions which are rendered plastic or soft by the action of the electrical current. Therefore, when the presser tool 10 descends, it enters for a short distance into the plate 7, as indicated in Fig. 2, and because the two plates are supported upon the unyielding projection 2, not only are the plates forced to unite over an area corresponding to the area of the bottom face of the tool 10, but the metal forming the body portion of said plates over said area is compressed and condensed, as indicated by the darker shaded portion 11 in the sectional views of said plates, Figs. 2, 5, 6, 7, 9, 10, 11. The extent of condensation is indicated by the reduced thickness of the two plates incident to the formation of the recess 12 in Fig. 5. Therefore it will be further obvious, first, that I have produced two plates welded together over a predetermined area or spot, at which area or spot the metal of the two plates, because compressed and condensed, as described, has different physical qualities from the metal of the plates elsewhere than at that spot; second, that the metal of the plates included within the space 9 and surrounding the highly compressed portion 11 above noted is also compressed and condensed, but in a less degree than is said portion 11. This less compressed portion is indicated in Figs. 5, 6, 7, 8, for example, at 13.

It will be apparent, therefore, that considering the whole weld made between the metal plates over the space 9 between the electrodes, I shall have a central portion 11 of greater compression and a surrounding or annular portion 13 of less compression. In other words, I do not produce between the plates a small sharply defined place of welding or spot isolated in position and bounded by a distinct and well defined area in which the pieces are not welded together. The area of this less compressed portion 13 is furthermore governed by the width of the space 9 which separates the electrodes, as will be evident by comparing Figs. 2 and 10. In Fig. 10, the electrodes are much more widely separated than in Fig. 2, thus presenting a much larger area of the plates to the heating effect of the current. If only the central portion of that increased area is condensed and compressed by the presser tool 10 of Fig. 10, then the area of less compression, 13, will be relatively much greater than as shown in Fig. 2. So that in this way I can vary the width of that less compressed area as I may see fit, or, conversely, and by the same means, vary the areas of no weld between the plates as I may desire. Thus, for example, referring to Fig. 9, here I have shown the plates 7 and 8 acted upon by the two presser tools 10, 10* opposed by the two projections 2, 2* on the insulated table 1. Between the tools 10, 10* are arranged electrodes 14 and 15, both connected here to the plus terminal of the supply circuit. The electrodes 16, 17, 18, 19 are all connected to the minus terminal of the same circuit. The width of the spaces 9 between the plus and minus electrodes is the same. As a consequence, when

the presser tools 10, 10* operate, two spots 11, 11* of high condensation are made, each surrounded by narrow areas 13, 13* of union of less compressed or condensed metal. The portions of the plates then which are in contact between the upper and lower electrodes are portions of no weld.

Now referring to Fig. 11, from which I have omitted for convenience the insulating table and projections, the middle electrodes 14, 15 are made very narrow, and the spaces 9, equaling one another, relatively wide. Here the spots of high compression are made, as before, but between the areas 13, 13* of less compression surrounding these highly condensed spots 11, 11* the plates are substantially united. In other words, the area of low compression 13 surrounding one highly condensed spot, as 11, Fig. 11, substantially joins the area of low compression 13* surrounding the other highly compressed spot 11*.

It will be obvious that in this way I produce what are practically two plates welded together over their entire opposing surfaces, having spots or circumscribed areas where the metal is not only united, but subjected to high compression and condensation—the result being a very much stronger product than can be obtained by uniting the plates by simply distinct isolated well defined spots separated by areas of no union.

In referring to Fig. 1, I have pointed out that the two plates 7 and 8 are actually separated, and each supplied by current from an independent source; this, in order to emphasize the fact that there is no current path from plate to plate across the joint between them. I do not intend in any wise to limit myself herein to this initial separation of the plates or to independent current sources. As shown in Fig. 3, I may place the plates in contact and connect the electrodes 5, 3 to one terminal, and the electrodes 6, 4 to the other terminal of a single source of supply—the presser tool 10 acting as before. Here, branch currents from the terminals will pass parallel to one another through the two plates. The only difference between this arrangement and that of Fig. 1 is that the dielectric between the plates is thinner.

Fig. 4 illustrates an arrangement in which the circuit connections are the same as in Fig. 3, but the projection 2 on the table 1 is removed, and a space left, similar to the space 9, between the electrodes. Two presser tools 10, 20 are here provided—the tool 10 operating downward and the tool 20 operating upward so as to compress the plates 7, 8 between them, thus producing recesses on both sides of the joined plates, as illustrated at 12, 12* in Fig. 6. It will be apparent that whether one or both of the joined plates are recessed on the back, as described, the surface of said back is altered over the spot, and does not remain unaltered as would be the case, for example, if the plates were spot-welded by electrodes merely contacting with the backs of the plates and transmitting a current directly across the joint.

I claim:

1. The method of electric welding, which consists in first electrically heating separately each of two stationary objects to be welded to render the same plastic, and then subjecting said objects to localized pressure while still plastic to cause said objects to unite.

2. The method of electric welding, which consists in electrically heating separately each of two stationary objects to be welded to render the same plastic, and then subjecting said objects to localized pressure while still plastic to cause condensation of the metal of the body portions of said objects and cause the opposing surfaces of said objects to unite.

3. The method of electric welding, which consists in electrically heating separately each of two stationary objects to be welded to render said objects plastic, and then subjecting said heated objects to localized pressure while still plastic to cause said objects to unite.

4. The method of fastening two stationary pieces of metal together by electrically welding them to one another at predetermined areas of their juxtaposed or opposite faces by first electrically heating separately each of said pieces to render the same plastic, and then applying pressure localized at said areas while said areas are still plastic.

5. The method of electric welding, which consists in heating two stationary objects to be welded by electric current through each of said objects separately in a longitudinal direction to render the same plastic, and then subjecting said objects to pressure while still plastic in a direction transverse to the said current direction to cause the same to unite.

6. The method of uniting two stationary pieces of metal, consisting in first passing electric current through each of said pieces separately in a direction parallel to the joint to heat said pieces and render the same plastic, and then applying localized pressure to said pieces while still plastic in a direction transverse to the joint.

7. The method of electric welding, which consists in separately electrically heating a portion of each of two stationary objects to be welded to render said portions plastic, and then subjecting said portions to pressure while still plastic to cause the same to unite.

8. The method of electric welding, which consists in separately electrically heating a portion of each of two stationary objects to

be welded to render said portions plastic, and then subjecting predetermined fractional areas of said portions to pressure while still plastic to cause a condensation and union of the metal at said areas.

9. The method of electric welding, which consists in electrically heating the objects to be welded, conducting the heat thus produced away from certain portions of said objects, and so confining the heating effect to the remaining portions of said objects, whereby said remaining portions are rendered plastic, and subjecting said heated and plastic portions to pressure to cause the same to unite.

10. The method of electric welding, which consists in placing two stationary objects to be welded in juxtaposition and each in contact with a pair of separated electrodes, separately electrically heating to a plastic state the portions of said objects extending across the space between said separated electrodes, and subjecting said heated portions to mechanical compression while still plastic to cause the welding together of opposing surfaces of said portions and to produce a condensation of the metal forming the bodies of said welded portions.

11. The method of electric welding, which consists in placing the objects to be welded in juxtaposition and each in contact with a pair of separated electrodes, electrically heating to a plastic state the portions of said objects extending across the space between said separated electrodes, and subjecting a predetermined fraction of the surface area of said heated portions to mechanical compression to cause the welding together of opposing surfaces of said portions and to produce a condensation of the metal forming the bodies of said welded portions, the said condensation being greater over said predetermined fractional area of said portions and less over the remainder of said portions.

In testimony whereof I have affixed my signature in presence of two witnesses.

THOMAS E. MURRAY, JR.

Witnesses:
GERTRUDE T. PORTER,
MAY T. MCGARRY.