A. L. JOHNSON.

PROCESS OF ELECTRIC WELDING.

APPLICATION FILED SEPT. 29, 1911.

1,039,135.

Patented Sept. 24, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

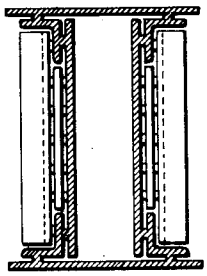


Fig. 2.

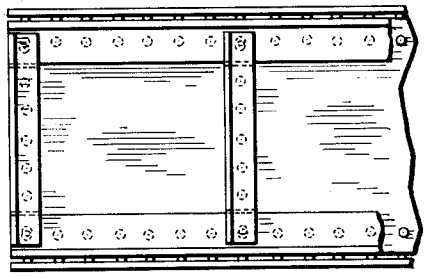


Fig. 3.

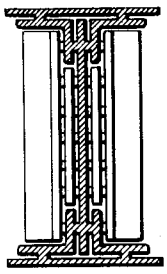


Fig. 4.

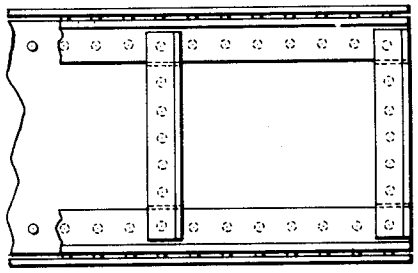


Fig. 5.

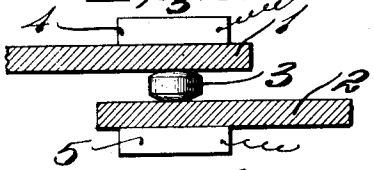


Fig. 7.

Fig. 6.

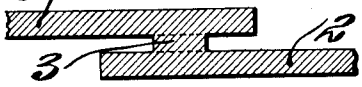


Fig. 8.

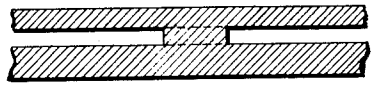
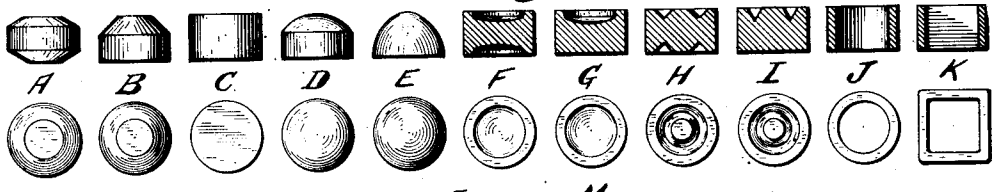


Fig. 9.



Witnesses:

Edgar T. Farmer.

G. A. Pennington

Inventor:

Albert L. Johnson,

By Connett Connett

his Attys.

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2 SHEETS—SHEET 2.

Fig. 10.

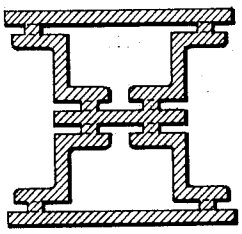


Fig. 11.

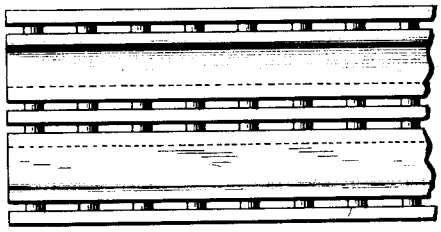


Fig. 12.

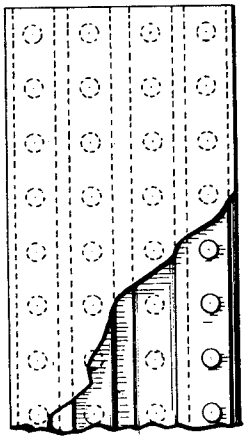


Fig. 13.

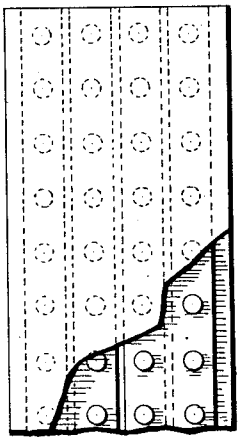


Fig. 14.

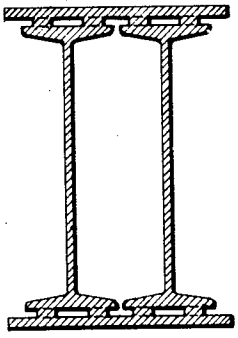
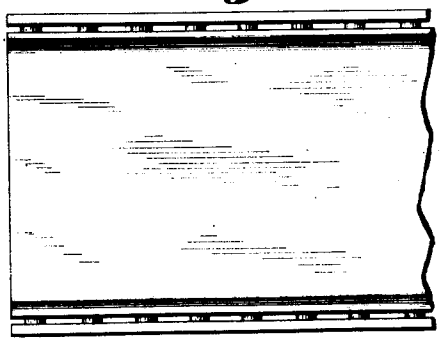


Fig. 15.



Witnesses:

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G. A. Pennington

Inventor:

Albert L. Johnson,

By Cameron & Cameron

his Attys.

UNITED STATES PATENT OFFICE.

ALBERT L. JOHNSON, OF HAMBURG, NEW YORK.

PROCESS OF ELECTRIC WELDING.

1,039,135. Specification of Letters Patent. Patented Sept. 24, 1912.

Application filed September 29, 1911. Serial No. 652,016.

To all whom it may concern:

Be it known that I, ALBERT L. JOHNSON, a citizen of the United States, and a resident of the town of Hamburg, county of Erie, and State of New York, have invented a new and useful Process of Electric Welding, of which the following is a specification.

My invention relates to the welding together of two or more metal members by means of an electric current; and has for its principal objects to provide for the instantaneous welding of such members without any previous treatment thereof, to provide for the welding together of members of different thicknesses, to provide for the proper spacing of the members when the welding operation is completed, to effect economies hereinafter mentioned, and to attain various advantages.

The invention consists principally in the use of metal buttons, or inserts, interposed between the members to be welded together, as hereinafter set forth.

In the accompanying drawing, which forms part of this specification, and wherein like symbols refer to like parts wherever they occur, Figure 1 is a cross section of the girder built up of members welded together according to my process; Fig. 2 is a side view of the end portion of such a girder; Fig. 3 is a cross section of a different form of girder made up of elements welded together; and Fig. 4 is a detailed view of the end portion of the girder shown in Fig. 3; Fig. 5 is a detailed view of two metal members with a metal button or insert interposed between them preparatory to the welding of said elements together; Fig. 6 is a detailed view in section showing said metal members and button welded together; Fig. 7 is a detailed view illustrating a button or insert interposed between two metal elements of different thicknesses preparatory to welding; and Fig. 8 is a detailed view thereof in section after the welding; Fig. 9 illustrates various forms of metal buttons or inserts showing a side or sectional view and an end view of each (excepting the spherical button "M"); Fig. 10 is a cross section; Fig. 11 is a detail elevation; and Fig. 12 is a detailed plan of a girder made up of elements welded together according to my invention; Figs. 13, 14 and 15 are a detail plan, cross sectional and a detailed elevation of another modified form of girder made up of elements welded together according to my invention.

Between the metal members 1 and 2, which are to be welded together, is interposed a metal button or insert 3, said button being positioned at the point where it is desired to weld the two members 1 and 2. The two members are then pressed toward each other and the electric current simultaneously applied by means of electrodes 4 and 5 in contact with the respective elements. The pressure may be effected by special mechanical appliances; but, in shop practice, it is preferable to mount the electrodes on rollers and effect the pressure thereby, the electrodes bearing against the outer surfaces of the respective members preferably in substantial alinement with the interposed button or insert. However, as the electric current will pass through the button regardless of the points of application of the electrodes, it is not essential that the electrodes should be in alinement with the button; and this fact widens the field of utility of the process. For instance, it enables the process to be used in securing the metal members of the framework of a building while the work is in progress. In such case, the cross sectional area of the metal building elements is so large that the increase of electrical resistance by reason of the electrodes being applied at a distance from the metal button is of little significance; but in the case of thin metal elements, such increase of resistance involves waste of current and possible injury of the element.

As indicated in the drawing, the area of the electrodes in contact with the members to be welded is preferably considerably larger than the area in contact with the button or insert. In consequence of the arrangement and conditions above stated, the electric current is localized on the button and the portions of the members 1 and 2 in contact with said button or immediately adjacent thereto. The current thus localized almost instantaneously melts the button and adjacent portions of the members 1 and 2 so as to effectively weld them together. As the button or insert is softened by the welding current, the pressure tends to force the two members 1 and 2 toward each other. Frequently it is desirable that the members 1 and 2 of the finished product should be spaced a predetermined distance apart;

and my invention is especially advantageous in acheiving this result. For this purpose, the button is especially designed so that, in addition to its function as a welding element by the melting of a greater or smaller portion thereof, it shall also serve to space the members apart, which function implies a certain degree of solidity. One design of button which harmonizes apparently conflicting requirements is illustrated in Fig. 7. In this design, the button is made in the form of a disk with axially projecting shoulders. In service, these shoulders are in contact with the members to be welded and the heat effects are concentrated on them in the middle portion of the disk. The marginal portion of the disk, being of greater area and consequently of less electrical resistance, remains comparatively cool during the very short interval required for the welding operation and thereby serves to limit the movement of the main members 1 and 2 and consequently fix the permanent spacing thereof. The shape of the button may be variously modified with a view to its service as a spacing member and divers forms are shown in Fig. 9. The portion of the button not in the direct path of the current tends to protect the button from the effects of too great concentration of the current.

The invention is especially advantageous for the instantaneous welding together of plates of different thicknesses. Other processes for such welding are either slow or liable to seriously impair the thinner plate in heating the thicker one to the welding temperature, or are open to both of these objections, and in some cases the welding cannot be done at all without previous preparation of the material. According to my invention, the metal button or insert is formed so that its area of contact with the thinner plate is larger than that with the thicker plate. The cone shaped button illustrated at B in Fig. 9 sufficiently illustrates this feature of the invention. By the use of such a cone shaped button, the electric current, and consequently the heat effect thereof, are concentrated on a small area of the thicker plate but are spread over a larger area of the thinner plate. It would be desirable to so proportion the areas with reference to the other factors that the temperatures of the two plates at the point of contact with the insert should always be the same; but as the pressure on the button while soft modifies the contact area, it is impracticable to adhere to mechanical nicety of design. Broadly, speaking, the area of the portion of the thinner plate in contact with the button should be larger than the like area of the thicker plate in inverse proportion to their thicknesses.

In the design illustrated at J in Fig. 9, the metal insert is of annular or tubular form. This form of insert has the advantages of a wide spreading joint with a comparatively small cross sectional area of material. Among the advantages of this wide spreading joint are an increase of rigidity and a larger area for the engagement of cooperating parts.

My process is well adapted for joining together the materials of composite structures, such as box girders and the like, whose members have heretofore been riveted; as the members of such constructions may be fed continuously through an electric welding machine whose electrodes are mounted on wheels which serve as feed wheels or are operatively connected to the feed wheels. When welds are to be formed at intervals, as in box girders and the like, the metal inserts therefor may take the form of protuberances on a continuous strip. This modification has the advantage of insuring the proper spacing and positioning of the welds and of facilitating the handling of the inserts; and the body portion of the strip likewise serves as a distance piece between the members to be welded and as a means for protecting the protruding portions against the effects of excessive heat. In the use of this continuous strip, the protuberances on the opposite sides thereof should be in transverse alinement with each other and also with the opposite electrodes. When separate buttons are used, they may be readily positioned by means of jigs or other devices specially provided therefor on the welding machine.

Among the principal advantages of my invention is its adaptability for joining members of different thicknesses, as above specified. Another important advantage is that the members to be welded require no preliminary treatment of any kind and consequently composite building structures of various types may be built up thereby out of ordinary commercial shapes. In comparison with the ordinary riveting process, wherein the members are weakened by the removal of a portion of their metal, my process utilizes the full cross section of the ordinary commercial shapes used for members of the built-up structure; in fact, the original cross section may be increased by the metal of the button. As the welding current is applied only where it is needed and as the buttons are easily positioned wherever they are wanted, the process is quite economical and very rapid. Another very important advantage of the process is that the wide range of variation in the design of the button gives the designer the greatest latitude in the building up of composite structures. This is especially true by reason of the facts that the welding may be effected at points which would be inaccessible for riveting, and that an intermedi-

ate sheet or member may be welded to two other members on its opposite sides simultaneously.

While I have shown the elements or members of the finished structure as spaced apart a slight distance, it is obvious that they may be pressed into contact with each other.

Obviously, the form of button and the various constructions hereinbefore mentioned admit of many variations without departing from my invention.

What I claim is:

1. The process of joining metal elements so that in the resulting product they will be spaced a predetermined distance apart, which process consists in interposing a metal insert between said elements, adjusting said elements and insert in desired relative position, pressing said elements against said insert, and welding the parts together by an electric current applied to said elements, said insert being of such shape that a portion thereof will remain firm during the welding operation and thereby serve to space said elements.

2. The process of joining metal elements so that in the resulting product they will be spaced a predetermined distance apart, which process consists in interposing a metal insert between said elements, adjusting said elements and insert in desired relative position, pressing said elements against said insert, and welding the parts together by an electric current applied to said elements in substantial alinement with said insert, said insert being of such shape that a portion thereof will remain firm during the welding operation and thereby serve to space said elements.

3. The process of electrically welding elements of different thicknesses which comprises the interposing of a metal insert between said elements at the point of welding, and then pressing the electrodes of the welding current against the outer surfaces of said elements, the insert being of such shape that the area of the portion thereof in contact with the thinner element is larger than the area of the portion of said insert in contact with the thicker element.

4. The process of electrically welding elements of different thicknesses which comprises the interposing of a metal insert between said elements at the point of welding, and then pressing the electrodes of the welding current against the outer surfaces of said elements substantially in alinement with said insert, the insert being of such shape that the area of the portion thereof in contact with the thinner element is larger than the area of the portion of said insert in contact with the thicker element.

5. The process of electrically welding elements of different thicknesses which comprises the interposing of a metal insert between said elements at the point of welding, and then pressing the electrodes of the welding current against the outer surfaces of said elements, the portion of the insert in contact with the thicker element being of smaller area than the cross-sectional area of the middle portion of said insert.

6. The process of electrically welding elements of different thicknesses which comprises the interposing of a metal insert between said elements at the point of welding, and then pressing the electrodes of the welding current against the outer surfaces of said elements substantially in alinement with said insert, the insert being disk-shaped with protuberances on its flat faces.

7. The process of joining metal elements which comprises the interposing of metal inserts between them at intervals and electrically welding the parts together under pressure by means of electrodes applied to the outer surfaces of said elements in substantial alinement with each of said inserts successively.

Signed at St. Louis, Missouri, this 27th day of September, 1911.

ALBERT L. JOHNSON.

Witnesses:

EDGAR T. FARMER,

M. A. SHELTON.