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A. T. KASLEY

METHOD OF UNITING METALS

Filed Jan. 26 1923

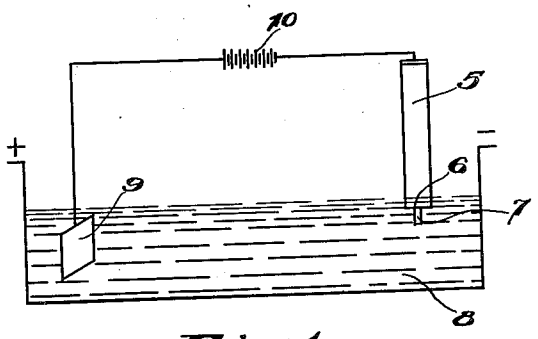


Fig: 1.

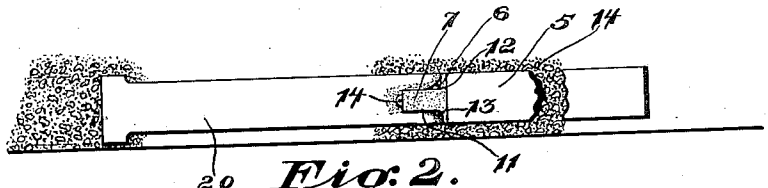


Fig: 2.

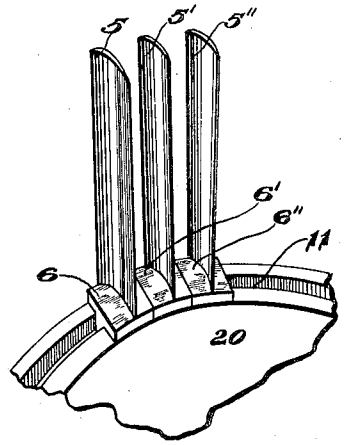


Fig: 3.

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UNITED STATES PATENT OFFICE.

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METHOD OF UNITING METALS.

Application filed January 26, 1923. Serial No. 615,118.

To all whom it may concern:

Be it known that I, ALEXANDER T. KASLEY, a citizen of the United States, and a resident of Essington, in the county of Delaware and State of Pennsylvania, have invented a new and useful Improvement in Methods of Uniting Metals, of which the following is a specification.

My invention relates to a method of uniting metals, particularly of an oxidizable nature, and has for its object to provide a method of the character designated which shall permit the uniting of metallic parts, such, for example, as iron or steel, in a simple and highly efficacious manner.

In the accompanying drawing, Fig. 1 is a diagrammatic illustration of the method of carrying out a preliminary step in my proposed method; Fig. 2 is a diagrammatic illustration of a further step and Fig. 3 is a perspective view of one form of the final product.

In the joining of metallic members formed, for example, of iron or steel, it has been proposed to heat the members while in contact in an atmosphere of hydrogen, placing in contact with the members a small amount of material such as copper, and heating the assemblage, whereupon the hydrogen prevented the formation of oxide and the copper or other alloying material flowed between and around the contacting surfaces with the formation of an effective weld.

In accordance with the present invention, I achieve a somewhat similar result without the use of a hydrogen atmosphere. To this end, I first place the abutting portions of the members to be joined in a hydrogen-depositing electrolytic bath, so connecting the member to be treated as to act as the cathode. By this means, the nascent hydrogen penetrates into the metal and there remains, either as occluded gas or in the form of an hydride of the metal.

After this preliminary step, the abutting faces of the members to be joined are placed in contact in the presence of a small amount of alloying material, such as copper, brass or other brazing material and the assemblage heated, whereupon the hydrogen within the metal plays an exceedingly important and valuable function in preventing the formation of oxide and in producing a highly efficacious union of the members. Preferably I supplement the reducing action of the hydrogen by covering the parts with powdered charcoal or other reducing agent before the application of heat.

Referring to the drawing, I show my method as carried out in the fastening of turbine blades to a turbine rotor, inasmuch as I have found this method to be very effective in thus mounting turbine blades.

In Fig. 1 I show a turbine blade at 5, having an upset base portion 6, provided with a tang 7. This root portion is submerged in an electrolytic bath 8 and is connected as the cathode in a suitable circuit embodying an anode 9, and a current source 10. While the electrolytic bath may have any one of a large number of acids or salts in solution, I find that a solution of borax or of boracic acid has the merits of being inexpensive and highly effective.

The current is passed for a considerable time from the current source 10 and the nascent hydrogen evolved at the cathode penetrates to a considerable depth thereinto, either forming physical union therewith as an occluded gas, or a chemical union as a hydride, or a mixture of both. In this connection, I do not desire to commit myself to either theory of the action, it sufficing to state that the hydrogen passes into exceedingly intimate union with the metal.

The upper portion of the blade 5 need not be treated and thus it may be left out of the bath as illustrated, or it may be coated, as with paraffin, in order to prevent electrolytic action thereupon.

In a similar manner, a turbine disc shown in partial section at 20 in Fig. 2, and embodying a peripheral groove 11 may have its rim or periphery suitably treated in a hydrogen bath.

The rotor 20 and the blade 5 are then placed in appropriate juxtaposition as illustrated in Fig. 2, the tang 7 resting within the groove 11 and the treated portion of the blade 5 being indicated by stippling as well as the treated portion of the disc 20. Preferably, the groove 11 has rounded corners as shown at 12 and 13, whereas the root portion of the blade has a smaller radius so that a small space is left for the insertion of a wire of copper, brass or other brazing material.

Having completed this assemblage, char-

coal or other reducing material is preferably placed over the members, as shown at 14 and the entire assemblage is heated to such a temperature as to cause the brazing material to flow freely, when I find that the action of the hydrogen promotes the establishment of an exceedingly close union of high tensile strength.

The resultant structure is shown in fragmentary view in Fig. 3, three blades 5, 5′ and 5″ being shown as seated on a disc 20, the root portions 6, 6′ and 6″ being in contact and the corresponding tangs being firmly held within the groove 11.

In certain cases, in order to enhance the strength and uniformity of the resultant product, it may be desirable to copper-plate the abutting surfaces in addition to the hydrogen treatment, thus making the weld, in effect, one of copper to copper.

Should it be desired to avoid injury to the steel parts to be joined as by the application of too high a brazing heat thereto, zinc may be employed as the brazing material. Where superheated steam is to be employed in the turbine of such temperature as to threaten the fusion of pure zinc, I find that an alloy of, for example, 90% zinc and 10% copper is highly effective.

While I have illustrated my improved method for use in mounting turbine blades, it will be obvious to those skilled in the art that it is not so limited, but that it is susceptible to a wide range of use in the arts in joining together metallic members.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:—

1. The method of uniting two metallic members which comprises impregnating the surfaces thereof to be united with hydrogen to an appreciable depth and thereafter placing said members in contact in the presence of an alloying metal and applying heat thereto.

2. The method of uniting two metallic members which comprises forming a layer of mingled metal and hydrogen of appreciable depth on the surfaces thereof to be united, placing said members in contact in the presence of an alloying metal and applying heat thereto.

3. The method of uniting two metallic members which comprises first inserting the contacting face of each member as the cathode in a hydrogen-depositing electrolytic bath and thereafter placing said members in contact in the presence of an alloying metal and subjecting them to heat.

4. The method of uniting two metallic members which comprises impregnating the surfaces thereof to be united with hydrogen to an appreciable depth and thereafter placing said members in contact in the presence of an alloying metal and applying heat thereto in a reducing furnace.

5. The method of uniting two metallic members which comprises forming a layer of mingled metal and hydrogen of appreciable depth on the surfaces thereof to be united, placing said members in contact in the presence of an alloying metal and applying heat thereto in a reducing furnace.

6. The method of uniting two metallic members which comprises first inserting the contacting face of each member as the cathode in a hydrogen-depositing electrolytic bath and thereafter placing said members in contact in the presence of an alloying metal and subjecting them to heat in a reducing furnace.

In testimony whereof, I have hereunto subscribed my name this 23rd day of January, 1923.

ALEXANDER T. KASLEY.