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METHOD OF PRODUCING A VACUUM-TIGHT JOINT OF RELATIVELY THIN PARTS

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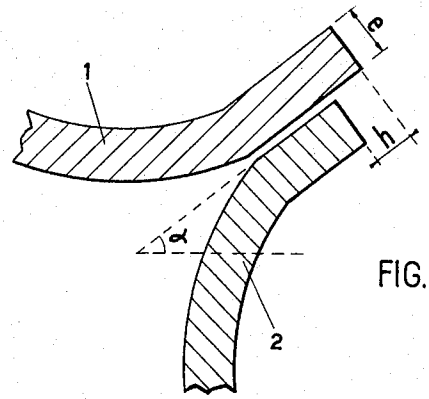


FIG. 1

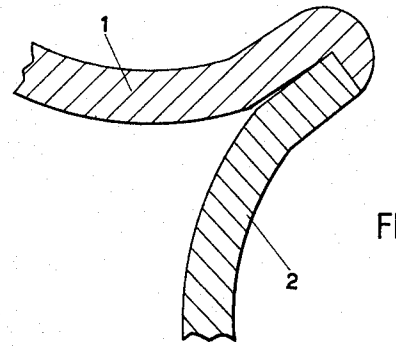


FIG. 2

INVENTOR
Pierre DUMON
Guy Chopinet

BY Paul M. Craig, Jr.
ATTORNEY

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METHOD OF PRODUCING A VACUUM-TIGHT JOINT OF RELATIVELY THIN PARTS

Guy Chopinet and Pierre Dumon, Paris, France, assignors to CSF-Compagnie Generale de Telegraphie Sans Fil, Paris, France

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The present invention relates to a vacuum-tight joint or assembly of relatively thin pieces.

According to the known prior art technique, the end parts of such pieces are bent, the bent faces are then placed one against the other to cause the edges thereof to coincide, and welding is thereupon effected along the end face of these edges by fusion of the two edges, generally without additional metal.

These prior art processes are suitable when the pieces to be joined together are made of the same metal or even of different metals which do not exhibit metallurgical incompatibility with respect to each other, such as fissuration or cracking of one metal by the other, danger of formation of a fragile phase, etc. Examples of such incompatibility are the pairs of copper-steel danger of fissuration) or of molybdenum-steel (danger of fragile phase).

The present invention aims at a method of assembling and joining by arc-auto-brazing relatively thin pieces, applicable successfully even if there exists metallurgical incompatibility between the metals used.

The method according to the present invention essentially consists in placing the plane terminal portions of the pieces to be joined together one against the other, i.e., in a position facing each other, while leaving a slight play therebetween in order to avoid stresses at the moment of fusion, and more particularly in such a manner that the edge of one piece overlaps or extends beyond the edge of the other piece by a certain distance, and to cause melting by the use of an arc of the projecting or overlapping edge while preventing melting of the other edge, in such a manner that the former folds or flanges over the end face of the latter and is secured thereat by auto-brazing.

Additionally, the method according to the present invention is characterized by the fact that, during the operation, the plane of junction of the two pieces to be assembled is maintained substantially in a position inclined to the horizontal plane, with the piece having the projecting or overlapping edge being arranged above the other piece.

Accordingly, it is an object of the present invention to provide a method for establishing a vacuum-tight joint, especially between two relatively thin pieces made of metallurgically incompatible materials, which effectively eliminates the shortcomings and inadequacies encountered in the prior art.

Another object of the present invention resides in the provision of a method for joining two pieces in a vacuum-tight manner which avoids the danger of cracking and/or of a fragile phase between the two pieces.

A further object of the present invention resides in the provision of a method which assures a satisfactory vacuum-tight joint between two pieces even if made of metallurgically incompatible materials.

A still further object of the present invention resides in the provision of a vacuum-tight joint, especially between two relatively thin parts made of metallurgically incompatible materials, which may be obtained in a simple manner without requiring additional material for the welded joint, for instance, by arc-auto-brazing.

These and other objects, features and advantages of the present invention will become more obvious from the following description, when taken in connection with the accompanying drawing, which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein

FIGURE 1 is a cross-sectional view through the two pieces to be joined prior to welding thereof, and

FIGURE 2 is a cross-sectional view similar to FIGURE 1 through the same pieces after welding thereof.

Referring now to the drawing, wherein like reference numerals are used in the two figures to designate like parts, reference numerals **1** and **2** generally designate therein the pieces, such as relatively thin metal sheets, to be joined, which are of a thickness *e* and of the same order of magnitude. The plane terminal parts of the two pieces are positioned in such a manner as to face each other, while leaving therebetween a small play of some tenths of a millimeter. The connecting or joining plane of the two pieces is maintained, during the operation, at an angle α with respect to the horizontal plane, for example, of the order of 45°. The piece **1** is placed above piece **2** with the edge portion thereof overlapping or extending beyond the opposite edge portion by a distance *h*, slightly smaller than the thickness *e*. The edge portion of piece **1** is then caused to melt with the aid of the arc, without, however, melting the edge portion of piece **2**. The edge portion of piece **1** thereupon folds or flanges over the end face of the edge portion of piece **2** and is secured thereto by auto-brazing. The joined assembly assumes the appearance shown in FIGURE 2.

While applicable to the welding of any similar or dissimilar metals, the method according to the present invention is particularly advantageous in the application thereof to the joining of a relatively good conductive metal to a relatively poor conductive metal, for example, for welding copper to stainless steel, or steel to molybdenum, or copper to molybdenum. In all of these cases, the methods known in the prior art have proved to be either inoperative, or have given rise to disappointments after a shorter or longer period of time.

Thus, while we have shown and described one embodiment in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of many changes and modifications within the spirit and scope of the present invention and we, therefore, do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

We claim:

1. A method of producing a vacuum-tight joint between two metal sheets, comprising the steps of placing at least the terminal portions of said sheets to face each other with a small gap left therebetween in such a manner that the respective edge portions of the sheets are substantially parallel, the edge portion of one of the two sheets projecting beyond the edge portion of the other sheet by a predetermined distance in the plane of said gap, and of melting only said projecting edge portion

whereby the molten metal of said one sheet folds over the unmolten edge portion of said other sheet to be welded together by self-brazing.

2. A method of producing a vacuum-tight joint between two metal sheets, comprising the steps of placing at least the terminal portions of said sheets to face each other with a small gap left therebetween in such a manner that the respective edge portions of said two sheets are substantially parallel, the edge portion of one of said sheets projecting beyond the edge portion of the other of said sheets by a predetermined distance in the plane of said gap, and of melting only said projecting edge portion whereby the molten metal of said one sheet folds over the unmolten edge portion of said other sheet to be welded together by self-brazing, the projecting distance of the edge portion of said one sheet being slightly smaller than the width of the sheets.

3. A method of producing a vacuum-tight joint between two metal sheets, comprising the steps of placing at least the terminal portions of said sheets to face each other with a small gap left therebetween in such a manner that the respective edge portions of said sheets are substantially parallel, the edge portion of the one of said two sheets which is disposed above the edge portion of the other sheet extends beyond the edge portion of the said other sheet by a predetermined distance in the plane of said gap, and of melting substantially only the extending edge portion whereby the molten metal of said one sheet flanges over the unmolten edge portion of said other sheet to be welded together by self-brazing.

4. A method of producing a vacuum-tight joint between two metal sheets, comprising the steps of placing at least the terminal portions of said sheets to face each other with a small gap left therebetween in such a manner that the respective edge portions of said sheets are substantially parallel and the plane of the gap is inclined to the horizontal, the edge portion of the one of said two sheets which is disposed above the edge portion of the other sheet extends beyond the edge portion of the said other sheet by a predetermined distance in the plane of said gap, and of melting substantially only the extending edge portion whereby the molten metal of said one sheet flanges over the unmolten edge portion of said other sheet to be welded together by self-brazing.

5. A method of producing a vacuum-tight joint between two metal sheets, comprising the steps of placing at least the terminal portions of said sheets to face each other with a small gap left therebetween in such a manner that the respective edge portions of said sheets are substantially parallel and the plane of the gap is inclined to the horizontal by an angle of the order of 45° and that the edge portion of the one of said two sheets which is disposed above the edge portion of the other sheet extends beyond the edge portion of the said other sheet by a predetermined distance in the plane of said gap, and of melting substantially only the extending edge portion whereby the molten metal of said one sheet flanges over the unmolten edge portion of said other sheet to be welded together by self-brazing.

6. A method of vacuum-tight joining together two relatively thin metallic pieces, comprising the steps of positioning the end portions of said pieces to face each other with a small gap therebetween in such a manner that the respective edge portions of said pieces are substantially parallel, the edge portion of one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, melting primarily only said extending edge portion to thereby fold the molten metal thereof over the substantially unmolten edge portion of said other piece, and welding together said edge portions by self-brazing.

7. A method of vacuum-tight joining two metal pieces with one of said pieces being of a relatively good conducting metal and the other of a relatively poor conducting metal, comprising the steps of placing at least the terminal portions of said pieces to face each other with a small gap therebetween in such a manner that the respective edge portions of said pieces are substantially parallel, the edge portion of one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, and of melting substantially only said extending edge portion to thereby cause the molten metal of said one piece to flange over the substantially unmolten edge portion of said other piece to be welded together.

8. A method of vacuum-tight joining together two relatively thin metallic pieces of metallurgically incompatible metals, comprising the steps of positioning the end portions of said pieces to face each other with a small gap therebetween in such a manner that the respective edge portions of said pieces are substantially parallel, the edge portion of one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, and of melting substantially only said extending edge portion to thereby fold the molten metal thereof over the edge portion of said other piece, and welding together said edge portions.

9. A method of producing a vacuum-tight joint between two metal pieces made of copper and stainless steel, respectively, comprising the steps of placing at least the terminal portions of said pieces to face each other with a small gap therebetween so that the respective edge portions of said pieces are substantially parallel, the edge portion of one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, and of melting substantially only said extending edge portion to thereby fold the molten metal of said one piece over the substantially unmolten edge portion of said other piece to be welded together.

10. A method of producing a vacuum-tight joint between two metal pieces made of stainless steel and molybdenum, respectively, comprising the steps of placing at least the terminal portions of said pieces to face each other with a small gap therebetween so that the respective edge portions of said pieces are substantially parallel, the edge portion of one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, and of melting substantially only said extending edge portion to thereby fold the molten metal of said one piece over the substantially unmolten edge portion of said other piece to be welded together.

11. A method of producing a vacuum-tight joint between two metal pieces made of copper and molybdenum, respectively, comprising the steps of placing at least the terminal portions of said pieces to face each other with a small gap therebetween so that the respective edge portions of said pieces are substantially parallel, the edge portion of one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, and of melting substantially only said extending edge portion to thereby fold the molten metal of said one piece over the substantially unmolten edge portion of said other piece to be welded together.

12. A method of vacuum-tight joining together two relatively thin metallic pieces of metallurgically incompatible metals, comprising the steps of positioning the end portions of said pieces to face each other with a small gap therebetween with the plane thereof inclined to the horizontal in such a manner that the respective edge portions of said pieces are substantially parallel, the edge portion of the upper one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, and of melting substantially only said extending edge portion to thereby fold the molten metal thereof over the edge portion of said other piece, and welding together said edge portions.

13. A method of vacuum-tight joining together two relatively thin metallic pieces of metallurgically incompatible metals, comprising the steps of positioning the end portions of said pieces to face each other with a small gap therebetween with the plane thereof inclined to the horizontal in such a manner that the respective edge portions of said pieces are substantially parallel, the edge portion of the upper one of said pieces extending beyond the edge portion of the other piece by a predetermined distance in the plane of said gap, melting primarily only said extending edge portion to thereby fold the molten metal thereof over the substantially unmolten edge portion of said other piece, and welding together said edge portions.

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JOHN F. CAMPBELL, *Primary Examiner.*