

PATENT SPECIFICATION (11)

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(54) BRAZING CLIP

(71) We, SUNDSTRAND CORPORATION, a corporation organised and existing under the laws of the State of Delaware, United States of America, of 4751 Harrison Avenue, Rockford, Illinois 61101, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to means for retaining together various elements to be brazed during a brazing operation.

There are a number of instances when it is desirable to braze together an assembly consisting of two copper wires each of rectangular cross section, with a small copper spacer of rectangular cross section inserted between the wires. For example, such a braze is particularly useful in manufacturing aircraft generators, since by brazing a small copper spacer between two rectangular cross-sectional copper wires, a stator end-turn can be readily formed. In addition it is advantageous to automate the brazing process insofar as possible.

By inserting a U-shaped clip of brazing material between the copper spacer and the wires, it is possible simultaneously to braze both wires to the copper spacer utilizing an automatic brazing machine. However, the compressive force of brazing machine contacts pressing on the wires, along with the electrical current required for brazing often causes the U-shaped brazing clip and the spacer element to slip out of position, resulting in an unacceptable braze joint.

The invention provides a brazing clip for use in brazing together two wires separated by a spacer element, which clip is made of a braze material and comprises parallel spaced legs for abutting opposite faces of the spacer element, a connecting crosspiece joining together the legs, and retaining flange portions on the legs and the crosspiece for contacting and locating the wires in use to retain the brazing clip in position during brazing. For example the brazing clip of the invention may comprise a first leg suitable for insertion between a first wire and the spacer element, a second leg suitable

for insertion between a second wire and the spacer element, a retaining flange portion projecting from one end of the first leg and configured to abut a first side of the first wire, a retaining flange portion projecting from one end of the second leg and configured to abut a first side of the second wire, and a connecting crosspiece between the other ends of the first and second legs, the crosspiece having an end flange portion abutable with a second side of the second wire to retain the brazing clip in position during brazing. If desired the crosspiece may have, in addition to its end flange portion abutable with the second side of the second wire, a second end flange portion abutable with a second side of the first wire to assist in retaining the brazing clip in position during brazing. In use, the brazing clip straddles one or both wires to maintain the assembly in position during brazing. It is advantageous for the connecting crosspiece to have a central portion for abutting an edge of the spacer element in use to help maintain the spacer element in position during brazing. If desired, the dimensions of the brazing clip and the resilience of the legs and crosspiece can be selected to retain the desired relationships by spring tension.

The invention is hereinafter particularly described, by way of example only, with reference to the drawings of which Figure 1 is an illustration of a conventional brazing clip for comparative purposes only, and Figures 2 and 3 illustrate the invention. In the drawings:

Figure 1 is an illustration of a conventional U-shaped brazing clip positioned between two wires and a spacer element immediately prior to brazing;

Figure 2 is a first embodiment of a brazing clip according to the present invention having portions positioned between two wires and a spacer element; and

Figure 3 is a second embodiment of a brazing clip according to the present invention having portions positioned between two wires and a spacer element.

In Figure 1 is illustrated a typical prior art arrangement for brazing together two

wires 10 and 12 each of rectangular cross section to form an end-turn for a generator stator winding. Positioned between the wires 10 and 12 is a copper spacer element 14 of rectangular cross section which in turn is separated from the wires 10 and 12 by a generally U-shaped brazing clip 16 of a material suitable for facilitating the brazing operation. Pressure and an electric current are applied to the wires 10 and 12, the spacer element 14 and the brazing clip by means of an automatic brazing machine having a pair of terminals 18 and 19. The automatic brazing machine automatically regulates the amount of physical pressure applied to the wires 10 and 12 along with the amount and duration of current transmitted through the wires 10 and 12. Such automatic brazing machines are in common use throughout industry.

However, it has been discovered through practical application of the brazing technique illustrated in Figure 1 that the application of pressure and current sufficient to braze the copper spacer element 14 to the wires 10 and 12 often results in the spacer element 14 and the brazing clip 16 sliding out of the desired position, resulting in an unacceptable braze joint.

In order to avoid the problem of the slippage of the copper spacing element 14 and the brazing clip 16, a brazing clip 20 as shown in Figure 2 is configured with two retaining portions 24 and 26 which, in the assembly of Figure 2, are positioned along one side of the wires 10 and 12. The retaining portions 24 and 26 are attached to legs 28 and 30 which are interposed between the wires 10 and 12 and the spacer element 14. In addition, the brazing clip 20 can also be considered to have a portion or a connecting crosspiece 32 which in turn has a central portion 34 positioned against one side of the spacer element 14 and end portion 36 positioned against the other side of wire 12. In the configuration shown in Figure 2 the brazing clip 20 effectively serves to retain the copper spacing element in the desired relationship between the wires 10 and 12 during the brazing operation.

In order further to enhance the retentive characteristics of the brazing clip 20, the length of the lower leg 30 can be made marginally shorter than the width of the lower wire 12 so that the clip 20 is retained on the lower wire 12 by means of a spring force acting on the retaining portion 26 and the connecting portion 36. In addition, it may be also desirable to configure the brazing clip 20 such that the spacer element 14 is retained between the legs 28 and 30 by means of a spring force. This can be accomplished by initially dimensioning the connecting portion 32 such that the normal distance between the members 28 and 30 is

less than the height of the spacer element 14.

A second embodiment of the invention is illustrated in Figure 3, in which the brazing clip, indicated generally as 38, has an additional end portion 40 of its connecting member 32¹ in contact with one side of the upper wire 10. This is in addition to a portion 36¹ of the connecting member 32¹ which is positioned against the corresponding side of the lower wire 12. Also, in brazing clip 38 of Figure 3 an additional portion 34¹ of the connecting member 32¹ is positioned against the copper spacer element 14 at approximately the mid-point of one side of the spacer element 14. Here again, the retaining portions 24¹ and 26¹ cooperate with the portions 40 and 36¹ of the connecting member 32 to retain the brazing clip 38 and the spacer element 14 in the desired position with respect to the wires 10 and 12.

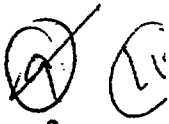
As with the brazing clip 20 of Figure 2, the retaining portions 28¹ and 30¹ can be spaced relative to the portions 40 and 36¹ so as to maintain the clip 38 on the wires 10 and 12 by means of a spring force. The connecting member can also be initially dimensioned so as to retain the spacing element 14 between the members 28¹ and 30¹ by spring tension.

The brazing clip is preferably formed out of a single piece of brazing material. The American Welding Society's AWS-BCUP-5 is one example of a material suitable for forming a brazing clip according to the invention which will form a satisfactory braze in combination with the copper wires and the copper spacer.

WHAT WE CLAIM IS:—

1. A brazing clip for use in brazing together two wires separated by a spacer element, which clip is made of a braze material and comprises parallel spaced legs for abutting opposite faces of the spacer element, a connecting crosspiece joining together the legs, and retaining flange portions on the legs and the crosspiece for contacting and locating the wires in use to retain the brazing clip in position during brazing.

2. A brazing clip according to claim 1, which comprises a first leg suitable for insertion between a first wire and the spacer element, a second leg suitable for insertion between a second wire and the spacer element, a retaining flange portion projecting from one end of the first leg and configured to abut a first side of the first wire, a retaining flange portion projecting from one end of the second leg and configured to abut a first side of the second wire, and a connecting crosspiece between the other ends of the first and second legs, wherein the crosspiece has an end flange portion abutable with a second side of the second



wires 10 and 12 each of rectangular cross section to form an end-turn for a generator stator winding. Positioned between the wires 10 and 12 is a copper spacer element 14 of rectangular cross section which in turn is separated from the wires 10 and 12 by a generally U-shaped brazing clip 16 of a material suitable for facilitating the brazing operation. Pressure and an electric current are applied to the wires 10 and 12, the spacer element 14 and the brazing clip by means of an automatic brazing machine having a pair of terminals 18 and 19. The automatic brazing machine automatically regulates the amount of physical pressure applied to the wires 10 and 12 along with the amount and duration of current transmitted through the wires 10 and 12. Such automatic brazing machines are in common use throughout industry.

However, it has been discovered through practical application of the brazing technique illustrated in Figure 1 that the application of pressure and current sufficient to braze the copper spacer element 14 to the wires 10 and 12 often results in the spacer element 14 and the brazing clip 6 sliding out of the desired position, resulting in an unacceptable braze joint.

In order to avoid the problem of the slippage of the copper spacing element 14 and the brazing clip 16, a brazing clip 20 as shown in Figure 2 is configured with two retaining portions 24 and 26 which, in the assembly of Figure 2, are positioned along one side of the wires 10 and 12. The retaining portions 24 and 26 are attached to legs 28 and 30 which are interposed between the wires 10 and 12 and the spacer element 14. In addition, the brazing clip 20 can also be considered to have a portion or a connecting crosspiece 32 which in turn has a central portion 34 positioned against one side of the spacer element 14 and end portion 36 positioned against the other side of wire 12. In the configuration shown in Figure 2 the brazing clip 20 effectively serves to retain the copper spacing element in the desired relationship between the wires 10 and 12 during the brazing operation.

In order further to enhance the retentive characteristics of the brazing clip 20, the length of the lower leg 30 can be made marginally shorter than the width of the lower wire 12 so that the clip 20 is retained on the lower wire 12 by means of a spring force acting on the retaining portion 26 and the connecting portion 36. In addition, it may be also desirable to configure the brazing clip 20 such that the spacer element 14 is retained between the legs 28 and 30 by means of a spring force. This can be accomplished by initially dimensioning the connecting portion 32 such that the normal distance between the members 28 and 30 is

less than the height of the spacer element 14.

A second embodiment of the invention is illustrated in Figure 3, in which the brazing clip, indicated generally as 38, has an additional end portion 40 of its connecting member 32¹ in contact with one side of the upper wire 10. This is in addition to a portion 36¹ of the connecting member 32¹ which is positioned against the corresponding side of the lower wire 12. Also, in brazing clip 38 of Figure 3 an additional portion 34¹ of the connecting member 32¹ is positioned against the copper spacer element 14 at approximately the mid-point of one side of the spacer element 14. Here again, the retaining portions 24¹ and 26¹ cooperate with the portions 40 and 36¹ of the connecting member 32 to retain the brazing clip 38 and the spacer element 14 in the desired position with respect to the wires 10 and 12.

As with the brazing clip 20 of Figure 2, the retaining portions 28¹ and 30¹ can be spaced relative to the portions 40 and 36¹ so as to maintain the clip 38 on the wires 10 and 12 by means of a spring force. The connecting member can also be initially dimensioned so as to retain the spacing element 14 between the members 28¹ and 30¹ by spring tension.

The brazing clip is preferably formed out of a single piece of brazing material. The American Welding Society's AWS-BCUP-5 is one example of a material suitable for forming a brazing clip according to the invention which will form a satisfactory braze in combination with the copper wires and the copper spacer.

WHAT WE CLAIM IS:—

1. A brazing clip for use in brazing together two wires separated by a spacer element, which clip is made of a braze material and comprises parallel spaced legs for abutting opposite faces of the spacer element, a connecting crosspiece joining together the legs, and retaining flange portions on the legs and the crosspiece for contacting and locating the wires in use to retain the brazing clip in position during brazing.

2. A brazing clip according to claim 1, which comprises a first leg suitable for insertion between a first wire and the spacer element, a second leg suitable for insertion between a second wire and the spacer element, a retaining flange portion projecting from one end of the first leg and configured to abut a first side of the first wire, a retaining flange portion projecting from one end of the second leg and configured to abut a first side of the second wire, and a connecting crosspiece between the other ends of the first and second legs, wherein the crosspiece has an end flange portion abutable with a second side of the second



wire to retain the brazing clip in position during brazing.

3. A brazing clip according to claim 2 wherein the second leg is resiliently deformable and is adapted in use to engage opposite sides of the second wire between its retaining flange portion and its crosspiece end flange portion.

4. A brazing clip according to claim 2 or claim 3 wherein the crosspiece has, in addition to its end flange portion abutable with the second side of the second wire, a second end flange portion abutable with a second side of the first wire to assist in retaining the brazing clip in position during brazing.

5. A brazing clip according to claim 4 wherein the first leg is resiliently deformable and is adapted in use to grip the first wire between its retaining flange portion and the second end flange portion of the crosspiece to retain the brazing clip in position during brazing.

6. A brazing clip according to any preceding claim wherein the crosspiece also has a central portion adapted to abut one side of the spacer element to retain the spacer element in position during brazing.

7. A brazing clip according to any preceding claim wherein the crosspiece is resiliently deformable so that in use the legs resiliently grip the spacer element to assist in retaining the spacer element in position during brazing.

8. A brazing clip for use in brazing together two wires and a spacer element, substantially as particularly described herein with reference to Figure 2 and Figure 3 of the drawings.

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