

"METHOD OF SPOT WELDING"

This invention concerns a method of spot welding first and second electrically conductive members to each other.

According to the present invention, there is provided a method of spot welding first and second electrically
5 conductive members to each other comprising establishing contact between the first and second members in a limited contact area only; establishing contact between a first electrode and the first member; passing a second electrode through an aperture in the first member to a position in which it contacts the
10 second member; and passing an electrical current through the first and second electrodes so as to spot weld the first and second members to each other at the said limited contact area.

Preferably, the aperture has a diameter, or maximum diameter, which is not more than three times that of the second electrode.

15 The second member is preferably mounted within a space in the first member. Thus the first member may be U-shaped, the said limited contact area being disposed at the base portion of the U-shaped first member.

The second member preferably has a projection which contacts
20 the first member in the said limited contact area, the first and second members being spaced from each other except at the said projection.

Preferably, the width, or the greatest width, of the projection is not more than one fifth that of the U-shaped
25 first member.

The first member may be a bell, the second member being a frame which is mounted within the bell, the frame carrying both a bell hammer and electromagnetic means for moving the bell hammer into and out of a position in which it strikes the bell.

The electromagnetic means may comprise a coil which is carried by the frame and an armature which is carried by the bell hammer and which is spaced from the coil when the latter is de-energized, energization of the coil causing the armature to be attracted to the coil.

One end of the bell hammer may be secured to the frame by means of an adjustable fixing device which enables the spacing between a hammer head of the bell hammer, when at rest, and the bell to be adjusted.

The frame is preferably U-shaped. In this case, the coil may be disposed within the U-shaped frame, the bell hammer being disposed externally of the latter, the frame having an aperture therethrough for the passage of the armature.

The invention also comprises an electromagnetic bell unit when made by the said method.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a sectional view of an electromagnetic bell unit which has been made by the method according to the present invention;

Figure 2 is a plan view of the bell unit shown in Figure 1;

Figure 3 is a plan view of a drive block forming part of the structure shown in Figure 1;

5 Figure 4 is a front view of the said drive block, the parts of the latter being shown in different relative positions to those shown in Figure 1; and Figure 5 is a right side view of the said drive block.

Referring to the drawings, an electromagnetic bell
10 unit has a drive block which comprises a substantially U-shaped yoke or frame 1 which is held stationary (as described below) and which surrounds a coil 2 which is disposed within the yoke 1. The yoke 1, to which the coil 2 is fixed, has a bell hammer adjustable fixing device 1a
15 formed integrally with one of the corners of the yoke 1 and extending upwardly. Further, at one end of the yoke 1, there is provided an arm 9 having a hole 9b through which the yoke 1 may be screwed to a frame (not shown) of a clock.

One end of a bell hammer 3 is fixed to the adjustable
20 fixing device 1a of the yoke 1 and externally of the latter by caulking, upsetting, soldering or resistance welding. The bell hammer 3 is provided at its opposite end with a hammer head 4, a movable yoke or armature 5 made of a magnetic material being secured to the bell hammer 3
25 substantially centrally of the length thereof. The armature

5 is disposed within a hole 1d drilled in the yoke 1.

The said drive block shown is disposed within a substantially U-shaped bell 6. The hammer head 4, which is thus mounted within the bell 6, is arranged for movement into and out of a position, shown in Figure 1, in which it strikes the bell 6, the said movement being effected by the electromagnetic means constituted by the coil 2 and the armature 5 which are also disposed within the bell 6. The armature 5 is spaced from the coil 2 when the latter is de-energized as shown in Figure 1, energization of the coil 2 causing the armature 5 to be attracted to the coil 2, as shown in Figure 4, the aperture 1d permitting passage therethrough of the armature 5. The bell 6 is provided with a recess 6a through which extends the arm 9 of the yoke 1.

The bell 6 may be provided with a hole (not shown) so that the adjustable fixing device 1a of the yoke 1 can be adjusted by the insertion of a jig (not shown) into the said hole. That is, by adjusting the angle of the adjustable fixing device 1a, the distance between the hammer head 4, when the latter is at rest, and the bell 6 can be adjusted so that an adjustment of the sound volume and quality is facilitated even after the bell unit has been assembled in the clock.

A method of spot-welding the bell 6 and the yoke 1 together will now be described. As indicated above, one end of the bell hammer 3 is secured to the yoke 1, the other

end of the bell hammer 3 being provided with the hammer head 4. The coil 2 is secured to the yoke 1 and the armature 5 is secured to the bell hammer 3 and thus also to the yoke 1. The yoke 1, together with the bell hammer 3, hammer head 4, coil 2 and armature 5, are mounted in the space in the U-shaped bell 6 so that the hammer head 4 may be moved by the coil 2 and armature 5 into and out of a position in which it strikes the bell 6. At this time, a dowel or projection 1b formed on the yoke 1 is thrust into contact with the inner side of the base portion of the U-shaped bell 6 at a suitable pressure, and a spot-welding electrode 7 is brought into contact with the outer side of the base portion of the bell 6. At the same time, another electrode 8 is brought into contact with the yoke 1 by inserting the electrode 8 through an aperture or boring 6b in the base portion of the bell 6. Then, when a voltage is applied across the electrodes 7, 8 in the above state, the current flows through the electrode 7, the bell 6, the projection 1b, the yoke 1 and the electrode 8, and as a result the projection 1b is spot-welded to the bell 6 at the contact area therebetween, such contact area being adjacent the aperture 6b.

Thus the bell 6 and yoke 1 are spot welded together in a limited contact area only, i.e. the contact area provided by the projection 1b whose width, or greatest width, for example may be not more than one fifth that of the bell 6. The bell 6

and yoke 1 are of course spaced from each other except at the projection 1b.

Thus even though the electrode 7 cannot be inserted into the bell 6 because of the existence of the coil 2 within the yoke 1, the spot-welding of the yoke 1 and bell 6 is possible. Moreover, the aperture 6b may, for example, have a diameter, or maximum diameter, which is not more than three times that of the electrode 8. In this case, there is almost no trace of welding on the outer bottom surface of the bell 6 so that the external appearance of the bell is not spoiled.

In the construction described above, the drive block comprising the coil, yoke and bell hammer is housed within the bell and the bell is fixed to the yoke so that the entire structure of the bell unit is miniaturized, the construction of the unit is simplified and the number of parts and the assembly labour are reduced, thereby lowering the manufacturing costs.

Further, the angle of the bell hammer 3 can be adjusted in a simple manner even after assembly and the distance between the hammer head 4 and the bell 6 can also be adjusted.

Moreover, due to the fact that the bell 6 and the yoke 1 can be spot-welded by bringing one of the electrodes 8 into contact with the yoke 1 through the aperture 6b of the base portion of the bell, even though the other electrode 7

cannot be inserted into the bell 6 from the open side of the latter because of the existence of the coil 2, spot-welding of a sufficient strength can be performed in a simple manner. Further, since each of the electrodes 7, 8 can be used from the same direction, the welding operation is simplified and as there need be no substantial trace of welding, the external appearance of the bell unit is not spoiled.

The use of spot welding, moreover, enables the number of component parts of the bell unit to be reduced and its assembly to be simplified.

Although the present invention has been described with reference to its use in connection with a bell unit, it is also applicable to other constructions in which it is difficult to weld two members together by the use of electrodes which are respectively disposed on opposite sides of the members but in which one of the members can be provided with an aperture for the passage therethrough of one of the electrodes so that both electrodes are disposed on the same side of the two members.



C L A I M S

1. A method of spot welding first and second electrically conductive members to each other comprising establishing contact between the first and second members in a limited contact area only; establishing contact between a first
5 electrode and the first member; passing a second electrode through an aperture in the first member to a position in which it contacts the second member; and passing an electrical current through the first and second electrodes so as to spot weld the first and second members to each other at the said
10 limited contact area.
2. A method as claimed in claim 1 in which the aperture has a diameter, or maximum diameter, which is not more than three times that of the second electrode.
3. A method as claimed in claim 1 or 2 in which the second
15 member is mounted within a space in the first member.
4. A method as claimed in claim 3 in which the first member is U-shaped, the said limited contact area being disposed at the base portion of the U-shaped first member.
5. A method as claimed in any preceding claim in which
20 the second member has a projection which contacts the first member in the said limited contact area, the first and second members being spaced from each other except at the said projection.



6. A method as claimed in claim 5 when dependent upon claim 4 in which the width, or the greatest width, of the projection is not more than one fifth that of the U-shaped first member.

5 7. A method as claimed in any preceding claim in which the first member is a bell, the second member being a frame which is mounted within the bell, the frame carrying both a bell hammer and electromagnetic means for moving the bell hammer into and out of a position in which it strikes the
10 bell.

8. A method as claimed in claim 7 in which the electromagnetic means comprises a coil which is carried by the frame and an armature which is carried by the bell hammer and which is spaced from the coil when the latter is de-energized,
15 energization of the coil causing the armature to be attracted to the coil.

9. A method as claimed in claim 7 or 8 in which one end of the bell hammer is secured to the frame by means of an adjustable fixing device which enables the spacing between
20 a hammer head of the bell hammer, when at rest, and the bell to be adjusted.

10. A method as claimed in any of claims 7-9 in which the frame is U-shaped.

11. A method as claimed in claim 10 when dependent upon claim 8 in which the coil is disposed within the U-shaped frame, the bell hammer being disposed externally of the latter, the frame having an aperture therethrough for the passage of the armature.

12. A method of spot welding first and second electrically conductive members to each other substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

13. An electromagnetic bell unit when made by the method claimed in any preceding claim.

~~14. Any novel integer or step or combination of integers or steps, hereinbefore described, irrespective of whether the particular claim is within the scope of, or relates to the same or a different invention from that of the preceding claims.~~

~~15. A method of spot welding characterised in that it comprises bringing a first member and a second member into mutual contact with a small contacting area and boring an aperture through a portion of the first member; bringing a first electrode into contact with the first member, and inserting a second electrode through said aperture so as to bring the second electrode into contact with the second member; and spot welding said contacting location by passing an electrical current through the first and second electrodes.~~
