

"ELECTROMAGNETIC BELL UNIT"

The present invention relates to an electromagnetic bell unit.

According to the present invention, there is provided an electromagnetic bell unit comprising a substantially U-shaped bell; a frame which is mounted within and fixed with respect to the bell; a bell hammer which is mounted within the bell and one end of which is secured to the frame, the other end of the bell hammer being provided with a hammer head which is arranged for movement into and out of a position in which it strikes the bell; electromagnetic means for effecting the said movement, the electromagnetic means being disposed within the bell; and stop means which are normally spaced from the frame, the stop means being engageable with the frame for resisting movement of the latter when the unit is subjected to shock.

The electromagnetic means preferably 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, energization of the coil causing the armature to be attached to the coil.

Preferably, the said ~~other~~^{one} end of the bell hammer is secured to the frame by means of an adjustable fixing device which enables the spacing between the hammer head, when at rest, and the bell to be adjusted.

The bell may be provided with a hole for the passage therethrough of a tool by means of which the adjustable fixing device may be adjusted.

Preferably, the frame is substantially U-shaped

and the coil is disposed within the U-shaped frame, the bell hammer being disposed externally of the latter, the U-shaped frame having an aperture therethrough for the passage of the armature.

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

10 The frame may if desired be fixed with respect to the bell by virtue of being provided with an arm which is secured to fixed structure.

15 The frame and the bell may be provided respectively with holes in which is mounted a positioning member for positioning the frame with respect to the bell.

20 The electromagnetic bell unit may be made by a method comprising securing the said one end of the bell hammer to the frame; securing the electromagnetic means to the frame; mounting the frame together with the bell hammer, hammer head and electromagnetic means within the bell, the latter having a through hole therethrough, the frame and bell being in contact with each other at a contact area adjacent the said through hole; bringing a first electrode into contact with the bell adjacent said contact area; passing a second electrode through the
25 through hole in the bell so as to contact the frame; and applying a voltage between the first and second electrodes so that the bell and frame are spot welded to each other at the said contact area.

30 In a preferred embodiment of the present invention, the electromagnetic bell unit is miniaturized and the number of parts and the amount of labour required for assembly are considerably reduced. Moreover, the bell hammer of the unit can be adjusted in

a simple manner even after the unit is assembled. The construction is also strong enough to withstand impacts applied thereto as a result of the unit being dropped. Additionally, the construction enables a bell and a frame or yoke of the bell unit to be firmly welded together in a simple manner.

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 according to the present invention;

Figure 2 is a view generally similar to (but upside down with respect to) Figure 1 but illustrating a method of spot welding the components of the unit together; and

Figure 3 is a plan view of the structure shown in Figure 2.

Figure 1 shows an embodiment of an electromagnetic bell unit according to the present invention. As shown therein, a drive block 8 comprises a substantially U-shaped yoke or frame 1 which is held stationary (as described below) so as to surround 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 formed integrally with one of the corners of the yoke 1. Further, at one end of the yoke 1, there is provided an arm 23 having a hole through which the yoke 1 is screwed to a fixing member 11.

One end of a bell hammer 3 is fixed to the adjustable 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 substantially at the

centre thereof. The movable yoke 5 is disposed within an aperture drilled in the yoke 1.

The structure described above 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 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, energization of the coil 2 causing the armature 5 to be attracted to the coil 2, the said aperture in the yoke 1 permitting such passage of the armature 5. The bottom of the bell 6 is fixed to the yoke 1 through a dowel 1e of the yoke 1 by means of a screw, caulking, upsetting, or resistance welding. The bell 6 is provided with a recess 6a through which extends the arm 23 of the yoke 1 which passes outwardly of the bell 6.

Further, the bell 6 may be provided with a hole (not shown) which is aligned with the adjustable fixing device 1a so that the latter can be adjusted by the insertion of a jig into the said hole. That is, by altering 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.

At the bottom of the bell 6, there is provided a hole 6c which is slightly larger than, and is drilled at a position corresponding to a hole 8a in the yoke 1.

A frame 10 of a clock is provided with a positioning member 9 and with the said fixing member 11

which is in the form of a rod, both said members extending upright from the frame 10.

With the above structure, when the positioning member 9 is fitted into the hole 6c of the bell 6 and into the hole 8a of the yoke 1, and then the arm portion 23 of the yoke 1 is screwed to the fixing member 11, the entire drive block 8 is fixed to the frame 10. As a consequence, it is possible to fix the drive block 8 simply and firmly by screwing the drive block 8 to the frame 10 at a single spot.

Further, the diameter of the hole 6c of the bell 6 is made larger than that of the positioning member 9 so that the bell 6 and the positioning member 9 do not come into contact with each other. Therefore, the bell 6 comes into contact only with the yoke 1, at the bottom of the former, thereby maintaining the required volume of sound.

A stop rod 12 is formed integrally with, or is separately attached to, the frame 10. One end of the stop rod 12 faces one end of the yoke 1 leaving a small clearance from the latter. The stop rod 12 may be adjusted to prevent the yoke 1 from becoming disconnected or deformed due to a possible impact resulting from the clock being dropped or from other causes. For example, if an impact is applied to the yoke 1, in the upward direction as seen in Figure 1 because the clock has been dropped, one end of the yoke 1 is brought into abutment with the adjacent end of the stop rod 12 so that the disconnection of the arm 23 of the yoke 1 with respect to the fixing member 11 of the clock frame, or the deformation of the yoke 1, is prevented.

A method of spot-welding the bell 6 and the yoke 1 together will now be described. As shown in Figures 2 and 3, 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 within the 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 the dowel 1e formed on the yoke 1 is thrust into contact with the bell 6 at a suitable pressure, and a spot-welding electrode 13 is brought into contact with the bottom of the bell 6. At the same time, another electrode 14 is brought into contact with the yoke 1 by inserting the electrode 14 into the hole 6c of the bell 6. Then, when a voltage is applied across the electrodes 13 and 14 in the above state, the current flows through the electrode 13, the bell 6, the dowel 1e, the yoke 1 and the electrode 14, and as a result the dowel 1e is spot-welded to the bell 6 at the contact area therebetween, such contact area being adjacent the hole 6c.

Thus even if the electrode 13 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, 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 constructions shown in the drawings, 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, if a bell hammer adjusting hole is drilled in the bottom surface of the bell 6, 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.

In addition, the bell 6 and the yoke 1 can be fixed simply and firmly by inserting the positioning member 9 into the holes 6c, 8a of the bell 6 and the yoke 1' respectively and then the arm 23 of the yoke 1 can be fixed to the fixing member 11. In this case, as the yoke 1 is directly fastened to the fixing member 11, the bell 6 is kept out of contact with the other members and the quality of the sound of the bell is not affected adversely, thereby ensuring a favourable sound.

Moreover, due to the fact that the bell 6 and the yoke 1 can be spot-welded to each other by bringing one of the electrodes 13, 14 employed into contact with the yoke 1 through the hole 6c of the bottom surface of the bell 6, even if the other electrode 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 13, 14 can be used from the same direction, the welding operation is simplified and as there is no trace of welding, the external appearance of the bell unit is not spoiled.

In our co-pending British patent application No. 8925306, which contains subject matter divided out of the present application, we have disclosed and claimed an electromagnetic bell unit comprising
5 a bell; a bell hammer which is mounted within the bell and which has a hammer head at one end thereof which is arranged for movement into and out of a position in which it strikes the bell, electro-magnetic means for effecting the said movement,
10 the electromagnetic means being disposed within the bell; the other end of the bell hammer being secured by way of an adjustable fixing device to a frame which is itself mounted within and fixed with respect to the bell; and the bell being
15 provided with a hole for the passage therethrough of a tool by means of which the adjustable fixing device can be adjusted so as to adjust the spacing between the hammer head, when at rest, and the bell.



CLAIMS

1. An electromagnetic bell unit comprising a substantially U-shaped bell, a frame which is mounted within and fixed with respect to the bell, a bell hammer which is mounted within the bell and one end of which is
5 secured to the frame, the other end of the bell hammer being provided with a hammer head which is arranged for movement into and out of a position in which it strikes the bell; electromagnetic means for effecting the said movement, the electromagnetic means being disposed
10 within the bell; and stop means which are normally spaced from the frame, the stop means being engageable with the frame for resisting movement of the latter when the unit is subjected to shock.

2. An electromagnetic bell unit as claimed in
15 claim 1 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, energization of the coil causing the armature to be attracted to the
20 coil.

3. An electromagnetic bell unit as claimed in claim 1 or 2 in which the said ~~other~~^{one} end of the bell hammer is secured to the frame by means of an adjustable
fixing device which enables the spacing between the
25 hammer head, when at rest, and the bell to be adjusted.

4. An electromagnetic bell unit as claimed in claim 3 in which the bell is provided with a hole for



the passage therethrough of a tool by means of which the adjustable fixing device may be adjusted.

5 5. An electromagnetic bell unit as claimed in ^{claim 2} ~~any preceding claim~~ in which the frame is substantially U-shaped and the coil is disposed within the U-shaped frame, the bell hammer being disposed externally of the latter, the U-shaped frame having an aperture therethrough for the passage of the armature.

10 6. An electromagnetic bell unit as claimed in any preceding claim in which the frame is fixed with respect to the bell by virtue of being provided with an arm which is secured to fixed structure.

15 7. An electromagnetic bell unit as claimed in any preceding claim in which the frame and the bell are provided respectively with holes in which is mounted a positioning member for positioning the frame with respect to the bell.

20 8. An electromagnetic bell unit as claimed in any preceding claim when made by a method comprising securing the said one end of the bell hammer to the frame; securing the electromagnetic means to the frame; mounting the frame together with the bell hammer, hammer head and electromagnetic means within the bell, the latter having a through hole therethrough, the frame and
25 bell being in contact with each other at a contact area adjacent the said through hole; bringing a first electrode into contact with the bell adjacent said contact area; passing a second electrode through the through hole in the bell so as to contact the frame; and
30 applying a voltage between the first and second electrodes so that the bell and frame are spot welded to each other at the said contact area.

9. An electromagnetic bell unit substantially as hereinbefore described with reference to and as shown

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in the accompanying drawings.

