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(54) Electrically conductive component

(57) A button battery for e.g. an electrically powered wrist watch has the two pressings 17 of its outer housing formed from stainless steel having a substantially smooth surface finish. In order to provide good electrical contact with the electrolyte structure of the battery the base of each housing is roughened by stamping with a press tool surface roughened by spark erosion.

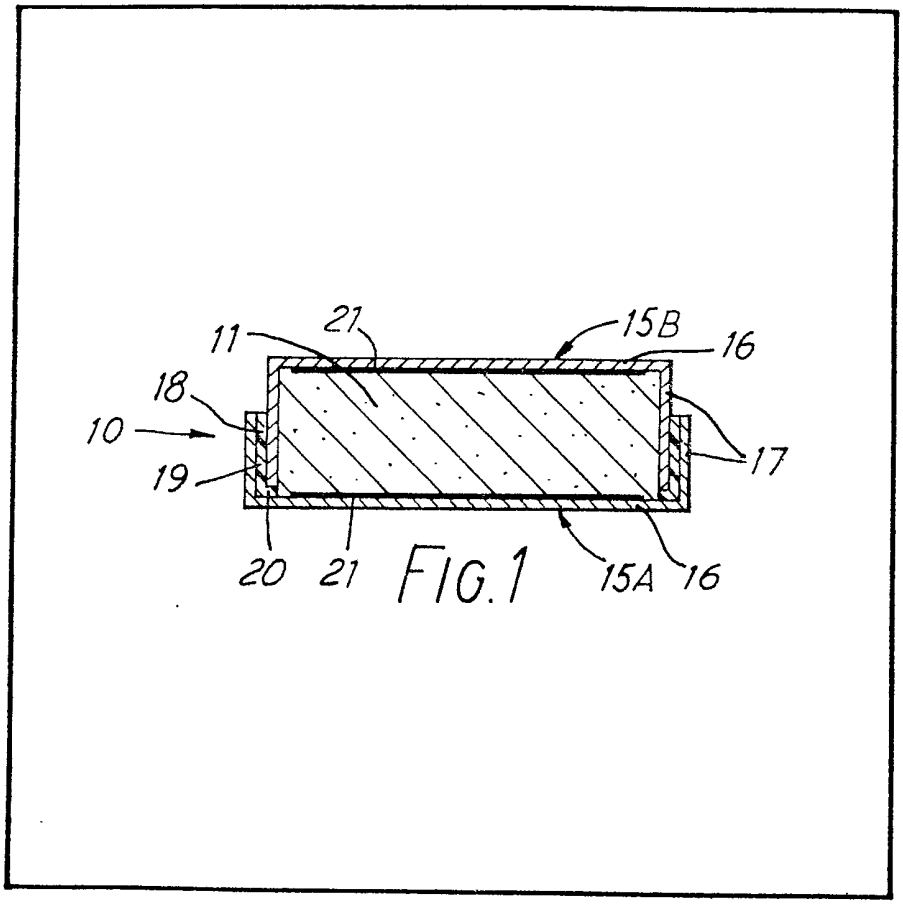

FIG.1

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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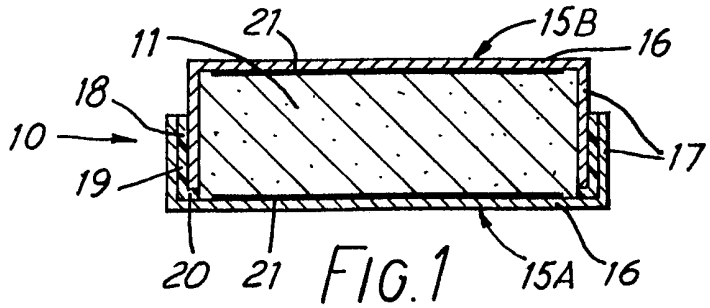

FIG.1

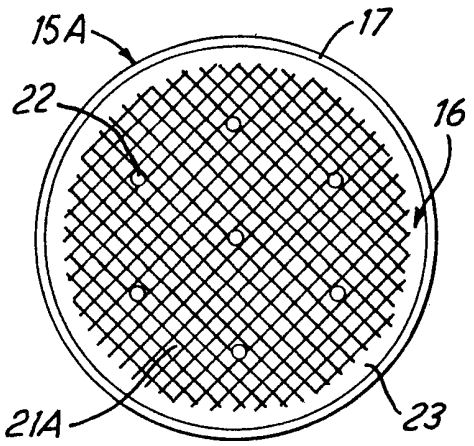

FIG.2

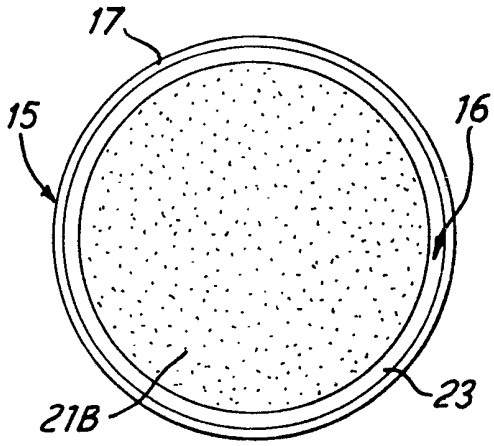

FIG.3

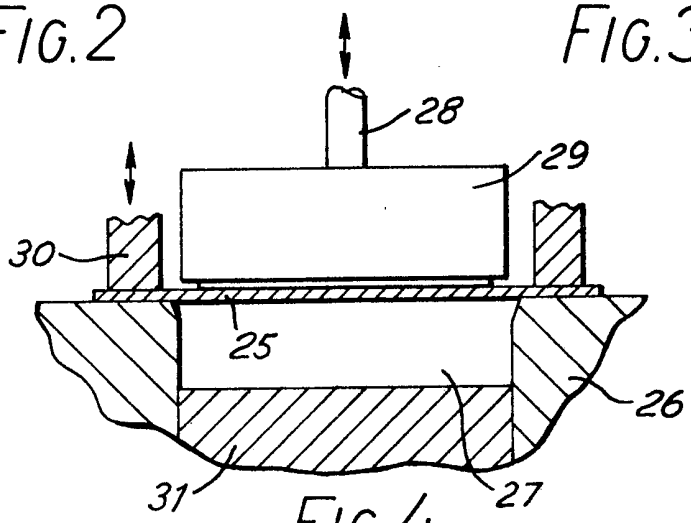

FIG.4

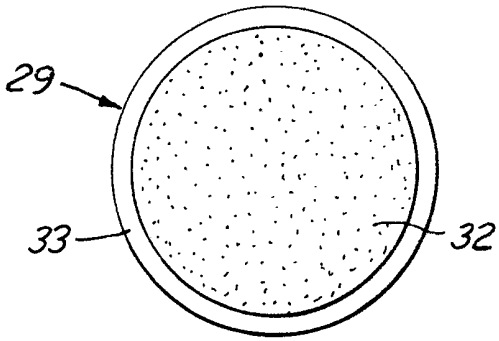

FIG.5

SPECIFICATION

Electrically conductive component

This invention relates to dry batteries, in particular (but not exclusively) button batteries for use in electrically powered wrist watches and other electrically powered devices.

Button batteries conventionally have a housing formed by two similar metal pressings having a flat base and an upturned peripheral rim, the pressings being disposed with their rims concentric and separated by an insulating spacer formed by a sleeve of insulating material. The housing acts as a container for the electrolyte structure of the battery; moreover, the pressings form the two battery electrodes, and for that purpose are each required to make good electrical contact with the electrolyte structure. In this respect it will be understood that the electrolyte structure is generally in the form of a non-homogeneous pasty mass in contact with the electrodes at each end.

For corrosion resistance the pressings are conventionally made from stainless steel sheet, but because of the smooth surface which this material normally presents it has hitherto been the practice to spot weld a disc of stainless steel mesh to the base of each pressing within the housing; in this way the surface area presented by the pressing to the electrolyte structure is increased, and a secure, low-resistance electrical contact between them can be achieved.

However, the provision of the discs and their location and attachment to the pressings represent a substantial production cost of the button battery as a whole, and it is one object of the present invention to provide a pressing for the housing of a button battery which has no such disc and yet which is nevertheless capable of making a satisfactory electrical contact with the electrolyte structure of the assembled battery. In accordance with the invention from a first aspect, therefore, there is provided an electrically conductive component for the housing of a dry battery, the component being intended to make electrical contact with the electrolyte structure of the battery but being formed from metal sheet having a substantially smooth surface finish, at least a substantial part of the component at the interior surface thereof being roughened by stamping with a roughened surface of a press tool.

In accordance with the invention from a second aspect there is provided a dry battery having a housing which comprises an electrically conductive component intended to make electrical contact with the electrolyte structure of the battery but formed from metal sheet having a substantially smooth surface finish, at least a substantial part of the component at the interior surface thereof being roughened by stamping with a roughened surface of a press tool.

In accordance with the invention from a third aspect there is provided a method of forming an electrically conductive component for the housing of a dry battery intended to make electrical contact with the electrolyte structure of the battery, which comprises forming the component from metal sheet having a substantially smooth surface finish, at least a substantial part of the component at the interior surface thereof being roughened by stamping with a roughened surface of a press tool.

The roughening of the surface of the press tool is preferably effected by spark erosion, although other treatments, chemical or otherwise, are possible. Where a drawing and/or stamping operation is used to create the component from its parent sheet, the roughening is preferably achieved in the same operation as the creation of the component, by the same press tool.

The roughening of the component is preferably such as to give a surface roughness reading of at least 100 when measured by a 'Talysurf' surface smoothness testing machine. By way of comparison, the stainless steel which is conventionally used for the pressings of button battery housings has a surface roughness reading of less than 10, and typically 1—2, on the above machine.

In order that the invention may be more fully understood, a button battery in accordance with the invention will now be described, by way of example and with reference to the accompanying drawings. In the drawings:—

Figure 1 diagrammatically shows the button battery in enlarged diametral cross-section;

Figure 2 is an enlarged plan view showing the interior of a pressing for a button battery housing as at present commercially available;

Figure 3 is a plan view similar to Figure 2 of a pressing in accordance with the invention;

Figure 4 diagrammatically shows the arrangement of tooling by which the pressing of Figure 3 may be formed; and

Figure 5 shows a detail of the tooling.

Referring now to Figure 1, a button battery for a wrist watch, hearing aid, camera or like electrically powered device has a circular housing 10 within which is contained an electrolyte structure 11 generally formed of a non-homogeneous pasty mass.

The housing 10 is formed of two similar pressings 15*A*, 15*B* made from stainless steel sheet which on both sides has a surface roughness tyipcally of 1—2(×10—5 ins) as measured by a 'Talysurf' surface smoothness testing machine. Each pressing 15 has a flat base 16 and a shallow cylindrical rim 17 upstanding peripherally and integrally around the base. The pressing 15*A* has a larger diameter than the pressing 15*B*.

The pressings are disposed with their bases 16 in parallel relation and with their rims 17 mutually concentric, the rim of the pressing 15*B* being disposed within, and in partially overlapped relation to, that of the pressing 15*A*.

A spacing sleeve 18 of a suitable thermoplastics or thermosetting material (e.g. high density polyethylene, polypropylene or nylon)

attaches the pressings together as a liquid and gas-tight enclosure for the electrolyte structure 11, whilst insulating pressings electrically from one another.

The sleeve 18 is generally L-shaped in cross-section, having a longer limb 19 which separates the rims 17, and a shorter limb 20 which separates the free edge of the innermost rim 17 from the adjacent base 16 of the pressing 15*A*. It will therefore be seen that the shorter limb accurately determines the thickness of the battery; its own material thickness is chosen accordingly.

The pressings are attached together through the agency of the sleeve 18. After the pressings have been assembled together with the sleeve between them, a bead (not shown) is rolled in the rim 17 of the pressing 15*A* in correspondence with a preformed bead (not shown) in the rim of the pressing 15*B*. The deformation of the sleeve into the inner bead, and the engagement of the outer bead in the deformity, serve to lock the pressings firmly together but in an insulating manner.

In use of the battery the pressings 15 are required to act as the positive and negative battery electrodes. However, the stainless steel of which they are made is substantially smooth, and in order to ensure a secure and low-resistance connection with the electrolyte structure the internal surfaces of their bases 16 are provided with means for increasing the surface area which they present to the electrolyte structure 11. In Figure 1 these means are generally represented by thick lines and denoted by the reference numeral 21.

Figure 2 shows one of the pressings 15*A* in a button battery which is currently marketed in UK. The means 21 of the pressing is provided by a circular disc 21*A* of stainless steel mesh which is centrally located against the inside surface of the base 16 and attached to it by spot welding at a number of discrete points 22.

The disc 21*A* is located centrally in relation to the pressing, and has a diameter such as to leave a surrounding annular space 23 at which the shorter limb 20 of the spacing sleeve 18 may closely engage the base 16. It will be appreciated that the formation of the disc and its location and attachment on the base represent substantial material and production costs. Although not shown, it is to be understood that the pressing 15*B* for the battery is similarly provided with a stainless steel disc 21*A*; an annular space 23 may however, be absent from this pressing.

Figure 3 shows one of the pressings 15 for a button battery in accordance with the invention. Instead of the separately provided disc 21*A* the pressing has a corresponding region 21*B* over which the internal surface of the base is roughened to provide asperities by which the effective surface area of the base is increased. As before, an annular clearance 23 may be provided for the spacing sleeve 18 to engage the base. The roughness of the stainless steel at the region 21*B* is at least, 100×10^{-5} ins and is typically 125×10^{-5} ins, as measured by a 'Talysurf' surface smoothness testing machine.

Figure 4 diagrammatically shows press tooling by which the pressing 15 of Figure 3 may be formed from a precut disc 25 of the parent (unroughened) stainless steel sheet. The tooling comprises a stationary female die member 26 having a cavity 27, and a punch 28 with a head 29 to force the disc into the cavity and so form it by a drawing operation with the base 16 and drawn rim 17. If desired a clamping ring 30 may be provided and arranged to lightly clamp the disc around the periphery of the head 29 and so provide peripheral restraint for the disc as drawing proceeds. The dimensions of the cavity 27 and head 29 are such that during the drawing operation they are separated by an annular clearance which is slightly greater than the material thickness of the disc 25.

The cavity 27 has a bottom defined by a member 31 arranged to eject the pressing upwardly from the cavity after the drawing operation has been completed. At the end of the drawing operation the member 31 also serves as an anvil for the head 29 to form the roughened region 21*B* (Figure 3) on the inside (i.e. upper) surface of the base of the pressing.

The head 29 is shown in underplan view in Figure 5, in which it will be seen that its undersurface is provided by a roughened central region 32, and a smooth annular margin 33 which is relieved in relation to the central region by approximately the depth of the asperities with which the central region is formed. The central region 32 of the head forms the roughening of the region 21*B* of the pressing base, the annular margin 33 corresponding to the annular clearance 23, which is accordingly unroughened. If desired the whole of the bottom surface of the head 29, and accordingly the whole of the pressing base, may be roughened.

The roughening of the central region 32 is preferably achieved by spark erosion before the head is fitted into position; however, other methods, chemical or otherwise, may be used. In one alternative, molten metal is sputtered onto the head.

Although of particular application to button batteries, the invention may be applied to other dry batteries having housing components which are electrically conductive and intended to make electrical contact with the electrolyte structure of the battery, but which are made from metal sheet usually having a substantially smooth surface finish.

Claims

1. An electrically conductive component for the housing of a dry battery, the component being intended to make electrical contact with the electrolyte structure of the battery but being formed from metal sheet having a substantially smooth surface finish, at least a substantial part of the component at the interior surface thereof

being roughened by stamping with a roughened surface of a press tool.

2. A dry battery having a housing which comprises an electrically conductive component intended to make electrical contact with the electrolyte structure of the battery but formed from metal sheet having a substantially smooth surface finish, at least a substantial part of the component at the interior surface thereof being roughened by stamping with a roughened surface of a press tool.

3. A button battery having a housing comprising two pressings each formed with a base and peripheral rim, and a spacer attaching the pressings together whilst insulating them electrically from one another, each pressing being intended to make electrical contact with the electrolyte structure of the battery but being formed from metal sheet having a substantially smooth surface finish, at least a substantial part of the pressing at the interior surface thereof being roughened by stamping with a roughened surface of a press tool.

4. A method of forming an electrically conductive component for the housing of a dry battery and intended to make electrical structure with the electrolyte structure of the battery, which comprises forming the component from sheet metal having a substantially smooth surface finish, at least a substantial part of the component at the interior surface thereof being roughened by stamping with a roughened surface of a press tool.

5. A method in accordance with claim 3, wherein the surface of the press tool is roughened by spark erosion.

6. A pressing for a button battery, substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

7. A button battery, substantially as hereinbefore described with reference to Figures 1 and 3 of the accompanying drawings.

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