

# PATENT SPECIFICATION

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## (54) APPARATUS FOR USE IN A TIMEPIECE

(71) We, KABUSHIKI KAISHA SUWA SEIKOSHA, a Japanese company of 3-4, 4-chome, Ginza, Chuo-ku, Tokyo, Japan, 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:—

This invention concerns apparatus for use in a timepiece.

Previously, in the case of a timepiece in which a photo-electric power source such as a solar battery has been attached to the timepiece dial, a lead-in wire has been employed for supplying the electricity from the photo-electric power source to a storage battery in the timepiece movement. Such a lead-in wire has had to be a long one in order to provide for the mounting and de-mounting of the dial to and from a plate of the timepiece movement to which it is secured. Such use of a long lead-in wire, however, requires a good deal of space to accommodate the wire itself, and it is liable to become twisted and to give rise to dust, while considerable labour may be involved in the mounting and removing of the dial.

According therefore to the present invention, there is provided apparatus for use in a timepiece comprising a timepiece dial made of an electrically insulating material, said dial carrying at least one electrode which is adapted to form one part of an electrical plug and socket connection to another part, and the dial also carrying a photoelectric power source which is electrically connected, directly or indirectly, to the or each said electrode.

The or each electrode may be a plug member which projects from the dial.

The or each electrode may moreover comprise a layer of electrically conductive material which is secured to a plug or

socket part of the dial. Alternatively the or each electrode may comprise an electrically conductive plug member a part of which is mounted in and secured in an aperture in the dial.

There may be two concentrically arranged electrodes the inner of which projects axially beyond the other.

The apparatus may also comprise a plate an electrically conductive portion of which forms the other part of the or each said plug and socket connection, and means for electrically connecting the or each said portion to a storage battery.

The invention also comprises a timepiece provided with apparatus as set forth above.

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

Figure 1 is a broken-away cross sectional view of one embodiment of an apparatus according to the present invention for use in a timepiece,

Figure 2 is a view similar to Figure 1 but showing another embodiment of such an apparatus,

Figure 3 is a broken-away cross sectional view of a plate of a timepiece movement to which the structure shown in either Figure 1 or Figure 2 may be plugged in.

Figure 4 is a broken-away cross-sectional view of yet another apparatus according to the present invention for use in a timepiece, and

Figure 5 is a broken-away cross-sectional view of a plate of a timepiece movement on which the apparatus shown in Figure 4 may be mounted.

In Figure 1 there is shown a timepiece dial 10 which is made of an electrically insulating material. The timepiece dial 10 is provided with an aperture 11 having an increased diameter portion 12 in which is seated a photoelectric power source such

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as a solar battery 13 which is carried by the timepiece dial 10.

The bottom surface 14 of the timepiece dial 10 is provided with a layer 15 of electrically conductive material which may be evaporated onto the bottom surface 14 or may be constituted by a thin metal leaf which is attached to the bottom surface 14 by adhesive. The layer 15 comprises at least two portions 15a, 15b which are separated and insulated from each other. The solar battery 13 has terminals which are connected by short lead-in wires 21 to the portions 15a, 15b, the lead-in wires 21 passing through the aperture 11.

An electrically conductive plug member or electrode 22 is mounted in and secured in an aperture 23 in the timepiece dial 10, the plug member 22 being electrically connected to the portion 15a (and hence to the solar battery 13) and extending through an aperture 24 in the portion 15a. The top of the plug member 22 is covered by a holder member 25 which is secured by adhesive to the timepiece dial 10 and which engages the solar battery 13 to hold the latter in position.

The embodiment of the invention shown in Figure 2 is generally similar to that of Figure 1, and for that reason will not be described in detail, like parts being given the same reference numerals. However, in the Figure 2 construction, instead of providing a separate plug member 22, the time piece dial 10 is provided with a projecting foot or plug portion 26 onto which is secured, by evaporation or by adhesive, a portion 27 of the electrically conductive layer 15. In the Figure 2 construction, moreover, a holder member 25 is not provided and the solar battery 13 is secured to the timepiece dial 10 by adhesive.

The plug member 22 of the Figure 1 construction, or the corresponding parts 26, 27 of the Figure 2 construction, is adapted to form the plug part of an electrical plug and socket connection of which the socket part is shown in Figure 3.

Referring now to Figure 3, a timepiece movement includes a plate 30 having a recess 31 in which is secured (by means of adhesive) an electrically insulating member 32. Secured (by means of adhesive) within the member 32 is an electrically conductive part 33 having a socket portion 34 for receiving the plug member 22 or the parts 26, 27. One terminal of the solar battery is connected electrically to the plate 30 when the dial 10 is attached thereto, the other terminal thereof being connected to a storage battery through the conductive part 33. The socket portion 34 has an aperture 35 extending radially therethrough in which is mounted a set screw 36. The set screw

36 may be screwed into mechanical but not electrical contact with the plug member 22 or the layer 27.

In the construction shown in Figure 4, a timepiece dial 40 of electrically insulating material has an aperture 41 therein, an increased diameter portion 42 of which serves as a seating for a solar battery 43. The timepiece dial 40 has a projecting foot portion 44 having a longitudinally extending recess 45 therein. Mounted in and secured by means of adhesive in the recess 45 is a plug electrode 46. The electrode 46 is disposed concentrically within an electrode 47 and projects axially beyond the latter. The electrode 47, which is adapted to be connected to a printed circuit on the lower side of the dial member 40, is constituted by a portion of a layer 50 of electrically conducting material which is applied to the bottom surface 51 of the timepiece dial 40 e.g. by evaporation or by a thin metal leaf secured to the surface 51 by means of adhesive.

The timepiece dial 40 has an upper surface 52 on which is mounted an electrically conducting layer 53 which is electrically connected to one electrode (not shown) of the solar battery 43. The layer 53 is secured to the upper surface 52 either by virtue of having been evaporated onto the latter, or by means of adhesive. The solar battery 43 also has terminal 54 which is electrically connected, by means of a short lead-in wire 55, to a terminal 56 at the bottom of the layer 50. The electrode 46 is thus electrically connected to the solar battery 43 by way of the layer 53, while the electrode 47 is electrically connected to the solar battery 43 by way of the layer 50.

A holder member 57 is mounted above and secured by adhesive to the layer 53, the holder member 57 serving to hold the solar battery 43 in position.

The structure shown in Figure 4 may be plugged into the structure shown in Figure 5. Referring to the latter, the timepiece movement comprises an electrically conductive plate 60 having a recess 61 therein for receiving the electrode 47, whereby the plate 60 is electrically connected to the electrode 54. At the bottom of the recess 61 there is mounted an electrically insulating plug member 62 which is secured in the recess 61 by means of adhesive. The plug member 62 carries an electrically conductive socket member 63 which is secured in the plug member 62 by adhesive and which is adapted to receive the electrode 46. Thus the socket member 63 is connected to the other electrode of the solar battery 43. A set screw 64 extends through a threaded opening 65 in the plate 60 and into the recess 61 so as to contact the electrode 47. The plate 60 and socket member

63 are connected to a storage battery (not shown).

Thus the timepiece dials 10, 40 can be mounted on and removed from the plates 5 30, 60 without using a lead-in wire between the timepiece dial and the inner portion of the timepiece, so that after-sales services on the timepiece may be more easily effected.

10 If the timepiece dial has a number of electrodes 22, or 26, 27 the electricity can be supplied not only from the photoelectric power source device, such as a solar battery, to the inner portion of the timepiece, 15 but also in addition from the storage battery and an electric circuit in the timepiece to electric elements on the dial.

WHAT WE CLAIM IS:—

20 1. Apparatus for use in a timepiece comprising a timepiece dial made of an electrically insulating material, said dial carrying at least one electrode which is adapted to form one part of an electrical plug and socket connection to another part, 25 and the dial also carrying a photoelectric power source which is electrically connected, directly or indirectly, to the or each said electrode.

30 2. Apparatus as claimed in claim 1 in which the or each electrode is a plug member which projects from the dial.

3. Apparatus as claimed in claim 1 or 2 in which the or each electrode comprises a layer of electrically conductive material which is secured to a plug or socket part 35 of the dial.

4. Apparatus as claimed in claim 1 or 2 in which the or each electrode comprises an electrically conductive plug member a part of which is mounted in and secured in 40 an aperture in the dial.

5. Apparatus as claimed in any preceding claim in which there are two concentrically arranged electrodes the inner of which projects axially beyond the other. 45

6. Apparatus as claimed in any preceding claim comprising a plate which is provided with at least one electrically conductive part which forms the said other part of the or each said plug and socket 50 connection.

7. Apparatus for use in a timepiece substantially as hereinbefore described with reference to and as shown in the accompanying drawings. 55

8. A timepiece provided with apparatus as claimed in any preceding claim.

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- 10 If the timepiece dial has a number of electrodes 22, or 26, 27 the electricity can be supplied not only from the photoelectric power source device, such as a solar battery, to the inner portion of the timepiece, but also in addition from the storage battery and an electric circuit in the timepiece to electric elements on the dial.

WHAT WE CLAIM IS:—

1. Apparatus for use in a timepiece 20 comprising a timepiece dial made of an electrically insulating material, said dial carrying at least one electrode which is adapted to form one part of an electrical plug and socket connection to another part, 25 and the dial also carrying a photoelectric power source which is electrically connected, directly or indirectly, to the or each said electrode.

2. Apparatus as claimed in claim 1 in 30 which the or each electrode is a plug member which projects from the dial.

3. Apparatus as claimed in claim 1 or 2 in which the or each electrode comprises a layer of electrically conductive material which is secured to a plug or socket part 35 of the dial.

4. Apparatus as claimed in claim 1 or 2 in which the or each electrode comprises an electrically conductive plug member a part of which is mounted in and secured in 40 an aperture in the dial.

5. Apparatus as claimed in any preceding claim in which there are two concentrically arranged electrodes the inner of which projects axially beyond the other. 45

6. Apparatus as claimed in any preceding claim comprising a plate which is provided with at least one electrically conductive part which forms the said other part of the or each said plug and socket 50 connection.

7. Apparatus for use in a timepiece substantially as hereinbefore described with reference to and as shown in the accompanying drawings. 55

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