

WM/TIM
Singapore

PATENT SPECIFICATION

(11) 1 359 624

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- (21) Application No. 43839/72 (22) Filed 21 Sept. 1972
(31) Convention Application No. 184 735
(32) Filed 29 Sept. 1971 in
(33) United States of America (US)
(44) Complete Specification published 10 July 1974
(51) International Classification G04C 21/20
(52) Index at acceptance G3T A1 A2B



(54) ELECTRIC ALARM WATCH

(71) We, TIMEX CORPORATION, a Corporation organized under the laws of the State of Delaware, United States of America, of Waterbury 20, Connecticut, 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 present invention relates to an alarm wrist watch.

In conventional electric (or electronic) alarm watches, such as known in United States Patent No. 3,462,943, a spring blade or tuning fork is vibrated at its natural frequency and co-operates with other portions of the watch to produce an audible alarm. Alarm watches *per se*, are known devices but existing alarm arrangements often are not water-proof or dust-proof. Furthermore, most alarm watches are not very efficient, that is, the alarm is often not loud enough.

It is an object of this invention to provide an improved alarm watch.

According to the invention there is provided an alarm wrist watch having electrically activated alarm means, wherein the alarm means comprises a piezoelectric resonator arranged to vibrate a portion of the watch to produce an audible sound.

The portion of the watch vibrated may be the watch dial, crystal, or parts of the bezel such as the crystal mounting ring, or such other portion of the watch would be appropriate.

A preferred embodiment of alarm wrist watch may comprise an energy cell connected to a voltage multiplying or transforming oscillator by a mechanical or electronic alarm switch which may be set to any particular time. The output of the oscillator energizes the piezoelectric resonator with AC or DC pulses to produce an audible alarm. The watch dial may be coated with a piezoelectric ceramic material, a piezoelectric ceramic material

may be mounted in the centre of the watch crystal or the crystal may be mounted on a piezoelectric ceramic ring.

The features and advantages of the present invention will be more readily appreciated from the following description given with reference to the accompanying drawings wherein:—

Figure 1 is a schematic block diagram showing the alarm portion of a wrist watch embodying the present invention; and

Figures 2 to 11 illustrate various arrangements of the piezoelectric resonator portion of the watch.

Referring to Figure 1, the alarm watch includes, in addition to a movement (not shown), a mechanical or electronic switch 11 which is settable to any particular time desired for the alarm to sound. A conventional watch energy cell 12 supplies 1.5 volts to an oscillator 13 when the switch 11 closes activating the alarm. The oscillator 13 and a voltage multiplier 14 are similar to the arrangements disclosed in our pending Application No. 51415/71 Specification No. 1349096. The 1.5 volt input is raised by the oscillator 13 and voltage multiplier 14 to a level sufficient to operate a piezoelectric resonator 15. Variations of the power supply arrangement such as using a transformer in place of the voltage multiplier 14 may be employed to operate the resonator 15 with AC or DC pulses.

The piezoelectric resonator 15 comprises any one of the arrangements shown in Figures 2 to 11. In Figure 2, for example, the resonator comprises a dial 16 which is coated with piezoelectric ceramic material 17. Upon receiving pulses from the voltage multiplier 14, the material 17 expands and contracts causing the movement of the dial 16 and crystal 18 shown in broken outline. The vibration of the dial 16 and crystal 18 produces the alarm sound. To maximize the vibration of the dial 16, it is mounted close to the edge as shown schematically with supports 19 and 20.

The numerical designations are retained

[Price 25p]

as far as possible for Figures 3 to 11 of the drawings for purposes of consistency. In Figure 3, for example, the arrangement is similar to Figure 2 except that the watch crystal 18 rests upon the dial 16. The dial 16 extends beyond the supports 19 and 20 while the crystal is of slightly different configuration.

Figure 4 is similar to Figures 2 and 3 with the prime exception that the mounting is close to the centre of the dial 16 with supports 19 and 20 being spaced in close proximity and engaging the ceramic material 17. The piezoelectric coating 17 also covers less of the dial surface.

In Figure 5, the watch crystal 18 rests upon a piezoelectric ceramic ring 21 and is vibrated up and down about the movement 25 as shown. The crystal 18 is connected to the watch case 22 by an elastic ring 23 of rubber or a similar material. Figure 6 is similar to Figure 5 with the difference that the watch crystal 18 is mounted to a piezoelectric ring 21 which is bonded to the case 22 with an elastic sealing compound 31. The ring 21 also includes a shoulder portion 24 and an upwardly extending outer portion 26 which engage the crystal 18.

In Figure 7, a disc of the ceramic material 17 is mounted to the centre of the watch crystal 18. The material 17 or the distribution thereof on the crystal should be such as not to obstruct the dial.

Figure 8 shows an alarm arrangement wherein the crystal 18 is fitted into a metal or plastics ring 27 which rests on the vibrating dial 16. The ring 27 has a cutaway upper portion 28 to accommodate the crystal 18 and a protrusion 29 to anchor the ring to the elastic sealing material 31.

Figure 9 depicts an arrangement wherein the crystal ring 27 rests upon a vibratory ceramic ring 21. It is similar in other respects to Figure 8.

Figures 10 and 11 shows two further arrangements employing piezoelectric ceramics 32 and 33, respectively. Figure 10 is similar to Figure 6 with the exception that an X-mode ceramic 32 is used rather than a Y-mode. On the other hand Figure 11 is similar to Figures 6 and 10 except that an X—Y mode piezoelectric ceramic 33 is used.

From the above embodiments, it is to be noted that complex mechanical alarm systems are avoided and a reliable, efficient and inexpensive electronic alarm wherein the alarm sound is produced by a piezoelectric resonator comprising a part of the watch such as the dial or crystal mounting ring is used. The alarm wrist watch may be readily made water-proof and dust-proof.

It is to be understood that the above-described arrangements are merely illustrative examples of the invention.

Numerous other arrangements may be readily devised by those skilled in the art which fall within the scope of the appended claims. For example, it will be noted that while some of the arrangements described use an X-mode piezoelectric ceramic, others use a Y-mode or an X—Y mode ceramic. The choice of the particular mode to use in a particular arrangement is a matter of preference and either an X-mode, a Y-mode or an X—Y mode ceramic may be used.

WHAT WE CLAIM IS:—

1. An alarm wrist watch having electrically activated alarm means, wherein the alarm means comprises a piezoelectric resonator arranged to vibrate a portion of the watch to produce an audible sound.

2. An alarm wrist watch comprising a source of electrical energy; switch means settable to any particular time for alarm purposes, a voltage multiplying means and oscillator connected in series with the switch means and the source to be activated when the switch is closed to provide output pulses, and alarm means activatable by the output pulses, said alarm means comprising a piezoelectric resonator arranged to vibrate a portion of the watch to produce an audible sound.

3. An alarm watch according to Claim 1 or Claim 2 wherein the alarm means comprises a dial coated with a piezoelectric ceramic material, the dial being mounted close to the periphery thereof, and a crystal which is not mounted on the dial but vibrates therewith.

4. An alarm watch according to Claim 1 or Claim 2 wherein the alarm means comprises a dial coated with a piezoelectric ceramic material, and a crystal resting on the dial and supported inwardly from the periphery thereof.

5. An alarm watch according to Claim 1 or Claim 2, including a crystal, wherein the alarm means comprises a piezoelectric ceramic material mounted on the crystal.

6. An alarm watch according to Claim 1 or Claim 2 including a watch case, wherein the alarm means comprises a piezoelectric ceramic ring having a crystal mounted thereon and an elastic ring joining the ceramic ring and crystal to the case.

7. An alarm watch according to Claim 1 or Claim 2 including a watch case, wherein the alarm means comprises a piezoelectric ceramic ring having a crystal mounted thereon and an elastic sealing material bonding the ceramic ring to the case.

8. An alarm watch according to Claim 1 or Claim 2 including a watch case and a crystal wherein the alarm means comprises a notched ring having the crystal periphery mounted in said notch, an elastic ring joining the notched ring to the watch case,



* C. L. N. S. *

as far as possible for Figures 3 to 11 of the drawings for purposes of consistency. In Figure 3, for example, the arrangement is similar to Figure 2 except that the watch crystal 18 rests upon the dial 16. The dial 16 extends beyond the supports 19 and 20 while the crystal is of slightly different configuration.

Figure 4 is similar to Figures 2 and 3 with the prime exception that the mounting is close to the centre of the dial 16 with supports 19 and 20 being spaced in close proximity and engaging the ceramic material 17. The piezoelectric coating 17 also covers less of the dial surface.

In Figure 5, the watch crystal 18 rests upon a piezoelectric ceramic ring 21 and is vibrated up and down about the movement 25 as shown. The crystal 18 is connected to the watch case 22 by an elastic ring 23 of rubber or a similar material. Figure 6 is similar to Figure 5 with the difference that the watch crystal 18 is mounted to a piezoelectric ring 21 which is bonded to the case 22 with an elastic sealing compound 31. The ring 21 also includes a shoulder portion 24 and an upwardly extending outer portion 26 which engage the crystal 18.

In Figure 7, a disc of the ceramic material 17 is mounted to the centre of the watch crystal 18. The material 17 or the distribution thereof on the crystal should be such as not to obstruct the dial.

Figure 8 shows an alarm arrangement wherein the crystal 18 is fitted into a metal or plastics ring 27 which rests on the vibrating dial 16. The ring 27 has a cutaway upper portion 28 to accommodate the crystal 18 and a protrusion 29 to anchor the ring to the elastic sealing material 31.

Figure 9 depicts an arrangement wherein the crystal ring 27 rests upon a vibratory ceramic ring 21. It is similar in other respects to Figure 8.

Figures 10 and 11 shows two further arrangements employing piezoelectric ceramics 32 and 33, respectively. Figure 10 is similar to Figure 6 with the exception that an X-mode ceramic 32 is used rather than a Y-mode. On the other hand Figure 11 is similar to Figures 6 and 10 except that an X—Y mode piezoelectric ceramic 33 is used.

From the above embodiments, it is to be noted that complex mechanical alarm systems are avoided and a reliable, efficient and inexpensive electronic alarm wherein the alarm sound is produced by a piezoelectric resonator comprising a part of the watch such as the dial or crystal mounting ring is used. The alarm wrist watch may be readily made water-proof and dust-proof.

It is to be understood that the above-described arrangements are merely illustrative examples of the invention.

Numerous other arrangements may be readily devised by those skilled in the art which fall within the scope of the appended claims. For example, it will be noted that while some of the arrangements described use an X-mode piezoelectric ceramic, others use a Y-mode or an X—Y mode ceramic. The choice of the particular mode to use in a particular arrangement is a matter of preference and either an X-mode, a Y-mode or an X—Y mode ceramic may be used.

WHAT WE CLAIM IS:—

1. An alarm wrist watch having electrically activated alarm means, wherein the alarm means comprises a piezoelectric resonator arranged to vibrate a portion of the watch to produce an audible sound.

2. An alarm wrist watch comprising a source of electrical energy; switch means settable to any particular time for alarm purposes, a voltage multiplying means and oscillator connected in series with the switch means and the source to be activated when the switch is closed to provide output pulses, and alarm means activatable by the output pulses, said alarm means comprising a piezoelectric resonator arranged to vibrate a portion of the watch to produce an audible sound.

3. An alarm watch according to Claim 1 or Claim 2 wherein the alarm means comprises a dial coated with a piezoelectric ceramic material, the dial being mounted close to the periphery thereof, and a crystal which is not mounted on the dial but vibrates therewith.

4. An alarm watch according to Claim 1 or Claim 2 wherein the alarm means comprises a dial coated with a piezoelectric ceramic material, and a crystal resting on the dial and supported inwardly from the periphery thereof.

5. An alarm watch according to Claim 1 or Claim 2, including a crystal, wherein the alarm means comprises a piezoelectric ceramic material mounted on the crystal.

6. An alarm watch according to Claim 1 or Claim 2 including a watch case, wherein the alarm means comprises a piezoelectric ceramic ring having a crystal mounted thereon and an elastic ring joining the ceramic ring and crystal to the case.

7. An alarm watch according to Claim 1 or Claim 2 including a watch case, wherein the alarm means comprises a piezoelectric ceramic ring having a crystal mounted thereon and an elastic sealing material bonding the ceramic ring to the case.

8. An alarm watch according to Claim 1 or Claim 2 including a watch case and a crystal wherein the alarm means comprises a notched ring having the crystal periphery mounted in said notch, an elastic ring joining the notched ring to the watch case,

and a dial having a coating of piezoelectric ceramic material mounted thereon.

- 5 9. An alarm watch according to Claim 1 or Claim 2 including a watch case and a crystal, wherein the alarm means comprises a notched ring having the crystal periphery mounted in the notch, an elastic ring joining the notched ring to the watch case, and a ring of piezoelectric ceramic material mounted on the notched ring.

- 10 10. An alarm watch according to any one of Claims 4 to 10, wherein the piezoelectric material is an X-mode ceramic.

11. An alarm watch according to any one

of Claims 4 to 10, wherein the piezoelectric material is a Y-mode ceramic. 15

12. An alarm watch according to any one of Claims 4 to 10 wherein the piezoelectric material is an X—Y mode ceramic.

13. An alarm wrist watch substantially as hereinbefore described with reference to Figure 1 and any of Figures 2 to 11 of the accompanying drawings. 20

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1974.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

