

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Watch Crown

We, THE UNITED STATES TIME CORPORATION, a Corporation organized under the laws of the State of Connecticut, United States of America, of Waterbury, 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 a waterproof watch crown.

The increased attention that the waters of the world are now receiving, for leisure activities and economic exploitation, has created a demand for a truly waterproof watch. The life of a deep sea diver may depend upon the accuracy and functioning of his watch, which he uses to time the duration of his dive.

Extensive testing, in the laboratory as well as in practical use, has shown that the present so-called "deep sea" watches often fail to exclude water from the watch works. This failure is not due to the watch case, but its crown, even when the crown is of a specially constructed "deep sea" type.

The cause of these failures was difficult to ascertain. Watches were tested under pressures equivalent to water pressure at six hundred feet and the watches worked. Surprisingly, the same watches leaked when they were tested by swimming around in a shallow pool at a depth of three or four feet. The watches could then be emptied of water and re-tested at a pressure equivalent to six hundred feet and again not leak. In contrast, other watches would leak in use at great depths and not leak in shallow water.

The requirement of water-tightness is essential to a crown for a waterproof watch intended for use under water. However, the crown must also meet the general requirements for a quality watch crown, namely that it does not wear out the tubular neck (case pendant) when it turns;

that it is relatively easy to turn; that the crown itself is not readily worn out by its turning on its pendant; and that the crown may be readily replaceable on its stem without requiring the use of special tools. In addition, preferably the crown should be relatively inexpensive. Its materials should not be costly and it should be simple to manufacture, in that it is adapted for high-speed production with high accuracy of its parts.

It is the objective of the present invention to provide a waterproof crown construction which prevents entry of water into a watch when the watch is worn under shallow or deep water, which is relatively inexpensive, and which is easily replaceable on its stem.

In accordance with the present invention, a crown is provided having an internal cavity which fits over its case pendant (the tubular neck portion of the case). An elastically deformable gasket, preferably of rubber, is compressed between the crown and the pendant to provide sealing. The gasket may be, for example, round (an "O" ring), square or "D" shaped.

A hard self-lubricating ring is provided within the cavity, either above or below the gasket, to prevent lateral motion of the crown with respect to the pendant. A metal washer is fastened on the bottom of the crown to retain the gasket and the ring in their positions.

It has been found that previous crowns permitted leakage because their gaskets were unsealed or unseated by lateral pressures on the crown. Such pressures are prevented from affecting the sealing of the crown of the present invention because of its self-lubricating ring.

Other objectives will be apparent from the detailed description of preferred embodiments given below, taken in conjunction with the accompanying drawings, in which:—

Figure 1 is a side vertical sectional view

[Price 4s. 6d.]

of an embodiment of a waterproof watch crown in accordance with the present invention; and

Figures 2 to 9 are side sectional views respectively of other embodiments of the present invention.

The waterproof crown construction shown in Figure 1 includes a crown body 1. The crown body, preferably constructed of brass or stainless steel, has teeth or serrations 2 to enable the fingers to grip the crown for turning. The crown is turned when the watch is set in either a mechanical or electric watch, and when the watch is wound in a mechanical watch. The crown body has a tubular cavity 3 forming a pedestal (centre body) 4. The pedestal 4 has internal screw threads 5 which are screwed on to the external screw threads 6 of the winding stem 7. The winding stem is connected to gears, which in a mechanical watch in one position of the crown, usually toward the case body, wind the mainspring. In its other position, usually pulled out from the case body, turning of the crown sets the hands. In an electric watch the crown usually is pulled out from the case body to set the hands.

The cavity 3 of the crown body 1 fits over the case pendant 8. The case pendant 8 is a tubular neck which is integral with a portion of the watch case, usually the bezel 30. The cavity 3 has an enlarged lower portion 9 which is adapted for the insertion of the crown members utilised to prevent entry of water from outside the crown and through the crown body and the internal opening of the case pendant and into the watch. A hard self-lubricating ring 10, preferably of plastics, is positioned at the top of cavity portion 9. The plastics ring may be relatively inexpensively moulded with great accuracy by conventional injection moulding techniques. The plastics is a self-lubricating bearing material, preferably an acetal copolymer resin. Suitable acetal copolymers include "Celcon" brand, manufactured by Celanese Corporation, or "Delrin" (registered Trade Mark) brand, manufactured by DuPont. Other suitable plastics are formed by the mixture of polytetrafluoroethylene, with polycarbonates or acetal copolymers. In addition, molybdenum-disulphide may be included in the plastics mixture to increase lubricity and reduce wear. The plastics ring has considerable compressive strength so it prevents lateral motion of the crown body 1 with respect to the pendant under lateral thrusts, such as is shown by arrow A. In addition, it prevents lateral motion of the crown body with respect to the pendant due to thrusts having similar lateral components. The plastics ring is large enough, in its internal diameter, so that it comes close to, and may even press against, the outer wall of the case pendant.

An elastically deformable gasket 11 is positioned beneath the plastics ring 10 and with-

in the lower portion 9 of cavity 3. This gasket 11, in the embodiment of Figure 1, is an "O" ring which is circular in cross section prior to the insertion of the case pendant within the cavity 3 of the crown body 1. Preferably, the "O" ring is made of rubber. The rubber preferably is of the type which is resistant to salt water and may be artificial rubber. The "O" ring is sufficiently large so that it is compressed and distorted when the crown is positioned over the case pendant. The "O" ring prevents water from seeping between the crown body and the case pendant.

A metal retaining washer 12 is glued within a ledge portion 13 of the crown body 1 or retained by the turning over of small portions of the metal of the crown i.e. by staking, to form a lip. The metal retaining washer is used to retain the "O" ring gasket 11 and the plastics ring 10 within the crown body. It is not possible to simply extend the metal retaining washer 13 as far as the case pendant and to utilise that washer to prevent lateral movement of the crown with respect to the pendant because it would rapidly wear out the case pendant when the crown is turned.

As a specific example, a crown having an internal diameter of 0.133 inches at its lower cavity section was constructed in accordance with the embodiment of Figure 1. A plastics ring having an internal diameter of 0.099 inches and an external diameter of 0.135 inches and an "O" ring rubber gasket having an external diameter of 0.143 inches and an internal diameter of 0.094 inches (all dimensions prior to insertion into the cavity) were inserted in the crown's cavity. The case pendant 8 had a diameter of 0.0982 ± 0.0002 inches at its outer circumference within the crown, providing a slight clearance between the plastics ring and the pendant. This watch would not leak under actual diving conditions and when tested at a water pressure of 267 lbs. per square inch under static conditions.

The embodiments shown in Figures 2 to 9 are similar in most of their parts to the embodiment of Figure 1 and the parts labelled with the same numerals perform the same function in the described embodiments.

In the embodiment of Figure 2 the elastically deformable gasket 14 fills the entire space between the metal retaining washer 13 and the plastics ring 10. In this embodiment the gasket 14 is an annular ring of a substantially square cross section before the case pendant is pushed within the crown. The gasket 14 is larger than the available space between the crown and the case pendant so that it is compressed when the case pendant is fitted within the crown.

In the embodiment shown in Figure 3 the elastically deformable gasket 15 is a ring, preferably of rubber, of a "D" shape, in cross

section prior to its being compressed when the case pendant is fitted within the crown.

In Figure 4 the annular rubber gasket 16 is, like the gasket 15 of Figure 3, of a "D" shape. However, gasket 16 has a cross section which tapers towards a rounded apex.

In the crown shown in Figure 5 the annular elastically deformable gasket 17 is in the form of a trapezoid in cross section. The crown of Figure 6 has an annular gasket 18 having an oval cross section.

In the crown of Figure 7 the rubber gasket 19 is in the form of a flat annular ring, i.e., shaped like a washer, prior to insertion of the case pendant within its cavity. The inner diameter of the gasket 19 is slightly smaller than the outer diameter of the case pendant 8. When the case pendant is forced up through this ring it bends the inside portion of gasket 19 upward into an open portion 20 of plastics ring 10'. The ring 10' has an inverted "L" shape. The outer portion of gasket 19 is held firmly between the bottom of ring 10' and the top of washer 12. The inner portion of gasket 19 is loose within opening 20.

In the embodiment of Figure 8 an elastically deformable gasket 21 is held, at its outer periphery, between inverted "L" shaped plastics ring 10' and the retainer washer 12. The gasket 21 is relatively thick compared to gasket 19 of Figure 7. The inner diameter of flat rubber annular gasket 21 is smaller than the outer diameter of case pendant 8 so that its inner portion is forced upward and squeezed between the case pendant 8 and the inner lower wall 22 of plastics ring 10'.

In all the embodiments a lubricating material, for example, a suitable lubricating oil, may be placed on the crown pendant prior to its being joined with the crown body, so that the gasket may more readily be turnable in relationship to the case pendant.

Modifications may readily be made within the scope of the present invention as specified in the subjoined claims. For example, the crown body and the winding stem may be made of an integral piece of metal or of a hard plastics. The plastics ring may be replaced by other relatively hard self-lubricating materials such as an oil impregnated porous metal made from sintered metal powder. As another example, in each of the embodiments of Figures 1 to 6 the position of the plastics ring and the gasket may be interchanged. The plastics ring may be placed next to the metal retaining washer and the gasket positioned on top of the plastics ring. This interchange is shown in Figure 9, which is the same as the construction of Figure 1 except that the positions of the ring and the gasket are interchanged and a lip 23 is used in place of washer 12.

WHAT WE CLAIM IS:—

1. A waterproof watch crown comprising a

crown body having an internal tubular cavity, said crown body being adapted to fit over a watch case tubular pendant; a pedestal portion affixed to said crown body within said cavity and adapted to fit within the said case pendant and to be attached to the winding stem of a watch; an elastically deformable gasket within said cavity adapted to be compressed between said crown and said pendant; and a hard ring of self-lubricating material positioned within said crown cavity, the ring being adapted to be positioned between said crown and said pendant to prevent lateral motion of said crown with respect to the pendant, and means for retaining said gasket and ring within said crown cavity.

2. A watch crown as claimed in claim 1 wherein the hard ring is made of a plastics material.

3. A watch crown as claimed in claim 2 wherein the plastics ring is of an acetal copolymer resin.

4. A watch crown as claimed in claim 1 wherein the hard ring is made of an oil impregnated sintered metal.

5. A watch crown as claimed in any one of claims 1 to 4 wherein the crown body has a plurality of external teeth or serrations.

6. A watch crown as claimed in any one of claims 1 to 5 wherein the gasket is an "O" ring which is substantially circular in cross section prior to its compression.

7. A watch crown as claimed in any one of claims 1 to 5 wherein the gasket is a ring which is substantially square in cross section prior to its compression.

8. A watch crown as claimed in any one of Claims 1 to 5 wherein the gasket is a ring which is substantially "D" shaped in cross section prior to its compression.

9. A watch crown as claimed in any one of Claims 1 to 5 wherein the gasket is in the form of a flat annular ring prior to its compression.

10. A watch crown as claimed in Claim 9 wherein the hard ring has a cross section in the form of an inverted "L".

11. A watch crown as claimed in any one of Claims 1 to 10 wherein the hard ring is positioned above the gasket and the gasket is positioned next to the retaining means.

12. A watch crown as claimed in any one of Claims 1 to 8 wherein the hard ring is positioned next to the retaining means and the gasket is positioned above the said ring.

13. A watch crown as claimed in any one of Claims 1 to 12 and having internal screw threads within its pedestal portion adapted to screw on to the winding stem.

14. A watch crown as claimed in any one of Claims 1 to 13 wherein the retaining means is a metal washer affixed to the crown to partially cover said cavity.

15. A watch crown as claimed in any one of Claims 1 to 13 wherein the retaining means

section prior to its being compressed when the case pendant is fitted within the crown.

In Figure 4 the annular rubber gasket 16 is, like the gasket 15 of Figure 3, of a "D" shape. However, gasket 16 has a cross section which tapers towards a rounded apex.

In the crown shown in Figure 5 the annular elastically deformable gasket 17 is in the form of a trapezoid in cross section. The crown of Figure 6 has an annular gasket 18 having an oval cross section.

In the crown of Figure 7 the rubber gasket 19 is in the form of a flat annular ring, i.e., shaped like a washer, prior to insertion of the case pendant within its cavity. The inner diameter of the gasket 19 is slightly smaller than the outer diameter of the case pendant 8. When the case pendant is forced up through this ring it bends the inside portion of gasket 19 upward into an open portion 20 of plastics ring 10'. The ring 10' has an inverted "L" shape. The outer portion of gasket 19 is held firmly between the bottom of ring 10' and the top of washer 12. The inner portion of gasket 19 is loose within opening 20.

In the embodiment of Figure 8 an elastically deformable gasket 21 is held, at its outer periphery, between inverted "L" shaped plastics ring 10' and the retainer washer 12. The gasket 21 is relatively thick compared to gasket 19 of Figure 7. The inner diameter of flat rubber annular gasket 21 is smaller than the outer diameter of case pendant 8 so that its inner portion is forced upward and squeezed between the case pendant 8 and the inner lower wall 22 of plastics ring 10'.

In all the embodiments a lubricating material, for example, a suitable lubricating oil, may be placed on the crown pendant prior to its being joined with the crown body, so that the gasket may more readily be turnable in relationship to the case pendant.

Modifications may readily be made within the scope of the present invention as specified in the subjoined claims. For example, the crown body and the winding stem may be made of an integral piece of metal or of a hard plastics. The plastics ring may be replaced by other relatively hard self-lubricating materials such as an oil impregnated porous metal made from sintered metal powder. As another example, in each of the embodiments of Figures 1 to 6 the position of the plastics ring and the gasket may be interchanged. The plastics ring may be placed next to the metal retaining washer and the gasket positioned on top of the plastics ring. This interchange is shown in Figure 9, which is the same as the construction of Figure 1 except that the positions of the ring and the gasket are interchanged and a lip 23 is used in place of washer 12.

crown body having an internal tubular cavity, said crown body being adapted to fit over a watch case tubular pendant; a pedestal portion affixed to said crown body within said cavity and adapted to fit within the said case pendant and to be attached to the winding stem of a watch; an elastically deformable gasket within said cavity adapted to be compressed between said crown and said pendant; and a hard ring of self-lubricating material positioned within said crown cavity, the ring being adapted to be positioned between said crown and said pendant to prevent lateral motion of said crown with respect to the pendant, and means for retaining said gasket and ring within said crown cavity.

2. A watch crown as claimed in claim 1 wherein the hard ring is made of a plastics material.

3. A watch crown as claimed in claim 2 wherein the plastics ring is of an acetal copolymer resin.

4. A watch crown as claimed in claim 1 wherein the hard ring is made of an oil impregnated sintered metal.

5. A watch crown as claimed in any one of claims 1 to 4 wherein the crown body has a plurality of external teeth or serrations.

6. A watch crown as claimed in any one of claims 1 to 5 wherein the gasket is an "O" ring which is substantially circular in cross section prior to its compression.

7. A watch crown as claimed in any one of claims 1 to 5 wherein the gasket is a ring which is substantially square in cross section prior to its compression.

8. A watch crown as claimed in any one of Claims 1 to 5 wherein the gasket is a ring which is substantially "D" shaped in cross section prior to its compression.

9. A watch crown as claimed in any one of Claims 1 to 5 wherein the gasket is in the form of a flat annular ring prior to its compression.

10. A watch crown as claimed in Claim 9 wherein the hard ring has a cross section in the form of an inverted "L".

11. A watch crown as claimed in any one of Claims 1 to 10 wherein the hard ring is positioned above the gasket and the gasket is positioned next to the retaining means.

12. A watch crown as claimed in any one of Claims 1 to 8 wherein the hard ring is positioned next to the retaining means and the gasket is positioned above the said ring.

13. A watch crown as claimed in any one of Claims 1 to 12 and having internal screw threads within its pedestal portion adapted to screw on to the winding stem.

14. A watch crown as claimed in any one of Claims 1 to 13 wherein the retaining means is a metal washer affixed to the crown to partially cover said cavity.

15. A watch crown as claimed in any one of Claims 1 to 13 wherein the retaining means

WHAT WE CLAIM IS:—

1. A waterproof watch crown comprising a



is a lip on the crown which partially covers said cavity.

16. A waterproof watch crown substantially as hereinbefore described with reference to any one of the Figures of the accompanying drawings.
- 5 17. A watch incorporating the waterproof

watch crown as claimed in any one of Claims 1 to 16.

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