April 9, 1968 R. J. GROHOSKI ET AL. 3,376,701

WATCH CROWN

Filed July 1, 1966 3 Sheets-Sheet 1

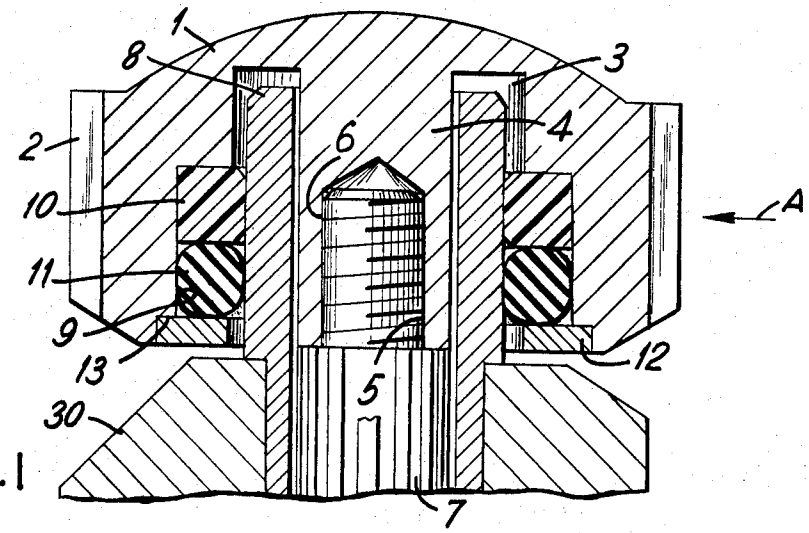

FIG. 1

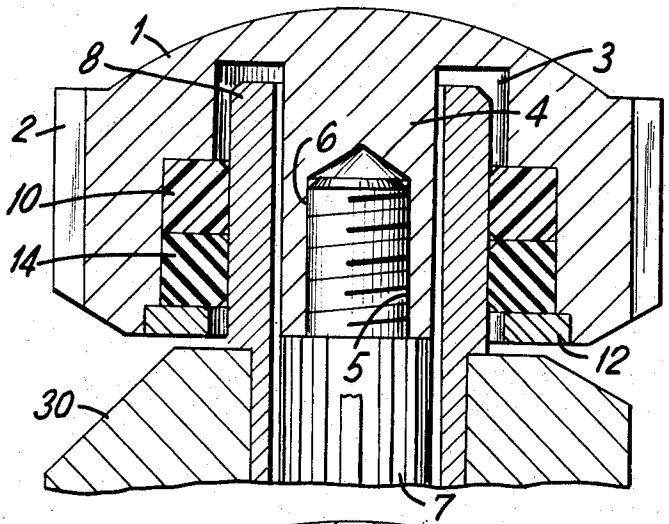

FIG. 2

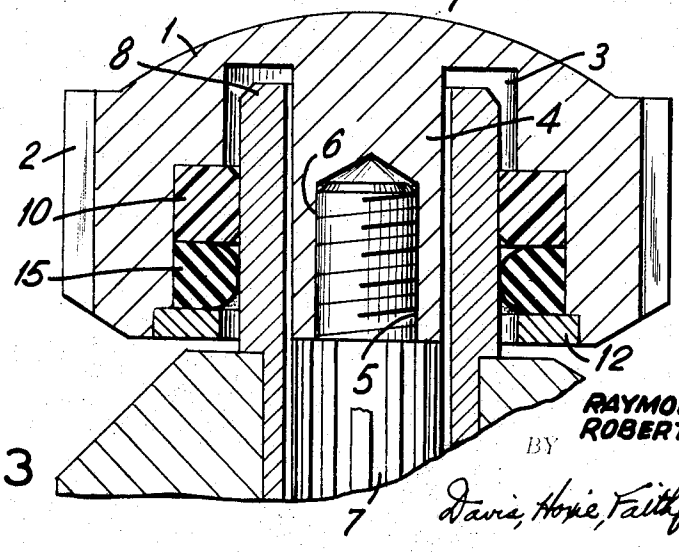

FIG. 3

INVENTORS
RAYMOND J. GROHOSKI
ROBERT W. DENLEY
BY
Davis, Hoxie, Faithfull & Hapgood
ATTORNEYS

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WATCH CROWN

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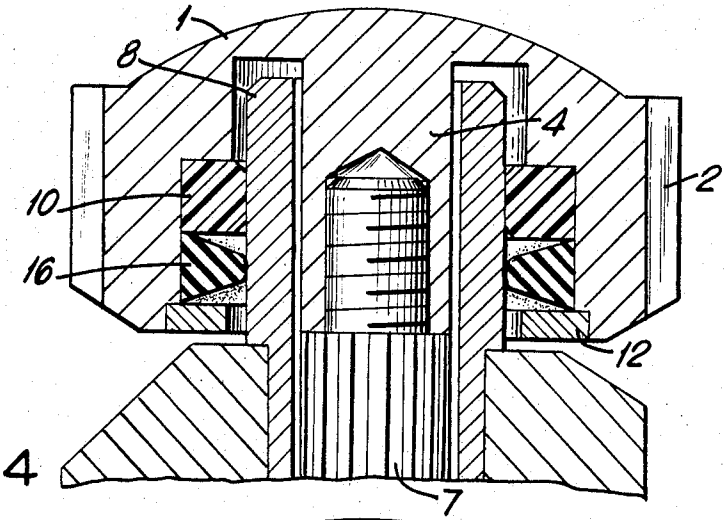

FIG. 4

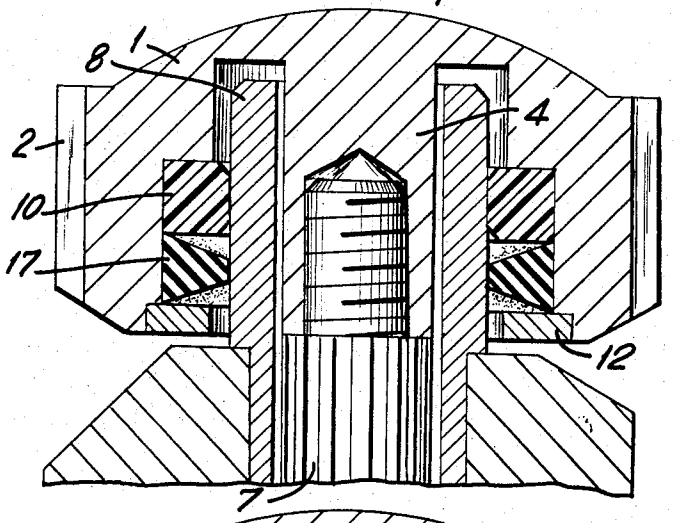

FIG. 5

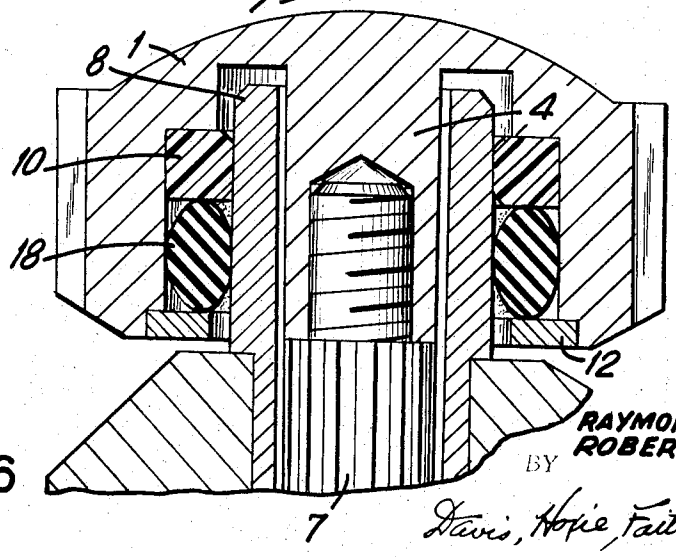

FIG. 6

INVENTORS
RAYMOND J. GROHOSKI
ROBERT W. DENLEY

BY

Davis, Hoxie, Faithfull & Hapgood
ATTORNEYS

April 9, 1968 R. J. GROHOSKI ET AL 3,376,701

WATCH CROWN

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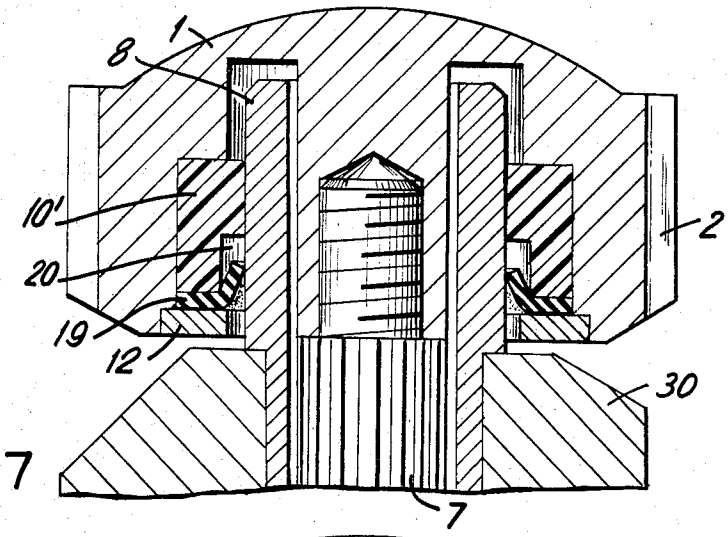

FIG. 7

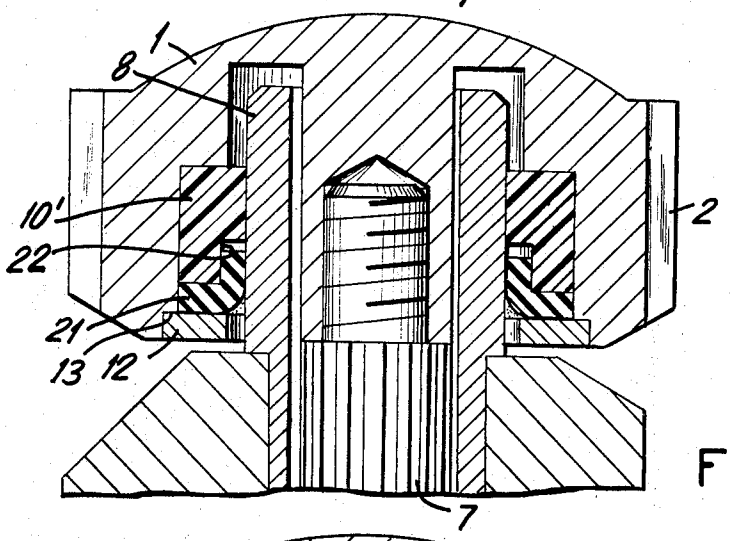

FIG. 8

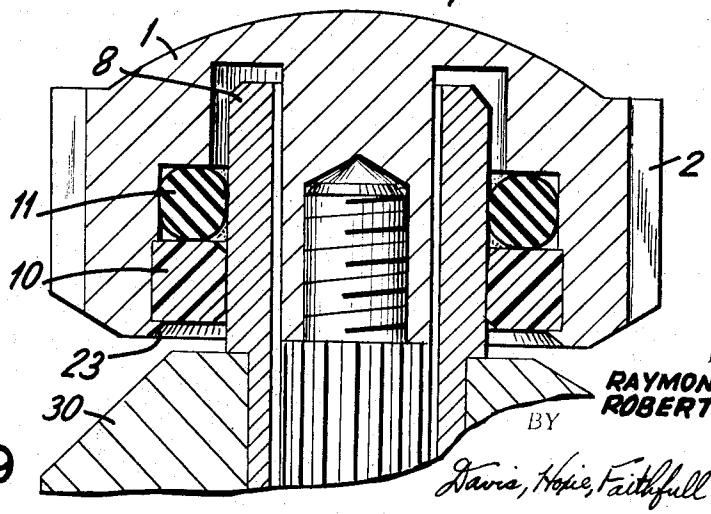

FIG. 9

INVENTORS
RAYMOND J. GROHOSKI
ROBERT W. DENLEY

BY

Davis, Hoxie, Faithfull & Hapgood
ATTORNEYS

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WATCH CROWN

Raymond J. Grohoski and Robert W. Denley, Watertown, Conn., assignors to the United States Time Corporation, Waterbury, Conn., a corporation of Connecticut

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15 Claims. (Cl. 58—90)

ABSTRACT OF THE DISCLOSURE

A crown for a watch is adapted to fit over a tubular pendant. The crown prevents leakage of water into the watch. The crown construction includes elastic annular gasket and a hard annular self-lubricating ring, both of which fit around the pendant.

The present invention relates to watches and more particularly 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 to its crown, even when the crown is of the 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 underwater. 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 elastic gasket, preferably of rubber, is tightly wedged 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 side-wise motion of the crown. A metal washer is staked 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 side-wise 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 the preferred embodiment given below, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side vertical sectional view of an embodiment of the present invention; and

FIGS. 2–9 are side sectional views of other embodiments of the present invention.

The waterproof crown construction shown in FIG. 1 includes a crown body **1**. The crown body, preferably constructed of brass or stainless steel, has teeth **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 latch is wound in a mechanical watch. The crown body has a tubular cavity **3** forming a pedestal (center body) **4**. The pedestal **4** has internal screw threads **5** which are screwed onto 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, usually toward the case body, winds the mainspring. In its other position, usually pulled out from the case body, 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 utilized to prevent entry of water from outside of 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 plastic, is positioned at the top of cavity portion **9**. The plastic ring may be relatively inexpensively molded with great accuracy by conventional injection molding techniques. The plastic is a self-lubricating bearing material, preferably an acetal copolymer. Suitable acetal copolymers include "Celcon" brand, manufactured by Celanese Corporation, or "Delrin" brand, manufactured by Du Pont. Other suitable plastics are formed by the mixture of "Teflon," Du Pont's brand of polytetrafluoroethylene, with polycarbonates or acetal copolymers. In addition, molybdenum-disulfide may be included in the plastic mixture to increase lubricity and reduce wear. The plastic ring has considerable compressive strength so it prevents side-wise motion of the crown body **1** under side-wise thrusts, such as is shown by arrow A. In addition, it prevents side-wise motion of the crown body **1** under those thrusts having side-wise components similar to the motion in the direction of arrow A.

A gasket **11** is positioned beneath the plastic ring **10** and within the lower portion **9** of cavity **3**. This gasket **11**, in the embodiment of FIG. 1, is originally 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 staked or glued within a ledge portion **13** of the crown body **1**. The metal retaining washer is used to retain the O ring gasket **11** and the plastic 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 utilize that washer to pre-

vent side-wise thrust 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 inch at its lower cavity section was constructed in accordance with the embodiment of FIG. 1. A plastic ring having an internal diameter of 0.099 inch and an external diameter of 0.135 inch and an O ring rubber gasket having an external diameter of 0.143 inch and an internal diameter of 0.094 inch (all dimensions prior to insertion into the cavity) were inserted in the crown's cavity. This watch would not leak under actual diving conditions and when tested at a pressure of 267 lbs. per square inch under static conditions.

The embodiments shown in FIGS. 2–9 are similar in most of their parts to the embodiment of FIG. 1 and the parts labeled with the same numerals perform the same function in the described embodiments.

In the embodiment of FIG. 2 the gasket **14** fills the entire space between the metal retaining washer **13** and the plastic 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 becomes under pressure when the case pendant is fitted within the crown.

In the embodiment shown in FIG. 3 the gasket **15** is a ring, preferably of rubber, of a D shape, in cross section prior to its being placed under pressure when the case pendant is fitted within the crown.

In FIG. 4 the annular rubber gasket **16** is, like the gasket **15** of FIG. 3, of a D shape. However, gasket **16** is relatively elongated in shape compared to its height.

In the crown shown in FIG. 5 the annular gasket **17** is in the form of a trapezoid in cross section. The crown of FIG. 6 has an annular gasket **18** having a cross section of an elongated rounded shape, similar in cross-section to an egg shape.

In the crown of FIG. 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 hole. The hole within the gasket **19** is slightly smaller than the outer diameter of the case pendant **8**. When the case pendant is forced up through this hole it bends the inside portion of gasket **19** upward into an open portion **20** of plastic 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 **18** is loose within opening **20**.

In the embodiment of FIG. 8 a gasket **21** is held, at its outer periphery, between inverted L shaped plastic ring **10'** and the retainer washer **12**. The gasket **21** is relatively thick compared to gasket **19** of FIG. 7. The inner hole 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 plastic 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 plastic. The plastic ring may be replaced by other relatively hard self-lubricating materials such as an artificial jewel or an oil impregnated porous metal made from sintered metal powder. As another example, in each of the embodiments of FIGS. 1–6 the position of the plastic ring and the gasket may be interchanged. The plastic ring may be placed next to the metal retaining washer and the gasket positioned on top of the plastic ring. This interchange is shown in FIG. 9, which is the same as the construction of FIG. 1 except that the position of the ring and the gasket are interchanged and a staking lip **23** is used in place of washer **12**.

We claim:

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; a hard ring of self-lubricating material within said crown cavity and adapted to be substantially pressed between said crown and said pendant to prevent side-wise motion of said crown; an elastic gasket within said cavity adapted to be compressed between said crown and said pendant; and means on said crown to partially cover said cavity and retain said ring and said gasket within said cavity.

2. A watch crown as in claim **1** wherein the hard ring is a plastic material.

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

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

5. A watch crown as in claim **1** wherein the crown body has a plurality of external teeth.

6. A watch crown as in claim **1** wherein the gasket is an O ring which is substantially circular in cross section prior to its compression.

7. A watch crown as in claim **1** wherein the gasket is a ring which is substantially square in cross-section prior to its compression.

8. A watch crown as in claim **1** wherein the gasket is a ring which is substantially D shaped in cross-section prior to its compression.

9. A watch crown as in claim **1** wherein the gasket is in the form of a flat annular ring prior to its compression.

10. A watch as in claim **9** wherein the hard ring is of the form of an inverted L.

11. A watch crown as in claim **1** wherein the hard ring is positioned above the gasket and the gasket is positioned next to the covering means.

12. A watch crown as in claim **1** wherein the hard ring is positioned next to the covering means and the gasket is positioned above the said ring.

13. A watch crown as in claim **1** and having internal screw threads within its pedestal portion adapted to screw onto a winding stem.

14. A watch crown as in claim **1** wherein the means on the crown to partially cover said cavity is a metal washer affixed to the crown.

15. A watch crown as in claim **1** wherein the means on the crown to partially cover said cavity is a staked lip on the crown.

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RICHARD B. WILKINSON, *Primary Examiner.*

S. A. WAL, M. LORCH, *Assistant Examiners.*