Oct. 27, 1970 C. J. J. ZELLWEGER ETAL 3,535,869

WATER-TIGHT WINDING STEM FOR A TIMEPIECE

Filed Aug. 15, 1968 4 Sheets-Sheet 1

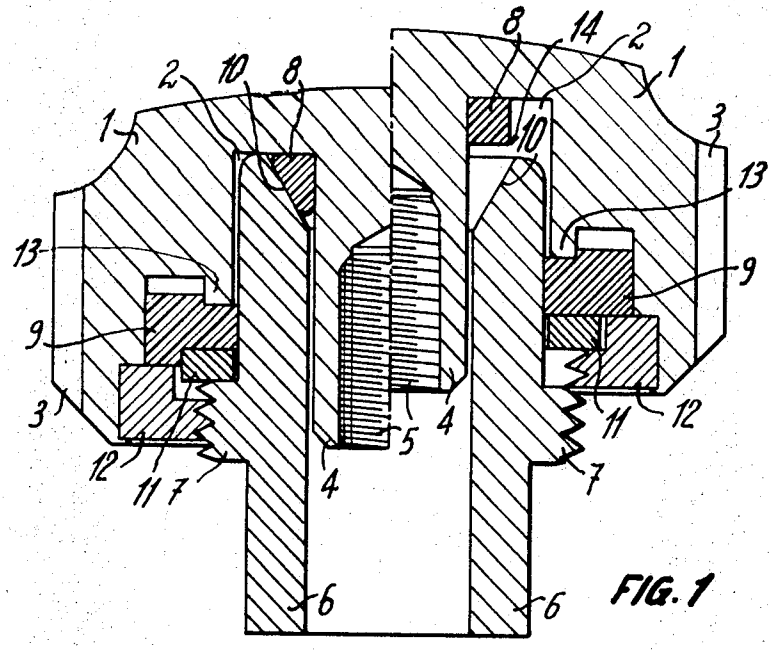

FIG. 1

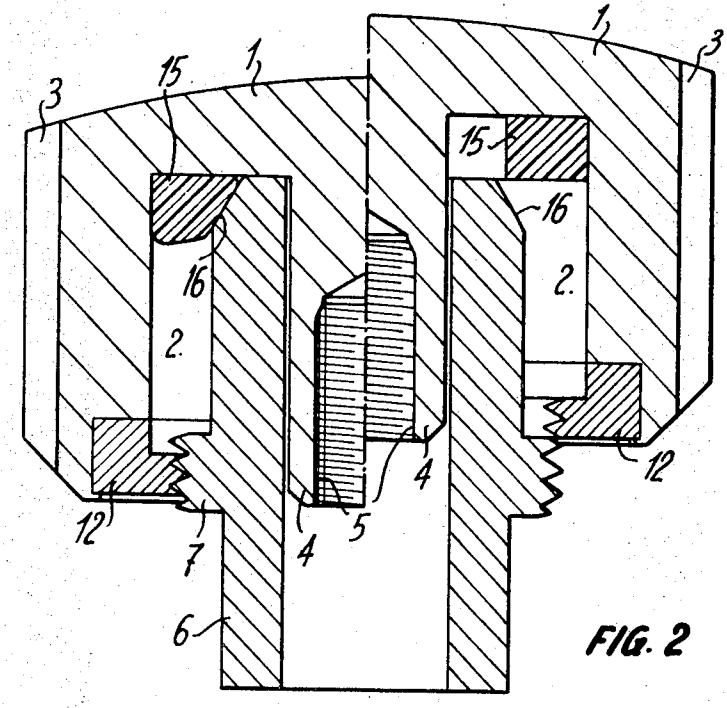

FIG. 2

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4 Sheets-Sheet 2

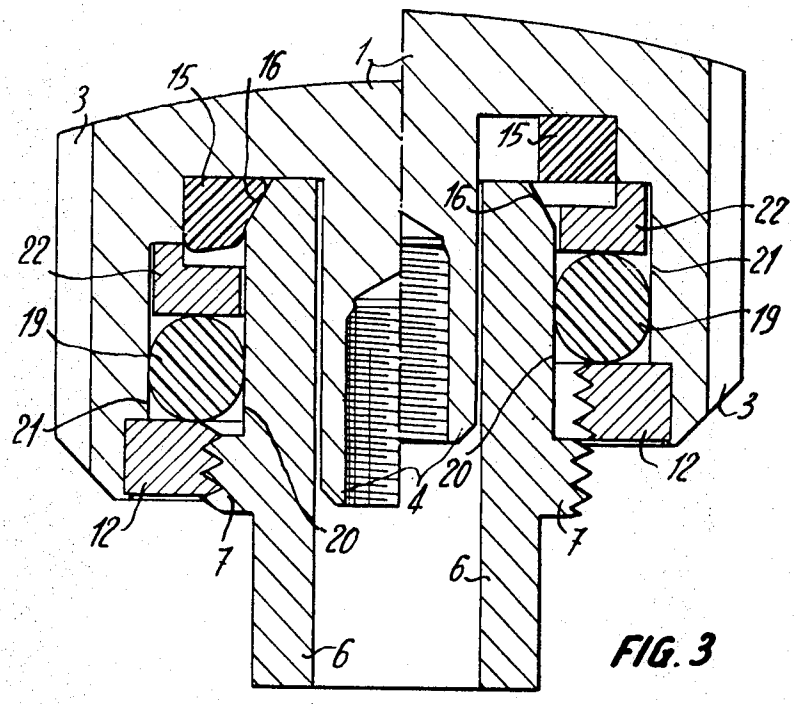

FIG. 3

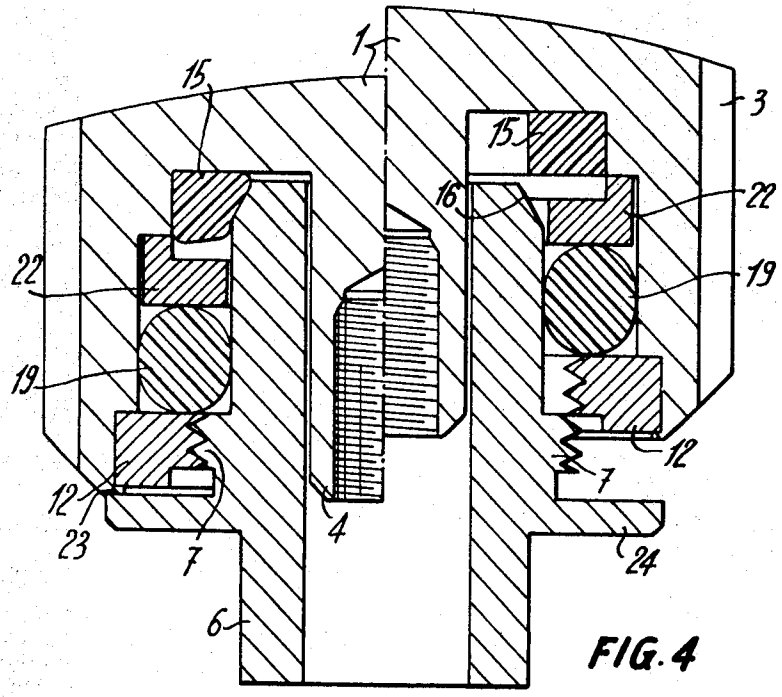

FIG. 4

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WATER-TIGHT WINDING STEM FOR A TIMEPIECE

Filed Aug. 15, 1968 4 Sheets-Sheet 3

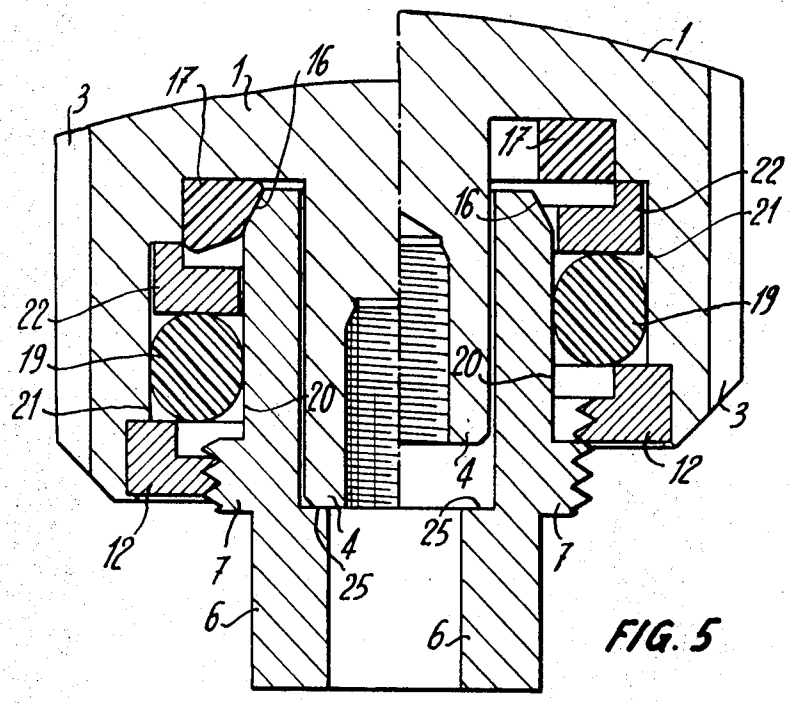

FIG. 5

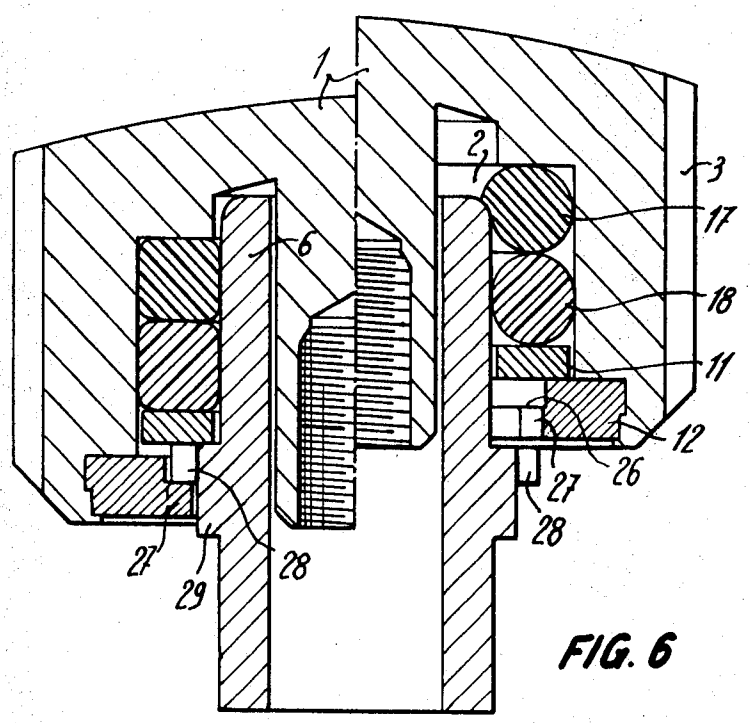

FIG. 6

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WATER-TIGHT WINDING STEM FOR A TIMEPIECE

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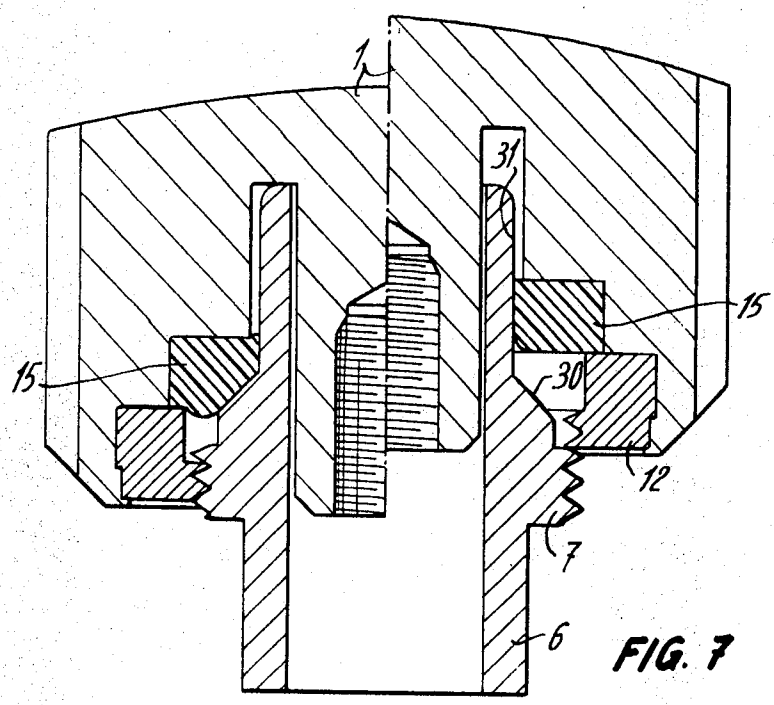

FIG. 7

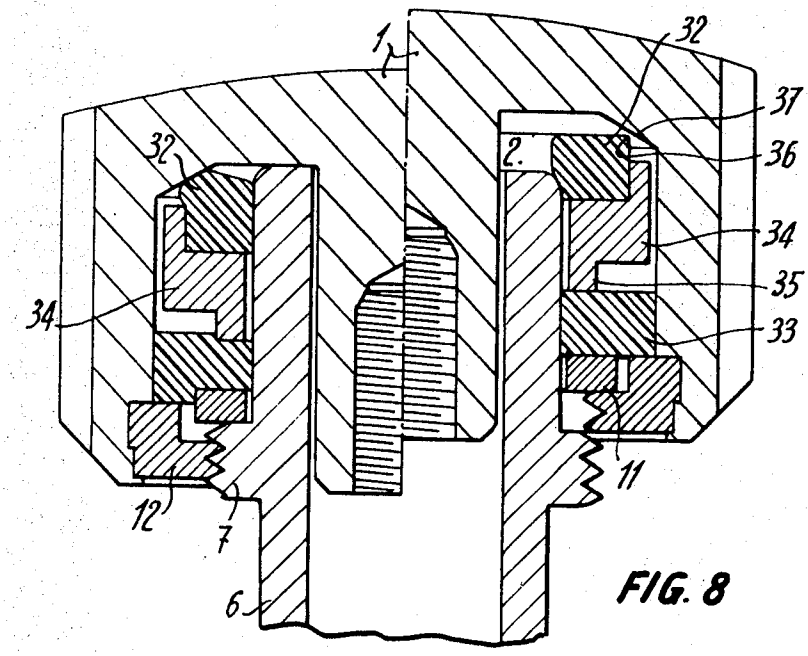

FIG. 8

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United States Patent Office

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WATER-TIGHT WINDING STEM FOR A TIMEPIECE

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Int. Cl. G04b 37/08
U.S. Cl. 58—90 20 Claims

ABSTRACT OF THE DISCLOSURE

A water-tight stem having at least one seal in a crown recess, and stop means to prevent the seal, when the crown is screwed onto the stem, from being excessively strained so as to fill all of the sealing cavity.

The invention relates to a water-tight stem for a timepiece.

The seals of waterproof watches, notably watches intended to be worn underwater, should desirably have a pressure resistance greater than 10 kg./cm.^{2}. To this end, there are employed water-tight winding stems for timepieces having a water-tight tube with a crown embodying a cylindrical shell-like recess housing a flexible and elastic annular seal, means for tightening the crown to a neutral position, and two surfaces between which the seal is positioned, the two surfaces approaching each other axially to compress the crown when the latter is tightened on the stem.

The degree to which the crown can be tightened onto the stem is limited by the extent to which the seal can be squeezed between the two said surfaces. The pressure exerted on the seal can be very high; and in the case where the crown is tightened by screwing it, the user frequently unintentionally exerts so great a stress on the seal, while screwing on the crown, that it is excessively strained and deteriorates.

The purpose of the invention is to provide a water-tight stem that avoids this drawback.

An object of the invention is a water-tight stem having stop means for determining when the crown has been completely tightened to its neutral position and preventing further tightening thereof, thereby to avoid excessively straining the seal. This object and others of the invention will be apparent from the following detailed description.

The invention will be described, with reference to the accompanying drawings, wherein:

FIG. 1 is a side-view in cross-section of a first embodiment of the invention, the left half of the figure showing the crown tightened down on the stem to the neutral position, and the right half the crown unscrewed for rewinding; and

FIGS. 2 to 8 are views similar to that of FIG. 1, each figure being devoted to a further embodiment of the invention.

With reference to FIG. 1, the winding button, or crown, **1** incorporates an interior cylindrical shell-like recess **2**, located between the circumference of the crown, which is milled at **3**, and an interior barrel **4**, which embodies a threaded hole **5** to permit the crown to be fixed to a winding stem, not shown.

The timepiece, which will usually be a wrist watch, is enclosed in a case having an exteriorly projecting tube **6** that surrounds the stem. The tube incorporates a threaded flange **7**.

Two flexible and elastic annular seals **8** and **9** ensure watertightness. The seal **8**, in the form of a flat washer, is set in the roof of the crown recess **2** and cooperates with an inner conical surface **10** on the upper end of the tube **6**.

Similarly, the seal **9** is positioned in the crown, and held in place by a free washer **11** which, when rewinding or setting the hands, presses against a collar **12** that is forced and crimped into the crown.

The inner wall of the collar **12** is threaded, so that the crown can be screwed onto the threaded flange **7** of the tube **6**. The outer surface of the collar is knurled, the grooves or flutes advantageously extending parallel to the crown axis, so as to prevent any movement of the collar **12** with respect to the crown **1**.

The main radial width of the seal **9** is the same as, or slightly greater than, the clearance between the respective outer cylindrical surfaces of the recess **2** and the tube **6**, whereby the seal remains water-tight even when the crown is in position to rewind or to reset the hands. Of course, the watch should not be rewound or the hands reset when it is deeply submerged, since the seal **9** presses only moderately against the tube **6**, in the two aforesaid positions of the crown.

When the crown is screwed on, the washer **11** is supported against downward movement by the shoulder of the tube flange **7**, whereby the seal **9** is squeezed between this washer and a flange **13** of the crown. The radial extents of the surfaces of the flange **13** and washer **11** contacting the seal **9** are smaller than the radially extending upper surface of the seal, so that the axial pressure exerted by the washer and the flange causes the seal **9** to expand radially, whereby the latter is tightly pressed against the outer wall surface of the tube **6**.

As illustrated in the left half of FIG. 1, the seal **8** is squeezed between the conical surface **10** and the roof of the recess **2**, thus ensuring an excellent watertightness. when screwing on the crown, the seal **8** at first presses on the surface **10** along the entire length of the sharp seal edge **14**, thereby immediately obtaining a relatively high pressure that ensures a first-class seal. The crown is tightened to its neutral position, in which the timepiece cannot be wound or its hands set, when the roof of the recess **2** contacts the upper face of the tube **6**. The seals **8** and **9** do not occupy all of the space in which they are located. They are thus elastically strained, but are not subjected to excessive forces as would be the case were they to fill the entire volume of their respective spaces, and therefore to act as stops limiting the downward axial movement of the crown.

The embodiment shown in FIG. 2 is a particularly simple form of the invention, the crown **1** having but a single seal **15** which is strained by a bevelled edge or conical surface **16** embodied on the outer edge of the tube **6**. The crown is stopped in its downward axial movement by the cooperation between the roof of the recess **2** and the upper face of the tube **6**.

In the embodiment illustrated in FIG. 3, the crown is similar to that shown in FIG. 2, except that it has a second seal **19**, a torous positioned between the outer cylindrical surface **20** of the tube **6** and the outer cylindrical surface **21** of the recess **2**. The seal **19** is held axially by the threaded collar **12** from below, and by a collar **22**, from above.

The embodiment shown in FIG. 4 differs from that of the preceding figure in that the metal-on-metal axial stop for the crown is obtained between the lower rim or face **23** of the crown **1** and a flange **24** of the tube **6**.

The embodiment illustrated in FIG. 5 differs from the form shown in FIG. 4 in that the axial stop comprises the lower face of the interior barrel **4** and a shoulder **25** in the inner wall of the tube **6**.

In the embodiment illustrated in FIG. 6, the recess 2 contains two toric seals 17 and 18, which press, on the one hand, against the outer cylindrical surface of the recess 2 and, on the other hand, against the outer surface of the tube 6. These two seals are held in place in the recess by a washer 11 supported by the collar 12 crimped into the base of the crown.

The collar 12 is not threaded as in the previous embodiments, but instead incorporates an inwardly extending projection 26 having two vertical slots 27 that accept respective pins 28 carried by a flange 29 of the tube 6, so as to constitute a bayonet coupling. When the crown is screwed on, the flange 29 supports the free washer 11 against further downward movement, the resulting axial pressure on the seals 17 and 18 expanding them axially to ensure a perfect water-tightness.

In this form of the invention, the stop arrangement for determining the screwed on position of the crown is composed of the pins 28 and the projection 26 in combination with the elasticity of the seals 17 and 18, which tends to push the crown axially away from the watch case and therefore to press the projection 26 against the pins 28.

The embodiment shown in FIG. 7 is related by its simplicity to that illustrated in FIG. 2. The seal 15 cooperates with a conical surface 30 located, not at the upper end of the tube 6 (as in the form shown in FIG. 2), but on the outer surface of the tube 6, slightly above the flange 7. With this construction, the seal 15 presses relatively slightly against the outer cylindrical surface 31 of the tube 6, thus ensuring that the crown is watertight when it is in position for winding or in position for setting the hands. In these latter two positions of the crown, it is apparent that the sealing will not be effective against the same high pressures as when the crown is screwed down tight, as shown in the left half of FIG. 7.

In the embodiment illustrated in FIG. 8, the crown 1 houses two seals 32 and 33 separated by a collar or free washer 34 acting as the seat for the seal 32. An annular flange 35 of hte washer 34, having a radially extending surface bearing on the seal 33 much smaller than that of the seal, cooperates with the seal 33. The latter rests on the free washer 11, which, when the crown is tightened by threading the collar 12 onto the flange 7, squeezes the seal 33, which consequently expands radially. As the crown is screwed on, the upper outer edge 36 of the seal 32 is squeezed by an inclined surface 37 formed by part of the crown recess 2. This embodiment also provides an acceptable water-tightness when the crown is in position for rewinding or for resetting of the hands, and a perfect water-tightness, without excessively straining the seals, when the crown is fully screwed on.

Although illustrative embodiments of this invention have been described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and modifications may be made therein by one skilled in the art without departing from the scope or spirit of the invention.

What is claimed is:

1. A water-tight winding stem for a timepiece having a water-tight tube projecting from the timepiece case in surrounding relation to the stem and defining a longitudinal axis, the stem having a crown, a cylindrical shell-like internal blind recess embodied in said crown, means for tightening said crown to a neutral position in which the timepiece cannot be wound or the hand set, a flexible and elastic annular sealing member located within said crown recess, and two surfaces between which said sealing member is positioned, at least one of said two surfaces being a surface of said recess and approaching the other of said two surfaces in a direction substantially parallel to said tube axis to compress said sealing member between said two surfaces when said crown is tightened to said neutral position, and wherein the improvement comprises rigid stop means apart from said sealing member for determining when said crown has been completely tightened to its neutral position and for preventing further tightening thereof and further compression of said sealing member, said means for tightening said crown acts between the latter and said tube, and said two surfaces cooperate with said sealing member and said stop means to provide a space open to the sealing member in said crown recess when said crown is completely tightened to its neutral position, whereby to limit the straining of said sealing member due to compression thereof.

2. The water-tight winding stem as defined in claim 1, including a threaded portion in said tube, and threads associated with said crown and cooperating with said tube threaded portion for screwing said crown to its neutral position onto said tube.

3. The water-tight winding stem as defined in claim 1, including a threaded portion in said tube, and threads associated with said crown and cooperating with said tube threaded portion for screwing said crown to its neutral position onto said tube, and including a metallic face defined by the end of said tube remote from the timepiece case, and a metallic roof defined by said crown recess and located opposite said tube face, and said stop means is constituted by said tube face and recess roof, which latter comes into abutment with the former at the neutral position of said crown, whereby to prevent further screwing of said crown onto said tube.

4. The water-tight winding stem as defined in claim 1, including at least one sharp edge incorporated by said sealing member, and said edge is squeezed against one of said two surfaces when said crown is tightened, for producing water-tight seal.

5. The water-tight winding stem as defined in claim 4, wherein said sealing member has the shape of a flat washer, and said one of said two surfaces is conical

6. The water-tight winding stem as defined in claim 1, including a collar mounted in said crown and supporting said sealing member in place, and means incorporated by said collar and by said tube for holding said crown on said tube.

7. The water-tight winding stem as defined in claim 6, including means incorporated by said collar and tube for forming a bayonet coupling therebetween.

8. The water-tight winding stem as defined in claim 6, including a threaded portion in said tube, and wherein said collar surrounds said tube and has threads which cooperate with said tube threaded portion for screwing said crown to its neutral position onto said tube, and means embodied by said collar for strengthening its mounting in said crown.

9. The water-tight winding stem as defined in claim 8, wherein said tube threaded portion is on the outer surface of said tube.

10. The water-tight winding stem as defined in claim 1, wherein said tube and crown incorporate metallic surfaces, and said stop means is constituted by a metallic surface of said tube and a metallic surface of said crown which come into abutment at the neutral position of said crown, whereby to prevent further tightening of said crown.

11. The water-tight winding stem as defined in claim 10, including a bevelled edge incorporated by the end of said tube remote from the timepiece case, said bevelled edge constituting one of said two surfaces, and a roof defined by said crown recess and located opposite said bevelled edge, and wherein said sealing member is set in said roof to be squeezed by said bevelled edge when said crown is tightened.

12. The water-tight winding stem as defined in claim 11, including first and second coaxial cylindrical surfaces defined by said crown recess, and wherein said tube projects into, and is coaxial with, said crown recess between

said first and second cylindrical surfaces thereof, and means for tightening said crown onto said tube by screwing.

13. The water-tight winding stem as defined in claim **10**, including a further annular sealing member located within said crown recess, a cylindrical surface defined by said crown recess, an outer cylindrical surface defined by said tube, said further sealing member is positioned squeezed between said two cylindrical surfaces, and means for squeezing said further sealing member in the direction of said tube axis, for causing said further sealing member to press tightly against said tube cylindrical surface, said squeezing means cooperating with said further sealing member so that there is still free space open to the latter in said crown recess when said crown is completely tightened to its neutral position.

14. The water-tight winding stem as defined in claim **13**, including a further cylindrical surface defined by said crown recess coaxial with, and of smaller radius then, said crown recess cylindrical surface, said tube projecting into, and being coaxial with, said crown recess between said two crown recess cylindrical surfaces.

15. The water-tight winding stem as defined in claim **13**, including at least one free washer positioned within said crown recess and adjacent said further sealing member and cooperating with said tube to squeeze said further sealing member in the direction of said tube axis when said crown is tightened.

16. The water-tight winding stem as defined in claim **15**, including a radially projecting shoulder incorporated by said tube, said free washer surrounds said tube and bears on said shoulder, and said further sealing means bears on said free washer and also surrounds said tube.

17. The water-tight winding stem as defined in claim **15**, including a radial surface defined by said further sealing member and a radial surface smaller than said

further sealing member radial surface defined by said free washer, each said radial surface lying in a radial plane of said tube and being in contact over their common areas, whereby said further sealing member bears on said free washer.

18. The water-tight winding stem as defined in claim **17**, including a further free washer located within said crown recess, said two free washers being positioned on respective sides of said further sealing member.

19. The water-tight winding stem as defined in claim **18**, wherein said two free washers and said further sealing member surround said tube.

20. The water-tight winding stem as defined in claim **18**, wherein one of said two free washers is located between said two sealing members.

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