United States Patent

Simon

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[54] FLUIDTIGHT WATCH

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[52] **U.S. Cl.** ..... **58/90 R**

[51] **Int. Cl.** **G04b 37/08**

[58] **Field of Search** ..... 58/88 C, 90 R, 94, 105

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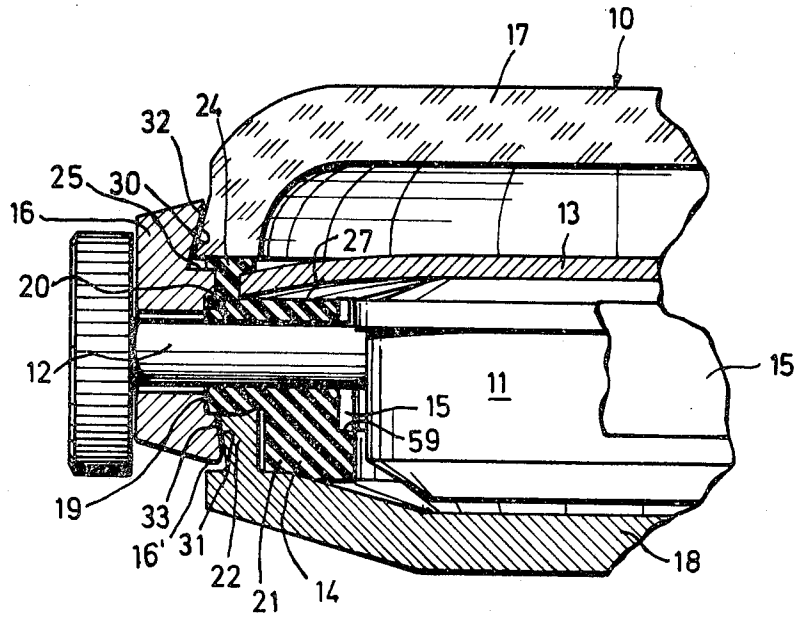
[57] **ABSTRACT**

In a watchcase a radially preloaded spring ring urges a soft-elastic packing ring radially outwardly against the inner walls of the case middle and axially outwardly against closure elements to provide a fluidtight watchcase and a floating support for said closure elements as well as for the movement.

26 Claims, 8 Drawing Figures



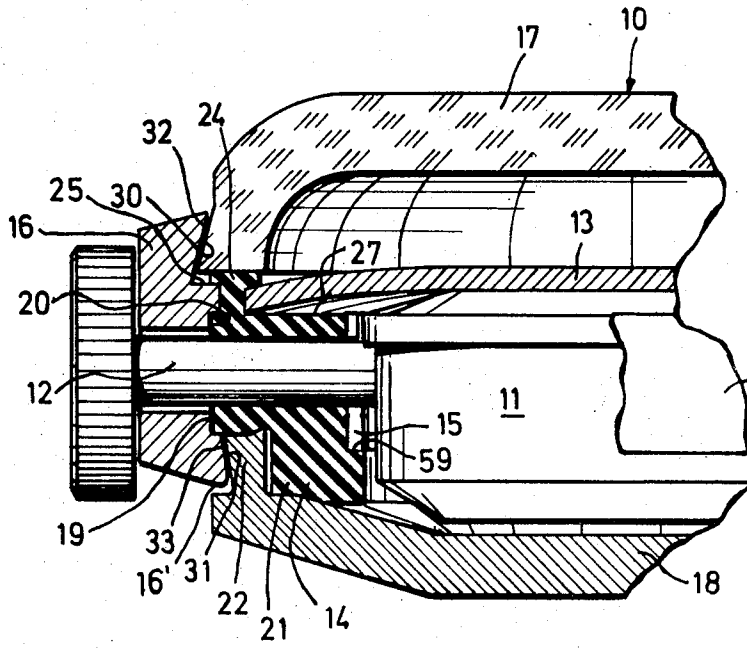


FIG.1

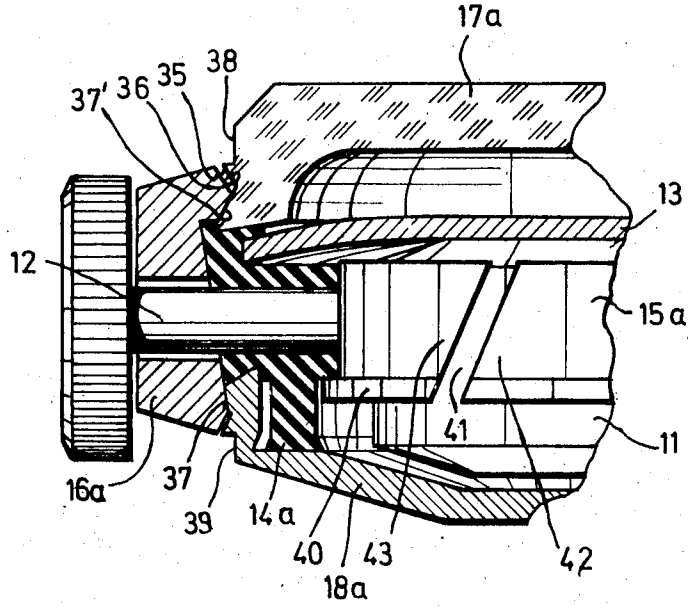


FIG.2

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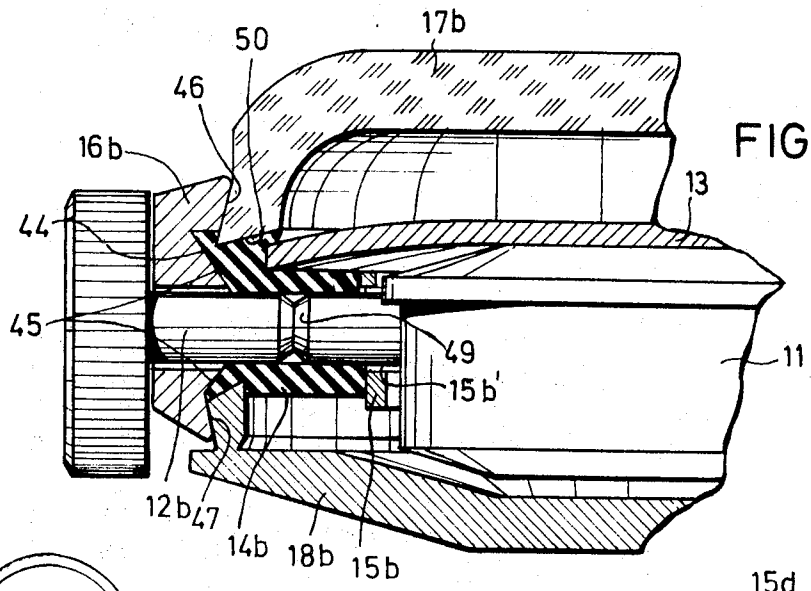

FIG. 3

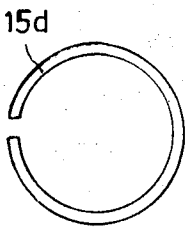

FIG. 6

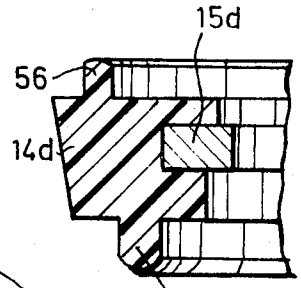

FIG. 5

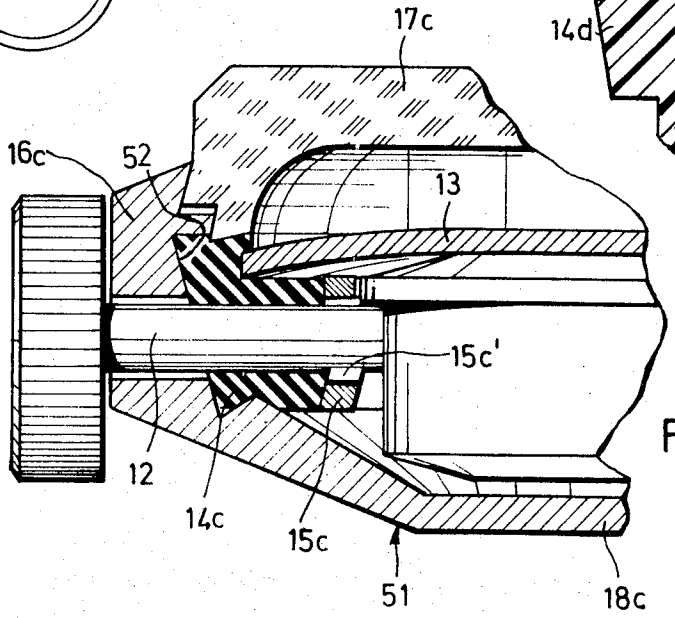

FIG 4

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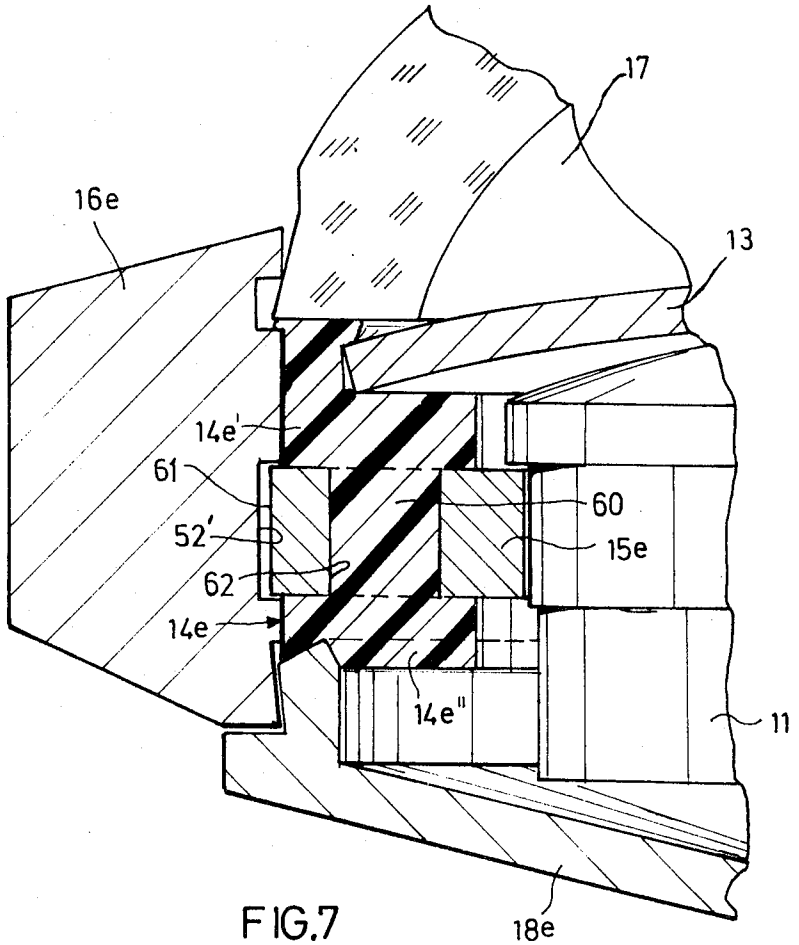

FIG.7

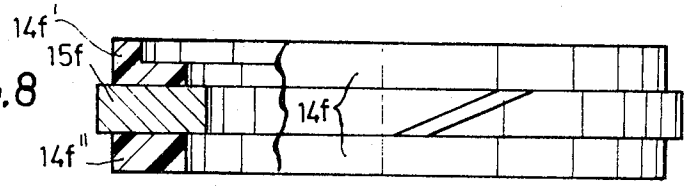

FIG.8

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FLUIDTIGHT WATCH

BACKGROUND OF THE INVENTION

This invention relates to a watch, such as a wristwatch, pocket watch, stopwatch, or the like, having a movement which is floatingly held in a case rendered fluidtight by a soft-elastic packing disposed between the movement and the watchcase.

Watch structures of the aforenoted type are known wherein the packing is secured to the watchcase or movement by adhesive means to seal the case at locations of joints with separately mounted closure elements such as the crystal and the base and provide a seal about the winding stem as well. Such a structure is disclosed for example in German Pat. No. 742,487. The securing of the packing by adhesive means is disadvantageous in that the assembly of the watch is made more complicated, a replacement of the packing is difficult, if at all possible, and, further, the presence of adhesives in a wrist watch case is generally undesirable. Also, the mounting of the movement is difficult and, in case of a frontal mounting, a two-part packing is necessary.

In another known structure, according to German Utility Model No. 1,905,489, to the packing there is secured a movement carrier to which the movement may be subsequently attached. The movement carrier is clamped about the packing or is inserted into an annular groove provided in the packing. Such a movement carrier, however, adds to costs, increases the mass of the oscillating system and renders the mounting operation more complicated. In a modification of this known watch structure, the movement carrier is omitted, while the packing extends into a concentric, peripheral annular groove provided in the movement. This solution, among other reasons, is disadvantageous with regard to the mounting operation; a frontal assembly is altogether unfeasible. In general, it is a common, serious disadvantage of these known watches that the packing, because of the unavoidable aging and fatigue of the packing material —which is preferably rubber— the quality of the seal deteriorates.

OBJECTS, SUMMARY AND ADVANTAGES OF THE INVENTION

It is the principal object of the invention to provide an improved watch of the aforenoted type in which the noted disadvantages are eliminated in a simple manner.

It is a further object of the invention to provide an improved watch, preferably a wristwatch, which has a simple structure and which may be assembled and disassembled easily and in a rapid manner, and which may be particularly easily assembled frontally.

It is still another object of the invention to provide an improved fluidtight watch wherein the packing, although of fatigable material, seals the case in a continuously uniform manner and retains its sealing properties even if exposed to high water pressures.

It is still another object of the invention to provide, in a watch case, an improved holding means for floatingly supporting the movement; said holding means may be easily repaired and, despite repeated reopening and reclosing of the case, ensures a continuously uniform, high-quality sealing therefor.

Briefly stated, according to the invention, there is provided a watch structure of the aforeoutlined type, wherein the packing — serving simultaneously to seal the case and support at least the crystal in an axially displaceable manner — is urged radially outwardly against the inner wall of the case middle by a resiliently yielding tensioning means, such as at least one preloaded spring ring. Thus, even if the elasticity of the packing deteriorates, its sealing properties may be maintained practically unchanged. The spring ring or the like — although exerting a force only in a radial direction — not only urges the packing against the case middle, but causes the soft-elastic material of the packing to expand axially and to be pressed, accordingly, against the sealing edges of the closure elements (such as the crystal and the base) and also against the winding stem.

An adhesive to secure the packing in place may be omitted without detriment to the sealing properties. The easy separation of the packing from the case middle permits a simple assembling of the watch and also, if necessary, a simple replacement of the packing. It is a particular advantage of the structure according to the invention that the case middle with the packing and the tensioning means may, without disadvantage, form a mounting unit of the watch, while the movement, the closure element or elements and the winding stem form further mounting units. In known watches it is difficult to mount the winding stem since for such an operation, the bores through which the winding stem has to pass and which are provided in the case middle, in the packing and in the movement carrier, have to be in exact alignment. It is very difficult and time-consuming to bring these parts into exact alignment and to maintain those parts in an aligned position for such a mounting operation. The mounting unit provided according to the invention obviates this disadvantage, since the case middle, the packing and the tensioning means may be easily preassembled with high precision. The pressing of the packing against the inner wall of the case middle ensures that the packing and the case middle, during further assembly of the watch and also thereafter, do not shift or move angularly with respect to one another. Such a characteristic is also essential for a uniform, unobstructed operation of the winding stem. The invention further permits the use of a threaded lid directly pressing against the packing, without danger that the latter, not secured by adhesives, is displaced.

The invention is particularly advantageous with respect to the floating support provided by the soft-elastic packing, since the tensioning means delivers a practically continuously uniform force and, as a result, it is ensured that the floating support changes its properties only in an insignificant manner with time, if at all. Further, because of the radial force generated by the tensioning means, the movement may be secured, preferably in a preloaded condition, directly to the packing in a simpler and more secure manner than heretofore possible. Thus, by directly fitting the movement into the packing, the movement carrier may be omitted.

In general, the watch constructed in accordance with the invention has a further advantage that the tolerances for the watchcase and the crystal at locations that accommodate the packing, may be larger than in watches of the prior art.

A further advantage resides in a relatively slight load on the packing. Since the resilient tensioning means provides for a continuous readjustment of the packing, the initial pressure force exerted on the closure elements may be held at a smaller value than in known watch structures. As a result, fatigue of the material is less significant and sets in slower.

The invention will be better understood, as well as further objects and advantages will become more apparent, from the ensuing detailed specification of several exemplary embodiments taken in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional side elevational view of an embodiment of the invention;

FIG. 2 is a sectional side elevational view of a modification of the structure shown in FIG. 1;

FIG. 3 is a sectional side elevational view of a further modification of the structure shown in FIG. 1;

FIG. 4 is a sectional side elevational view of still another modification of the structure shown in FIG. 1;

FIG. 5 is a sectional side elevational view of another embodiment of the packing and tensioning means;

FIG. 6 is a plan view of a tensioning means forming part of the structure shown in FIG. 5;

FIG. 7 is a sectional side elevational view of a further embodiment of the invention, and

FIG. 8 is a side elevational view, partially in section, of a modification of the embodiment shown in FIG. 7.

DESCRIPTION OF THE EMBODIMENTS

It is a common feature of all the embodiments hereinafter discussed that they may be assembled frontally and that the case middle forms a mounting unit with the packing and the tensioning means. The material of the axially symmetrical packing is rubber or a suitable soft-elastic, synthetic material. The packing is further provided with a radial bore through which the winding stem of the watch may extend. Frontally, the watch case is covered by a frameless crystal. The separately mountable closure elements, such as the crystal and the base — with the exception of the embodiment illustrated in FIG. 4, where the case middle and the base are integral — are held in such a manner that they are resiliently displaceable in both axial directions with respect to the case middle. Such closure elements may be inserted with a radial preload that is smaller than required heretofore. Consequently, the crystal and the base may be inserted and removed easier, and, because of the lesser preload, the stresses are smaller. Thus, cracks caused by stresses are much less likely to occur. As a further result, the base of the watch may be designed in such a manner that its insertion or removal may be effected by the same frontal clamp used for handling the crystal.

Turning now to FIG. 1, the watch shown therein is formed of an assembly comprising an enclosure generally indicated at 10, a movement 11 from which there extends radially outwardly a winding stem 12 and a dial 13 affixed to said movement, a packing 14 which serves for a complete sealing of the enclosure, and a spring ring 15 disposed concentrically and radially inwardly with respect to the packing and adapted to exert a resilient force thereto in a radially outward direction. The enclosure 10 is formed of a case middle 16, a crystal 17, and a base 18, all made of the usual materials. By virtue of the spring ring 15, the packing 14, due to its soft-elastic properties, is pressed both in an axial and a radial direction against portions of the enclosure.

The spring ring 15 has cylindrical sidewall faces and is an open annulus made of spring steel or the like. The free ends of spring ring 15 are disposed, in this embodiment, at either side of winding stem 12 so that the latter may pass radially through the spring ring 15 without the necessity of providing a bore therein. The gap defined by the free ends of the spring ring 15 is substantially filled by the packing to improve the seal about the winding stem 12. For this purpose it is advantageous to mold or spray the packing to the outer cylindrical face of spring ring 15. The latter engages with its lower edge a shoulder 59 of the packing 14. The height of the spring ring 15 approximately corresponds to the height of that part of the inner wall of the case middle 16 which is engaged by the outer peripheral face 19 of the packing 14. Said peripheral face 19 is designed in such a manner that it extends into an annular circumferential groove 20 provided in the inner face of case middle 16. The packing 14 is further provided with an annular projection 21 extending downwardly from its mid portion and pressed against the inner face of base 18. In addition, the upstanding annular projection 22 of base 18, securing the latter to the case middle 16, also exerts pressure to the packing 14, whereby the sealing of the base is further improved. Also, the packing 14 has an upper annular rim 24 projecting axially upwardly and engaging the radial terminal edge of crystal 17. By virtue of this engagement and with the cooperation of a shoulder 25 of the case middle 16 and of the marginal peripheral portions of the dial 13, the rim 24 is compressed causing a lateral (radial) spreading thereof. The underside of the marginal peripheral portion of the dial 13 is in engagement with an upper radial face 27 of the packing 14 adjacent crystal 17. Thus, this portion of the packing 14 serves as a seal and an axial support for the crystal 17 and as a radial holding means for the dial 13. The movement 11, being secured to the dial 13, is supported in the casing by dial 13 which, in turn, is fitted, in a preloaded condition, into packing 14. Thus, a simple floating support for movement 11 is provided which causes no stresses therein. Further, no separate securing means for the dial are needed.

Both the crystal 17 and the base 18 are axially resiliently held in the case middle 16 after insertion in a preloaded condition. As a result of the cooperation between the bezel 30 and the frustoconical peripheral face 32 of the crystal 17, the latter, by virtue of its preloaded condition, is urged downwardly towards the inside of the case middle 16. Similarly, as a result of the cooperation between the frustoconical wall 33 of the case middle 16 and the frustoconical peripheral face 31 of annular projection 22, the base 18, by virtue of its preloaded condition, is urged upwardly towards the inside of the case middle 16. The pressures thus generated are counteracted by the elastically resisting forces exerted by the packing 14 on the crystal 17 and base 18. Thus, both the crystal 17 and the base 18 are exposed to two opposed axial forces which, as a function of external forces, preload, as well as pressures exerted by the packing 14, determine the axial position of crystal 17 and base 18 with respect to the case middle 16. Should the external axial pressure on the watch decrease, the crystal 17 and the base 18 move outwardly; conversely, if the external pressure increases, the named parts move inwardly. The pressures between the crystal 17 and base 18 adjust themselves to the outer pressures and also to the changes in the forces exerted by the packing 14. The shoulder 25 forming part of the case middle 16 prevents the crystal 17 from moving too far downward axially. The lower edge 16′ of the case middle 16 has a similar function: it prevents the base 18 from moving too far upward axially. Also, these means prevent an overloading of the packing 14 by accidentally applying excessive strains thereto. If desired, those parts of the closure elements (such as crystal 17 and base 18) that engage the packing, may be provided with additional annular lips or the like which bite into the packing.

Turning now to FIG. 2, the crystal 17*a* comprises a locking groove 35 having a V-shaped section. The adjacent wall portion of the case middle 16*a* has a complemental annular projection formed of angularly converging frustoconical wall faces 36 and 37′ of case middle 16′. As seen, here again, the crystal 17*a*, by virtue of the face 37′, is urged downwardly against the resilient force of the packing 14*a*. Base 18*a* is provided with a V-groove 37 which, with complemental inner peripheral parts of base 18*a* forms a locking means therefor which is similar in function to the aforedescribed locking means between crystal 17*a* and the case middle 16*a*. Since, because of the large sealing faces between the base 18*a* and the packing 14*a*, only a small preloading at the base lock is necessary, the base 18*a* (which, instead of metal may be made of a synthetic material) may be inserted or removed with a conventional crystal clamp. For this purpose, the diameters of cylindrical axial faces 38 (integral with crystal 17*a*) and 39 (integral with base 18*a*) are of substantially identical magnitude.

The spring ring 15*a* has a lower rim 40 which extends over a radial shoulder of the packing 14*a* so that at that location the packing may not spread downwardly. In this embodiment the free ends 42 and 43 of the spring ring 15*a* define a gap 41 that extends obliquely with respect to the axis of the ring 15*a*. The spring ring 15*a* is provided with a radial bore (not shown) through which the winding stem 12 extends. The movement 11, as in the precedingly described embodiment, is held by the dial 13 which, in turn, is supported at its peripheral portions by the packing 14*a*. The lower peripheral face of the crystal 17*a* presses a radially inwardly projecting rim of the packing 14*a* downwardly onto the upper peripheral portion of the dial 13 for providing a floating suspension of the latter.

Turning now to the embodiment shown in FIG. 3, there is illustrated a packing ring 14*b* provided with an annular peripheral V-groove 44 extending over the entire thickness thereof. The inner wall of the case middle 16*b* has two axially adjacent circumferential V-grooves arranged in such a manner as to accommodate marginal peripheral portions of packing 14*b* contoured by V-groove 44. The annular, rimlike V-projection 45 formed of two adjacent converging walls of the two aforenoted V-grooves provided in case middle 16*b* prevents an excessive inward displacement of crystal 17 and

base 18*b*. The abutment, however, does not provide for a sudden and rigid stoppage of crystal 17*b* and base 18*b*; portions of the packing 14*b* disposed between the crystal and the case middle as well as between the base and the case middle resist resiliently to axially inwardly directed external pressures. The dial 13 is held in the case similarly to the precedingly described embodiments. The spring ring 15*b* and the packing 14*b* are so arranged with respect to one another that the outer wall of the former is in engagement with the inner wall of the latter through the entire height thereof. The spring ring 15*b* is provided with a bore 15*b'* through which the winding stem 12*b* extends. The split ends of the spring ring 15*b* interengage with one another in a manner not shown.

According to the invention, the winding stem 12*b* is provided with a peripheral V-groove 49 forming a lubricating channel which may be at least partially filled with a lubricating material. The surrounding packing 14*b* prevents leaking of the lubricant which may be oil or grease. Further, in this embodiment, the crystal 17*b* and the base 18*b* bite into the packing 14*b* by means of sharp-edged, annular projections. Further, the lower edge face 50 of the crystal 17*b* immediately adjacent the packing 14*b* has a frustoconical surface, the imaginary apex of which is disposed above the dial 13 and externally of the movement 11. In this manner the securing means for the dial 13 is further improved.

Turning now to FIG. 4, in the embodiment shown therein the case middle 16*c* and the base 18*c* form an integral enclosure element generally indicated at 51. In a watchcase formed in such a manner the elastic securing of the dial 13 by inserting the latter into the packing in a preloaded condition is particularly advantageous. The crystal 17*c* is again held in such a manner that it may be resiliently displaced in both axial directions in the same manner, in principle, as in the precedingly described embodiments. The inner wall portion 52 of the case middle 16*c* has a frustoconical configuration over its entire height. Correspondingly, the packing 14*c* has a periphery designed so that it conforms to the surface 52. The spring ring 15*c* is provided with a bore 15*c'* through which the winding stem 12 may extend.

Turning now to FIG. 5, the packing 14*d* shown therein is in principle similar to the packing 14*a* of FIG. 2 and may find use in a watch designed according to that figure. The packing 14*d* differs from the packing 14*a* substantially in that it is formed of a soft-elastic, synthetic material and that the spring ring 15*d* may be substantially embedded therein. Accordingly, in this embodiment, the height dimension of the spring ring 15*d* is lesser than that of spring ring 15*a*. The two axially extending rims 56 and 57 of packing 14*d* perform the same function as the corresponding annular rims of the packing 14*a*. In particular, the rim 56 serves for elastically holding the dial 13 and simultaneously sealing the crystal. The rim 57 serves to additionally seal the base. FIG. 6 is a plan view of the spring ring 15*d*.

Turning now to FIG. 7, which shows a modification of the embodiment of FIG. 5, the packing 14*e* is formed of an upper packing ring 14*e'*, a lower packing ring 14*e''* and axial spacers 60 (only one shown) arranged in a circular array and interconnecting the two packing rings. The spring 15*e* is provided with a plurality of axial bores 62 (only one shown) disposed in a circular array for receiving the axial spacers 60 of packing 14*e*. It is thus seen that by virtue of this structure, the spring ring 15*e* is securely anchored to the packing 14*e*. The outer peripheral portions 61 of the spring ring 15*e* project radially beyond the contour of packing 14*e* and extends into an annular groove 52' provided in the case middle 16*e*. The interengagement between the spring ring 15*e* and the groove 52' ensures that no axial displacement of packing rings 14*e'* and 14*e''* takes place. By virtue of the resilient, outwardly directed radial force exerted by the spring ring 15*e*, the packing rings 14*e'* and 14*e''* are urged against the inner wall of the case middle 16*e*.

The movement 11, dial 13, crystal 17 and base 18*e* are secured and sealed in a manner similar to the embodiment depicted in FIG. 3.

Turning now to FIG. 8, the assembly formed of packing 14*f* and spring ring 15*f* differs from the embodiment shown in FIG. 7 in that the packing rings 14*f'* and 14*f''* are entirely separate and are bonded to opposed radial faces of spring ring 15*f*.

In all the foregoing embodiments the tensioning means have been described as being a single metallic split ring.

It is within the scope of the invention to use tensioning means made of a suitable resilient material other than metal.

Further, the spring ring may be closed and provided with circumferential corrugations to generate radially outwardly directed forces.

Instead of a single spring ring, a plurality of spring rings may be used.

It is further within the scope of the invention to use other tensioning means in addition to or in lieu of spring rings. Thus, a coil spring or the like may be inserted in a radially and axially preloaded condition to exert a radial force on the packing pressing it against the case middle and also, to exert an axial force on the closure elements.

Depending upon the design of the movement, the dial may be fitted into the packing together with the frontal plate member of the movement. In case the dial has a diameter that is smaller than that of the movement, said plate member, fitted alone into the packing, may serve as the sole holding means for the movement.

What is claimed is:

1. In a watch of the type that has (A) a watch case, including a case middle, (B) a packing made of soft-elastic material and rendering said watch case outwardly fluid tight and (C) a movement floatingly supported in said watch case, the improvement comprising, tensioning means exerting a force on said packing urging the same against a surrounding inner wall of said case middle.

2. An improvement as defined in claim 1, wherein said watch includes a winding stem which is provided with a peripheral annular lubricating groove at a location surrounded by said packing.

3. An improvement as defined in claim 1, wherein said packing sealingly engages said base closure element along two spaced annular concentric areas.

4. An improvement as defined in claim 1, wherein said tensioning means includes at least one spring adapted to exert both an axially and a radially directed force.

5. An improvement as defined in claim 1, wherein said case middle is provided with an inner circumferential frustoconical wall; said tensioning means presses said packing into a conforming engagement with said frustoconical wall.

6. An improvement as defined in claim 1, wherein said tensioning means, said packing and said watch case formed of at least said case middle, constitute a mounting unit in which said packing is urged against said case middle by said tensioning means.

7. An improvement as defined in claim 1, wherein said watch case includes frontal and base closure elements, at least one of said closure elements is adapted to shift axially with respect to said case middle.

8. An improvement as defined in claim 7, wherein said axially shiftable closure element is exposed to an axially outwardly directed force exerted by said packing; said case middle includes an outwardly tapering frustoconical inner circumferential wall into which said axially shiftable closure element is inserted in a radially preloaded condition; the radial pressure exerted by said last-named closure element on said frustoconical wall generates a force urging said last-named closure element axially inwardly.

9. An improvement as defined in claim 1, wherein said packing is annular and part thereof is forced into an inner annular circumferential groove provided in said case middle.

10. An improvement as defined in claim 9, wherein said circumferential groove is V-shaped.

11. An improvement as defined in claim 1, wherein said watchcase is covered by a frontal closure element; said packing has an upper radial face to support a holding means

attached to said movement for floatingly positioning the latter; said packing further includes an upper rim pressed by said frontal closure element onto said holding means.

12. An improvement as defined in claim 11, wherein said holding means is a dial secured to said movement, said dial is fitted in an axially preloaded condition into said packing below said upper rim and on said upper radial face.

13. An improvement as defined in claim 11, wherein said holding means is constituted by a plate member forming part of said movement and disposed adjacent a dial secured to said movement; said plate constituting the sole holding means for said movement.

14. An improvement as defined in claim 11, wherein said frontal closure element has a frustoconical edge face pressing on said upper rim.

15. An improvement as defined in claim 14, wherein the apex of said frustoconical edge face is externally of said movement above said holding means.

16. An improvement as defined in claim 1, wherein said packing has an annular configuration and said tensioning means comprises a preloaded spring ring disposed substantially concentrically with said packing and exerting thereon a radially outwardly directed force.

17. An improvement as defined in claim 16, wherein at least the outer marginal peripheral portions of said spring ring are embedded into said packing.

18. An improvement as defined in claim 16, wherein said spring ring is in direct contact with an inner cylindrical face of said packing.

19. An improvement as defined in claim 18, wherein said packing is bonded to said spring ring.

20. An improvement as defined in claim 16, wherein said spring ring is split.

21. An improvement as defined in claim 20, wherein said split spring ring has two free ends that define a gap, part of said packing is pressed into said gap by said force.

22. An improvement as defined in claim 20, wherein said watch includes a winding stem; said split spring ring has two free ends that define a gap; said split spring ring is so positioned that said winding stem extends radially through said gap.

23. An improvement as defined in claim 16, wherein said packing is formed of two axially spaced packing rings, said spring ring is disposed between said two axially spaced packing rings.

24. An improvement as defined in claim 23, wherein said spring ring projects radially beyond the contour of said packing rings, said case middle is provided with an inner circumferential groove into which said spring ring extends.

25. An improvement as defined in claim 23, wherein said axially spaced packing rings are interconnected by a plurality of axially extending spacers arranged in a circular array; said spring ring is provided with a plurality of axially extending throughgoing bores through each of which one of said spacers passes.

26. An improvement as defined in claim 23, wherein said axially spaced packing rings are bonded to opposed radial faces of said spring ring.

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