United States Patent

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[54] **STRUCTURE FOR SEALING A WATCH CRYSTAL IN A WATERPROOF WATCH**

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[51] **Int. Cl.**.....**G04b 37/08,** G04b 39/00

[58] **Field of Search**.....58/90 R, 91, 105

[56] **References Cited**

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[57] **ABSTRACT**

A watch crystal is sealed into a watch by means of an annular gasket of a relatively hard material such as a synthetic resin or soft metal. The parts comprising the seal are so dimensioned that the crystal seats in the gasket in an interference fit and the gasket fits in the case body in an interference fit. Such gaskets, while providing an effective seal even when subjected to high pressure, have long life, and hold the crystal sufficiently strongly so that a bezel is not needed.

7 Claims, 3 Drawing Figures

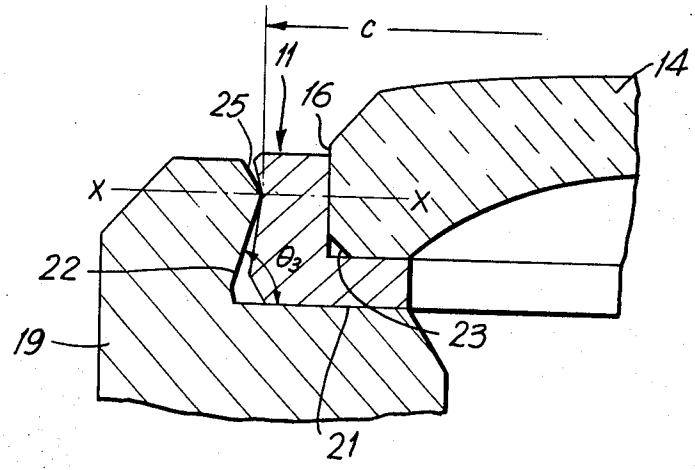


FIG. 1

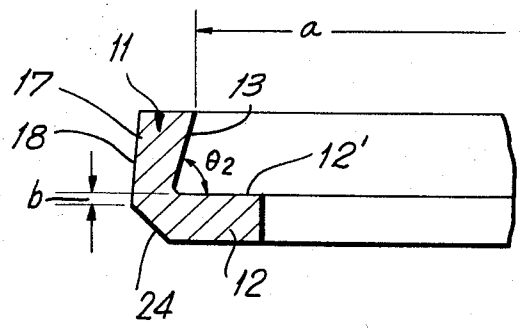


FIG. 2

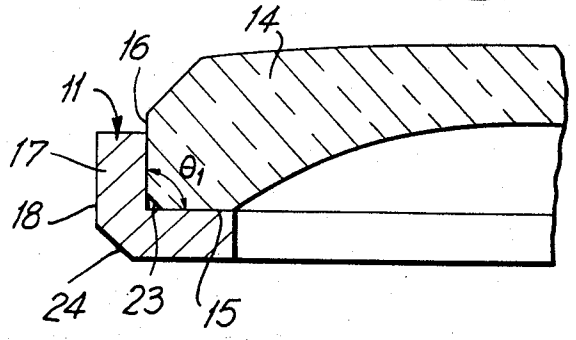
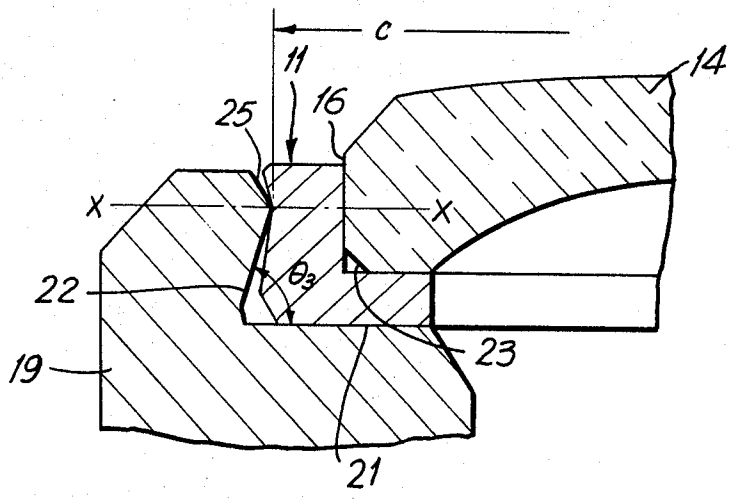


FIG. 3



STRUCTURE FOR SEALING A WATCH CRYSTAL IN A WATERPROOF WATCH

BACKGROUND OF THE INVENTION

In conventional constructions for sealing a watch crystal into a waterproof watch, a relatively soft gasket is inserted between the crystal and the case body. Where such soft gaskets are used, it is necessary to provide a bezel to prevent disengagement of the glass from the case body. In such a construction, the packing is deformed to a considerable extent, particularly where it is to be maintained in waterproof condition against relatively high pressure. Under such circumstances, the packing is apt to cold-flow and deteriorate so that the maintenance of the waterproof condition is of relatively short duration.

The use of a bezel increases the cost of the watch and has disadvantages with respect to design. In order to avoid these disadvantages, attempts have been made to use materials which are harder than rubber. However, these have not been successful because the gasket material has been found to break or to deform excessively during assembly.

SUMMARY OF THE INVENTION

In accordance with the present invention, it has been found to be possible to use gasket materials harder than rubber by proper design of the pertinent components, namely the watch crystal, the gasket and the interior of the case body.

To effect a waterproof seal between the watch crystal and the gasket, the gasket, which is annular, has a frustoconical interior surface into which the watch crystal can be inserted to form an interference fit. Similarly, the interior of the case body also has a frustoconical inner surface into which the gasket, holding the watch crystal, can be inserted to form an interference fit. The gasket, preferably, is made of a synthetic resin or a soft metal. The watch crystal, the exterior of the gasket and the interior of the case body may be provided with guide surfaces to facilitate assembly. The dimensions of the components can be matched to the hardness of the gasket so that the watch crystal may be of an inorganic glass without encountering the problem of breakage during assembly.

Accordingly, an object of the present invention is to provide a structure for sealing a watch glass to a waterproof watch where the structure will have long life.

Another object of the invention is to provide a structure for sealing a watch glass to a waterproof watch while eliminating the need for a bezel.

A further object of the invention is to provide a structure for sealing a watch crystal to a waterproof watch where the assembly must withstand high pressure.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWING

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawing, in which:

FIG. **1** is a cross sectional view of a gasket in accordance with the present invention;

FIG. **2** is a cross sectional view of the same gasket as deformed by a watch crystal; and

FIG. **3** is a cross sectional view of a complete watch crystal assembly in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A gasket **11** is shown in FIG. **1** prior to assembly. The gasket **11** is essentially L-shaped with lower arm **12** having an inner

base **12'** which is planar. Angle θ_2 between peripheral lip **13** and inner base **12'** is less than 90° is subject to a further restriction which will be described below.

Watch crystal **14** also has a planar base **15** designed to seat against inner base **12'** of gasket **11**. Angle θ_1 between the base **15** of watch crystal **14** and periphery **16** of the watch crystal is such that upper arm **17** of gasket **11** is deformed outwardly during insertion of the watch crystal. To form an effective seal, angle θ_1 must be larger than angle θ_2. Angle θ_1 may suitably lie in the range of about 85° to 90°, and preferably is 9020 . The amount by which angle θ_2 is less than θ_1 will depend on the hardness and deformability of gasket **11**. As part of the gasket design, outer surface **18** of upper arm **17** is so shaped that when the watch crystal is inserted in the gasket, outer surface **18** will become cylindrical in shape.

To effect a tight seal between gasket **11** and case body **19**, angle θ_3 between inner bottom **21** and inner periphery **22** of case body **19** is made less than 90°. The inner periphery **22** of case body **19** is frustoconical and has a minimum diameter in the plane indicated in FIG. **3** by the reference letters *x*—*x*. As can be seen, the plane of the minimum circle intersects periphery **16** of the watch crystal.

To facilitate assembly of the structure, watch glass **14** is provided with a guide surface **23**, gasket **11** is provided with an exterior guide surface **24** and case body **19** is provided with an interior guide surface **25**.

It is important in order to achieve proper sealing that the inner surface **13** and the exterior surface **17** of gasket **11** be smooth in finish. The same is true of inner periphery **22** of case body **19**. The inner periphery **22** is preferably finished with a buff cloth. The outer surface **18** of gasket **11** can be rendered cylindrical by finishing while deformed by the watch crystal.

In forming the guide surface **24**, the plane at its maximum diameter should lie within the lower arm **12**, i.e., below the plane of inner base **12'**. The distance between these two planes is indicated by the reference letter *b* in FIG. **1** and is not critical. By locating the maximum circle of the guide surface **24** within the lower arm **12**, pressure on the watch glass **14** during assembly of the gasket into the case body **19** is avoided.

Suitable materials for the gasket **11** are synthetic resins such as polycarbonate and ABS resin. The gasket may also be made of a soft metal such as copper or silver.

Despite the fact that relatively hard gaskets of synthetic plastic or soft metal are used in the present structure, forces on the watch crystal are compressive and symmetrical. Consequently, the watch crystal may be of inorganic glass and yet the assembly operation can be carried out without breaking said crystal.

The structure disclosed herein, using a gasket of synthetic resin or soft metal, and with interference fits between watch crystal and gasket and case body provides resistance to the entry of water for long periods of time while eliminating problems of breakage during assembly. Moreover, since the necessity for a bezel is eliminated, the structure is simplified and cost of the final watch is decreased.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A structure for sealing a waterproof watch comprising a watch glass having a base perpendicular to the axis of said glass and a periphery making an angle θ_1 with said base of said

glass, and annular gasket having an inner base perpendicular to the axis of said gasket and an inner peripheral lip making an angle θ_2 with said inner base, where θ_2 is less than θ_1 and the dimensions of said glass and said gasket are such that said glass can be seated firmly against the inner base and the inner peripheral lip of said gasket by deforming said gasket outwardly, the outer surface of said gasket being cylindrical when said gasket is deformed by said glass, and a metallic case body having an inner bottom against which said gasket can be firmly seated and a frustoconical inner surface tapering inwardly away from said inner bottom, said inner surface having a circle of minimum diameter dimensioned for receiving said gasket in an interference fit, the plane of said circle of minimum diameter intersecting said periphery of said glass.

2. The structure of claim 1, wherein θ_1 lies between 90° and about 85°.

3. The structure of claim 1, wherein said glass is inorganic.

4. The structure of claim 1, wherein said glass has a frustoconical guide surface to facilitate insertion of said glass into said gasket.

5. The structure of claim 1, wherein said gasket has an exterior frustoconical guide surface to facilitate insertion of said gasket into said case body, and said case body has an interior frustoconical guide surface to facilitate the insertion of said gasket into said case body.

6. The structure of claim 1, wherein said gasket is of a material selected from the group consisting of synthetic resin and a soft metal.

7. The structure of claim 6, wherein said synthetic resin is selected from the group consisting of polycarbonate and ABS.

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