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(54) WATCH CASE

(71) We, CITIZEN WATCH COMPANY LIMITED, a corporation organized under the laws of Japan, of No. 1-1, 2-chome, Nishishinjuku, Shinjuku-ku, Tokyo, Japan, 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:

10 This invention relates to a watch case.

A conventional structure for fixing a watchglass made use of a synthetic resin packing ring. The synthetic resin packing ring. The synthetic resin packing ring is compressed between the 15 outer circumference of a watchglass and the inner circumference of a case band, whereby the watchglass and packing are fixed against axial movement by the frictional force existing between them, while the packing ring and case 20 band are fixed against axial movement by the frictional force existing between them. Since the fixing force between the packing ring and case band in this instance is greater than that between the watchglass and the packing ring, 25 the force which fixes the watchglass against axial movement is decided by the frictional force between the watchglass and the packing ring, hence, the packing ring must be subjected to a large compressing force in the direction of 30 its diameter in order to provide a sufficient fixing force and water-tight seal over a long period of time. However, when a large amount of compression is applied, the packing ring protrudes excessively in the upward direction at 35 the time that it is press-fitted about the outer circumference of the watchglass. It is therefore not possible to obtain reliable fixing force and waterproofness.

In another prior art watch case, a watchglass 40 and case band sandwich and compress a synthetic resin packing ring the height of which is greater than that of the vertical portion of the outer circumference of the watchglass and the vertical portion of the inner circumference of

the case band. The upper portion of the packing 45 ring extends up onto the inclined surface of the watchglass and the inclined surface of the case band, thereby pressuring the watchglass and fixing it against movement in both the diametric and axial directions. In this case, the watchglass 50 is fixed against axial movement by virtue of the upper portion of the packing ring which has crept over the inclined surface of the watchglass as well as the thickened portion of the packing 55 ring. At a glance the present structure provides slightly greater reliability in terms of fixing force than that of the firstly mentioned prior art, but a closer inspection will reveal that the fixing force with respect to the upper part of the watchglass is determined by the bending 60 strength primarily of the upper portion of the synthetic resin packing ring which, since it possesses resiliency, does not provide the necessary fixing force.

Neither of the described prior art watch 65 cases provides stable fixing or waterproofness, and both are relatively large due to the considerable thickness of the packing about the circumference of the watchglass, a defect which places severe restrictions upon design. In particular, the secondly mentioned prior art watch 70 case drastically limits design since the upper portion of the packing ring spreads and widens.

The present invention seeks to overcome the above mentioned problems encountered in the 75 prior art.

According to the present invention, there is provided a watch case comprising a disc-like member having a predetermined contour, a fixing member for fixing the disc-like member 80 and having a recess with a shape corresponding to the predetermined contour of the disc-like member and a flange at the axially outer end of said recess; the disc-like member having a cylindrical radially outer surface with a portion 85 of reduced diameter on the axially inner side of said cylindrical surface; and a synthetic resin ring disposed in said recess of said fixing mem-

ber and sandwiched between said recess and said disc-like member and having a protrusion formed when said disc-like member is press fitted into said synthetic resin ring, said protrusion serving as means for retaining said disc-like member.

The present invention can provide a thin and compact watch case in which a very thin watchglass is fixed to a bezel or case band.

10 In the accompanying drawings:—

Figure 1 is a cross-sectional view of a prior art watch case;

Figure 2 is a cross section of a preferred watch case according to the present invention;

15 Figure 3 is a cross section of the watch case shown in Figure 2 during assembly;

Figure 4 is a modified form of the watch case shown in Figure 2;

Figure 5 shows examples of a synthetic resin ring to be used in the case shown in Figure 2;

20 Figure 6 is a cross section of a further prior art watch case;

Figure 7 is a cross section of a modified form of the watch case shown in Figure 2;

25 Figure 8 is a cross section of the watch case shown in Figure 7 during assembly;

Figure 9 is a cross section of a modification of the watch case shown in Figure 7;

30 Figure 10 is a cross section of a synthetic resin ring shown in Figures 7 and 8;

Figure 11 is a cross section of a modification of the watch case shown in Figure 7;

35 Figure 12 is a cross section of another modification of the watch case shown in Figure 7;

Figure 13 is a cross section of another modified form of the watch case shown in Figure 7;

Figure 14 is a cross section of the watch case shown in Figure 13 during assembly;

40 Figure 15 is a cross section of a modification of the watch case shown in Figure 13;

Figure 16 is a cross section of another preferred watch case according to the present invention;

45 Figure 17 is a cross section of the watch case shown in Figure 16 during assembly;

Figure 18 is a cross section of a modified form of the watch case shown in Figure 16;

50 Figure 19 is a cross section of a modification of the watch case in Figure 16;

Figure 20 is a cross section of another preferred watch case according to the present invention;

55 Figure 21 is a cross section showing a modification of the watch case shown in Figure 20;

Figure 22 is a cross section of still another preferred watch case according to the present invention;

60 Figure 23 is a cross section of the watch case shown in Figure 22 during assembly;

Figure 24 is a cross section of another watch case according to the present invention;

Figure 25 shows a modification of the watch case shown in Figure 24;

65 Figure 26 shows examples of a synthetic

resin ring for the watch cases shown in Figures 24 and 25; and

Figure 27 is a cross section of the watch case shown in Figure 24 during assembly.

Figure 1 shows a typical known structure for fixing a watchglass to a watchglass fixing member such as a bezel or case band through the intermediary of a synthetic resin ring. In Figure 1, a watchglass 10 is press-fitted into the stepped portion of a case band 12 through the intermediary of a synthetic resin ring 14. Owing to the excellent plasticity, heat-resistance and chemical resistance of the synthetic resin, the watchglass fixing structure of this type has come into widest use. Based upon experience, such a structure requires that the height of the ring 14 be at least 1.2mm in order to maintain the fixing force and water-tight seal between the watchglass and case band; a height of less than 1.2mm does afford the intended function. Moreover, the thickness of the watchglass in actual practice must be at least 1.3mm since an upper inclined surface 10a must be provided order to enhance appearance and prevent breakage. However, since modern mechanical watch movements now possess a thickness of only 2 to 3mm and electronic watch movements a thickness of 3 to 4mm, there is an increasing need to produce ever thinner and more compact watch cases.

The watchcase according to the present invention was devised in view of the above-mentioned requirements and seeks to minimize watch case thickness by making it possible to fix a watchglass of a thickness as of between 0.4 to 1.2mm, representing a thickness reduction in comparison to the prior art, to a watch glass fixing member such as a bezel or case band.

More specifically, the conventional synthetic ring was disposed between and embraced by the watchglass and case band, whereby frictional force provided the fixing force and waterproofness between the watchglass and ring as well as between the ring and case band. However, when the synthetic ring was compressed in the diametric direction it underwent elastic and plastic deformation directed along its upper edge. As a result, this was accompanied by a corresponding decrease in the force applied to the case band and watchglass so that a strong fixing force and reliable watertight seal could not be obtained.

The inventors have conducted extensive experiments relating to the above mentioned problems and have discovered the following facts:—

- (1) The water-tight seal between the watchglass and synthetic resin ring can be assured if the outer circumference of the watchglass possesses even a short cylindrical outer surface.
- (2) A water-tight seal and fixing force which are greater than expected are obtained at the outer diametric surface of the watchglass and inner circumferential surface of the case band if the synthetic resin ring is subjected to volume com-

pression.

(3) The watchglass fixing force is greatly enhanced when a portion of the synthetic resin ring, in the volume compressed state, is allowed to protrude through a small clearance and cover a portion of the upper inclined surface of the watchglass.

Figures 2 and 3 depict an embodiment of the present invention in which reference numeral 22 denotes a watchglass bezel which serves as a watchglass fixing member, 23 a watchglass, 24 a synthetic resin ring, 25 a sealing ring and 26 a case band. The inner circumferential surface of bezel 22 is formed to include an inwardly facing annular or ring-shaped recess 22a for accommodating the synthetic resin ring 24, an inwardly projecting ring-shaped flange 22b for compressing the upper edge of the ring 24, and a ring-shaped watchglass seating surface 22c for seating the bottom surface of the watchglass 22. The upper surface of flange 22b is formed to include an inclined surface 22d which facilitates the installation of the watchglass. The depth L_1 of the annular recess 22a is selected such that a portion of the compressed synthetic resin ring partially protrudes between a slanted wall 23a of the watchglass and the edge of flange 22b of bezel 22 to firmly retain the watchglass 23 in place. The inner diameter D_1 of flange 22b is slightly larger than the outer diameter D_2 of watchglass 23 in order to serve as a guide when installing the watchglass.

The outer circumference of watchglass 23 includes a substantially vertical outer diametric surface 23b below which is formed an inclined surface 23c that serves as a guide when the watchglass is inserted within the synthetic resin ring 24. As already stated, the diameter D_2 of the outer diametric surface 23b is slightly less than the inner diameter of flange 22d of the bezel 22 and this serves to compress the ring 24. An edge 28 at the intersection of the outer diametric surface 23b and upper inclined surface 23a is formed at a distance H_2 from the bottom surface 23d of the watchglass such that the edge 28 is at a lower level than the inner surface 30 at the upper portion of annular recess 22a, whereby a clearance C is formed between the inner surface 30 and the edge 28 between the slanted wall 23a of watchglass and vertical portion 23b. The edge between the inclined guiding surface 23c and the bottom surface 23d of the watchglass is positioned further inward than the inner surface 24a of the synthetic resin ring 24. This prevents the edge of the watchglass from pulling the ring during the press-fitting of the glass and mitigates the resistance offered by the ring to insertion of the glass. The upper inclined surface 23a of the watchglass is necessary for the sake of appearance and also prevents splintering of the glass. However, in other embodiments of the present invention, the other diametric surface 23b of the watchglass may be joined directly to the

top surface 23e without the intermediary of an inclined portion, as can be seen in, for example, Figure 4.

In Figure 5(a) the synthetic resin ring 24 has a plain rectangular cross-section prior to assembly. The inward side of the ring includes an inner surface 24a which is compressed by the outer diametric surface 23b of the watchglass 23, while the other side includes an outer surface 24b which contacts the bottom of the annular recess 22a of the bezel 22. The height of the ring in this case is the same as or slightly lower than that of the annular groove. Shown in Figure 5(b) is a synthetic resin ring 24 the lower portion of which is equipped with a bulge 24c adapted to creep under the inclined guiding surface 23c of the watchglass 23. Figure 5(c) shows another example in which the inner surface 24a of the ring is provided with a bulge 24d.

The synthetic resin ring 24 is forcibly compressed in the space defined by the annular groove 22a, outer diametric surface 23b and inclined guiding surface 23c. Owing to the plasticity of the resin, the entire space is filled to ensure a waterproof seal and provide the fixing force for the watchglass. Further, the intense volume compression causes a portion of the synthetic resin ring 24 to protrude from the clearance C and form protrusion 24e, the upper inclined surface 23a of the watchglass being pressed in the downward direction by the protrusion 24e.

The assembly proceeds as follows. As shown in Figure 3, the synthetic resin ring 24 is disposed in the annular recess 22a of watchglass bezel 22. Once the watchglass 23 is disposed at a position where it can be guided by flange 22b and inclined surface 22d, the glass is pressed downward by means of a jig and comes into uniform pressured contact with the inner surface 24a of the ring 24, the glass being assisted by the flange 22b so as to approach from the correct position. Finally as shown in figure 2, a portion of the synthetic resin ring 24 protrudes from the clearance C and forms the protrusion 24e on the upper inclined surface 23a, thereby greatly enhancing the force which fixes the watchglass 23.

The results of an experiment shown in the following table relate to fixing force and waterproofness of a watchglass designed and tested on the basis of the structure shown in Figure 2. For reference the table also includes the results of an experiment conducted using a structure illustrated in Figure 6, wherein a watchglass 40 was press-fitted in a synthetic resin ring 42 disposed in the stepped portion of a case band 44. The structure depicted in Figures 2 and 6 made use of the same watchglass as well as an identical synthetic resin ring and ring compressibility; the ring maybe of TEFLON (Registered Trade Mark). The test to determine waterproofness was conducted at a pressure of 4 Atm. for 10 minutes.

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Structure as shown in Figure 2			Structure as shown in Figure 6		
Sample No.	Fixing force	waterproofness	Fixing force	waterproofness	
5	1 17kg	good	5.5kg	good	70
	2 15kg	↑	4 kg	Glass fogged: unsatisfactory	
	3 21kg	↑	8 kg	good	
	4 13kg	↑	4.5kg	Glass fogged: unsatisfactory	
	5 16kg	↑	7.5kg	good	
10	6 25kg	↑	5 kg	↑	75
	7 18kg	↑	6.5kg	↑	
	8 20kg	↑	6.5kg	↑	
	9 17kg	↑	8.5kg	↑	
	10 21kg	↑	7 kg	↑	
15	Average	18.3kg (Fixing force offered no problems during actual use)	6.3kg (Fixing force led to problems during actual use)		80

It is clear from these experimental results that the watchcase of Figure 2 affords waterproofness and fixing force far superior to that of the prior art. Moreover, experiments conducted show that because the ring protrusion covers the upper inclined surface of the watchglass it is possible to reduce the thickness of the watchglass to 0.4mm. This is an accomplishment in view of the fact that the prior art structure could not make use of a watchglass having a thickness of less than 1.3mm.

Although the synthetic resin ring utilized in the experiments was made of Teflon, any material exhibiting suitable plastic characteristics may be used. Teflon is the most appropriate owing to its extremely high degrees of plasticity, but other suitable materials are nylon 11, nylon 12, Tefzel (Registered Trade Mark), Pelpren, Aflon, polyethylene and polycarbonate.

In the present embodiment of the invention, a watchglass bezel is provided with an annular recess which fixes the watchglass, as shown in Figure 2. However, it is also possible to adopt the structure of Figure 4 in which the recess for fixing the watchglass is provided in a case band which will therefore serve as the watchglass fixing member. It is of course possible to adopt the structure of the present invention when attaching other external components such as a back cover, battery hatch, etc.

Since the present embodiment of the invention provides a structure wherein a synthetic resin ring is forcibly compressed between a watchglass and the annular recess of a watchglass fixing member such as a bezel or case band so that a portion of the ring protrudes from a clearance between the watchglass and annular groove to form a protrusion, the force which fixes the watchglass and the watertight seal between the watchglass and its fixing member can both be greatly enhanced. With the prior art watch case, in order to maintain the fixing force and water-tight seal at this portion, it is necessary to increase the thickness of the watchglass and the height of the ring etc. With the embodiment of Figures 2 and 3, a fixing force and waterproofness superior to that of

the prior art can be obtained even when using an extremely small ring and a thin watchglass, and this embodiment of the present invention accordingly meets the demand for thinner, more compact modern watch cases.

Figures 7 to 10 show another watch case according to the present invention, with like parts bearing the same reference numerals as those used in Figures 2 to 4. In this illustrated embodiment, the synthetic resin ring 24 has an L-shaped cross-section prior to assembly. The upper portion of the inward side of the ring includes an inner surface 24a which is compressed by the outer diametric surface 23b of the watchglass 23, while the outer side includes an outer surface 24b which contacts the bottom of the annular recess 22a of bezel 22. The upper surface 24f of an inwardly directed projection 24g serving as a damper to prevent the glass 23 from being damaged when it is assembled to the watch case is adapted to receive the outer circumferential portion at the bottom surface of the watchglass 23. The height of the ring in this case is the same as or slightly lower than that of the annular recess.

The synthetic resin ring 24 is forcibly compressed in the space defined by the annular recess 22a, outer diametric surface 23b and inclined guiding surface 23c. Owing to the plasticity of the resin, the entire space is filled to ensure a waterproof seal and provide the fixing force for the watchglass. Further, the intense volume compression causes a portion of the synthetic resin ring 24 to protrude from the clearance C and form a protrusion 24e, the upper inclined surface 23a of the watchglass being pressed in the downward direction.

Figure 9 shows a modification of the assembly shown in Figure 7. In this modification, the case band 26 is formed with an annular recess 26a in which the ring 24 is disposed to retain the glass 23 in a fixed place.

Figure 10 shows a variant of the ring 24 which is thinner and in which the projection 24g is replaced by a shorter projection 33 having an upper surface 35.

Figure 11 shows another modification of the

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assembly shown in Figure 7. In this modification, the glass plate 23 has on its lower surface a ring-shaped shoulder 23f adapted to hold the projection 24g.

Figure 12 shows still another modified form of the assembly shown in Figure 2. In the modification, a case band 40 has a ring-shaped recess 42 in which a synthetic resin ring 44 is disposed. A watchglass 46 has an upper slanted surface 46a, a lower slanted surface 46, a vertical surface 46c, and a ring-shaped shoulder 46d formed between surfaces 46a and 46c to partially accommodate an inward protrusion of the ring 42 by which the watchglass is retained; this protrusion is formed by compression in assembly.

Figures 13 and 14 show still another modified form of the assembly shown in Figure 2, with like parts bearing the same reference numerals as those used in Figure 2. In this modification, the upper part of the annular recess 22a has an inclined surface 50 inclined at an angle θ to facilitate the installation of the ring 24 and the formation of a protrusion 24e. Figure 14 shows the state before the watch glass 23 is inserted in the ring 24. Other parts are identical to those shown in Figure 2 and therefore a detailed description of the same is omitted.

Figure 15 shows a modification of the watch case shown in Figure 13. In this modification, the synthetic resin ring 51 has an inwardly directed projection 51a, which is compressed between the watch glass 23 and the shoulder 22c of the bezel 22.

Figures 16 and 17 depict another preferred embodiment of the present invention in which reference numeral 60 denotes a bezel which serves as a watchglass fixing member, 62, a watchglass, 64 a synthetic resin ring, 66 a case band, and 68 an inner ring member for seating the bottom surface of the watchglass 62. The inner circumferential surface of bezel 60 is formed to include an annular recess 60a for accommodating the synthetic resin ring 64. The upper portion of the bezel 60 includes a flange 63 for compressing the ring 64, and the lower portion includes a synthetic resin ring seating portion 164 below which is formed a ring-shaped stepped portion 66 adapted to seat the inner ring member 68. The upper surface of flange 63 is formed to include an inclined surface 63a which facilitates the installation of the watchglass. Depth L_1 of the annular recess is approximately equal to the amount of inward compression of the ring. The inner diameter D_1 of flange 63 is slightly greater than the outer diameter D_2 of watchglass 62 in order to serve as a guide when installing the watchglass. The bottom part of inner ring 68 includes a seating surface 68a which rests on the stepped portion 66 of the bezel 60, and the upper part includes a watchglass seating surface 68b adapted to seat the bottom surface 62c of the watchglass 62, the levels of the watchglass seating surface 68b and synthetic resin ring

seating surface 64 being in substantially perfect agreement.

The outer circumference of watchglass 62 includes a substantially vertical i.e. cylindrical outer diametric surface 62a below which is formed an inclined surface 62d that serves as a guide when the watchglass is inserted within the synthetic resin ring. The diameter D_2 of the outer diametric surface 62a is slightly smaller than the inner diameter D_1 of flange 63 of bezel 60 and is designed to compress the ring 64. The edge 70 at the intersection of the outer diametric surface 62a and upper inclined surface 62b is formed at a distance H_2 from the bottom surface 62c of the watchglass 62 so as to be at a lower level than the inner surface 72 at the upper portion of annular recess 60a, whereby a clearance C is formed between the inner surface 72 and the edge 70. The point of intersection between the inclined guiding surface 62d and the bottom 62c of the watchglass is positioned further inward than the inner surface 64a of the synthetic resin ring 64. This prevents the edge of the watchglass from pulling the ring during the press fitting of the glass and reduces the resistance offered by the ring to the insertion of the glass.

As shown in Figure 17, the synthetic resin ring 64 has a rectangular cross-section prior to assembly. The inward side of the ring includes an inner surface 64a which is compressed by the outer diametric surface 62a of the watchglass 62, while the outer side includes an outer surface 64b which contacts the bottom of the annular recess 60a of the bezel 60. The height of the ring in this case is the same as or slightly smaller than that of the annular groove.

The synthetic resin ring is forcibly compressed in the space defined by the annular recess 60a, outer diametric surface 62a and inclined guiding surface 62d. Owing to the plasticity of the resin, the entire space is filled to ensure a waterproof seal and provide the fixing force for the watchglass. Further, the intense volume compression and the depth L_1 of the recess are such as to cause a portion of the synthetic resin ring 64 to protrude from the clearance C and form a protrusion 74, the upper inclined surface 62b of the watchglass being thereby pressed in the downward direction.

The assembly proceeds as follows. As shown in Figure 17, the ring member 68 is disposed in the stepped portion 66 of the watchglass bezel 60 from above, and the synthetic resin ring 64 is then placed in the annular recess 60a of the bezel. Once the watchglass is disposed at a position where it can be guided by flange 63 and inclined surface 63a the glass is pressed downward by means of a jig and comes into uniform pressured contact with the inner surface 64a of the ring 64, the glass being assisted by the flange 63 so as to approach from the correct position. Finally, as shown in Figure 16, a portion of the synthetic ring 64 protrudes

from the clearance C and forms the protrusion 74 on the upper inclined surface 62b, thereby greatly enhancing the force which fixes the watchglass 62 and strongly securing the inner ring 68 to the bezel 60.

Figure 18 is a cross-sectional view of a modified form of the watch case shown in figure 16. In Figure 18, the synthetic resin ring seating surface 64 of bezel 60 also serves as means for seating inner ring member 80; hence, the step of forming the stepped portion 66 can be eliminated. The assembly proceeds as described above.

While, in Figure 17, an upper wall of the inner ring member 68 is aligned with a lower radial wall of the recess 60a, the inner ring member 68 may be arranged such that the upper wall 68b engages the bottom wall of the watchglass at a position displaced from the lower radial wall of the recess 60a as shown in Figure 19.

Figure 20 shows another watch case according to the present invention. In Figure 20, reference numeral 80 denotes a watchglass, 82 a synthetic resin ring, 84 a bezel, 86 a case band, and 88 a packing ring compressed between the bezel 84 and the case band 85. The bezel 84 has an annular recess 84a at its upper portion and an outer circumferential shoulder portion 84b for receiving a ring 90. Bezel 84 and ring 90 constitute a watchglass fixing member. The ring 90 includes a flange 90a which, together with the annular recess 84a of the bezel 84, forms a channel-shaped annular recess when the ring is fitted about the outer circumferential shoulder portion 84b of the bezel. The synthetic resin packing 82 is disposed in the annular recess formed by combining the bezel 84 and ring 90, and the watchglass 80 is installed by pressing it into the packing from above. The vertical distance 1b between the edge formed between an upper inclined surface 80 and an outer diametric portion 80b of the glass 80 is less than the vertical height of the annular recess 84a while the outer diameter of the watchglass 80 is slightly smaller than the inner diameter of the flange 90a. The watchglass 80 also includes a lower inclined surface 80c below the vertical portion 80b. The watchglass 80 is inserted into the annular recess and compresses the synthetic resin packing so that a portion of the packing is caused to protrude from between the outer diametric portion 80b and flange 90b which defines a portion of the annular recess, whereby a protrusion 82a is formed on the ring 82 adjacent the upper inclined surface 80a of watchglass 80. Thus, the packing 82 is disposed in the annular recess defined by bezel 84 and ring 90 and a portion of the packing undergoes plastic deformation owing to the insertion of the watchglass, thereby forming the protrusion 82a on the ring 82 adjacent the upper inclined surface 80a of the watchglass 80 in order to prevent the glass from falling out. Since only a

small gap is defined between the outer diametric portion 80b of the watchglass and a watchglass guiding surface 90c on the flange 90a of ring 90, the breaking strength of the protrusion 82a formed in said gap is increased so that the watchglass is strongly retained and fixed. The small gap also facilitates the installation of the watchglass, as does an inclined surface 90d which is formed on the top surface of the flange 90a.

Figure 21 shows another embodiment of the present invention in which the ring 82 is press fitted and secured in an annular recess 84a defined by a flange 84c and a lower shoulder provided by a separate ring 92. Because an annular recess is not formed in the bezel 84 it is easier to produce on a lathe. As in the embodiment of Figure 20, the packing 82 is compressed by the outer diametric portion 80b of the watchglass and thus undergoes plastic deformation so that a portion of the packing is caused to protrude from the space formed by the outer diametric portion 80b and the flange 84c so as to form a protrusion 82a on the ring 82 adjacent the upper inclined surface 80a of the watchglass which is therefore prevented from falling out. In this embodiment, the ring 92 rests on the annular shoulder 86a of case band 86.

Figures 22 and 23 show another watch case according to the present invention. In Figure 22, the outer circumference of watchglass 100 includes a substantially vertical outer diametric surface 100a below which is formed an inclined surface 100b that serves as a guide when the watchglass is inserted within synthetic resin ring 102. The outer diametric surface 100a of the watchglass is provided with a groove 104. The outer diameter D_2 of the surface 100a is slightly less than the inner diameter D_1 of flange 105 of bezel 106 and is designed so as to compress the ring 102. The edge 108 at the intersection of the lower portion of the outer diametric surface 100g and the groove 104 is formed at a distance H_2 from the bottom surface 112 of the watchglass so that the edge 108 is at a lower level than the inner surface 114 at the upper portion of annular recess 116, whereby a clearance C is formed between the inner surface 114 and the edge 108. The point of intersection between the inclined guiding surface 100b and the bottom surface 112 of the watchglass is positioned further inward than the inner surface 102a of the synthetic resin ring 102. This prevents the edge of the watchglass from pulling the ring during the press fitting of the glass and mitigates the resistance offered by the ring to the insertion of the glass.

The assembly proceeds as follows. As shown in Figure 23, the synthetic resin ring 102 is disposed in the annular recess 116 of watchglass bezel 106. Once the watchglass is disposed at a position where it can be guided by flange 105 and inclined surface 118, the glass is pressed downward by means of a jig and comes into

uniform pressured contact with the inner surface 102a of the ring 102, the glass being assisted by the flange 105 so as to approach from the correct position. Finally, as shown in Figure 22, a portion of the synthetic resin ring 102 protrudes from the clearance C and forms a protrusion 120 in the recess 104, thereby greatly enhancing the force which fixes the watchglass 100. In addition, since the protrusion 120 is disposed in the recess 104, no part of the synthetic resin ring is visible from the outside.

Figures 24 and 25 show other embodiments of the present invention. Reference numeral 120 denotes a case band which serves as a back cover fixing member, 122 a back cover, and 124 a synthetic resin ring. The inner circumferential surface of case band 120 is formed to include an annular recess 126 for accommodating the synthetic ring 124. The lower portion of the annular recess 126 includes a flange 128 for compressing the ring 124, and the upper portion includes a back cover seating surface 130 for seating the top surface of the back cover 122. The lower surface of flange 128 is formed to include an inclined surface 132 which facilitates the installation of the back cover 122. The depth L_1 of the annular recess 126 is approximately equal to the amount of inward compression of the synthetic resin ring, and the inner diameter D_1 of flange 128 is slightly greater than the outer diameter D_2 of back cover 122 in order to serve as a guide when installing the back cover.

The outer circumference of back cover 122 includes a substantially vertical outer diametric surface 134 above which is formed an inclined surface 136 that serves as a guide when the back cover is inserted within the synthetic resin ring. The edge 138 between the outer diametric surface 134 and lower inclined surface 140 is at a distance H_2 from the surface 130; distance H_2 is less than the height of the annular recess 126, whereby a clearance C is formed between the lower inner surface 144 and the edge 138. The edge between the inclined guiding surface 136 and the surface 142 of the back cover is positioned further inward than the inner surface of the synthetic resin ring. This prevents the edge of the back cover from pulling the ring during the press-fitting of the back cover and mitigates the resistance offered by the ring to the back cover.

In Figure 26(a) the synthetic resin ring 124 has rectangular cross-section prior to assembly. The inward side of the ring includes an inner surface 124a which is compressed by the outer diametric surface 134 of the back cover 122, while the outer side includes an outer surface 124b which contacts the bottom of the annular recess 126 of the case band 120. The height of the ring in this case is the same as or slightly lower than that of the annular groove. Shown in Figure 26(b) is a synthetic resin ring 124 the upper portion of which is equipped with a

bulge 124c adapted to creep under the inclined guiding surface 136 of the back cover 122. Figure 26(c) shows another example in which the inner surface 124a of the ring is provided with a bulge 124d.

The synthetic ring 124 is forcibly compressed in the space defined by the annular recess 126, outer diametric surface 134 and inclined guiding surface 136. Owing to the plasticity of the resin, the entire space is filled to ensure a waterproof state and provide the fixing force for the back cover. Further, the intense volume compression causes a portion of the synthetic resin ring 124 to protrude from the clearance C and form a protrusion 146, the lower inclined surface 140 of the back cover being pressed in the upward direction.

The assembly proceeds as follows. As shown in Figure 23, the synthetic resin ring 124 is disposed in the annular recess 126 of case band 120. Once the back cover is disposed at a position where it can be guided by flange 128 and inclined surface 132, the cover is pressed upward by means of a jig and comes into uniform pressured contact with the inner surface 124a of the ring 124, the back cover being assisted by the flange 128 so as to approach from the correct position. Finally, as shown in Figure 24, a portion of the synthetic resin ring 124 protrudes from the clearance C and forms the protrusion 146 on the lower inclined surface 140, thereby greatly enhancing the force which fixes the back cover.

WHAT WE CLAIM IS:—

1. A watch case comprising a disc-like member having a predetermined contour, a fixing member for fixing the disc-like member and having a recess with a shape corresponding to the predetermined contour of the disc-like member and a flange at the axially outer end of said recess, the disc-like member having a cylindrical radially outer surface with a portion of reduced diameter on the axially inner side of said cylindrical surface; and a synthetic resin ring disposed in said recess of said fixing member and sandwiched between said recess and said disc-like member and having a protrusion formed when said disc-like member is press fitted into said synthetic resin ring, said protrusion serving as means for retaining said disc-like member.

2. A watch case as claimed in Claim 1, in which said disc-like member also has an inclined surface formed at the axially outer edge of said cylindrical surface, said protrusion of said synthetic resin ring engaging said inclined surface for thereby retaining said disc-like member in place.

3. A watch case as claimed in Claim 1, in which said protrusion of said synthetic resin ring engages the axially outer circumferential edge of the circumferential surface.

4. A watch case as claimed in any of Claims 1 to 3 in which the disc-like member is a watch glass.



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uniform pressured contact with the inner surface 102a of the ring 102, the glass being assisted by the flange 105 so as to approach from the correct position. Finally, as shown in Figure 22, a portion of the synthetic resin ring 102 protrudes from the clearance C and forms a protrusion 120 in the recess 104, thereby greatly enhancing the force which fixes the watchglass 100. In addition, since the protrusion 120 is disposed in the recess 104, no part of the synthetic resin ring is visible from the outside.

Figures 24 and 25 show other embodiments of the present invention. Reference numeral 120 denotes a case band which serves as a back cover fixing member, 122 a back cover, and 124 a synthetic resin ring. The inner circumferential surface of case band 120 is formed to include an annular recess 126 for accommodating the synthetic ring 124. The lower portion of the annular recess 126 includes a flange 128 for compressing the ring 124, and the upper portion includes a back cover seating surface 130 for seating the top surface of the back cover 122. The lower surface of flange 128 is formed to include an inclined surface 132 which facilitates the installation of the back cover 122. The depth L_1 of the annular recess 126 is approximately equal to the amount of inward compression of the synthetic resin ring, and the inner diameter D_1 of flange 128 is slightly greater than the outer diameter D_2 of back cover 122 in order to serve as a guide when installing the back cover.

The outer circumference of back cover 122 includes a substantially vertical outer diametric surface 134 above which is formed an inclined surface 136 that serves as a guide when the back cover is inserted within the synthetic resin ring. The edge 138 between the outer diametric surface 134 and lower inclined surface 140 is at a distance H_2 from the surface 130; distance H_2 is less than the height of the annular recess 126, whereby a clearance C is formed between the lower inner surface 144 and the edge 138. The edge between the inclined guiding surface 136 and the surface 142 of the back cover is positioned further inward than the inner surface of the synthetic resin ring. This prevents the edge of the back cover from pulling the ring during the press-fitting of the back cover and mitigates the resistance offered by the ring to the back cover.

In Figure 26(a) the synthetic resin ring 124 has rectangular cross-section prior to assembly. The inward side of the ring includes an inner surface 124a which is compressed by the outer diametric surface 134 of the back cover 122, while the outer side includes an outer surface 124b which contacts the bottom of the annular recess 126 of the case band 120. The height of the ring in this case is the same as or slightly lower than that of the annular groove. Shown in Figure 26(b) is a synthetic resin ring 124 the upper portion of which is equipped with a

bulge 124c adapted to creep under the inclined guiding surface 136 of the back cover 122. Figure 26(c) shows another example in which the inner surface 124a of the ring is provided with a bulge 124d.

The synthetic ring 124 is forcibly compressed in the space defined by the annular recess 126, outer diametric surface 134 and inclined guiding surface 136. Owing to the plasticity of the resin, the entire space is filled to ensure a waterproof state and provide the fixing force for the back cover. Further, the intense volume compression causes a portion of the synthetic resin ring 124 to protrude from the clearance C and form a protrusion 146, the lower inclined surface 140 of the back cover being pressed in the upward direction.

The assembly proceeds as follows. As shown in Figure 23, the synthetic resin ring 124 is disposed in the annular recess 126 of case band 120. Once the back cover is disposed at a position where it can be guided by flange 128 and inclined surface 132, the cover is pressed upward by means of a jig and comes into uniform pressured contact with the inner surface 124a of the ring 124, the back cover being assisted by the flange 128 so as to approach from the correct position. Finally, as shown in Figure 24, a portion of the synthetic resin ring 124 protrudes from the clearance C and forms the protrusion 146 on the lower inclined surface 140, thereby greatly enhancing the force which fixes the back cover.

WHAT WE CLAIM IS:-

1. A watch case comprising a disc-like member having a predetermined contour, a fixing member for fixing the disc-like member and having a recess with a shape corresponding to the predetermined contour of the disc-like member and a flange at the axially outer end of said recess, the disc-like member having a cylindrical radially outer surface with a portion of reduced diameter on the axially inner side of said cylindrical surface; and a synthetic resin ring disposed in said recess of said fixing member and sandwiched between said recess and said disc-like member and having a protrusion formed when said disc-like member is press fitted into said synthetic resin ring, said protrusion serving as means for retaining said disc-like member.

2. A watch case as claimed in Claim 1, in which said disc-like member also has an inclined surface formed at the axially outer edge of said cylindrical surface, said protrusion of said synthetic resin ring engaging said inclined surface for thereby retaining said disc-like member in place.

3. A watch case as claimed in Claim 1, in which said protrusion of said synthetic resin ring engages the axially outer circumferential edge of the circumferential surface.

4. A watch case as claimed in any of Claims 1 to 3 in which the disc-like member is a watch glass.

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5. A watch case as claimed in Claim 4 wherein said portion defines an inclined surface.
6. A watch case as claimed in Claim 5, in which said recess has its axially outer portion formed with an inclined surface.
- 5 7. A watch case as claimed in Claim 5, in which said recess has a radially extending seating surface and said synthetic resin ring has a portion sandwiched between said watchglass and said seating surface.
- 10 8. A watch case as claimed in Claim 4, in which said watchglass has groove formed in its cylindrical surface, said protrusion engaging said groove of said watchglass to retain said watchglass.
- 15 9. A watch case as claimed in Claim 5, in which said fixing member has a stepped portion formed at a position axially inwards of said recess of said fixing member, and further comprising a watchglass seating ring received by
- 20 said stepped portion, said watchglass being seated on said watchglass seating ring.
10. A watch case as claimed in Claim 5, in which said fixing member comprises a bezel having an inwardly directed recess and an outwardly directed recess, and a ring member fitted to said outwardly directed recess of said bezel, said flange of said fixing member being formed by a portion of said ring member.
- 25 11. A watch case as claimed in Claim 5, further comprising a watchglass seating ring disposed in said recess of said fixing member and having a seating surface on which said watchglass and a bottom wall of said synthetic resin ring are seated.
- 30 12. A watch case substantially as hereinbefore described with reference to Figures 2 to 5 and 7 to 27 of the accompanying drawings.
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- MARKS & CLERK 40

