

SUPPORTING AND RETAINING DEVICE
FOR A CIRCULAR MEMBER

The present invention relates to a supporting and a retaining device for a circular member, such as a circular lens.

For example, a circular lens is fitted in the correspondingly circular opening of a lens holder and is retained at the peripheral edge by a lens retaining ring. The retaining ring is usually secured to the lens holder by set screws. However, in a recent inexpensive lens holder made of molded plastic, no set screws are used. Instead, the plastic lens holder has supporting projections (bosses) which are located along an imaginary circle coaxial to the circular lens to surround the circular opening. On the other hand, the plate like retaining ring (annular member) which comes into contact with the peripheral edge of the circular lens has a plurality of holes in which the supporting projections of the lens holder are fitted. The heads of the supporting projections which are fitted in the corresponding holes of the retaining ring are fused to connect to the lens holder. With the connection of the lens to the lens holder by means of the retaining ring mentioned above, manufacturing and assembling costs of the elements can be reduced.

In the connection, the position and the diameter of the supporting projections of the lens holder must correspond to the position and diameter of the holes of the retaining ring as exactly as possible. However, it is very difficult to machine the lens holder and the retaining ring so as to precisely correspond the position and the diameter of the supporting projections of the lens holder to those of the holes of the retaining ring. If there is a slight deviation in position or disagreement in size, no assembly can be effected.

In a situation where the retaining ring is secured to the lens holder with play by fusing the supporting projections as mentioned before, no precise positioning of the lens to the lens holder of the retaining ring can be ensured. Furthermore, since the fusing conditions of the supporting projections depends on the size of the corresponding holes of the lens holder, no stable fusing can be realised.

An object of the present invention is to eliminate the above-mentioned drawbacks by providing a supporting and retaining device for a circular member in which when the supporting projections are fitted in the corresponding holes of the retaining ring, there is no displacement of the retaining ring, that is, there is no play between the supporting projections and the corresponding holes.

Another object of the present invention is to provide a supporting and retaining device for a circular member in which a plurality of supporting projections can be fused to be connected under the same fusing conditions.

According to the present invention there is provided a supporting and retaining device for a circular member, the device comprising:-

a supporting member having three supporting projections provided along an imaginary circle;

and an annular member having three supporting holes elongated in the radial direction thereof;

wherein said supporting projections are fitted in said supporting holes for supporting and retaining said circular

member.

With this arrangement, the three supporting projections and the three elongated holes corresponding thereto make it possible to assemble the supporting and retaining device even if the tolerance in diameter of the supporting projections and the elongated holes is very strictly set.

Preferably, said supporting member is made of synthetic resin.

Conveniently, said supporting projections are thermally fused at the heads when the supporting projections are fitted in the supporting holes.

In one embodiment, said supporting member has a circular holding portion for holding the circular member therein, said supporting projections being located around the circular holding portion; and wherein said annular member is in contact with the peripheral edge of the circular member held in the circular holding portion to retain the circular member to the supporting member.

In another embodiment, said annular member has arched holes located along an imaginary circle concentric to the annular member to define elastically deformable arched portions.

In one case, said elastically deformable arched projections have projections which come into elastic contact with the circular member.

The supporting holes may be identical to each other.

Preferably, said supporting holes are located along an imaginary circle concentric to the annular member.

The present invention encompasses a lens frame including a supporting and retaining device as herein above defined and a plastic lens as said circular member.

An example of the present invention will be described below in detail with reference to the accompanying drawings, in which:

Figure 1 is a front elevation view of the main part of a

supporting and retaining device for a circular member embodying the present invention;

Figure 2 is a sectional view taken along the line II-II in Figure 1; and ,

Figure 3 is an exploded perspective view of the support and retaining device shown in Figure 1.

The illustrated embodiment concerns a supporting and retaining device for a circular plastic lens 11 as a circular member. The plastic lens which is made of molded plastic has a gate portion 11a which was used as a sprue through which molten plastic is poured upon molding and which radially projects from the outer periphery of the plastic lens 11. A lens holder (frame) 12 holds the plastic lens 11 and a glass lens 13. The lens holder 12 has holding portions (circular

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openings) 14 and 15 at its axial opposite ends. The holding portion 14 for the plastic lens 11 has a circular opening 14a and a recess 14b which radially extends from the circular opening 14a, so that the gate portion 11a is fitted in the recess 14b. The holding portion 15 for the glass lens 13 is in the form of a simple circular opening.

The lens holder 12 constitutes a variable power lens group of a zoom lens together with another lens group. The lens holder 12 has a linear guide plate 16 which lies in a plane substantially parallel with the optical axis of the zoom lens to engage with a linear guide member of a lens barrel not shown.

The plastic lens 11 is secured to the lens holder 12 by a lens retaining ring 17 in a state in which the gate portion 11a is fitted in the recess 14b of the holding portion 14. The glass lens 13 is secured to the lens holder 12 for example by calking the end of the holding portion 15.

The lens retaining ring 17 is made of leaf spring and has three arched holes 17a which are spaced from one another at an equiangular distance along an imaginary circle having a center located on a center of the ring and which define three elastically deformable arched portions 17b located inside the associated arched holes 17a. The arched portions 17b have at their center portions projections 17c which come into contact with the plastic lens 11. The lens retaining ring 17 has three identical elongated supporting holes 17d which are spaced from one another at an equiangular distance of 120° along an imaginary circle coaxial to the ring between the adjacent arched holes 17a. The supporting holes 17d extend in a radial direction of the ring 17.

The lens holder 12 has three supporting projections (bosses) 12a which have a circular cross section and which are fitted in the corresponding supporting holes 17d of the lens retaining ring 17. The diameter d of the supporting projections 12a is slightly smaller than the width s of the

elongated supporting holes⁶ 17d to provide a smallest clearance therebetween. The position of the supporting projections 12a in the radial direction is such that the centers of the supporting projections 12a are located at the centers of the associated elongated supporting holes 17d.

In the arrangement as mentioned above, even if there is a slight error in position between the elongated supporting holes 17d and the supporting projections 12a, caused upon manufacturing, the supporting projections 12a of the lens holder 12 can be certainly fitted in the associated supporting holes 17d of the lens retaining ring 17 and there is no play therebetween after the supporting projections 12a are fitted in the corresponding supporting holes 17d. The reasons thereof are as follows.

Supposing that only two of the three supporting projections 12a are fitted in the corresponding supporting holes 17d, the fitting can be easily effected, since the length ℓ of the elongated supporting holes 17d is sufficiently larger than the diameter of the supporting projections 12a. In this state, the lens retaining ring 17 is rotatable and movable within a range corresponding to play between the supporting projection 12a and the associated supporting holes 17d of the length ℓ . The displacement (including the rotational displacement) permits the remaining supporting projection 12a to be certainly fitted in the remaining supporting hole 17d. Namely, since the remaining (third) supporting hole 17d is an elongated hole extending in the radial direction of the lens retaining ring 17, the portion in which the remaining (third) supporting projection 12a can be fitted exists. Furthermore, since the width s of the supporting holes 17d and the diameter d of the associated supporting projections 12a are designed to minimize the clearance therebetween, as mentioned before, when all of the supporting projections 12a are fitted in the associated supporting holes 17d, no

displacement of the lens retaining ring 17 takes place due to no play. The length ℓ of the elongated supporting holes 17d is determined so as to perform the above-mentioned operation, taking the dimensional precision of the supporting projections 12a and the supporting holes 17d into account.

The heads of the supporting projections 12a are fused so as to be connected (thermal calking) after the lens retaining ring 17 is fitted therein. In this state, the projections 17c of the lens retaining ring 17 are elastically brought into contact with the plastic lens 11 by the elasticity of the elastically deformable arched portions 17b to retain the plastic lens 11 in the holding portion 14 of the lens holder 12. The fusing of the supporting projections 12a can be stably and uniformly effected under the same fusing condition, since all the supporting holes 17d are identical to each other.

Although the above discussion has been directed to the supporting and retaining device of the plastic lens 11, the present invention can be generally applied to any circular member other than a lens.

In the illustrated embodiment, the supporting projections 12a are fused so as to be connected to the lens holder 12. Alternatively, the present invention can be applied also to supporting projections 12a which are made of, for example, metal. In such an alternative, another securing means can be additionally provided to secure the lens retaining ring to the lens holder.

CLAIMS

1. A supporting and retaining device for a circular member, the device comprising:-
a supporting member having three supporting projections provided along an imaginary circle;
and an annular member having three supporting holes elongated in the radial direction thereof;
wherein said supporting projections are fitted in said supporting holes for supporting and retaining said circular member.
2. A device according to claim 1 wherein said supporting member is made of synthetic resin.
3. A device according to claim 1 or 2 wherein said supporting projections are thermally fused at the heads when the supporting projections are fitted in the supporting holes.
4. A device according to any preceding claim wherein said supporting member has a circular holding portion for holding the circular member therein, said supporting projections being located around the circular holding portion; and wherein said annular member is in contact with the peripheral edge of the circular member held in the circular holding portion to retain the circular member to the supporting member.
5. A device according to any preceding claim wherein said annular member has arched holes located along an imaginary circle concentric to the annular member to define elastically deformable arched portions.
6. A device according to claim 5 wherein said elastically deformable arched projections have projections which come into elastic contact with the circular member.



7. A device according to any preceding claim wherein said supporting holes are identical to each other.

8. A device according to claim 7 wherein said supporting holes are located along an imaginary circle concentric to the annular member.

9. A supporting and retaining device for a circular member substantially as herein described with reference to the accompanying drawings.

10. A lens frame including a supporting and retaining device according to any preceding claim and a plastic lens as said circular member.
