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(54) An optical axis adjusting apparatus of a projector type headlight.

(57) An optical axis adjusting apparatus of a projector type headlight including a bracket for supporting a frame integrally fixed with the lamp unit composed of a reflector, a light source, a shade for shaping the light reflected by the reflector and condensed at a predetermined region suitably, and a convex lens for forwardly projecting the shaped light. The bracket's position is adjustable with respect to the lamp housing, and the bracket supports the frame rotatably around the horizontal and vertical axes perpendicular with respect to the reflector's axis. The rotation around the horizontal axis is effected by an adjusting screw rod which is screwed to a nut fixed at a portion of the frame and rotatable without moving in the reflector's axis direction, and on the other hand the rotation around the vertical axis is effected by another adjusting screw rod which is screwed to a nut fixed at a portion of the bracket and rotatable without moving in the reflector's axis direction with respect to the housing. By this, the direction of the optical aixs of the lamp unit is easily adjusted and the adjusted position thereof is held surely.

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Description

AN OPTICAL AXIS ADJUSTING APPARATUS OF A PROJECTOR TYPE HEADLIGHT

Background of the Invention

a) Field of the Invention

The present invention relates to an optical axis adjusting apparatus of a projector headlight adopted as a headlight of automobiles, more particularly to an optical axis adjusting apparatus in which when a projector type headlight is mounted on the automobile's body, an optical axis of the headlight is preliminarily adjustable in the vertical and horizontal directions in order to obtain the most suitable illumination position thereof.

b) Description of Related Art

In a conventional headlight, the adjustment of the optical axis has been made by the mechanism in which the reflecting surface of a reflector having a bulb and disposed within a housing is arranged tiltably with respect to the horizontal axis and the vertical axis of the reflector, or the mechnism in which a whole housing including a reflector is arranged tiltably with respect to the horizontal and vertical axes. On the other hand, it is requested for a projector type headlight to condensing the light reflected by the reflector at the focal point of a convex lens. To this end, both of the leflector and the convex lens are mounted on the same frame so as not to change the relative position therebetween. Such projector type headlight unit is received in the housing having a front lens formed with the prism for diffusing the light projected from the convex lens, therefore it is not possible to apply the conventional optical axis adjusting apparatus in which only the reflecting surface of a reflector is tilted with respect to a housing, to the projector type headlight as it is. Furthermore, the projector type headlight is compact in comparison with the conventional headlight, and it is necessary that the front portion of the housing mounted with the diffusing prism forms a portion of the automobile's body. Therefore, it is necessary that the whole lamp unit inclusing the housing is fixed on the automobile's body, so that it is not possible to apply the conventional optical axis adjusting mechanism in which the whole housing including a reflector is tilted around the horizontal and vertical axes, to the projector type headlight. The projector type headlight unit is compact in comparison with a conventional headlight but the unit is formed in a configuration elongated in the reflector's axial direction, therefore it is important that the whole lamp unit including housing is mounted on the automobile's body, and then the optical axis thereof is adjusted and the headlight is surely held at a predetermined position.

The history of development in utilization level, of the projector type haedlight is comparatively short, therefore there is currently no optical axis adjusting apparatus having the reliability enough for mounting the optical axis adjusting apparatus on automobiles and a compact construction. Therefore, a development of the optical axis adjusting apparatus satisfying the above condition has been desired.

Summary of the Invention

The object of the present invention is to present an optical axis adjusting apparatus of a projector type headlight having a compact constitution and high reliability.

Other object of the present invention is to present the optical axis adjusting aparatus of a projector type headlight in which the adjusting operation of the optical axis is made very easily and further it is possible to surely maintain the adjusted condition of the headlight.

A further object of the present invention is to present the optical axis adjusting apparatus of a projector type headlight having the constitution that no resonance of a lamp unit is caused with respect to any vibration from external.

A further object of the present invention is to present the optical axis adjusting apparatus of a projector type headlight in which the size of a lamp housing is not affected by the existence of adjusting means and a minimum size of the lamp unit corresponding to the lamp unit installed in the lamp housing can be obtained.

Other objects of the present invention will be understood with reference to the following detailed descriptions and attached drawings.

Brief Description of the Drawings

Figs. 1 to 9 show a first embodiment of the optical axis adjusting apparatus of a projector type headlight of the present invention, Fig. 1 is a longitudinal sectional view showing the projector type headlight providing the optical axis adjusting apparatus, Fig. 2 is a perspective view showing a headlight including the optical axis adjusting apparatus, and a part of a housing, Fig. 3 is a front view showing the projector type headlight, Fig. 4 is a sectional view taken along the line IV - IV in Fig. 3, Fig. 5 is a sectional view taken along the line V - V in Fig. 3, Figs. 6 to 9 are schematic views for explaining the position of the opening which may be formed in a reflector.

Figs. 10 to 13 show a second embodiment of the optical axis adjusting apparatus of a projector type headlight of the present invention, Fig. 10 is a front view of the projector type headlight, Fig. 11 is a sectional view taken along the line XI - XI in Fig. 10, Fig. 12 is a sectional view taken along the line XII - XII in Fig. 10, Fig. 13 is a sectional view taken along the line XIII - XIII in Fig. 10.

Detailed Description of Preferred Embodiments

Referring to Fig. 1 a whole projector type headlight 10 is shown, in which a reflector 12 has an inside reflecting surface 14 and a bulb 16 as a light source is installed on a reflector's axis Z - Z. The inside reflecting surface 14 is formed in such as revolutional spheroid, the bulb 16 as a light source is disposed in such a manner that the filament of the

bulb 16 is located on one focal point of the spheroid, and a shade 18 for shaping the light reflected on the inside reflecting sur face 14 and condensing the light toward the other focal point of the spheroid, is desposed in such a manner that the upper edge portion of the shade locates on the horizontal surface including the reflector's azis Z - Z. A convex lens 20 for projecting forwardly the pencil shaped by the shade 18 is apart from the shade by a constant distance (the focal distance of the convex lens), and the convex lens 20 is disposed such that the center of the convex lens is lcocated on the reflector's axis Z - Z. These optical system is fixed on the same frame 22 integrally to form a lamp unit. As shown in Fig. 2 the frame 22 is formed approximately cylindrical, and the convex lens 20 is fixed at one end of the frame 22. The other end of the frame 22 is formed approximately rectangular as a flange portion 23 for the purpose of fixing the reflector 12 as mentioned hereinafter. The reflector 12 is made of synthetic resin, and the opening portion is formed as an approximately rectangular in this embodiment, though it is general to form the opening portion as the flange portion 24 projected in the direction perpendicular to the reflector's axis in view of strength. There are disposed on the flange portion 24 cylindrical connecting members 26 projecting in the direction parallel with the reflector's axis, at the vicinity of the four corners of the flange portion 24. These connecting members 26 are formed integrally with the reflector 12. The flange portion 23 of the frame 22 is connected to the reflector 12 by screwing male screws 28 into female screws formed at the end point of the connecting members 26 respectively. There are formed openings 30 for heat radiation at the periphery of the cylindrical frame 22 as shown in Fig. 2.

The lamp unit is supported by another bracket 36 rotatably disposed with respect to the bracket 34 fixed in the housing 32. The rotatable bracket 36 is, as shown in Fig. 3, composed of a base wall 38 approximately parallel with the horizontal plane including the horizontal axis X - X perpendicular to the reflector's axis, and a pair of vertical walls 40a and 40b rising from both end portions of the base wall 38, thereby forming U-shaped formation as a whole. The bracket 36 is mounted rotatably around a rotation shaft 42 inserted into a hole formed on a portion of the base wall 38 adjacent to the vertical wall 40a, namely around the axis perpendicular to the reflector's axis and further parallel with the horizontal axis X - X and the vertical axis Y - Y. Numeral 44 denotes a slide shoe formed at the rear surface of the base wall 38 in the vicinity of the vertical wall 40b among the vertical walls 40a and 40b, and the slide shoe 44 is contacted with the bracket 36. The slide shoe 44 supports a portion of the weight of the above-mentioned lamp unit and the bracket 36, and the slide shoe 44 is formed as perlforming the function to reduce the friction force between the bracket 36 and the slide shoe 44 upon rotation of the bracket 36 around the rotation shaft 42. The lamp unit is installed rotatably around the horizontal axis with respect to the bracket 36. Namely, there are provided horizontal shafts 50a and 50b at the upper portion of the paired vertical walls 40a' and 40b respectively, and both side portions of the flange portion 23 of the frame 22 are rotatably supported at the horizontal shafts 50a and 50b respectively. The lamp unit is preferably constructed such that the center of gravity of the lamp unit is located in the vertical surface perpendicular to the reflector's axis and including the horizontal shafts 50a and 50b. In this embodiment, the center of gravity thereof is located in the vicinity of the line connecting the horizontal shafts 50a and 50b with each other.

There are provided means for rotating the lamp unit around the vertical shaft 42 and the horizontal shafts 50a and 50b between the bracket 36 and the housing 32, and between the frame 22 and the housing 32 respectively. Its construction will be described specifically hereinafter. There are disposed two adjusting screw rod 60 and 62 in parallel with the reflector's axis and through holes mounted on the housing 32 respectively, and the adjusting screw rod 62 is disposed, as shown in Fig. 2, through the through hole 70 formed on the flange portion 24 of the reflector 12. The adjusting screw rods are constructed so as not to be moved in the axial direction respectively, and the male screw portion of each adjusting screw rods 61 and 63 is screwed, as shown in Figs. 4 and 5, into each of nuts 64 and 66 fixed at the upper portion of the flange 23 of the frame 22 and the vertical wall 40b of the bracket 36 respectively. The nut 64 is positioned at the position apart from the rotation shaft 42, and the nut 66 is positioned at the position apart upwardly from the line connecting the horizontal shafts 50a and 50b. In the embodiment, the center of gravity of the unit lamp is located in the vicinity of the line connecting the horizontal shafts 50a and 50b, therefore the load to be applied to the adjusting screw rods 60 and 62 may be small.

According to the optical axis adjusting apparatus thus constructed, by rotating the screw rod 60 forwardly or reversely, the bracket 36 is rotated around the vertical shaft 42 with respect to the housing 32 forwardly or reversely, in the state that the rotation position of the lamp unit around the horizontal axis is held with respect to the bracket 26, on the other hand by rotating the adjusting screw rod 62 forwardly or reversely, the lamp unit is rotated around the horizontal shafts 50a and 50b with respect to the bracket 36, in the state that the rotation position of the bracket 36 around the vertical shaft is held with respect to the housing 32. Therefore, the optical axis of the lamp unit can be easily adjustable and held at the adjusted position thereof, by rotating the adjusting screw rod 60 or 62 in the suitable direction. Furthermore, according to the above-mentioned construction, it is prevented bo be resonated due to the external vibration. Numeral 80 denotes a transparent cover for covering the front opening of the housing 32 and it is fixed at the opening portion of the housing 32 by using adhesive 82. Numeral 84 denotes a non-transparent inner plate for blocking the light incident on the transparent cover 80 through the openings 30 of the frame 22 among the light emitted from the optical source bulb 16 thereby not leaking the light.

In this embodiment, there is provided the through hole 70 of loosely passing the screw rod 62 on the portion of the flange 24 of the reflector 12 as shown in Fig. 6, however it may be provided at the position, as shown in Figs. 7 to 9, in which the function of the reflecting surface 14 that the light emitted from the light source bulb 16 is reflected toward the other focal point of the reflector 12, is not affected substantially. In Fig. 7, the through hole 72 is provided at the boundary line between the flange 24 and the reflecting surface 14, in Fig. 8 the through hole 74 being provided at the boundary line between the reflecting surface 14 and the flange 24, and in Fig. 9 a recess 76 being provided over the flange 24 and the reflecting surface 14 in the vicinity of the boundary line between the flange 24 and the reflecting surface 14. The size of the through hole or the recess may be one by which the screw rod 62 can be passed loosely. By thus constitution, the size of the housing can be minimized in accordance with the size of the lamp unit received therein, without the influence due to the existence of the screw rod 62, especially without increasing the dimension in the vertical direction.

Referring to Figs. 10 to 13, a second embodiment of the present invention is shown, the same numeral is used therein for the same member or a similar member as that of the first embodiment. In this embodiment, a frame 23 mounted with the lamp unit is installed on a bracket 90, and the bracket 90 is connected to the housing 32 through a ball joint 92. The bracket 90 is corresponding to the rotation bracket 36 in the first embodiment, but it is different from each other that the frame 23 is fixed on the bracket 90 and the bracket 90 is freely tiltable with resepct to the housing 32. The bracket 90 is composed of a base wall 94, a pair of vertical walls 96a and 96b rising from both end portions of the base wall 94, and a tiltable shaft portion 98 having the receiving portion for receiving the ball portion of the ball joint 92 and formed on the rear surface of the base wall 94 integrally. The lamp unit and the bracket 90 are arranged such that the center of gravity G of the system including the lamp unit and the bracket 90 is located on the vertical surface perpendicular to the reflector's axis and including the line connecting the paired vertical walls 96a and 96b, and the ball joint 92 is disposed at the position on the same plane as the center gravity G or on the plane slightly apart from the above panel, and at the position toward the vertical wall 96a from the reflector's axis. The weight of the system including the lamp unit and the bracket 90 is supported by the ball joint 92, and by rotating the screw rod 60 forwardly or reversely, the bracket 90, i.e. the lamp unit, is rotated with the center at the ball joint 92 around the vertical axis forwardly or reversely, on the other hand by rotating the screw rod 62 forwardly or reversely, the lamp unit can be rotated forwardly or reversely with the center at the ball joint 92 around the horizontal axis. Therefore, after fixing the housing 32 including the lamp unit on the automobile's body, an optical axis of the lamp unit can be easily adjusted and further held at the adjusted position. In this em bodiment, the through hole 70 for passing the screw rod 62 loosely is formed on the flange portion 24 of the reflector 12, but it may be formed at the positions as shown in Figs. 7 to 9.

Claims

1. An optical axis adjusting apparatus having a housing for receiving a projector type headlight unit provided with a frame integrally including a reflector with a concave reflecting surface, a light source bulb disposed on the axis of said reflector, a shade disposed in the region at which the light reflected by said concave surface is condensed, for shaping said light to a predetermined formation, and a convex lens having a focal point thereof at the position of said shade for projecting the light passing through said shade forwardly; comprising a bracket adjustably mounted with respect to said housing, for supporting said frame in a rotatable condition around the horizontal and the vertical axes perpendicular to the axis of said reflector respectively, first adjusting means composed of a first nut member fixed on a portion of said frame apart from said horizontal axis and a first screw rod mounted in such a manner that said first screw rod is disposed in parallel with said reflector's axis so as to screw one end of said first screw rod into said first nut member from the external of said housing, and the other end of said first screw rod is mounted on said housing such that its rotation is allowed and further its movement in the axial direction is inhibited, and second adjusting means composed of a second nut member fixed on a portion of said bracket apart from said vertical axis and a second screw rod mounted in such a manner that said second screw rod is disposed in parallel with said reflecltor's axis so as to screw one end of said second screw rod into said second nut member from the external of said housing, and the other end of said second screw rod is mounted on said housing such that its rotation is allowed and further its movement in the axial direction is inhibited.

2. An optical axis adjusting apparatus according to Claim 1, wherein said bracket is composed of a base wall parallel with the horizontal plane spanned by said reflector's axis and said horizontal axis, and a pair of vertical walls rising from both side portions of said base wall, said bracket being rotatably mounted at a portion of said base wall such that said bracket rotates around the vertical axis perpendicular to said reflector's axis, and said paired vertical walls being positioned at both side portions of said frame to ratatably support said frame around the horizontal axis perpendicular to said reflector's axis.

3. An optical axis adjusting apparatus according to Claim 1, wherein said horizontal axis and said vertical axis of said bracket are substantially disposed in the plane perpendicu-

lar to said reflector's axis and passing the center of gravity of said projector type headlight.

4. An optical axis adjusting apparatus according to Claim 2, wherein said first nut of said first adjusting mean is fixed on said frame at the upper portion of said vertical axis of said bracket, and said second nut of said second adjusting means is fixed on said vertical wall remote from said vertical shaft of said bracket.

5. An optical axis adjusting apparatus according to Claim 3, wherein there is provided an opening for passing at least one of said first and second screw rods loosely at the portion not contributing the substantial condensation of the light emitted from said lioght source of said reflector.

6. An optical axis adjusting apparatus according to Claim 1, wherein said lamp unit is fixed on said bracket, and said bracket is connected to said housing through a ball joint substantially disposed in the plane passing the center of gravity of the body to be supported including said projector type headlight and said bracket and perpendicular to said reflector's axis.

7. An optical axis adjusting apparatus alccording to Calim 6, wherein said bracket is composed of a base wall parallel with the horizontal plane spanned by said reflector's axis and said horizontal axis, and a pair of vertical walls rising from both side portions of said base wall, said bracket being rotabably mounted with respect to said housing by said ball joint at a portion of said base wall, said paired vertical walls being positioned at both side portions of said frame to support said frame.

8. An optical axis adjusting apparatus according to Claim 6, wherein there is provided an opening for passing at least one of said first and second screw rods loosely at the portion not contributing the substantial condensation of the light emitted from said light source of said reflector.

FIG. 1

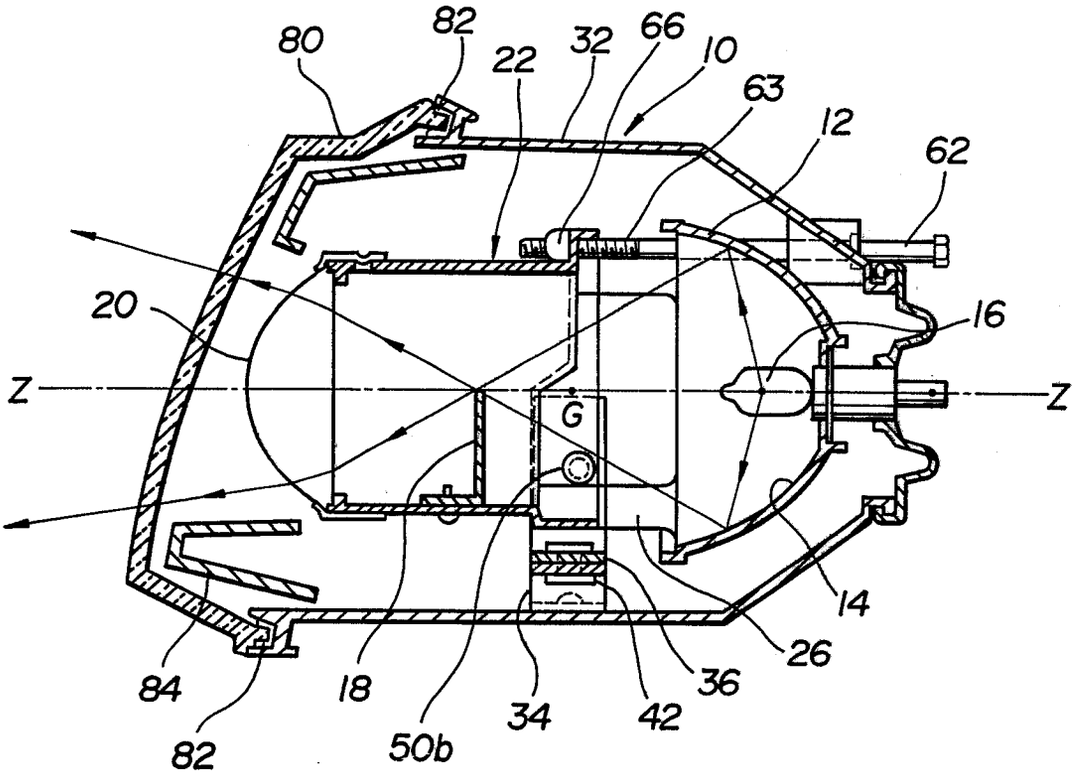
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FIG. 3

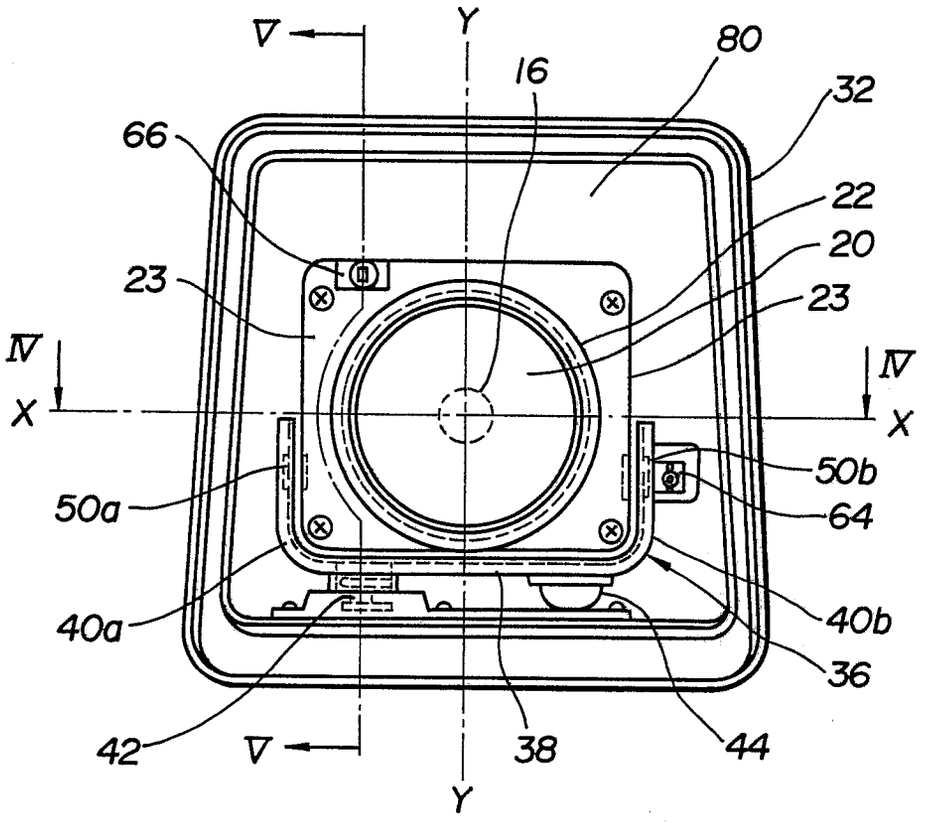
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FIG. 2

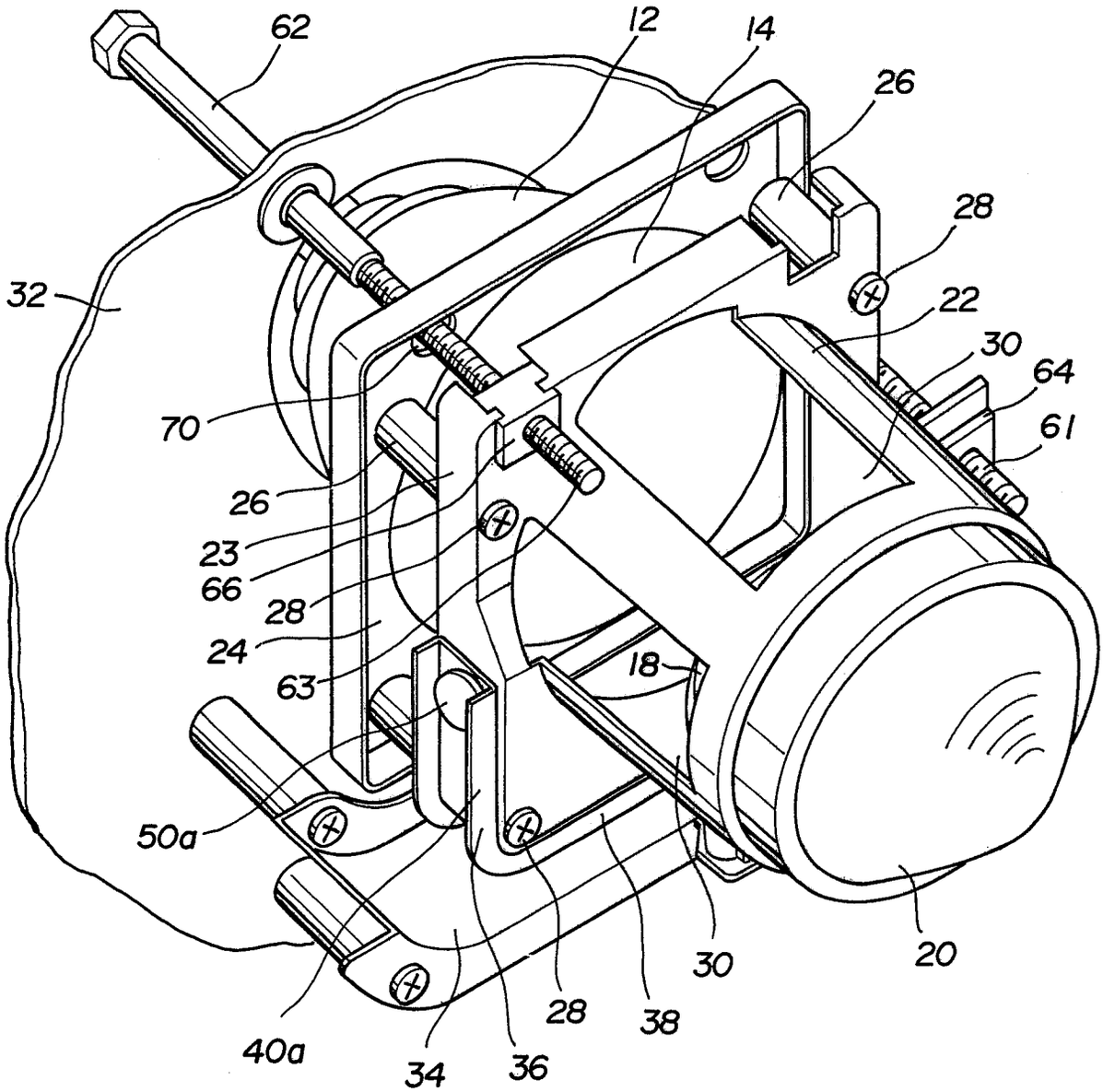
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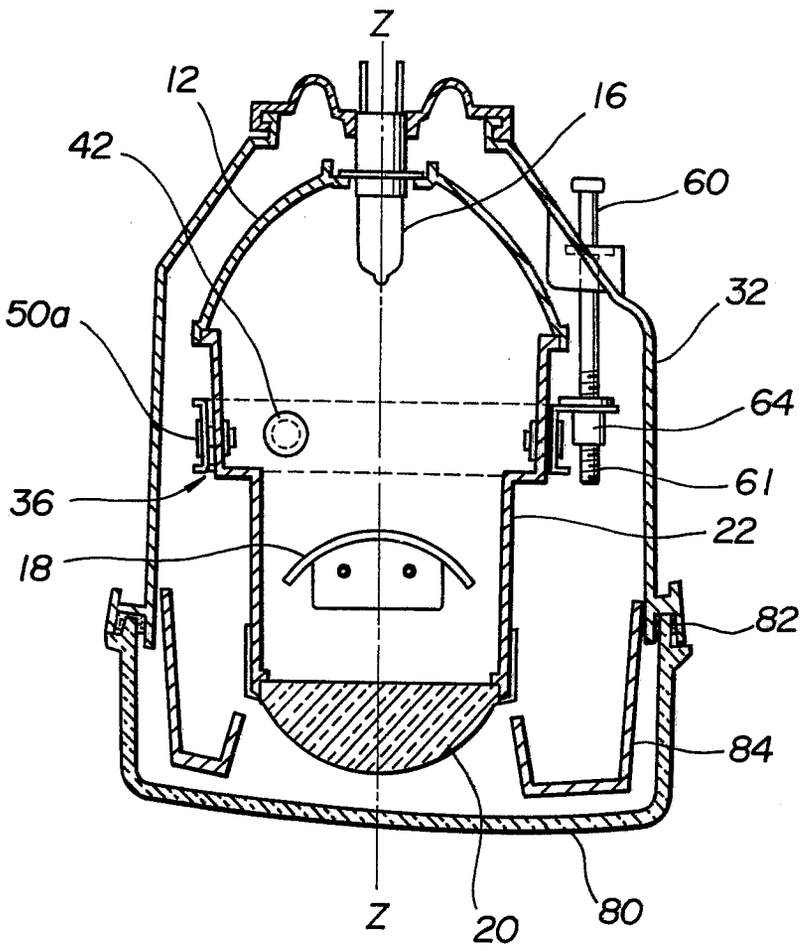
FIG. 4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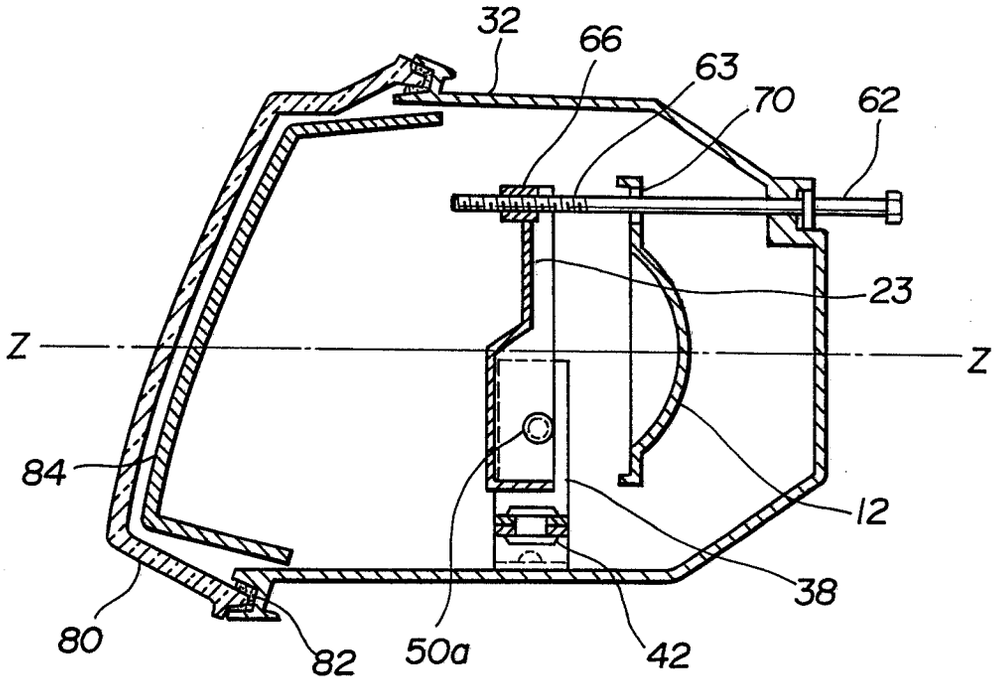
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FIG. 6

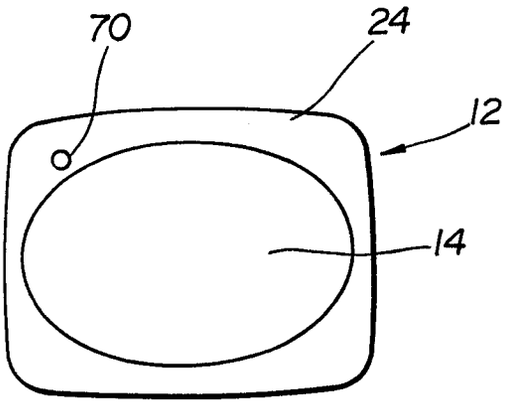

FIG. 8

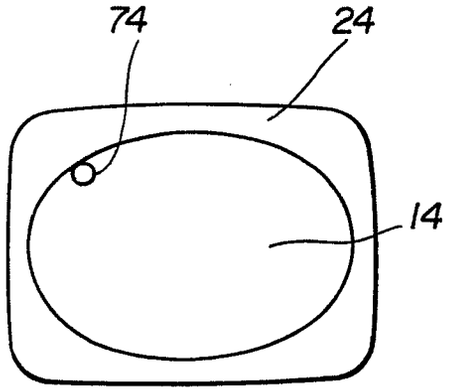

FIG. 7

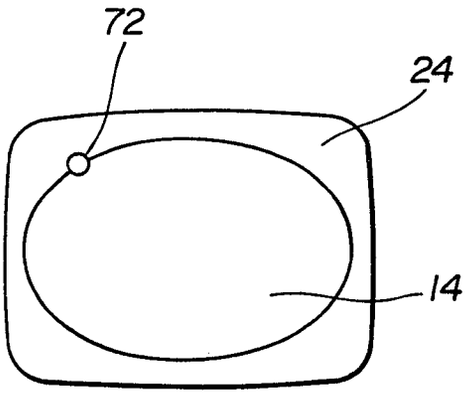

FIG. 9

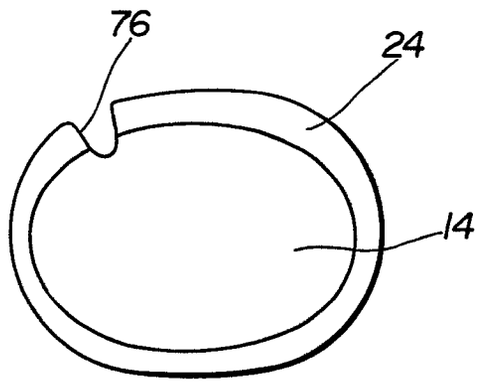

FIG. 10

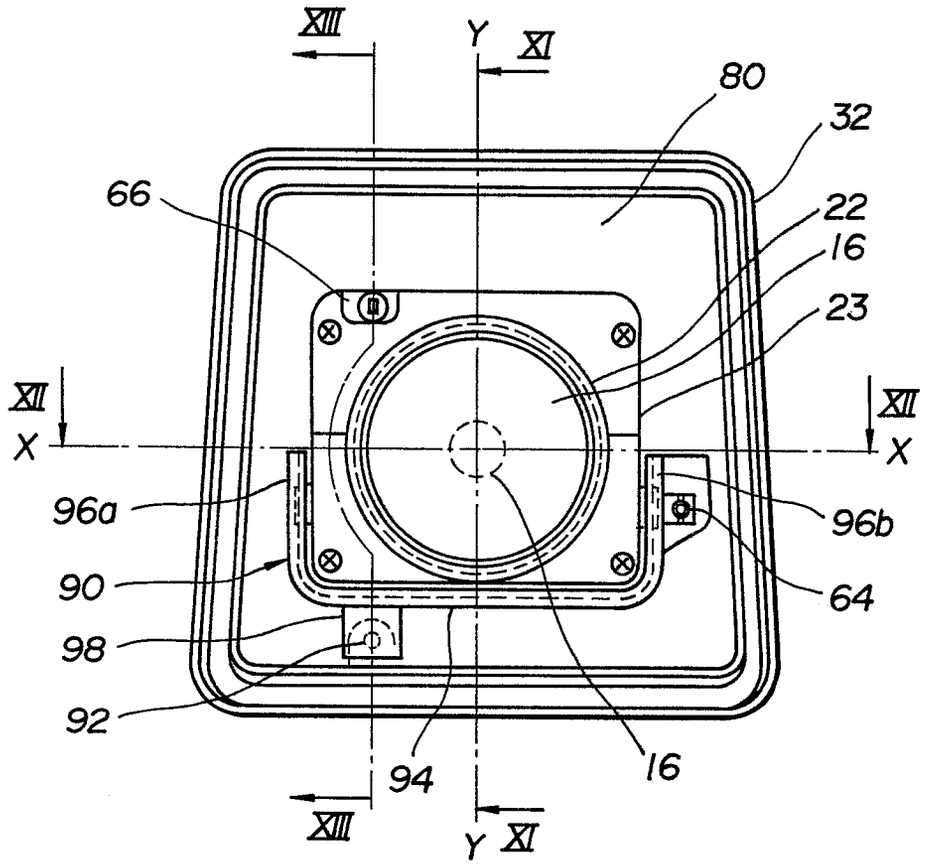
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FIG. 11

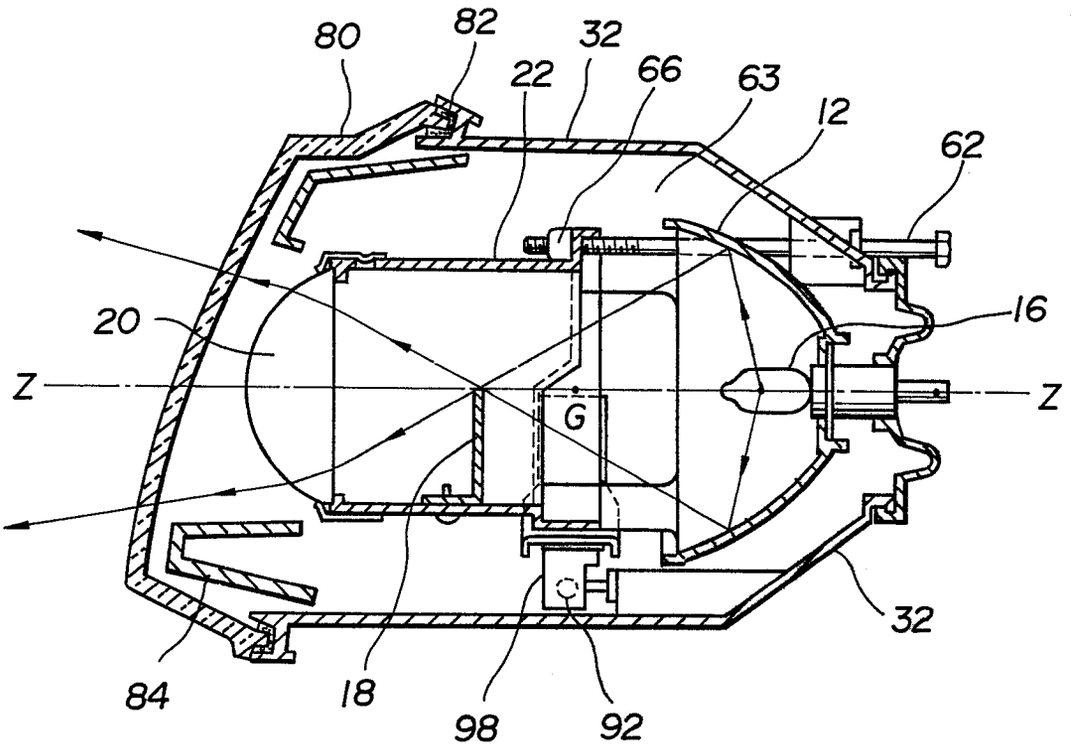
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FIG. 12

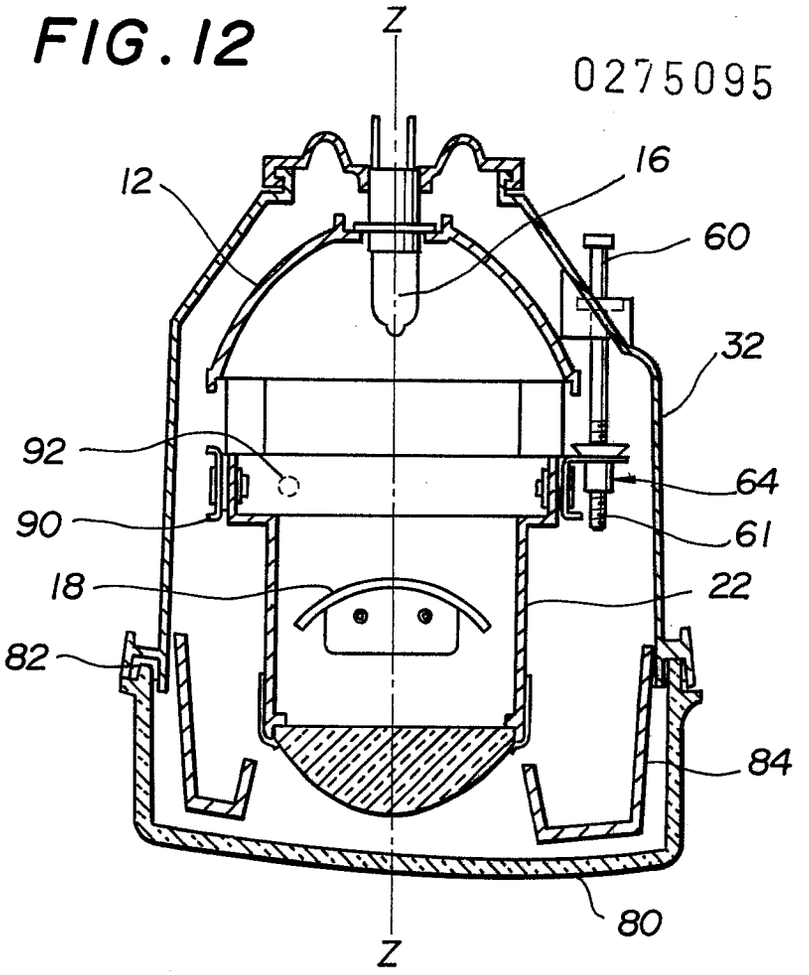
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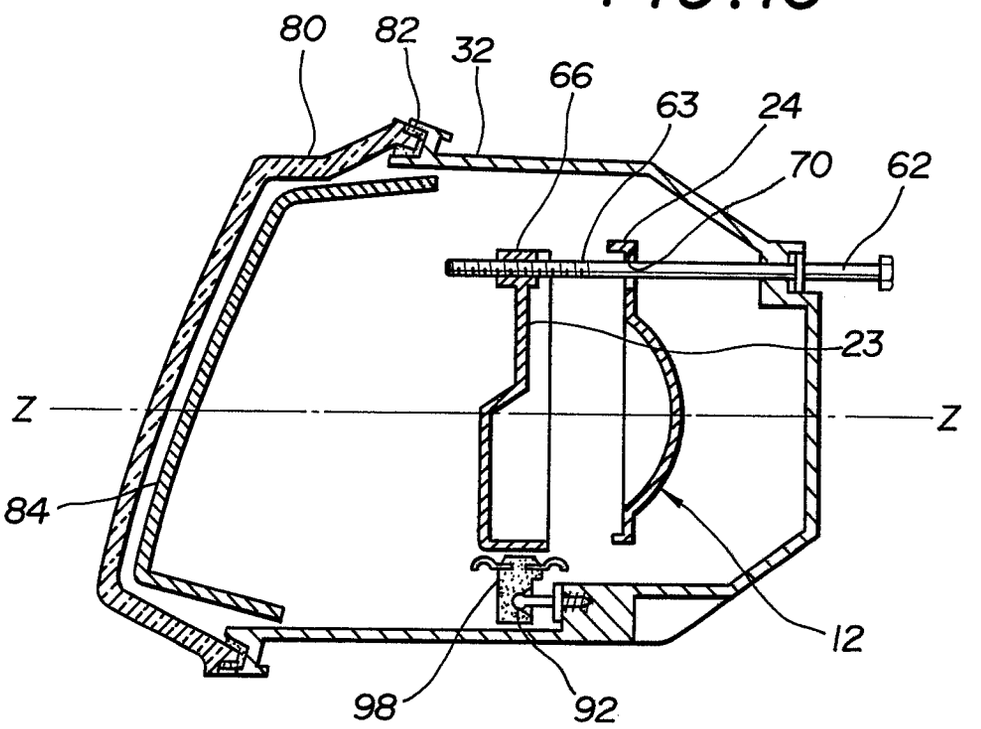
FIG. 13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