(12) UK Patent Application (19) GB (11) 2 253 900 (13) A

(43) Date of A publication 23.09.1992

(21) Application No 9203074.1

(22) Date of filing 11.02.1992

(30) Priority data
(31) 03040605 (32) 13.02.1991 (33) JP

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(51) INT CL[5]
F21M 3/18

(52) UK CL (Edition K)
F4R RMC R364 R765 R787
U1S S1934

(56) Documents cited
None

(58) Field of search
UK CL (Edition K) F4R RMC
INT CL[5] F21M 3/18

(54) Headlamp levelling mechanism

(57) A leveling mechanism for a vehicle head-lamp comprises a leveling member (41) linearly moved back and forth by a leveling motor (26) via drive gear means (27, 28, 28a, 29) for tilting the reflector (9) so as to level the beam. A printed circuit board (59) is provided which has formed thereon a conductive pattern connected in circuit with the leveling motor. A contact gear rotatably mounted on a main shaft rigidly mounted to the printed circuit board carries contact means for revolving the same in sliding engagement with the conductive pattern so that the leveling motor may be set out of rotation when the beam is leveled. The contact gear is driven from the drive gear means via speed reduction gear means (84). Characteristically, for the ease of assemblage and for the accurate interengagement of the contact gear and the speed reduction gear means (84), the speed reduction gear means is rotatably mounted to a bearing member (76) which is supported by the main shaft (86).

FIG.2

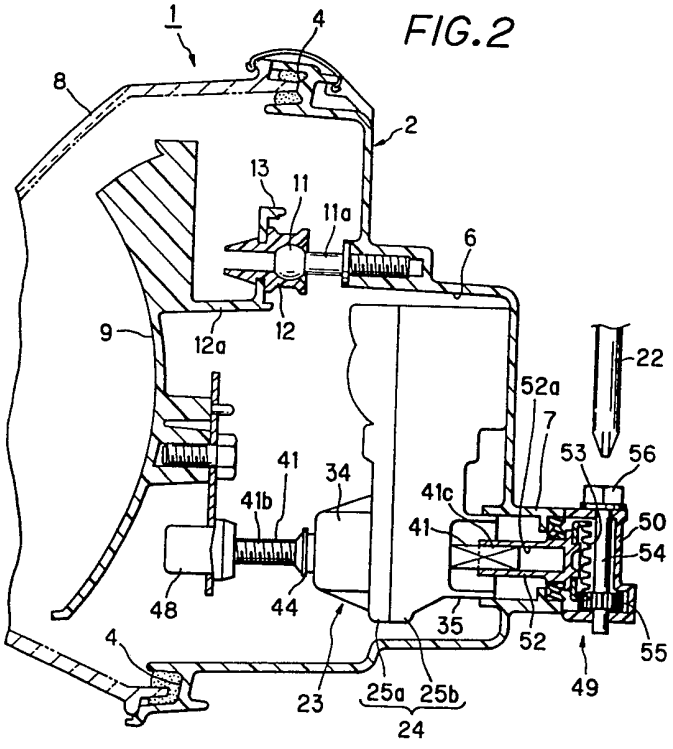
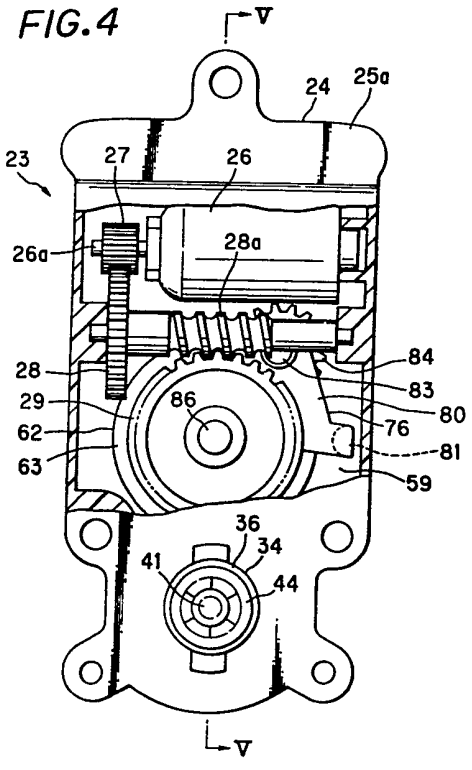


FIG.4



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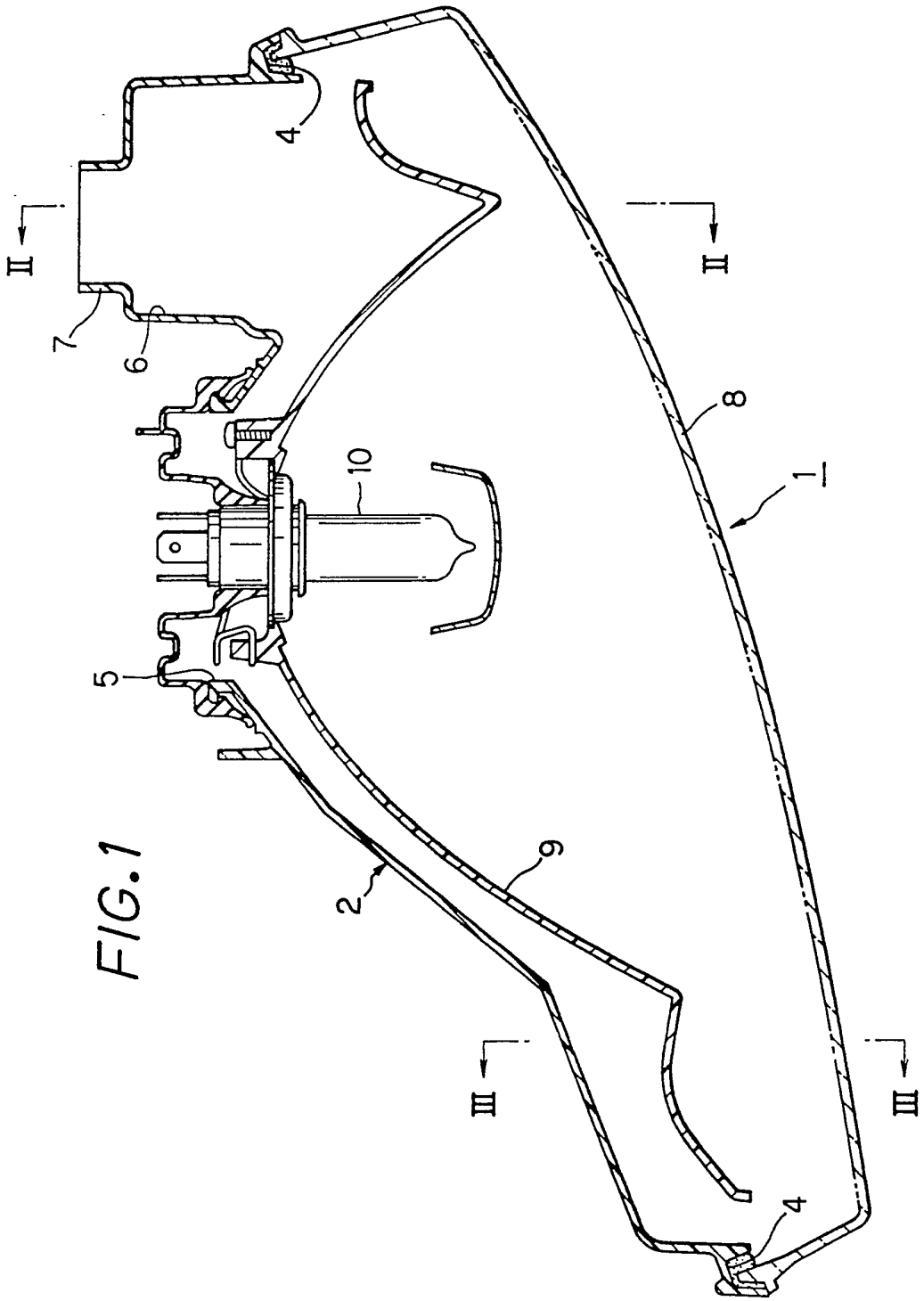
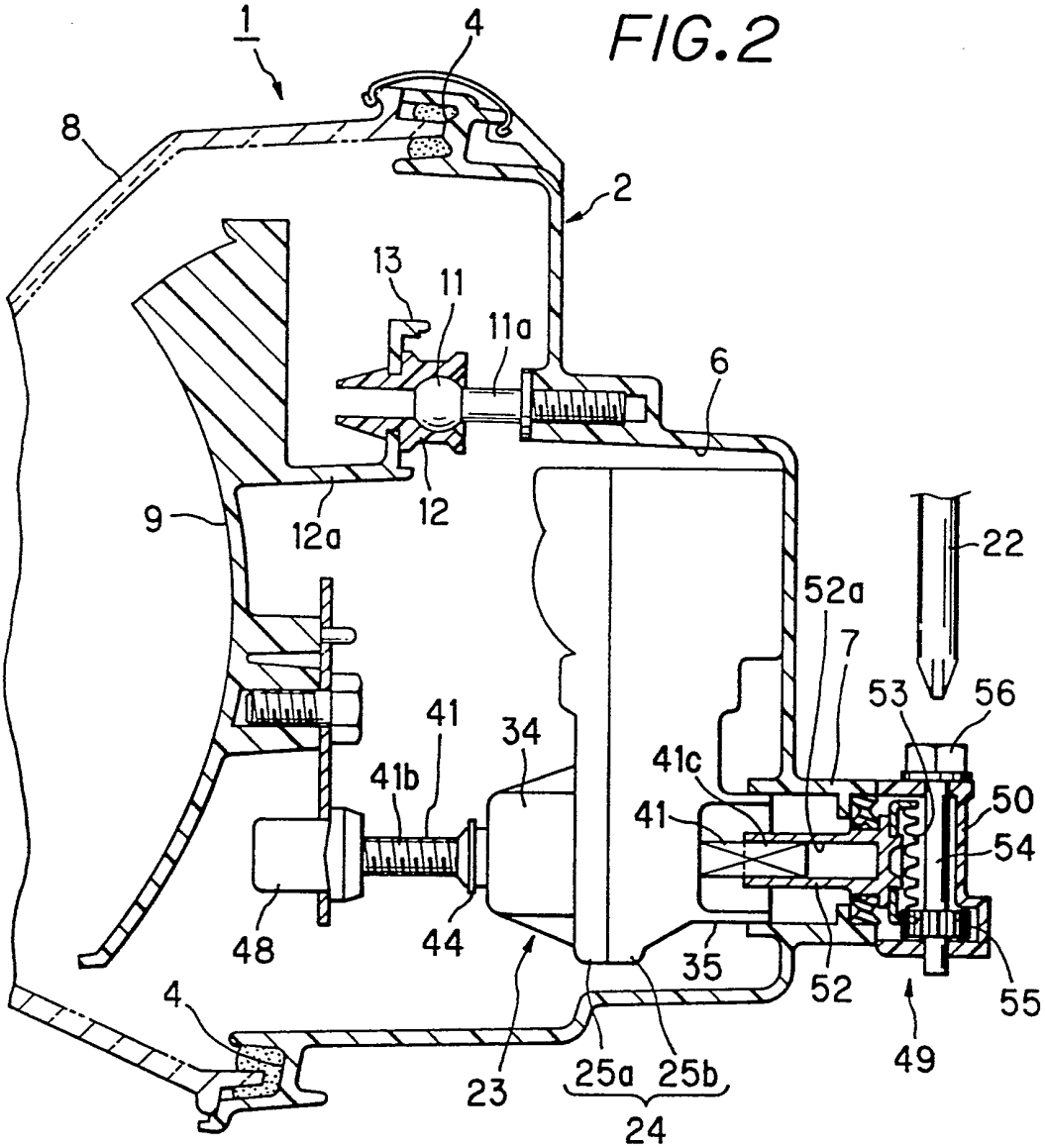


FIG. 1

FIG.2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4
8
2
13
11
11a
6
9
12a
12
22
52a
7
53
56
41
34
41b
41c
50
41
54
48
44
35
52
55
4
23
25a
25b
24
49

FIG.3

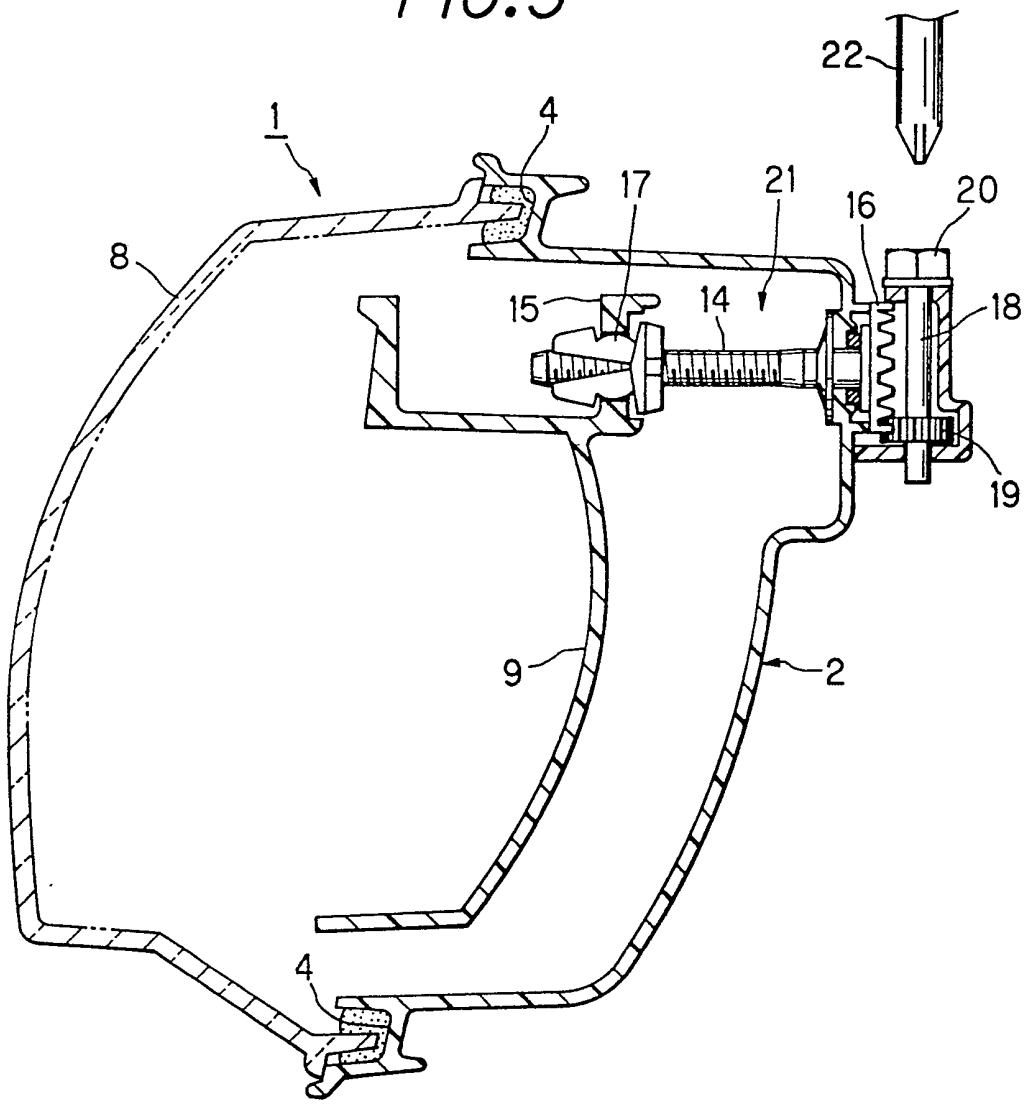


FIG.4

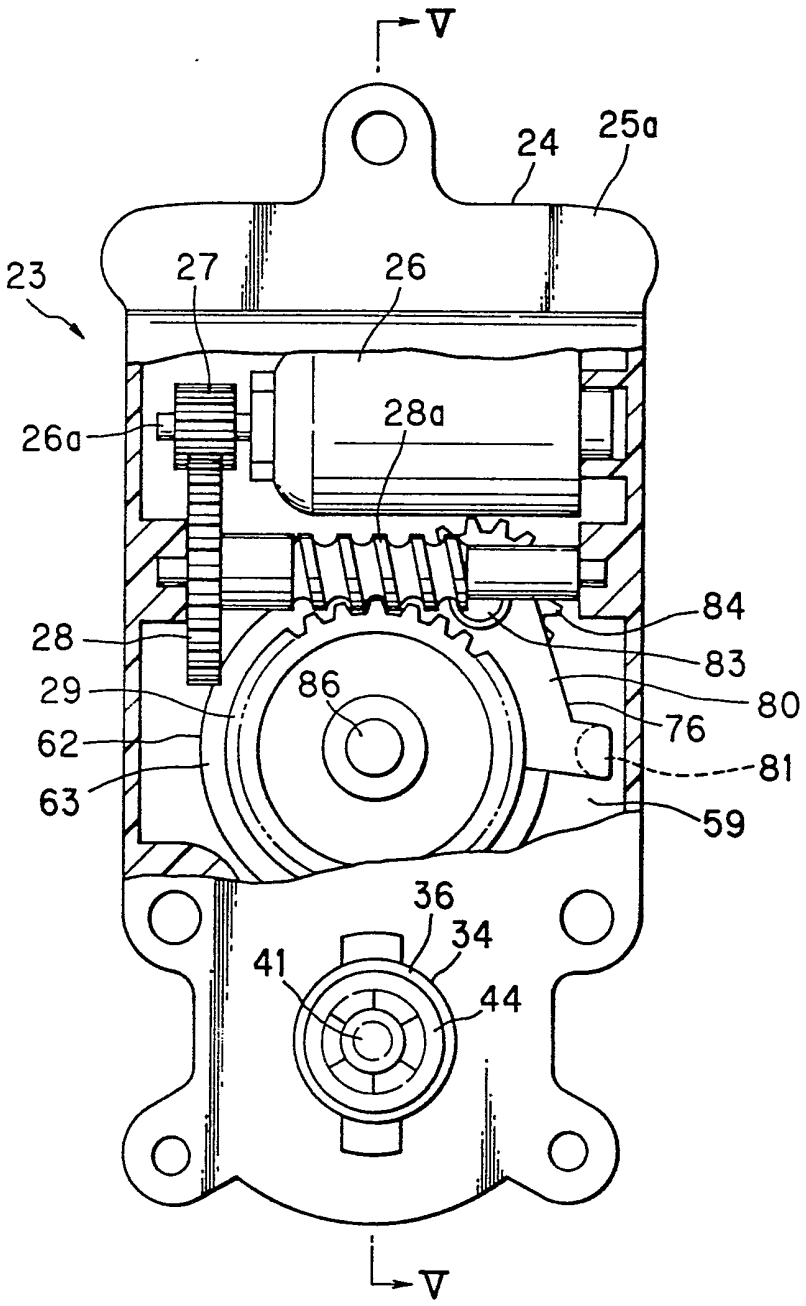
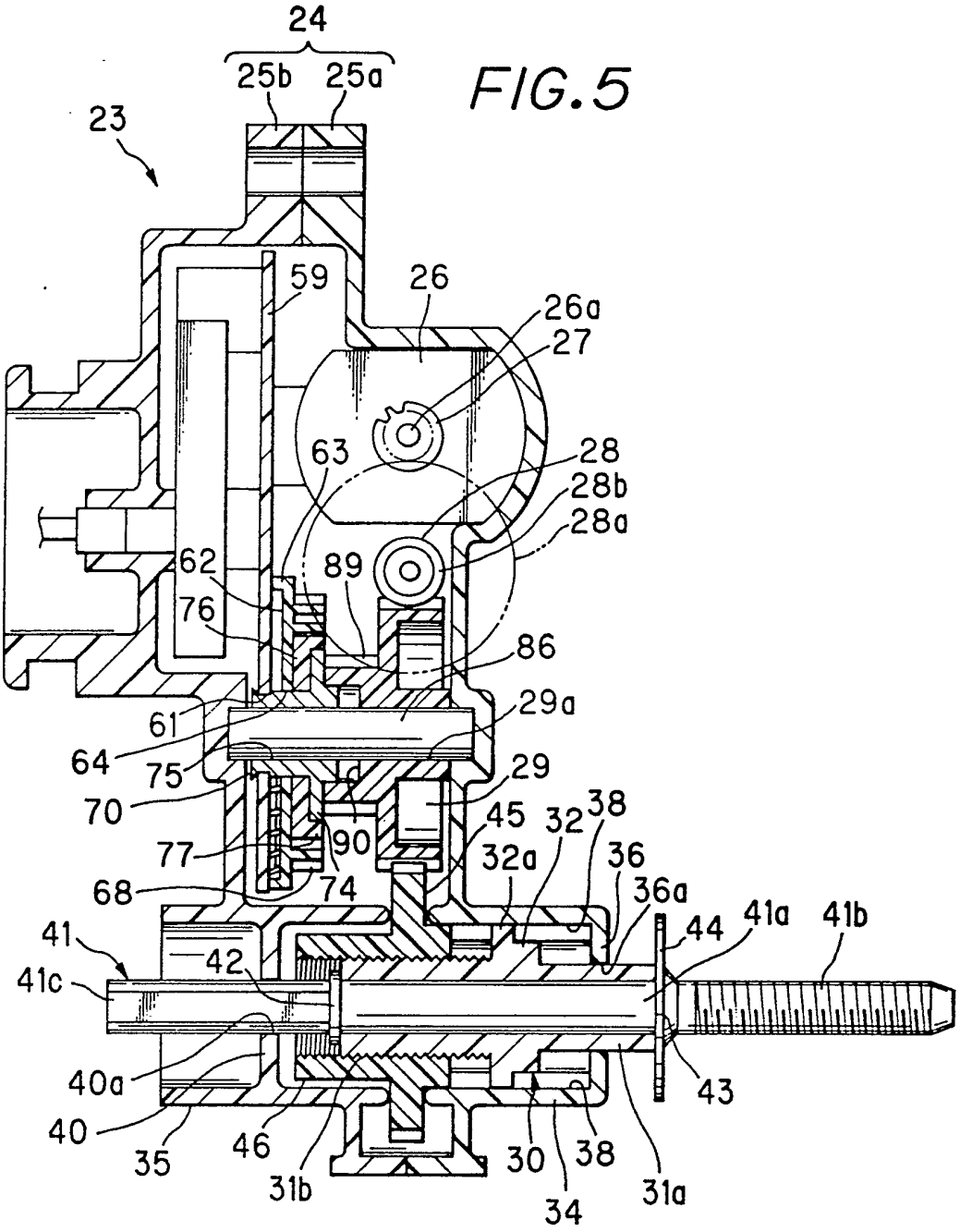


FIG.5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29
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32
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32a
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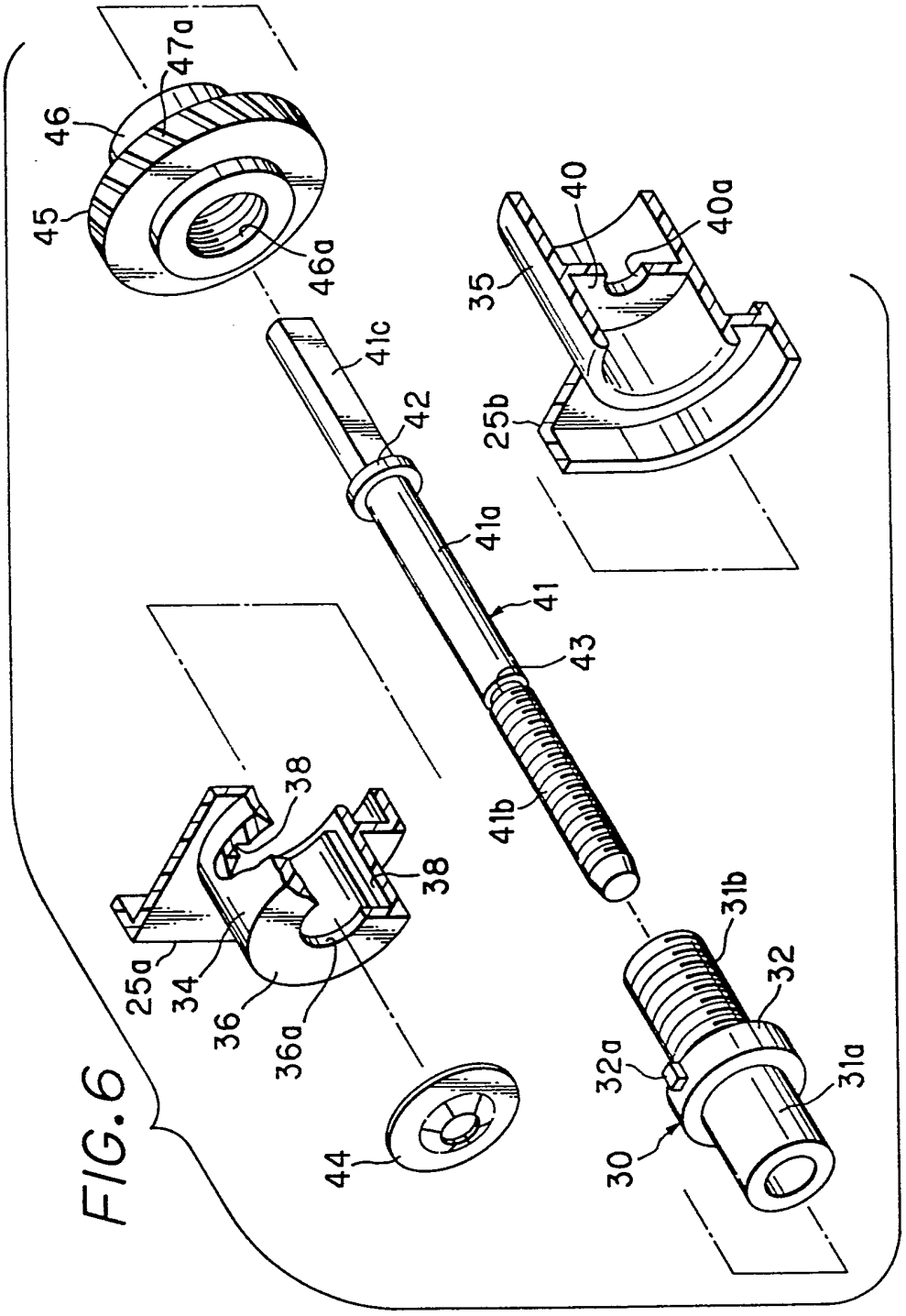
31a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25b
41a
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41b
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34
36
36a
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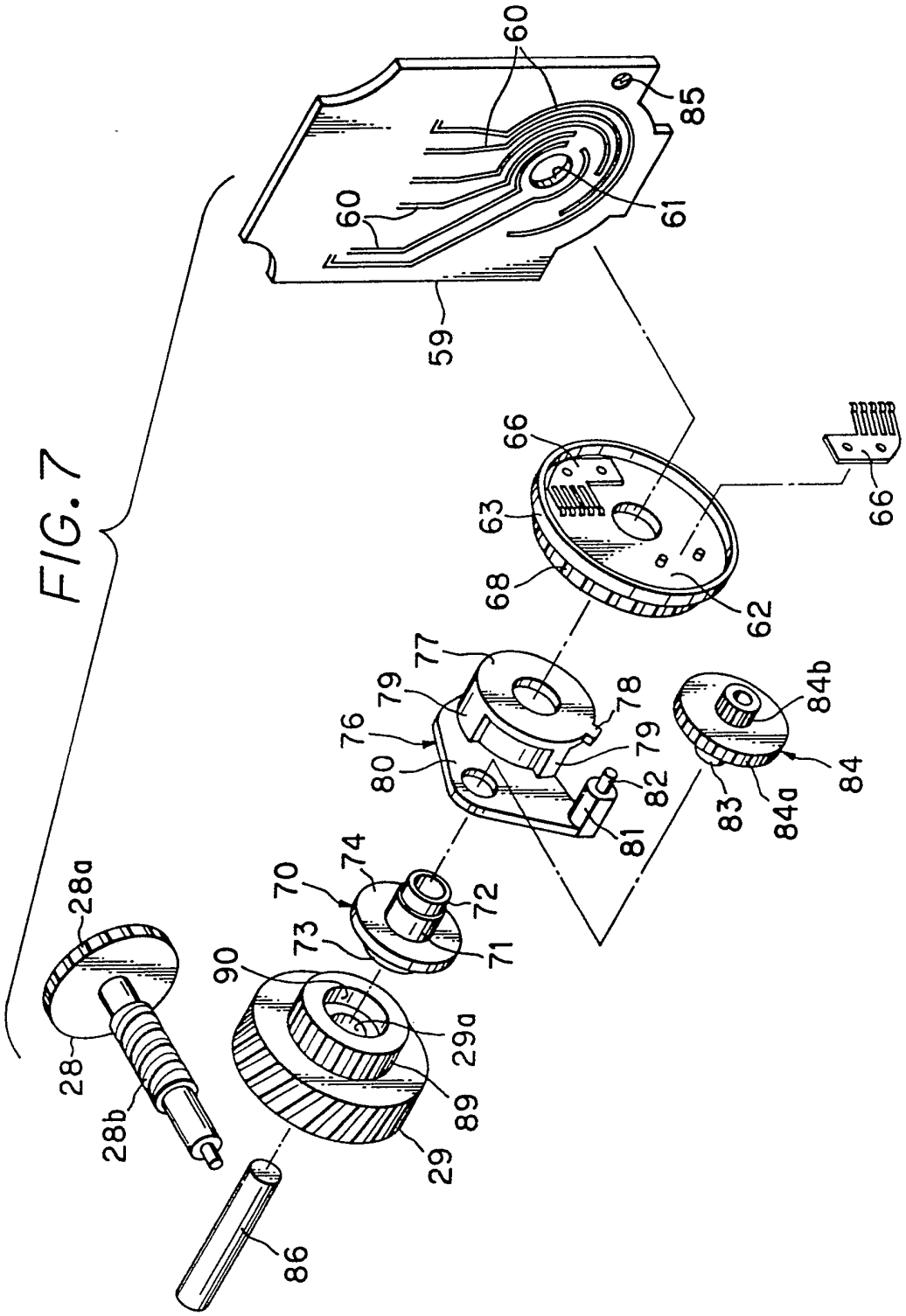
32a
31a
44
30

FIG. 6

FIG. 7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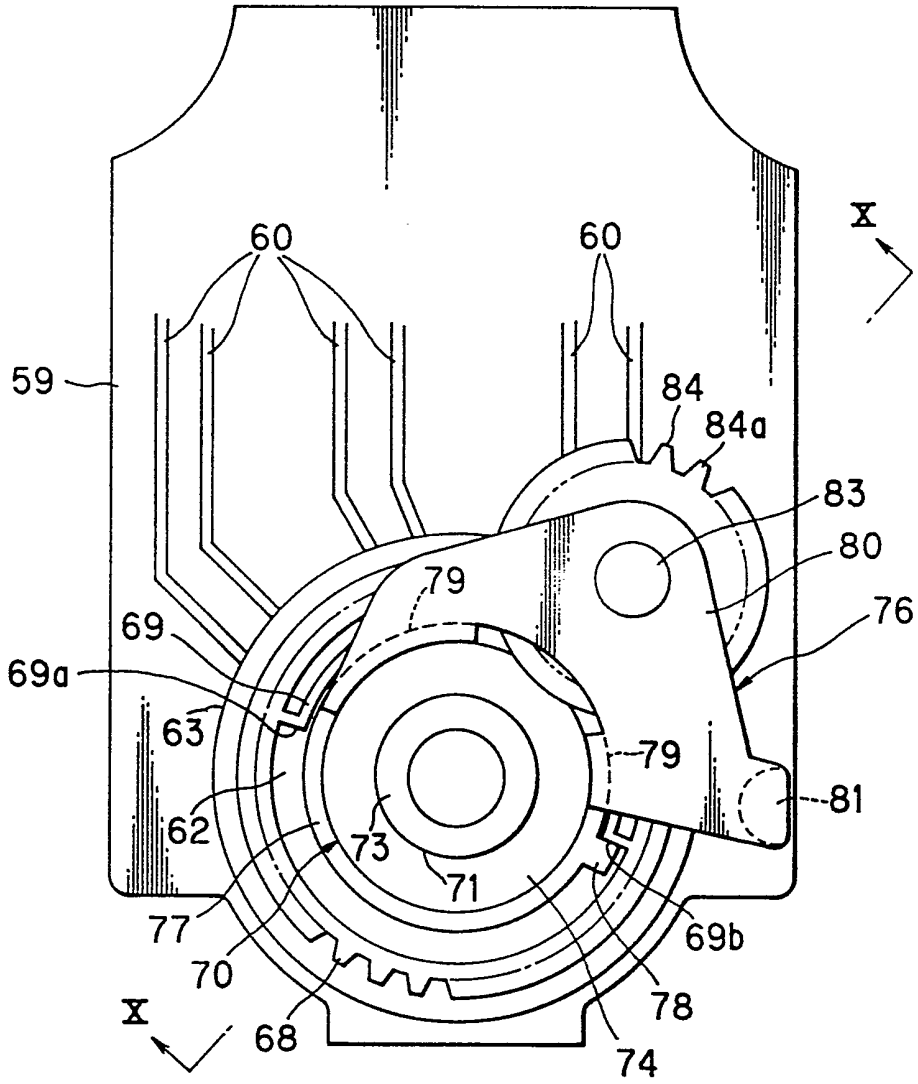
28b
29
86

FIG.8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69b
78
74
X

FIG. 9

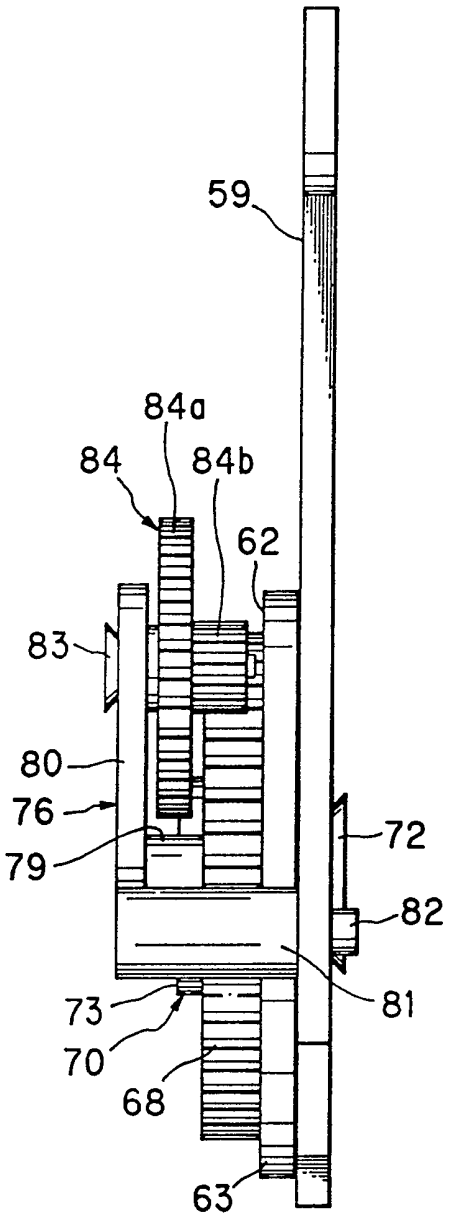
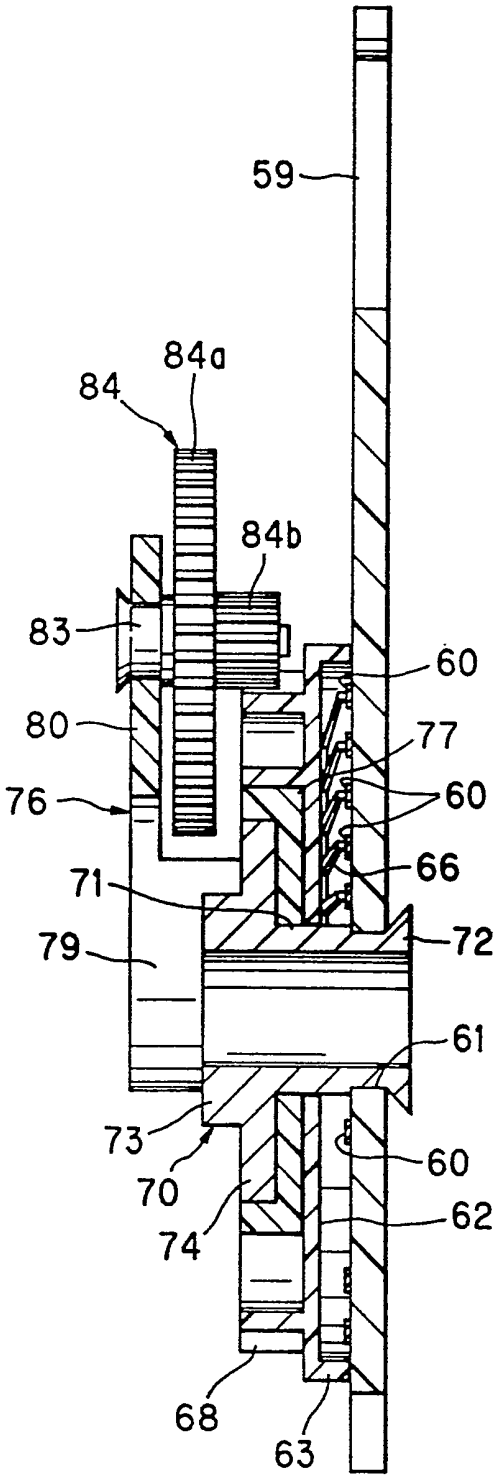


FIG. 10



IMPROVEMENTS IN OR RELATING TO A VEHICLE HEADLAMP LEVELING MECHANISM

This invention relates generally to vehicle headlamps, and particularly to improvements in or relating to a motor driven mechanism operating under remote control for leveling the beam of light thrown by a vehicle headlamp.

A leveling mechanism is usually incorporated with aimable headlamps. The aiming of the beam is accomplished by tilting the reflector relative to the lamp body in some headlamps, and by tilting the complete lamp unit relative to the lamp housing in others. In both types the headlamp is aimed manually, both immediately after having been mounted to the vehicle at the manufacturing plant and periodically in use of the vehicle.

The motor driven leveling mechanism, on the other hand, is intended for the vertical correction of the beam angle as required by the variable passenger or cargo load on the vehicle. It is operated remotely by the vehicle driver.

While a variety of leveling mechanisms have been suggested and used, Japanese Unexamined Utility Model Publication No. 2-13838 proposes one that is particularly pertinent to the present invention. This prior art leveling mechanism utilizes one of the aiming screws as a leveling member acting between the tiltable member, such as the tiltable reflector or the tiltable lamp unit, and the untiltable member such as the lamp body or housing. The bidirectional rotation of the leveling motor is transmitted via a train of drive gears to a motion translating mechanism whereby the leveling member is linearly moved back and forth for vertically tilting the tiltable member relative to the untiltable member.

For automatically controlling the angle through which the tiltable member is tilted, a printed circuit board is employed which has formed thereon a conductive pattern connected in circuit with the leveling motor. A contact gear carries contacts which revolve in and out of sliding engagement with the conductive pattern. The contact gear is driven from one of the train of drive gears via speed reduction gears on a countershaft laid parallel to the main shaft on which the contact gear is mount-

ed.

The prior art leveling mechanism of the foregoing construction has proved to have weaknesses in connection with its assemblage. The main shaft has been mounted to one of the two separable halves of a casing in which the leveling mechanism is housed. The countershaft, on the other hand, has been supported by and between the casing halves. The accuracy with which the contact gear meshes with one of the speed reduction gears has therefore depended on how exactly the casing halves are coupled to each other and how exactly the main shaft and the countershaft are mounted to the casing. Consequently, the contact gear has been easy to mesh too loosely or too tightly with one of the speed reduction gears, resulting in the malfunctioning of the leveling mechanism.

According to the present invention, there is provided an improved leveling mechanism for a vehicle headlamp of the type having a tiltable member and a nontiltable member, the tiltable member being tiltable relative to the nontiltable member for leveling a beam of light thrown by the headlamp, comprising a reversible leveling motor mounted in fixed relation to the nontiltable member, a leveling member acting between the tiltable member and the nontiltable member, the leveling member being linearly movable back and forth relative to the nontiltable member for tilting the tiltable member and hence for leveling the beam of light, drive gear means coupled to the leveling motor, motion translating means for translating the bidirectional rotation of the drive gear means into the linear bidirectional movement of the leveling member, a printed circuit board mounted in fixed relation to the nontiltable member, the printed circuit board having formed thereon a conductive pattern connected in circuit with the leveling motor, a main shaft rigidly mounted to the printed circuit board, a contact gear rotatably mounted on the main shaft, contact means mounted to the contact gear and disposed for sliding engagement with the conductive pattern on the printed circuit board in order to set the leveling motor out of rotation when the tiltable member is tilted to a required angular position relative to the nontiltable member, and speed reduction gear means rotatable about an axis parallel to the axis of the main shaft, the contact gear being driven from the drive gear means via the speed reduction gear means for revolving the contact means in sliding engagement with the conductive pattern on the printed

circuit board, characterized in that the speed reduction gear means is rotatably mounted to a bearing member which is supported by the main shaft.

Thus, in the improved leveling mechanism according to the invention, both contact gear and speed reduction gear means are both essentially mounted to the printed circuit board, the main shaft and the countershaft being both mounted, either directly or indirectly, to the printed circuit board. The assemblage of the leveling mechanism can therefore be completed simply by mounting the printed circuit board, with the contact gear and speed reduction gear means mounted thereto, in position within a housing.

As an additional advantage, the bearing member rotatably supporting the speed reduction gear means is mounted to the printed circuit board via the main shaft on which the contact gear is mounted. The contact gear and the speed reduction gear means can therefore be far more accurately interengaged than heretofore because the number of parts that affect the accuracy of interengagement therebetween is reduced to an absolute minimum.

An embodiment of the invention will now be described in detail with reference to the drawings, in which:

Figure 1 is a horizontal section through a typical vehicle headlamp to which the improved leveling mechanism of the invention finds application,

Figure 2 is a vertical section through the headlamp, taken along the line II-II in Figure 1 and showing the leveling mechanism mounted in position therein,

Figure 3 is also a vertical section through the headlamp, taken along the line III-III in Figure 1,

Figure 4 is an enlarged front elevation of the leveling mechanism, with the housing of the leveling mechanism shown partly broken away to reveal the inner details,

Figure 5 is a vertical section through the leveling mechanism, taken along the line V-V in Figure 4,

Figure 6 is an exploded perspective view of some parts of the leveling mechanism,

Figure 7 is an exploded perspective view of other parts of the

leveling mechanism,

Figure 8 is an enlarged front elevation of the printed circuit board of the leveling mechanism together with the contact gear, speed reduction gears, etc., mounted thereto,

Figure 9 is a right hand side elevation of the showing of Figure 8, and

Figure 10 is a section taken along the line X-X in Figure 8.

The above drawings illustrate the invention as embodied in a vehicle headlamp having a tiltable reflector rather than a tiltable lamp unit. Generally designated 1 in Figures 1-3, the representative headlamp has a forwardly open lamp body 2 with a lens 8 closing its open front end. Both lamp body 2 and lens 8 can be molded from plastics. The lens 8 has its peripheral edge engaged in a groove 4 in the periphery of the lamp body 2 and is secured thereto by an adhesive or sealant.

A reflector 9 is disposed in the space bounded by the lamp body 2 and the lens 8. A light bulb 10 is detachably mounted in a central position on the reflector 9. The reflector 9 is tiltably mounted to the lamp body 2 for both aiming and leveling of the beam thrown by the headlamp 1, as discussed in detail hereafter.

The reference numeral 13 in Figure 2 generally denotes a universal coupling comprising a ball 11 and a socket 12, with the ball rotatably engaged in the socket. The ball 11 is mounted fast on one end of a stud 11*a* screwed to the lamp body 2. The socket 12 is mounted to an L shaped flange 12*a* formed on the back of the reflector 9 in one piece therewith. The reflector 9 is to be tilted both vertically and laterally about this ball and socket joint 13.

At 21 in Figure 3 is seen a lateral aiming mechanism disposed approximately on a level with the ball and socket joint 13. This mechanism 21 includes an aiming screw 14 engaged in a nut 17 secured to a flange 15 formed in one piece with the reflector 9. The aiming screw 14 has a crown gear 16 formed on one end thereof for engagement with a pinion 19 on a shaft 18 rotatably supported on the back of the lamp body 2. The shaft 18 has a head 20 to be turned manually by a matching tool such as a screwdriver 22.

Thus, for laterally aiming the headlamp 1, the shaft 18 may be turned in either direction by the screwdriver 22. The rotation of the

shaft 18 will be transmitted to the aiming screw 14 via the pinion 19 and the crown gear 16. With the consequent rotation of the aiming screw 14 the nut 17 will travel back or forth thereon, resulting in the lateral tilting of the reflector 9 relative to the lamp body 2.

A vertical aiming mechanism, on the other hand, is incorporated with a leveling mechanism forming the gist of the present invention and will therefore be described in the course of the following discussion of the leveling mechanism.

As shown in Figure 2, the leveling mechanism 23 is disposed in a recess 6 in the lamp body 2. The leveling mechanism 23 has a boxlike housing 24 divided into a front section 25*a* and a rear section 25*b*. Mounted within this housing 24 is, first of all, a bidirectional direct current motor 26 (hereinafter referred to as the leveling motor) shown in both Figures 4 and 5. The leveling motor 26 has an armature shaft 26*a* with a pinion 27 mounted thereon. The pinion 27 meshes with a gear 28 formed in one piece with a worm 28*a* coaxial with the gear. The worm 28*a* is rotatably supported by the housing 24. The worm 28*a* meshes with a worm wheel 29 rotatably mounted on a main shaft 86 supported by and extending between the two sections 25*a* and 25*b* of the housing 24.

The bidirectional rotation of the worm wheel 29 is translated into the linear back and forth travel of a combined leveling and aiming rod 41 (hereinafter referred to as the leveling member) by means set forth hereafter.

Both Figures 5 and 6 show that the leveling member 41 has a cylindrical midportion 41*a*, a screw threaded front portion 41*b* and a rear portion 41*c* of polygonal cross section, with a collar 42 between the midportion and the rear portion. A sleeve 30 is rotatably fitted over the midportion 41*a* of the leveling member 41. A collar 44 is engaged in an annular groove 43 in the leveling member 41 after inserting the midportion 41*a* of the leveling member in the sleeve 30. The leveling member 41 is therefore rotatable relative to the sleeve 30 but is restrained from axial displacement relative to the same.

The sleeve 30 with the leveling member 41 extending therethrough is received in an approximately cylindrical space defined by a tubular portion 34 of the front housing section 25*a* and by a tubular portion 35

of the rear housing section 25*b*. The sleeve 30 has a blank front portion 31*a* and an externally threaded rear portion 31*b*, with the blank front portion extending, either slidably or with clearance, through a hole 36*a* in the front wall 36 of the front tubular portion 34.

Formed between the front portion 31*a* and rear portion 31*b* of the sleeve 30, a flange 32 has a pair of projections 32*a* in diametrically opposite positions thereon. These projections are slidably engaged in respective guideways 38 formed in the front tubular portion 34. Thus the sleeve 30 is constrained to axial travel relative to the housing 24 in the front to rear direction of the headlamp 10. The leveling member 41 also travels longitudinally with the sleeve 30 but, as aforesaid, is rotatable relative to the sleeve. The rear portion 41*c* of the leveling member 41 rotatably extends through a hole 40*a* in a wall 40 of the rear tubular portion 35.

In order to cause the linear back and forth travel of the sleeve 30 and the leveling member 41 in response to the bidirectional rotation of the noted worm wheel 29 driven from the leveling motor 26, there is provided a helical gear 45, seen also in Figures 5 and 6, which is in direct engagement with the worm wheel 29. The gear 45 is molded from a plastic in one piece with a tubular, internally threaded member 46 fitted over and engaged with the externally threaded rear portion 31*b* of the sleeve 30. Rotatably caught between the opposed ends of the front and rear tubular portions 34 and 35, the gear 45 is restrained from axial displacement relative to the housing 24.

With reference back to Figure 2 the housing 24 of the leveling mechanism 23 is accommodated as aforesaid in the recess 6 in the lamp body 2, with the rear tubular portion 35 of the housing firmly received in part in a tubular portion 7 of the lamp body. Projecting from the front tubular portion 34 of the housing 24, the threaded front portion 41*b* of the leveling member 41 is engaged in a nut 48 resiliently carried on the back of the reflector 9.

Thus the bidirectional rotation of the leveling motor 26 will be transmitted to the internally threaded tubular member 46 via the driving train of pinion 27, spur gear 28*a*, worm 28*b*, worm wheel 29 and helical gear 45. The bidirectional rotation of the internally threaded member 46 will result in the linear travel of the sleeve 30, together with the level-

ing member 41 carried thereby, toward or away from the reflector 9. Consequently, the reflector 9 will tilt vertically.

The reference numeral 49 in Figure 2 generally designates a vertical aiming mechanism associated with the leveling mechanism 23. The vertical aiming mechanism 49 has its own housing 50 affixed to the rear end of the tubular portion 7 of the lamp body 2. Within the housing 50 a shaft 54 having a head 56 is rotatably mounted. A pinion 55 mounted fast on the shaft 54 meshes with a crown gear 53 on one end of a hollow shaft 52 rotatably supported within the tubular portion 7 of the lamp body 2. The shaft 52 has formed therein a hollow 52*a* of polygonal cross section. The rear portion 41*c* of the leveling member 41 is received in the hollow 52*a* of the shaft 52 for axial sliding movement while being constrained to joint rotation therewith.

The shaft 54 of the vertical aiming mechanism 49 may be turned manually in either direction as by the screwdriver 22 engaged with its head 56. As will be understood by referring to Figure 5 again, the levveling member 41 is rotatable, but not axially displaceable, relative to the sleeve 30. Therefore, with the rotation of the leveling member 41, the nut 48 will travel back or forth thereon, resulting in the vertical aiming of the beam.

The leveling mechanism 23 further comprises a printed circuit board (PCB) 59 shown in all of Figures 5 and 7-10. Mounted fast within the rear section 5*b* of the housing 4, the PCB 59 has formed thereon an electrically conductive pattern 60 seen in Figures 7 and 8. The conductive pattern 60 is connected in circuit with the leveling motor 6 for automatically controlling the amount of travel of the leveling member 41, that is, for automatically setting the leveling motor 26 out of rotation when the reflector 9 is tilted to an angular position indicated by the operator.

Disposed opposite the PCB 59 is a rotary disc 62 carrying contact means 66 for sliding engagement with the conductive pattern 60. The rotary disc 62 has an annular rim 63 slidably held against the PCB 59 for protection of the mating surfaces of the conductive pattern 60 and contact means 66 from dust. A gear 68 is formed coaxially and in one piece with the rotary disk 62. This gear 68 will be hereinafter referred to as the contact gear because of its intended function of revolving the

contact means 66 in sliding engagement with the conductive pattern 60.

As will be noted from both Figures 5 and 10, taken together with Figure 7, the rotary disc 62 and contact gear 68 are rotatably mounted on the main shaft 86 via a stepped sleeve unit 70 of aluminum or like material. The stepped sleeve unit 70 comprises a midportion 71, a rear portion 72 which is less in diameter than the midportion, and a front portion 73 greater in diameter than the midportion, with a flange 74 between the midportion and the front portion.

The smallest diameter rear portion 72 of the sleeve unit 70 is inserted and through in a hole 61 in the PCB 59 and secured thereto by having its rear end clinched as shown in Figure 10. The rotary disk 62 complete with the contact gear 68 is rotatably mounted on the midportion 71 of the sleeve unit 70.

Figures 5 and 7–10 all show a bearing unit 76 for rotatably supporting speed reduction gear means 84 through which the contact gear 68 is driven from the worm wheel 29. As best shown in Figure 7, the bearing unit 76 is molded from a plastic to include a disc 77 concentrically mounted on the midportion 71 of the sleeve unit 70 and disposed inside the contact gear 68. The disc 77 of the bearing unit 76 is joined via two connective portions 79 to a bearing plate 80 of approximately triangular shape. The bearing plate 80 has a leg 81 with a pin 82 extending rearwardly therefrom and closely inserted in a hole 85 in the PCB 59. Thus the complete bearing unit 76 is prevented from angular displacement about the sleeve unit 70.

As seen in Figures 8–10, a countershaft 83 is inserted in a hole in the bearing plate 80 and secured thereto by having one end clinched. Rotatably mounted on the countershaft 83 is the noted speed reduction gear means 84 shown as a unitary combination of a larger gear 84*a* and a smaller gear 84*b*. The larger gear 84*a* meshes with a gear 89, Figures 5 and 7, formed in one piece with the worm wheel 29 in coaxial relation thereto. The smaller gear 84*b* meshes with the contact gear 68. Thus the contact gear 58 is driven from the worm wheel 29, revolving the contact means 66 in sliding engagement with the conductive pattern on the PCB 59.

Figures 5 and 7 also show a hole 90 formed centrally in the gear 89 for rotatably receiving the front portion 73 of the sleeve unit 70 on

the main shaft 86. This interengagement of the sleeve unit 70 and the gear 89 is effective to assure precise positional relationship among the worm wheel 29, contact gear 68 and speed reduction gear means 84.

Figures 8 and 10 indicate that the disc 77 of the bearing unit 76 is received in the contact gear 68. A stop 78, Figures 7 and 8, extends radially outwardly from the disc 77. The contact gear 68 has a radially inward projection 69, Figure 8, of arcuate shape extending through an angle of somewhat more than 180 degrees about the axis of the contact gear. The opposite ends 69*a* and 69*b* of the arcuate projection 69 are movable into and out of abutment against the stop 78 on the disc 77 of the bearing unit 76. Consequently, the contact gear 78 together with the rimmed disc 62 carrying the contact means 66 is bidirectionally rotatable on the stepped sleeve unit 70 through an angle determined by the stop 78 and the arcuate projection 69.

Thus the direction and amount of travel of the leveling member 41 are transmitted to the contact gear 68 via the speed reduction gear means 84 on the countershaft 83. As the contact means 66 thus travel in sliding engagement with the conductive pattern 60 on the PCB 59, the leveling motor 26 will be set out of rotation when the reflector 9 is tilted to an angular position commanded by the operator.

Such being the improved construction of the leveling mechanism according to the invention, both contact gear 68 and speed reduction gear means 84 may first be mounted to the PCB 59 together with the stepped sleeve unit 70 and bearing unit 76 in the assemblage of the leveling mechanism. Then the PCB 59 with the various parts mounted thereto may be mounted in position within the housing 24. The mounting of the contact gear and the speed reduction gears is therefore far easier than heretofore, and they will remain in proper interengagement throughout the lifetime of the leveling mechanism.

Additionally, as will be best understood from Figure 10, the stepped sleeve unit 70 is positively retrained from displacement in either axial direction relative to the PCB 59. The smooth rotation of the contact gear 68 is therefore assured, the contact gear being disposed between the PCB 59 and the flange 74 of the stepped sleeve unit 70.

Notwithstanding the foregoing detailed disclosure, it is understood that the present invention is not to be limited by the exact details of

the illustrated embodiment. For example, although the invention has been disclosed as applied to a vehicle headlamp having a tiltable reflector, the invention is readily adaptable for headlamps of the type wherein the complete lamp unit is tiltable relative to the lamp housing. It is therefore appropriate that the present invention be construed broadly and in a manner consistent with the fair meaning or proper scope of the appended claims.

CLAIMS

1. A leveling mechanism for a vehicle headlamp of the type having a tiltable member (9) and a nontiltable member (2), the tiltable member being tiltable relative to the nontiltable member for leveling a beam of light thrown by the headlamp, comprising a reversible leveling motor (26) mounted in fixed relation to the nontiltable member, a leveling member (41) acting between the tiltable member and the nontiltable member, the leveling member being linearly movable back and forth relative to the nontiltable member (2) for tilting the tiltable member (9) and hence for leveling the beam of light, drive gear means (27, 28, 28a, 29) coupled to the leveling motor, motion translating means (45, 46, 30, 38) for translating the bidirectional rotation of the drive gear means into the linear bidirectional movement of the leveling member, a printed circuit board (59) mounted in fixed relation to the nontiltable member, the printed circuit board having formed thereon a conductive pattern (60) connected in circuit with the leveling motor, a main shaft (86) rigidly mounted to the printed circuit board, a contact gear (68) rotatably mounted on the main shaft, contact means (66) mounted to the contact gear and disposed for sliding engagement with the conductive pattern on the printed circuit board in order to set the leveling motor out of rotation when the tiltable member is tilted to a required angular position relative to the nontiltable member, and speed reduction gear means (84) rotatable about an axis parallel to the axis of the main shaft, the contact gear being driven from the drive gear means via the speed reduction gear means for revolving the contact means in sliding engagement with the conductive pattern on the printed circuit board, characterized in that the speed reduction gear means (84) is rotatably mounted to a bearing member (76) which is supported by the main shaft (86).

2. The leveling mechanism as claimed in claim 1, characterized in that the speed reduction gear means (84) is rotatably mounted on a countershaft (83) secured to the bearing member (76).

3. The leveling mechanism as claimed in claim 1, characterized in that the bearing member (76) is additionally secured directly to the

printed circuit board (59).

4. The leveling mechanism as claimed in claim 1, characterized in that the bearing member (76) is supported on the main shaft (86) via a sleeve unit (70).

5. The leveling mechanism as claimed in claim 4, characterized in that the sleeve unit (70) is secured to the printed circuit board (59).

Patents Act 1977
Examiner's Report to the Comptroller under Section 17 (The Search Report)

Application number
9203074.1

Relevant Technical fields

(i) UK Cl (Edition K) F4R (RMC)

(ii) Int CL (Edition 5) F21M 3/18

Search Examiner
N JACOBS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
5 JUNE 1992

Documents considered relevant following a search in respect of claims 1-5

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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