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(54) Electrical adjusting device for headlamps of motor vehicles

(57) An electromotive adjusting device for headlamps of motor vehicles infinitely controls or regulates the light range of the dipped beam in conformity with variations in the deflection of the spring suspension of the body. The device has a two-part dust-proof housing (34, 56) which contains an electric motor having a reduction gear, an output gear wheel (30) of which moves a push rod by virtue of screw threads (32, 33) and a connecting member (14) transmits the stroke of the push rod to the reflector. A printed circuit board (50) having round plug pins carries an induction coil (45) of an actual value transducer whose plunger (46) is disposed on the worm wheel (30).

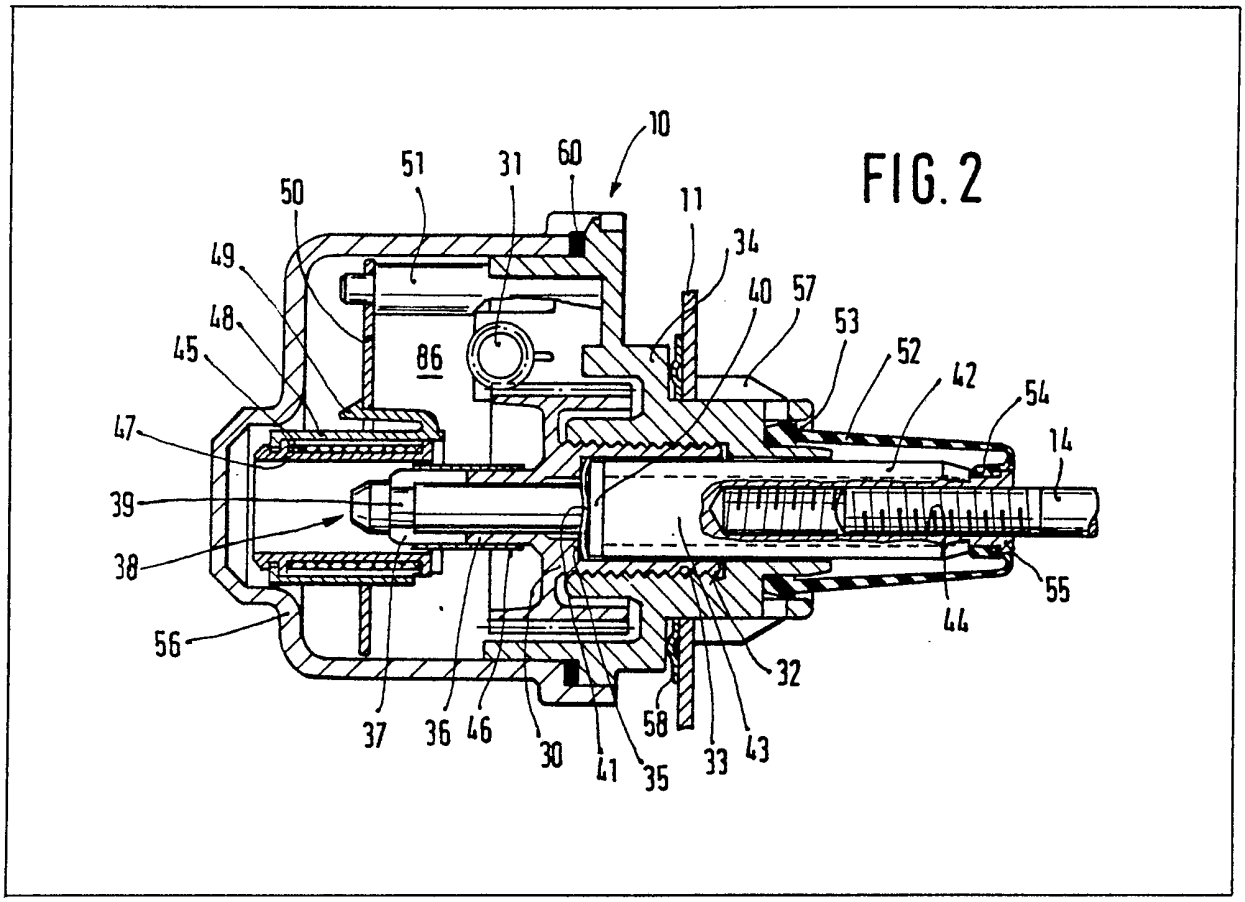

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FIG.1

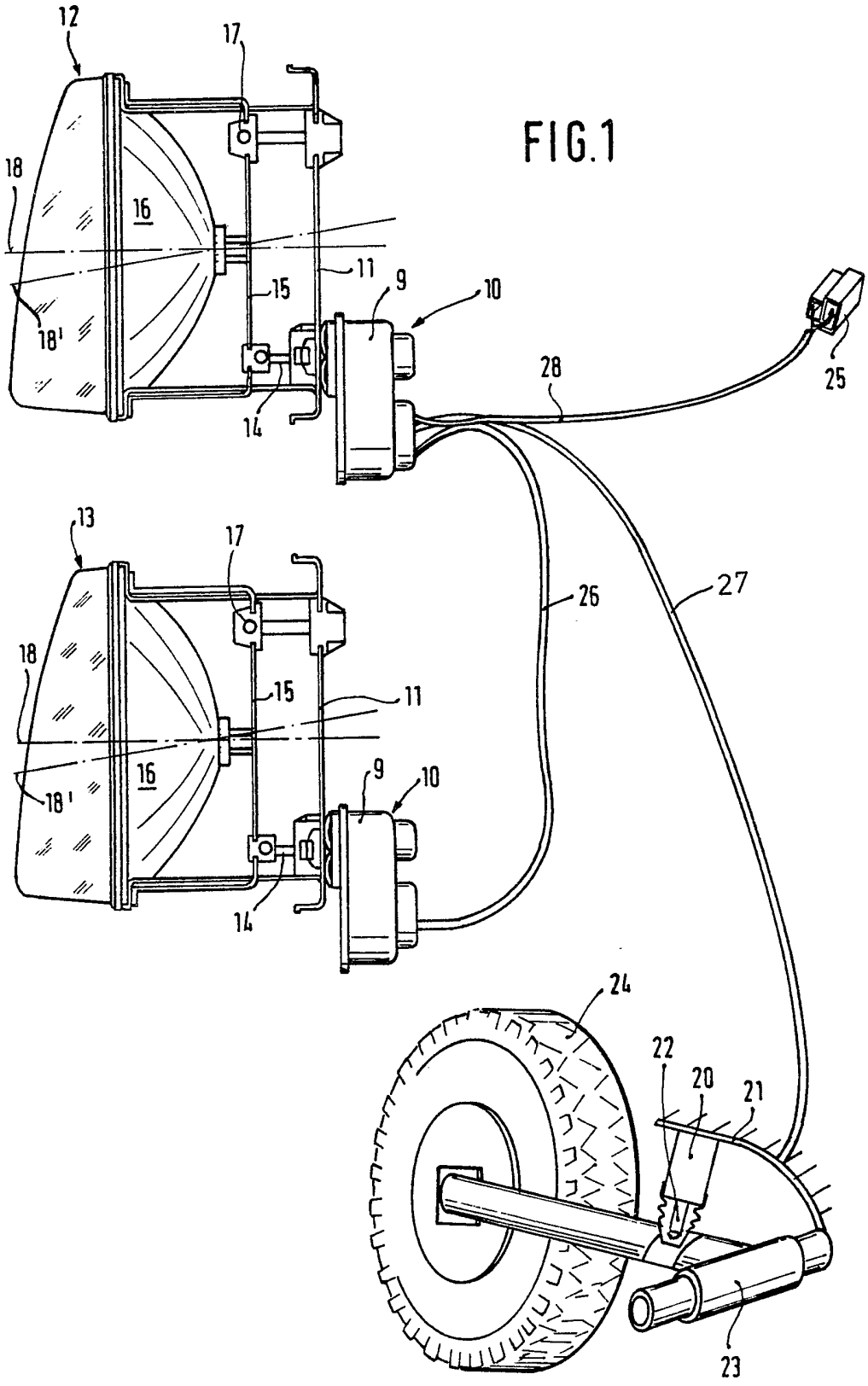
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FIG. 2

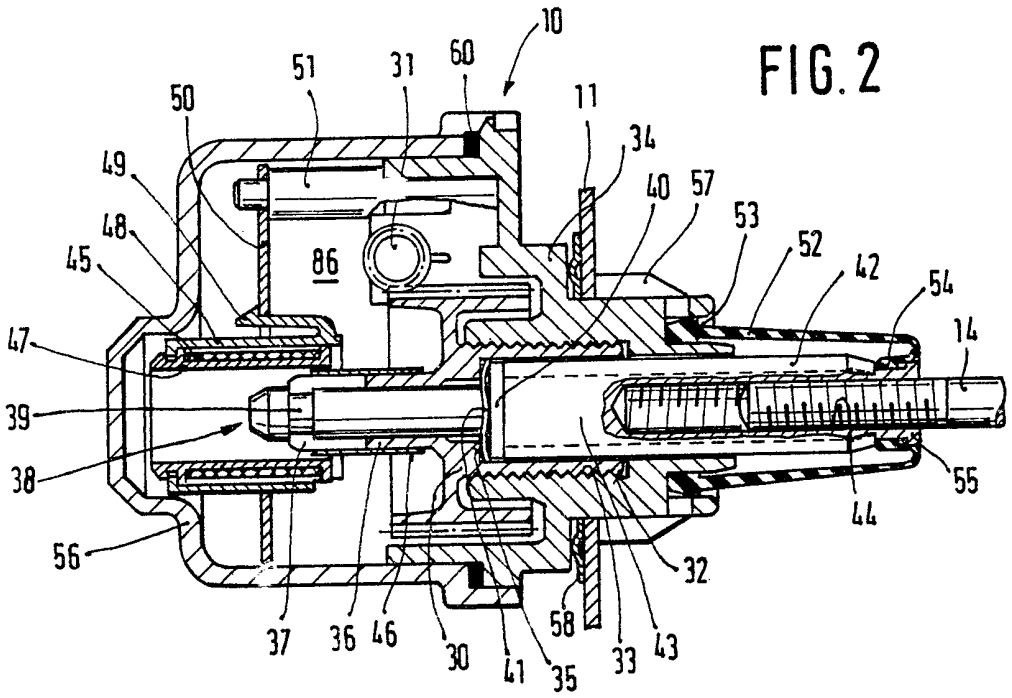
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FIG. 3

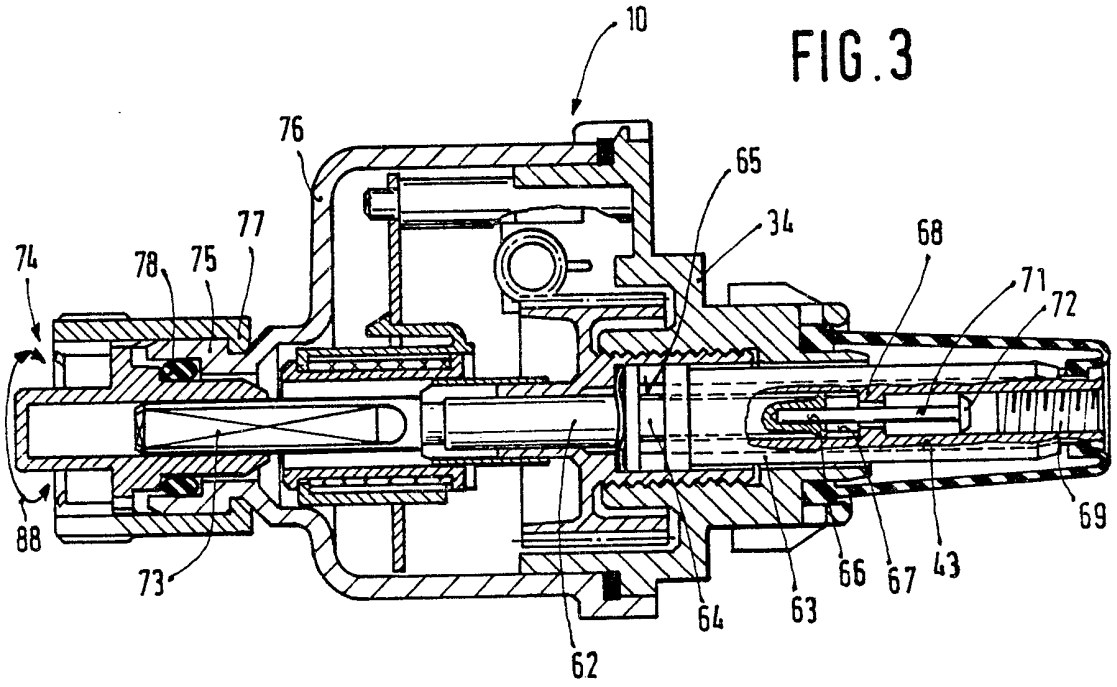
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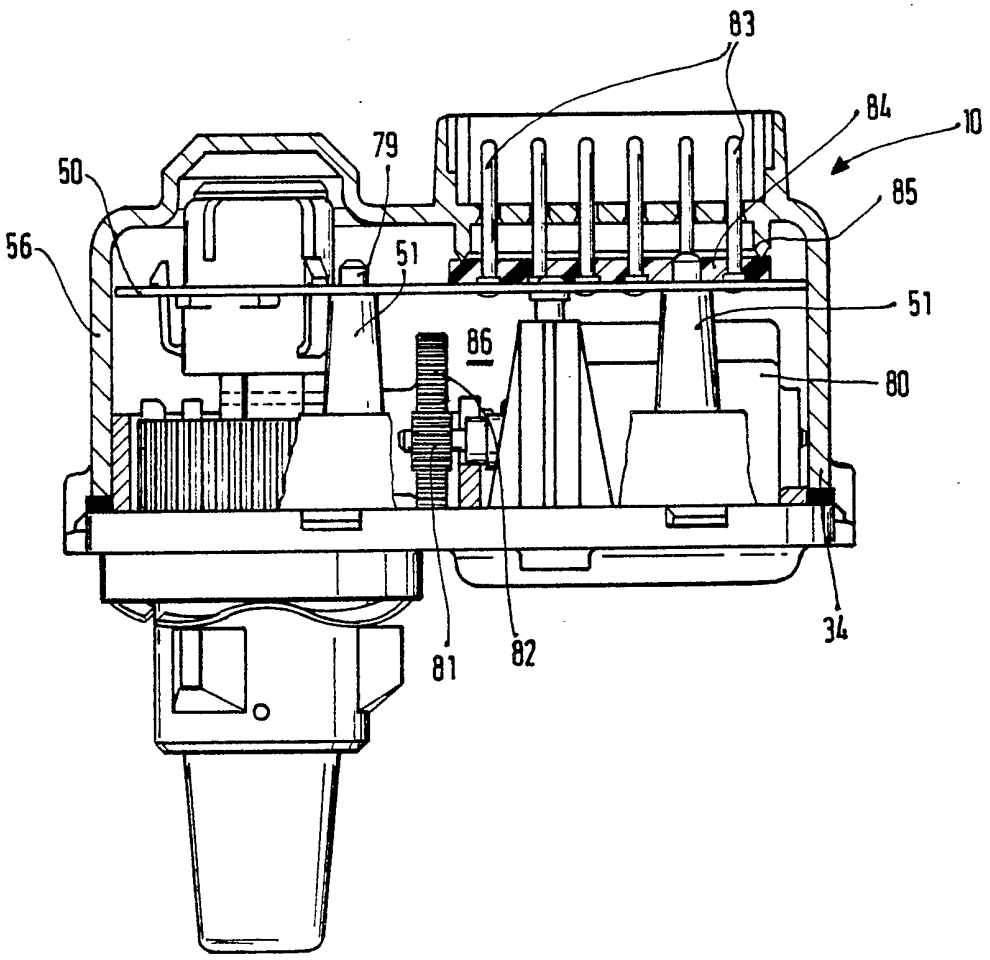
FIG.4



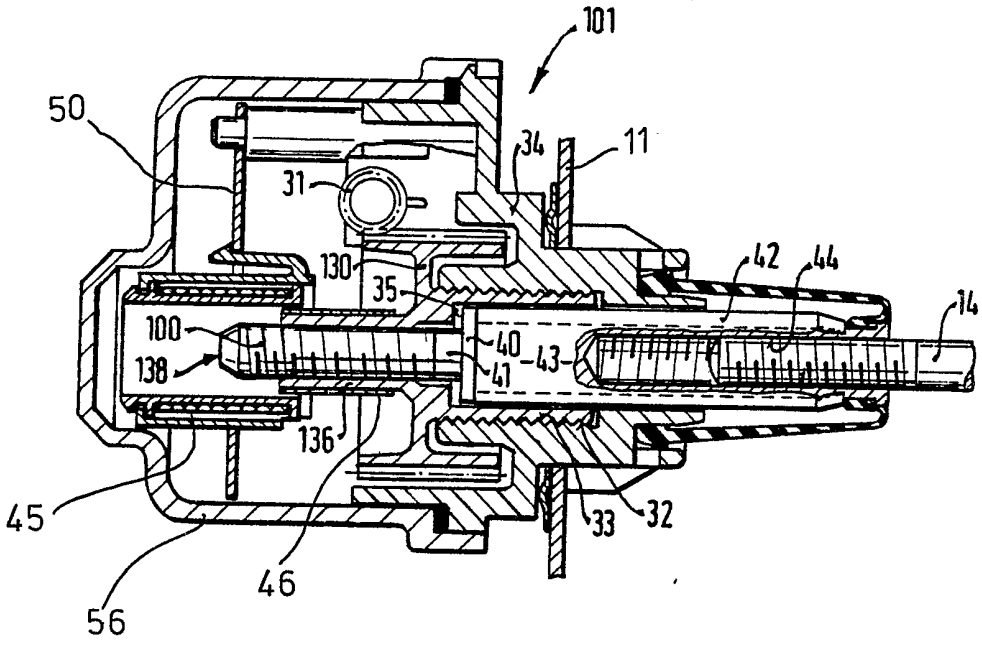


FIG. 5

SPECIFICATION

Electrical adjusting device for headlamps of motor vehicles

The invention relates to an electrical adjusting device, for headlamps of motor vehicles.

Various electrical adjusting devices for the infinite or stepless control or regulation of the light range have already been proposed, although they have not provided any practical solutions. In particular, the problems of irreversibility and the low wear on the device have not yet been recognised, since these two factors are essential to the satisfactory operation of the device over the entire life or operation of the vehicle and in the prescribed range of tolerance.

The present invention provides an electromotive adjusting device for headlamps of motor vehicles which, upon a change in the deflection of the spring suspension of the body, pivots the headlamp reflector for the dipped beam in a stepless manner into the position in which the dipped beam does not exceed the prescribed light range, which device comprises a fixed housing, an electrical motor having a reduction gear disposed in the housing, an output gear wheel of the reduction gear having an external screw-thread which co-operates with an internal screw-thread in the housing, the screw threads being in the form of fine pitch screw threads, a push rod axially displaceable in the housing of the device and secured against rotation, the push rod being axially held in the output gear wheel, and a coupling member for conneting the push rod to the reflector.

Complete irreversibility of the drive mechanism is thereby obtained, in that external forces acting upon the drive mechanism cannot displace the latter even under unfavourable circumstances. By virtue of the fact that the axial forces acting externally are transmitted to the housing of the adjusting device by way of the push rod, these forces cannot have a detrimetal effect on the drive mechanism located therebeyond. Furthermore, the adjusting forces applied are relatively very high despite a relatively small drive motor.

If the output gear wheel is provided with a latching device which engages an annular groove in the push rod, the push rod is held in an exailly play-free manner in the housing, and the tolerances of the movable elements are compensated for.

In order to increase the stroke of the push rod, the cumulative effect of two screw connections of opposite hand can be used. That is to say the push rod can have a screw-threaded bolt co-operating with a screw-threaded sleeve of the worm wheel, these screw threads being of opposite hand to those between the worm wheel and the housing. An increased range of adjustment is thereby obtained at little extra expense.

The wear on the individual parts can be further reduced by the close-tolerance fit achieved by a flat on the push rod co-operating with a counter-surface of the housing to prevent the push rod from turning. A dust-proof seal in the region in which the push rod is coupled to the reflector can be achieved if one end portion of a rolling-type bellows is secured in the housing, and the other end portion of the rolling-type bellows is secured to the push rod.

In a development of the invention, a position transducer is provided and comprises a steel sleeve secured to a hub of the output gear wheel and acting as a plunger and an induction coil secured in the housing such that the steel sleeve is axially displaceably received in the induction coil. This is advantageous if the device is to operate with comparison of the desired value and the actual value during regulating operation. In an arrangement of the induction coil, which is economic to manufacture and which operates reliably, the induction coil is accommodated in a coil former which is secured in a reception sleeve, the reception sleeve being snapped into a plate secured to the housing.

If it is desired to adjust the basic setting of the reflector from the rear of the device, this can be achieved if the push rod is of two-part construction and comprises an adjusting spindle having an external screw-thread and an adjusting sleeve having an internal screw-thread, which screw threads mate with one another and are in the form of fine pitch screw threads, and in which the adjusting spindle is mounted in the gear wheel so as to be rotatable and secured against axial displacement relative thereto, and the adjusting sleeve is mounted in the housing of the device so as to be axially displaceable therein but is secured against rotation.

Preferably the housing is of two-part construction and comprises a main body which is insertable into the fixed portion of the headlamp in the manner of a bayonet joint, and a cover, which can be snapped onto the main body by way of a sealing ring. It is advantageous for a sealing disc to surround the round plug pins projecting out of the cover and to keep the cover pressed against the plate. The interior of the device is thereby made readily accessible in the region of the two parts of the housing on the one hand, and on the other hand, in the region of the plug.

The invention is further described, by way of example, with reference to the drawings, in which:-

Figure 1 is a schematic view to show the basic arrangement of an electromotive light-range reguating means for headlamps of motor vehicles;

Figure 2 is an axial section through the adjusting device of a light-range regulating means which is only controlled;

Figure 3 is a similar axail section through the adjusting device, but for regulated actuation of the light range;

Figure 4 is a side elevation of the main body of the adjusting device, and a cross section through the cover of the device in the region of the electrical connections; and

Figure 5 is an axial section through a further embodiment of the adjusting device.

Figure 1 shows an electromotive adjusting device 10 whose housing 9 is secured to a fixed support frame 11 for the right-hand and left-hand headlamps 12, 13, and whose coupling member 14, which performs a stroke, is hinged to the headlamp reflector 16 by way of a frame 15. The frame 15 is infinitely pivotable about a hinge 17 by the adjusting device 10, such that the optical axis of the reflector 16 can assume the extreme position 18 or 18'.

A transducer 20 is secured to the body or chassis 21 of the motor vehicle (only a portion of which is illustrated), and the sensing element 22 of the transducer is held in abutment with a rocker 23 carrying the rear wheel 24. A respective electrical lead 26, 27 or 28 connects the adjusting device 10 to the other device, to the transducer 20 and to a plug connector 25 for connection to the vehicle electrical system (not illustrated).

The electromotive adjusting device 10 of Figure 2 has a worm wheel 30 which is driven by a worm 31 and which has a fine-pitch external screw-thread 32 which co-operates with similar internal screw-thread 33 incorporated in the main body 34 of the housing. Furthermore,the worm wheel 30 has a shoulder 35 and a hub 36 having a latching device 37 which comprises a plurality of latching hooks directed towards one another.

A stepped diameter push rod 38 has an annular groove 39 into which the latching hooks of the latching device 37 engage, and a shoulder 40 which is spaced from the shoulder 35 by a wavy washer 41 which acts in an axial direction, and a portion 42. The outer surface of the portion 42 has a flate 43 which cooperates with a counter-surface (not visible) of the main body 32 which is located therebehind. Furthermore, a blind bore is incorporated in the end face of the portion 42 and is provided with an internal screw-thread 44 into which the coupling member 14 hinged to the reflector 16 (Figure 1) is screwed.

A so-called actual value transducer of a light-range regulating device chiefly comprises a fixed induction coil 45 and a plunger 46 which is axially displaceable in the induction coil which influences its inductance and which is in the form of a steel sleeve and surrounds the hub 36 and the latching device 37 on the worm wheel 30. A sleeve-shaped coil former 47 accommodates the induction coil 45 and is inserted into a reception sleeve 48 which is in turn lockable in a plate 50 by means of latches 49, the plate 50 being secured to a plurality of spacer pins 51 projecting from the main body 34.

One end portion 53 of a rolling type bellows 52 is secured in the basic body 34 by a snap fit, and its other end portion 54 is secured in a groove 55 in the push rod 38 by a snap fit.

The main body 34 has a bayonet joint 57 for securing the main body to the support frame 11, the resilience of the joint being effected by a corrugated washer 58. A cup-shaped cover 56 is secured to the main body 34 by a snap fit by way of a sealing ring 60, and the main body 34 and the cover 56 essentially form the housing providing protection from the atmosphere in a dust-proof manner.

The electromotive adjusting device of Figure 3 additionally has an adjusting means for setting the basic position of the headlamp in a vertical direction and differs from the previously described device in the following manner:

Instead of a single push rod 38, the push rod is of two-part construction and comprises an adjusting spindle 62 and an adjusting sleeve 63. The adjusting spindle 62 has a portion 64 incorporating an external screw-thread 65 and its front end incorporates a screw-threaded blind bore 66. An internal screw-thread 67 for receiving the portion 64 is provided in the adjusting sleeve 63, an internal ring 68 being contiguous to the internal screw-thread 67, and a blind bore 69, a portion of which is provided with an internal-screw thread to receive the coupling member 14, being contiguous to the internal ring 68. Furthermore, the outer surface of the portion 64 also incorporates the flat 43 which co-operates with a counter-surface (not visible) of the main body 34. The screw-threaded shank of a cap screw 71 is screwed into the screw-threaded blind bore 66 in the adjusting spindle 62, the distance between the head 72 of the screw and the internal ring 68 being dimensioned such that the adjusting sleeve 63 cannot be unintentionally released from the adjusting spindle 62.

The adjusing spindle 62 has an end portion 73 which extends out of the cover 76 and onto which a rotatable handle 74 is slipped, the handle being non-rotatable relative to the adjusting spindle. An annular rim 77 of the pivotable handle 74 engages behind a collar 75 of the cover 76. An O-ring 78 seals the region between the handle 74 and the collar 75 of the housing cover 76.

Referring to Figure 4, a fractional horse-power motor 80 is secured to the main body 34 of the housing of the adjusting device 10 and its shaft end carries a pinion 81. The pinion 81 meshes with a spur wheel 82 which is integrally formed with the worm 31 (Figure 2). The motor 80 thus has a reduction gear 81, 82, 31, 30 of which the worm wheel 30 forms the output gear wheel. In all, four spacer pins 51 project from the main body 34, each pin having a tapered spigot 79. The plate 50 secured to the spacer pins 51 is a printed circuit board on which are disposed the electrical-electronic elements of the adjusting device and, if required, the entire light-range regulating system. The electrical connections of the printed circuit board 50 are in the form of round plug pins 83, a sealing disc 84 embraces the round plug pins 83 extending out of the housing cover 56, and an annular projection 85 of the cover 56 keeps the sealing disc 85 pressed against the plate 50, whereby the interior space 86 is sealed relative to the atmosphere.

The electromotive adjusting device of Figs. 2 and 4 operates in the following manner:

The worm wheel 30 and consequently the push rod 38 are illustrated in Fig. 2 in one (right-hand) end position. If, for example, the electronic motor

80 (Fig. 4) receives a corresponding signal by way of the transducer 20 (Fig. 1) as a result of a change in the deflection of the spring suspension of the body, the worm wheel 30 is rotated by way of the reduction gear 81, 82 and 31 and is thereby moved out of the main body 34 into the interior space 86. The push rod 38 is thereby carried along in an axial direction, rotation being prevented by the flat 43. The coupling member 14 secured in the push rod 38 transmits the stroke to the frame 15 and to the reflector 16 of the headlamp (Fig. 1) and correspondingly pivots the latter.

The electric motor 80 switches itself off when the reflector assumes its pivoted position associated with the new deflection of the suspension of the body, this being essentially determined by a comparison of the desired and actual values as measured by the transducers 45, 46, and 20.

The additional adjustment of the basic setting of the headlamp will be described hereinafter with reference to Figure 3:

If the basic vertical setting of the headlamp is to be adjusted, the handle 74 is turned in the corresponding direction in accordance with the double arrow 88, and, with the worm wheel 30 locked by the worn 31, the adjusting spindle 62 is jointly rotated. The adjusting sleeve 63, secured against turning, is thereby displaced in one or other of the two directions, and the support frame 15 and the reflector 16 are consequently pivoted by the coupling member 14 (Fig. 1) in the manner described previously.

Fig. 5 shows another embodiment 101 of the adjusting device and parts like those of Figs. 2 and 3 are denoted by like reference numerals. The adjusting device 101 has a worm wheel 130 which is driven by a worm 31 and which has the fine pitch external screw-thread 32 which co-operates with the complementary internal screw-thread 33 of the main body 34. The worm wheel 130 has the shoulder 35 thereon and a screw-threaded sleeve 136.

A stepped diameter push rod 138 has a portion 42 which contains the blind bore incorporated in its end face and which has the internal screw-thread 44 into which the coupling member 14 hinged to the reflector frame 15 (Fig. 1) is screwed. The push rod 138 has a screw-threaded bolt 100 and its shoulder 40 is spaced from the housing shoulder 35 by a wavy washer 41 which acts in an axial direction. The outer surface of the portion 42 has the planar flat 43 which co-operates with a counter-surface (not visible) of the main body 34 which is located therebehind.

The worm wheel 130 has a screw-threaded sleeve 136 which co-operates with the screw-threaded bolt 100 of the push rod 138. The screw-threads of the bolt 100 and of the sleeve 136 are of opposite hand to the external screw-thread 32 of the worm wheel 130 and the internal screw-thread 33 of the main body 34 co-operating therewith. That is to say, if the screw-threads of the bolt 100 and of the sleeve 136 are left-hand, the external screw-thread 32 and the internal screw-thread 33 must be right-hand, or vice versa. The adjusting device of Fig. 5 operates in stages as follows:

When the worm wheel 130 moves, for example, out of the main body 34 by the amount of the corresponding stroke owing to the pitch of the screw-threads 32 and 33, the opposing screw-threads of the bolt 100 and of the sleeve 136 effect an additional stroke of the push rod 138 owing to their pitch. Consequently, the two strokes are added together and result in a larger pivoting movement of the reflector without any changes in the signals from the transducer.

CLAIMS

1. An electromotive adjusting device for headlamps of motor vehicles which, upon a change in the deflection of the spring suspension of the body, pivots the headlamp reflector for the dipped beam in a stepless manner into the position in which the dipped beam does not exceed the prescribed light range, which device comprises a fixed housing, an electric motor having a reduction gear disposed in the housing, an output gear wheel of the reduction gear having an internal screw thread which co-operates with an internal screw thread in the housing, the screw threads being in the form of fine pitch screw threads, a push rod axially displaceable in the housing of the device and secured against rotation, the push rod being axially held in the output gear wheel, and a coupling member for connecting the push rod to the reflector.

2. A device as claimed in claim 1, in which the output gear wheel has a latching device which engages an annular groove in the push rod to axially fix the push rod to the gear wheel.

3. A device as claimed in claim 2, in which the output gear wheel has a hub and the latching device comprises a plurality of latching hooks which are incorporated in the hub and engage the annular groove in the push rod.

4. A device as claimed in claim 2 or 3, in which a shoulder on the push rod and a shoulder of the gear wheel are spaced apart by a washer.

5. A device as claimed in any of claims 1 to 4, in which the push rod is of two-part construction and comprises an adjusting spindle having an external screw-thread and an adjusting sleeve having an internal screw-thread, which screw threads mate with one another and are in the form of fine pitch screw threads, and in which the adjusting spindle is mounted in the gear wheel so as to be rotatable and secured against axial displacement relative thereto, and the adjusting sleeve is mounting in the housing of the device so as to be axially displaceable therein but is secured against rotation.

6. A device as claimed in claim 5, in which a handle is secured to that end portion of the adjusting spindle which projects out of the housing, and engages behind a collar projecting from the housing, and an O-ring seals the region between the handwheel and the collar of the housing.

7. A device as claimed in claim 5 or 6, in which a cap screw projects from the end face of that portion of the adjusting spindle which is provided with an external screw-thread, and the head of the cap screw abuts against an internal ring disposed in the adjusting sleeve and thereby limits displacement of the adjusting spindle in one direction relative to the adjusting sleeve.

8. An electromotive adjusting device for headlamps of motor vehicles which, upon a change in the deflection of the spring suspension of the body, pivots the headlamp reflector for the dipped beam in a stepless manner into that position in which the dipped beam does not exceed the prescribed light range, wherein the device comprises a fixed housing, an electric motor having a reduction gear disposed in the housing, an output gear wheel of the reduction gear having an external screw-thread which co-operates with an internal thread in the housing, a push rod axially displaceable in the housing of the device and secured against rotation, and a coupling member for connecting the push rod to the reflector, the push rod having a screw-thread bolt and the worm wheel having a screw-threaded sleeve which co-operates with the screw-threaded bolt, with the screw threads of the screw-threaded bolt and of the screw-threaded sleeve being of opposite hand to the external screw-thread of the worm wheel and of the internal screw-thread of the housing.

9. A device as claimed in any preceding claim, in which a flat is disposed on the outer surface of the push rod and co-operates with a counter-surface of the housing to prevent the push rod from turning.

10. A device as claimed in any preceding claim, in which one end portion of a rolling-type bellows is secured in the housing, and the other end portion of the rolling-type bellows is secured to the push rod.

11. A device as claimed in any preceding claim, in which a position transducer is provided and comprises a steel sleeve secured to a hub of the output gear wheel and acting as a plunger and an induction coil secured in the housing such that the steel sleeve is axially displaceably received in the induction coil.

12. A device as claimed in claim 11, in which the induction coil is accommodated in a coil former which is secured in a reception sleeve, the reception sleeve being snapped into a plate secured to the housing.

13. A device as claimed in claim 12, in which the plate is in the form of a printed circuit board and electrical-electronic elements of at least the adjusting device are disposed thereon, the plate being secured to a plurality of spacer pins which project internally in the housing.

14. A device as claimed in claim 12 or 13, in which the electrical connections of the plate are in the form of round plug pins.

15. A device as claimed in any preceding claim, in which the housing is of two-part construction and comprises a main body which is insertable into the fixed portion of the headlamp in the manner of a bayonet joint, and a cover, which can be snapped onto the main body by way of a sealing ring.

16. A device as claimed in claims 14 and 15, in which a sealing disc surrounds the round plug pins projecting out of the cover and keeps the cover pressed against the plate.

17. An electromotive adjusting device for motor vehicle headlamps, constructed, arranged and adapted to operate substantially as herein described with reference to and as illustrated in the drawings.

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