Feb. 25, 1958 F. K. H. NALLINGER 2,824,733

SPRING ADJUSTING MEANS

Filed Nov. 18, 1952 2 Sheets-Sheet 1

Fig. 1

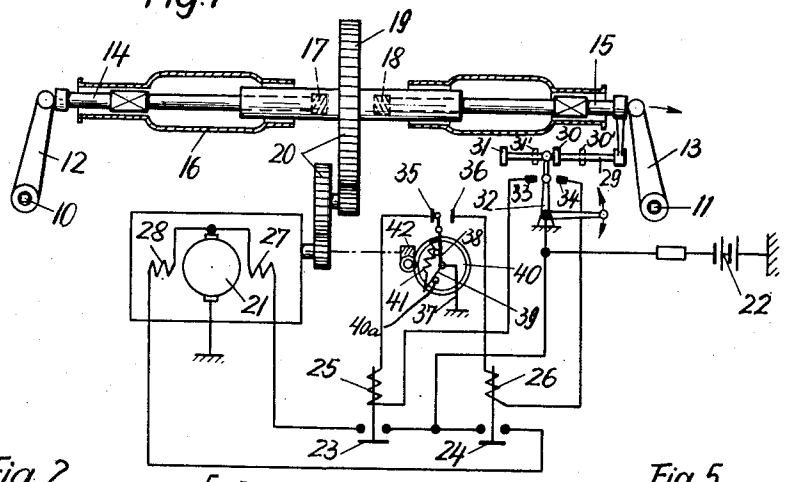


Fig. 2

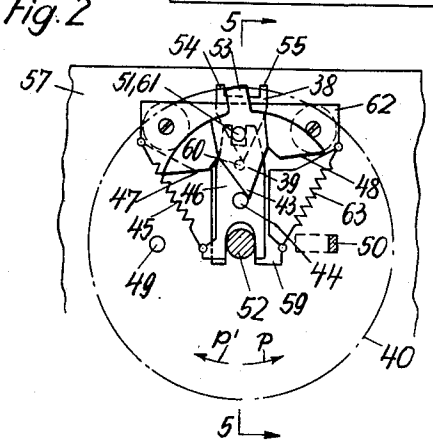


Fig. 5

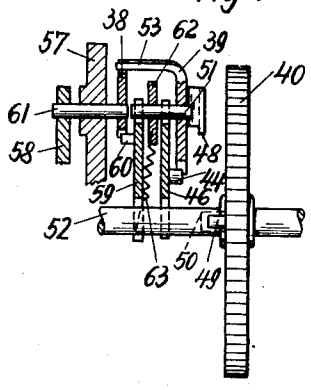


Fig. 4

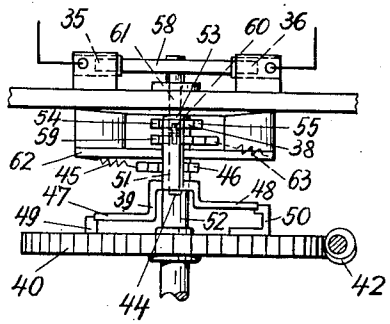
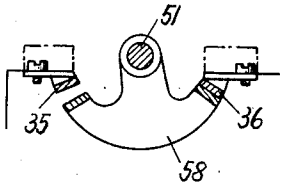


Fig. 3



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Fig. 6

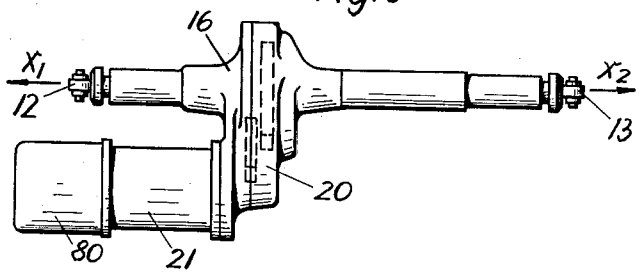


Fig. 7

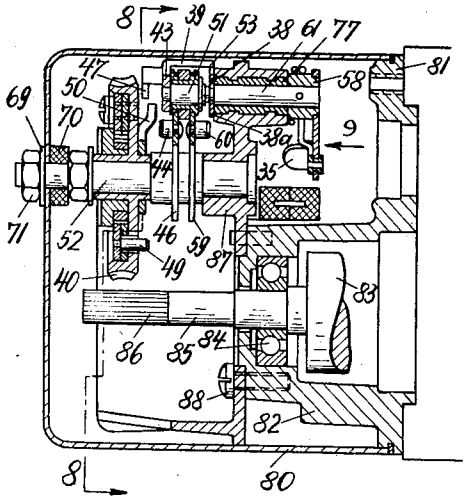


Fig. 8

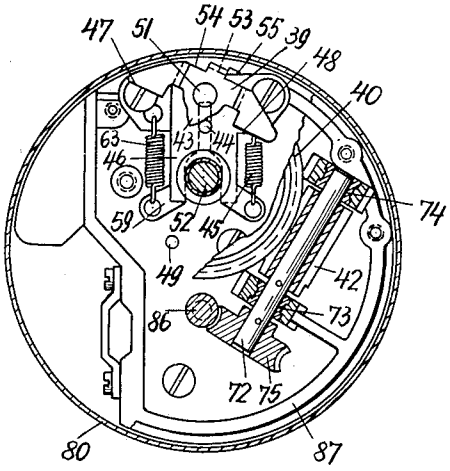
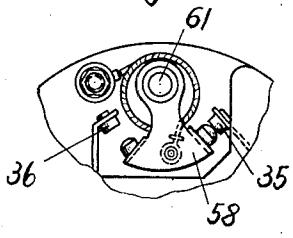


Fig. 9



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SPRING ADJUSTING MEANS

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Application November 18, 1952, Serial No. 321,086

Claims priority, application Germany November 20, 1951

7 Claims. (Cl. 267—57)

This invention relates to motor-driven spring-adjusting means and, more particularly, to a device for altering the tension of a spring system for a road vehicle, especially an additional auxiliary spring system which, according to requirements, is alternately put in tension respectively cut in, or relieved of tension respectively cut out.

The present invention is a continuation-in-part of my copending application, Serial No. 295,792, filed June 26, 1952, entitled "Motor-Driven Spring-Adjusting Device for Vehicles," now Patent No. 2,757,923.

It is a principal object of the present invention to provide a spring-adjusting device of the type indicated which is simple in design and easy to operate.

It is another object of the present invention to provide a spring-adjusting device of the type indicated which is driven by an electric motor and reliable under service conditions.

Another object of the present invention relates to a spatially compact structure of the whole aggregate comprising an electric motor and switchgear, to an improved and simplified mounting and dismounting of the aggregate, and to such a construction of the electric motor and switchgear that both of them may be fabricated each for itself, yet may readily and quickly be attached and detached from one another, particularly also in such a manner that the switchgear does not require any separate bearing members on the vehicle.

A further object of the invention relates to a protected location of the switchgear and to a particularly effective driving arrangement for driving the latter by means of the electric motor.

With these objects in view, the present invention comprises a change-over switchgear adapted to automatically switch or preselect the drive, on reaching one or the other end position, to the opposite direction of rotation, thereby securing the advantage that the drive will be positively prepared for the next switching operation and that faulty manipulation by the driver is rendered impossible, switching over being preferably achieved by means of a limit switch simultaneously or approximately simultaneously with the stopping of the drive, and preferably by means of a toggle switch adapted for rapid switching into one or the other end position by the action of a spring.

Another feature of the present invention consists in a construction whereby the change-over switch connects alternately, preferably by means of relays, a circuit for switching the driving motor to forward direction of rotation, and a circuit for switching the motor to backward direction of rotating in a manner whereby the circuits will be disconnected by the simultaneously operated limit switch until the circuit will be closed again after the switch has been shifted to neutral position by means of end stops.

A further feature of the present invention concerns the particularly advantageous construction of the toggle switch. Thus is attained a switch simpler in design,

cheaper to build and of a particularly compact and rugged structure requiring but little space.

A still further feature of the present invention consists in that the switchgear together with the interposed reduction gearing forms a unitary structure with the electric motor, the switchgear being most appropriately attached to the motor casing as a unit, for example, by means of a plate- or pan-shaped supporting member.

Other objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows for purposes of illustration only several preferred embodiments in accordance with the present invention and wherein:

Fig. 1 is a wiring diagram of the arrangement provided by the present invention,

Fig. 2 is a front view of the toggle switch,

Fig. 3 is a front view of the toggle switch lever which actually closes the circuit,

Fig. 4 is a top plan view of the switch, showing some parts in section,

Fig. 5 is a vertical sectional view through the center of the subject matter shown in Fig. 2 taken along line 5—5 thereof,

Fig. 6 is a general view of an electric motor drive similar to Figure 1 with attached switchgear,

Fig. 7 is an axial sectional view through the switchgear attached to the electric motor of Figure 6,

Fig. 8 is a view of the switchgear as seen from the left with the housing hood cut open in section taken on line 8—8 of Fig. 7, and

Fig. 9 is a view of the switchgear as viewed in direction of arrow 9 of Fig. 7.

The numerals 10 and 11 in Fig. 1 represent torsional rods, for example, auxiliary springs additional to the main spring system of a motor vehicle which are attached to arms 12, 13 abutting against spindles 14, 15. The spindles 14 and 15 are slidingly, but non-rotatably guided in a casing 16, and in threaded engagement with a gear 19 by means of left- and right-hand threads 17 and 18 respectively so that on rotation of the gear 19 in one direction, the spindles 14, 15 will be displaced outwardly, and on rotation of the gear 19 in opposite direction, the spindles 14, 15 will be displaced inwardly. The gear 19 is in mesh with reducing gears 20 driven by an electric motor 21 diagrammatically indicated on the drawing. The foregoing arrangement is substantially as shown, described and claimed in the copending patent application Serial No. 282,589, filed on April 16, 1952, entitled "Spring-adjusting means for vehicles," now Patent No. 2,705,139. The electric motor 21 is connected to a source of current 22 through switches 23, 24 which will be closed by coils 25, 26 as soon as the respective coil is supplied with electric current. An exciting coil 27 induces the motor 21 to rotate in forward direction of rotation and a similar coil 28 to rotate in backward direction of rotation.

In addition, the spindle 15 is connected with a bar 29 having stops 30 and 31 coacting with a lever 32 in a manner permitting displacement of the said lever at any given time in one direction for the purpose of connecting the source of current 22 with the contacts 33 and 34 respectively.

The coils 25 and 26 are further connected with contacts 35 and 36 which may be alternately connected by means of the lever 38 of a toggle switch 38, 39 with the wire 37 leading to the ground. The toggle switch is actuated by stops located on a gear 40 constituting a switch actuating member which abuttingly engage the lever 39 and displace the same beyond the dead center position of a spring 41. As soon as the spring 41 has passed the dead center position of the levers 38, 39, the lever 38 of the toggle

switch will be rapidly shifted from contact 35 to contact 36 or conversely. The gear 40 may be driven in any suitable manner as, for example, by a worm gearing 42 from the motor 21 or by a gear member of the gearing 20, by way of example in such a way that it makes approximately half a revolution in the full travel of the spindles 14, 15 from the no-load or partial load end-position to the full load end-position.

The method of operation of the spring-adjusting device according to Fig. 1 is as follows: In the particular position shown on the drawings, the torsional springs 10, 11 are adjusted to lowest tension. The lever 32 is in the center or neutral position so that the circuit connecting the coils 25 and 26 and therewith the motor 21 is disconnected. If it is desired to activate or cut in the springs 10, 11, i. e. to adjust them to their greatest tension, the lever 32 will be shifted to the left whereby the contact 33 will be connected with the source of current 22. Since the toggle switch 38 is in abutting engagement with the contact 35, the current may flow through the coil 25. As a result of this, the switch 23 will be closed so that the coil 27 will now be supplied with current from the source 22 through 23 and the electric motor 21 will be driven in forward direction of rotation. The gear 19 is set in motion and the spindles 14 and 15 respectively are displaced outwardly so that the torsional springs 10, 11 are put in tension.

As soon as the springs have attained their ultimate tension, the lever 32 will be engaged by the stop 31 and shifted to its center position where it is held, for example, by a detent. As a result thereof the switch 32 will be opened, the current flowing through the coil 25 and exciting coil 27 respectively will be interrupted and the motor 21 stopped. Previously to that the stop 40*a* on the gear 40 has already engaged the lever 39 and shifted it, with respect to the lever 38, into the dead center position. As soon as it passes the dead center position, which takes place simltaneously with the shifting of the lever 32 into the center position, the lever 38, by the action of the spring 41, will also be shifted into its other end-position in that it now abuts against the contact 36.

Should it be desired now to inactivate or cut out the torsional springs 10 and 11, i. e. to relieve them of the tension it is merely necessary to shift the lever 32 to the right so that the current will flow from the source of current 22 through the contact 34, coil 26, and contact 36 to the ground 37. As a result, the switch 24 will be closed, the exciting coil 28 supplied with current, whereby the electric motor 21 will be caused to run in the backward direction of rotation. As soon as the end position is reached (positions 30' and 31' of the stops 30 and 31) the lever 32 will be returned by the stop 30 to its center position, and the motor stopped. Simultaneously therewith the lever 39 will be returned and the lever 38 shifted into the position shown on the drawing.

Figs. 2–4 show the construction of the toggle switch 38, 39 in accordance with the present invention. The lever 39, as shown in Fig. 2, has a wedge-shaped extension 43, the edges of which cooperate with a pin 44 disposed on a slide 46 pulled upwardly by springs 45. Further the lever 39 is provided with wing-shaped stops 47, 48 which cooperate with the stops 49 and 50 on the gear 4 in such a way that on rotation of the gear 40 in direction of the arrow *p'*, the stop 49, after completing approximately one-quarter of a revolution, will abut against the projecting stop 47 and attempts to swing the lever 39 in clockwise direction; the latter movement is, however, only possible when the pin 44 and slide 46 are downwardly displaced by the wedge 43, against the action of the spring 45, beyond the outer extremity of said wedge 43. As soon as the pin 44 has reached the outer extremity of the wedge 43, the lever 39 will be rapidly urged by the spring 45 into the other end position. In a corresponding manner the stop 50, on rotation of the gear 40 in direction of the arrow *p*, may be brought into abutting engagement with the stop 48 so as to swing the lever 39 in counterclockwise direction. As clearly shown in Fig. 4 stops 47, 48 at the lever 39 are also displaced to each other in the axial direction of the shaft 51 of the lever 39, so that stop 49 will come in contact with stop 47 only, and stop 50 will stop 48 only.

In this case the slide 46 is guided on the lever shaft 51 and on the shaft 52 of the gear by means of slots.

Between the shafts 51 and 52 there is furthermore a slide 59 similar to the slide 46 arranged behind the intermediate plate 62 forming the bearing for the shaft 51. Toward the side of the casing 57 this slide 59 carries a pin 60 which, by way of a wedge shaped profile, is in connection with a shaft 61 and the lever 38 fixed on it, analogous to the pin 44 with the lever 39; the shaft 61 is thereby mounted in the case 57 and arranged in the axial direction of the shaft 51.

On the other side of the casing 57 there is the switch lever 58 fixed on the shaft 61 which constitutes a change-over switch controlling the operation of motor 21. The tongue 53 of the lever 39 brings about the movement of the switch lever 58 toward the one or the other direction by way of stops 54, 55 of the lever 38 on the shaft 51.

As soon as the lever 38 is swung so much that the point of its wedge-shaped extension slides over the pin 60 against the force of the tension spring 63, the switch lever 58 connected with the lever 38 contacts the points 35 and 36 elastically. This contact keeps on till the tongue 53 of the lever 39 contacts the opposite stop of the lever 38 and forces the wedge-shaped point of the lever over the pin 60 of the slide 59 against the resistance of the spring 63. After the pin 60 has passed the wedge-shaped point of the lever 38, this lever 38 snaps toward the other side and establishes the next contact with the switch lever 58. Owing to this jerky snap action there occurs no sparking at the contacts.

The levers 38, 39 as well as the slides 46, 59 are integrally formed from sheet metal stampings, the stops 47, 48, 53, 54, 55 being produced by punching or bending. By mounting the levers and the slides closely side by side on the shafts 61 and 51 a short overall length of the switch is obtained.

As for the operation of the toggle switch in connection with the control circuit reference is made to the description of Fig. 1.

Figs. 6–9 show an embodiment of the invention similar to Figures 1 to 5 in which both electric motor and switchgear form a unitary structure and wherein like references indicate the same or similar parts as in Figs. 1–5.

The numeral 16 in Fig. 6 represents again a tensioning device for the spring system, for example, for the torsional springs which can be tensioned by means of the arms 12, 13 (in Fig. 6 shown in top plan view) as hereinbefore described in detail. Putting the springs in tension is accomplished by means of the spindles which are driven from the motor 21 through the interposed gearing 20 in the direction of arrows x_1, x_2 for tensioning the springs and in the opposite direction for relieving them of tension. The change-over switch gear adapted to automatically switch the drive, on reaching one or the other end position, to reverse the direction of rotations, forms, in the embodiment shown in Figs. 6–9, a unitary structure with the electric motor 21, and is arranged within a housing cover 80 which is attached to the front wall 81 of the motor. The front wall 81 is provided with an extension 82 in the form of a housing, wherein the motor shaft 83 is rotatably supported by means of a ball bearing 84, the motor shaft passing with an extension 85 into the interior of the housing cover 80 and formed with a worm 86 at its extremity.

A plate- or pan-shaped supporting member 87 is flange-mounted by means of screws 88 on the end of the extension 82. It serves as support for the switch gear accommodated within the housing cover 80, and particularly also for supporting the shaft 52 for the worm wheel 40

of the switch gear. The shaft 52 extends through an opening 69 to the outside of the cover 80; the cover is securely held upon its seat on the front wall 81 by means of a nut 71 with a rubber buffer 70 interposed.

The worm wheel 40 which effectively constitutes a driven switch actuating member is driven through the worm 86 by an intermediate shaft 72 crossing the motor shaft 85 respectively the shaft 52 and supported in bearings 73 and 74 on the supporting member 87. This intermediate shaft carries a worm wheel 75 meshing with the worm 86, on the one hand, and a worm 42 meshing with the worm wheel 40 on the other hand.

The worm wheel 40, which is rotatably mounted upon the shaft 52, carries the two stops 49 and 50 which cooperate with the two stops according to Figs. 1–5 in such a manner that the stop 49 cooperates with the stop 47, and the stop 50 with the stop 48 on the lever 39 thereby actuating the change-over switch 58. The lever 39 is mounted on a shaft 51 and has again a wedge-shaped portion 43, against which abuts a pin 44, fastened to the slide 46, under the action of a spring 45, in such a manner that it is held by the pin in the one or the other end position, respectively brought thereinto, as soon as it gets, by downward pressure upon the wedge edges, beyond the dead center position of the wedge 43. By means of a tongue 53, the lever 39 grips with play into the interval between stops 54 and 55 of a lever 38, which is rigidly coupled with the shaft 61 and of similar form as the lever 39, in that it cooperates by means of a wedge edge 38*a* with a pin 60 of a slide 59, which analogous to the slide 46 is upwardly displaced by a spring 63 and thereby guided on the shaft 52.

The shaft 61 is supported in a bearing in the supporting member 87 and carries on its opposite end a switch lever 58 which according to its end position closes contacts 35 and 36 as clearly shown in Fig. 9.

Owing to the interposition of the two worm gearings 86, 75 and 42, 40 the switch gear is driven with substantial gear reduction by the shaft 83 of the electric motor. After a certain number of revolutions either the stop 49 comes into abutting engagement with the stop 57 on the stop 50 with the stop 48 of the lever 39, and shifts the latter, under displacement of the pin 44, into the one or the other end position, as has already been described above. The throwing over of the lever 39 has the result that the lever 38 and thereby the switch lever 58 are also switched over so that at the one time the contact 35 is closed and at the other time the contact 36, which takes place simultaneously with the operation of a limit switch for limiting the motion for putting the springs in tension and for relieving them of tension.

It will be noted that the whole switch aggregate is mounted on the supporting member 87 as an integral unit, and may within the housing 80 be flange-mounted to the motor as an entirety.

It is also understood that the embodiment of Figure 6 includes an electric control arrangement and actuating mechanism including elements 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36 which cooperate with the change over switch gear illustrated in Figures 7 through 9 in a manner similar to corresponding parts of Figures 1 through 5.

It will be obvious that the details of construction may be varied from those shown in the drawings. I therefore do not limit myself to such details.

What I claim is:

1. A device for adjusting the springing condition of a spring system of a vehicle comprising, a spring adjusting member displaceable from one end position into another end position, means including a motor operatively connected with and driving said spring adjusting member, a change-over switching device operatively connected with said motor for controlling the operation of said motor in one or the other direction of rotation, a switch actuating member, means for positively moving

said switch actuating member by said motor, means including limitedly movable stop members within the range of movement of said switch actuating member, said switch actuating member upon movement after a travel in one or the other direction coming into abutting engagement with one or the other of said stop members and displacing said stop members by a limited travel, means for transmitting the movement of said stop members to said change-over switching device to shift said change-over switching device in accordance with the displacement of one or the other of said stop members in one or the other direction to thereby control the operation of said motor in one or the other direction of rotation, a separate supporting member for supporting thereon the entire switchgear including said change-over switching device, said switch actuating member, said stop members and said transmitting means as a subassembly, and means for detachably attaching said supporting member to said motor.

2. In a device for adjusting the springing condition of a spring system of a vehicle the combination comprising an adjusting device operatively connected with said spring system, a motor, drive means for drivingly connecting said motor with said adjusting device, a switchgear with means for preselecting reversal of rotation of said motor upon arrival of said spring system in an end position thereof to ready said motor for rotation in the direction opposite to the pre-existing direction of rotation during the next energization thereof, means for operating said switchgear upon arrival by said spring system in said end position, a housing for said switchgear and said last-mentioned means and means including a separate support member supporting thereon the subassembly consisting of said switchgear and said last-mentioned means for directly securing said switchgear, said last-mentioned means and said housing to said motor.

3. In a device for adjusting the springing condition of a spring system of a vehicle the combination comprising an adjusting device operatively connected with said spring system, a motor, means for drivingly connecting said motor with said adjusting device, a shaft driven by said motor, a supporting member separate from said motor, means for detachably attaching said supporting member to said motor, a reduction gearing driven by said shaft, a switch actuating member having two stops, means for driving said switch actuating member by said reduction gearing, movable stop means for controlling change-over switch means alternately cooperating with said stops, change-over switch means for alternately controlling the adjusting movement of said motor, means for reversing said change-over switch means by said stop means upon reaching certain springing conditions of said system, and means for supporting said reduction gearing, said switch actuating member, said stop means and said change-over switch means as a subassembly on said supporting member.

4. The combination according to claim 3, further comprising a shaft carried by said supporting member which in its turn carries said switch actuating member, a housing enclosing the switchgear constituting said reduction gearing, said switch actuating member, said stops and stop means and said reversing means, and means for attaching said housing to said second-mentioned shaft.

5. A device for adjusting the springing condition of a spring system of a vehicle comprising an adjusting device, means including a motor operatively connected with said adjusting device and adapted to drive the same, said motor including a housing having an outwardly protruding extension, a separate supporting member detachably attached to said extension, a shaft extending beyond said extension and driven by said motor, a switchgear for alternately controlling the adjusting movement of said motor carried by said supporting member and adapted to be driven by said first-named shaft, said

switchgear having a carrying shaft, means for driving said carrying shaft by said first-named shaft, means supporting said carrying shaft on said supporting member, said carrying shaft extending away from said motor, a housing enclosing said switchgear, and means for attaching said housing to said carrying shaft in such a manner that it fits tightly against the motor housing.

6. A device for adjusting the springing condition of a spring system of a vehicle comprising an adjusting device, means including a motor operatively connected with said adjusting device and adapted to drive the same, said motor including a housing, a supporting member attached to said housing, a shaft driven by said motor, a switchgear for alternately controlling the adjusting movement of said motor carried by said supporting member and driven by said shaft, said switchgear having a carrying shaft, means for driving said carrying shaft by said first-mentioned shaft, means supporting said carrying shaft on said supporting member, said carrying shaft extending away from said motor, a housing enclosing said switchgear, and means for attaching said housing to said carrying shaft, said means comprising at least a screw member and an elastic member mounted on said carrying shaft permitting tightening of said screw member on said carrying shaft against the action of said elastic element until said housing forms a tight fit with the motor housing.

7. In a device for adjusting the springing condition of a spring system of a vehicle the combination comprising an adjusting device operatively connected with said spring system, a motor, means for drivingly connecting said motor with said adjusting device, a shaft driven by said motor, a supporting member, means for attaching said supporting member to said motor, a reduction gearing driven by said shaft, a switch actuating member having two stops, means for driving said switch actuating member by said reduction gearing, movable stop means for controlling change-over switch means alternately cooperating said stops, change-over switch means for alternately controlling the adjusting movement of said motor, means for reversing said change-over switch means by said stop means upon reaching certain springing conditions of said system, and means for supporting said reduction gearing, said switch actuating member, said stop means and said change-over switch means on said supporting member, said shaft carrying a worm, and said reduction gearing comprising a worm wheel driven by said worm, a second shaft crossing said first-mentioned shaft and carrying said worm wheel, a second worm provided on said second-mentioned shaft, and a worm wheel driven by said second-mentioned worm, the last-mentioned worm wheel forming said switch actuating member provided with said stops.

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