April 25, 1967 G. P. S. YSSEL 3,316,397

VEHICLE HEADLAMP ADJUSTING MEANS

Filed Nov. 10, 1964 3 Sheets-Sheet 1

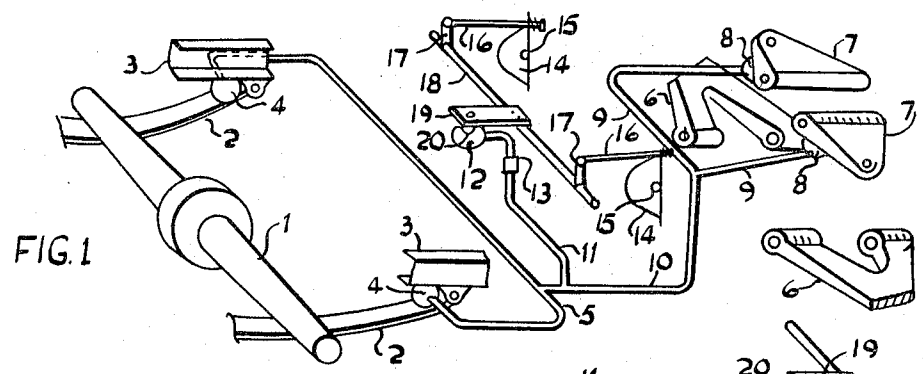

FIG. 1

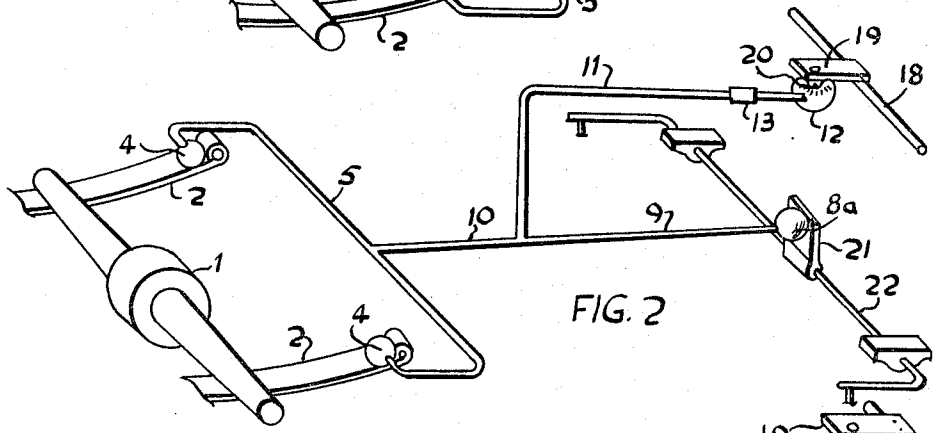

FIG. 2

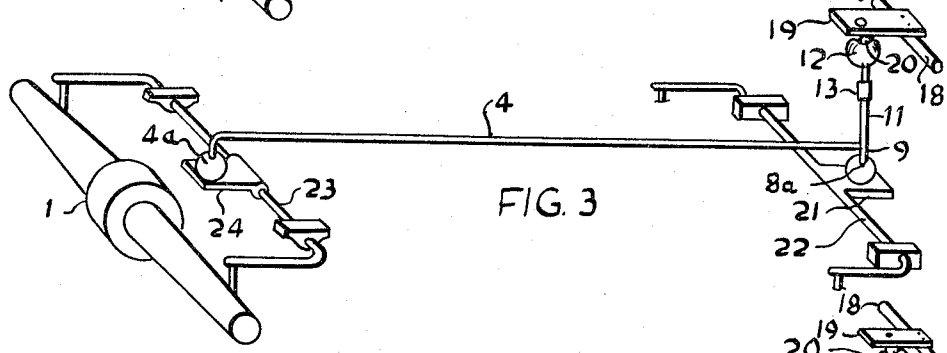

FIG. 3

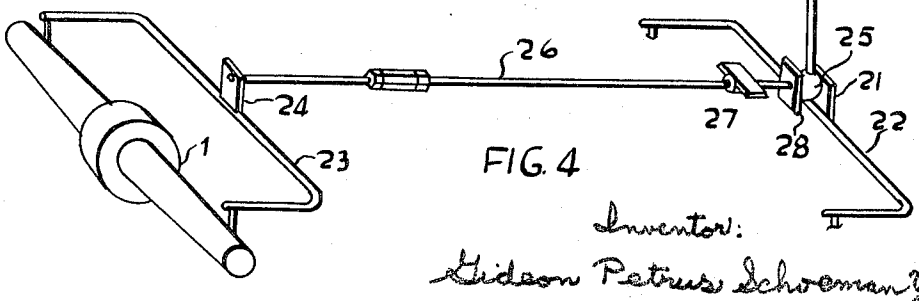

FIG. 4

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VEHICLE HEADLAMP ADJUSTING MEANS

Filed Nov. 10, 1964 3 Sheets-Sheet 2

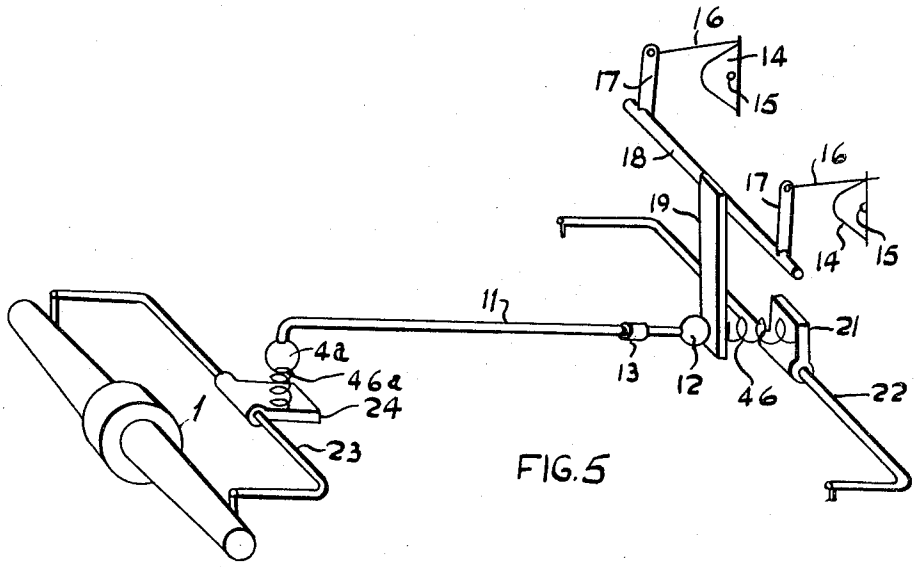

FIG. 5

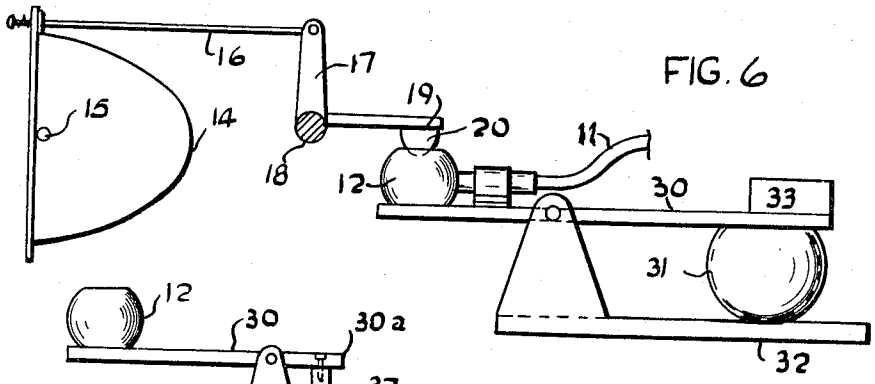

FIG. 6

FIG. 8

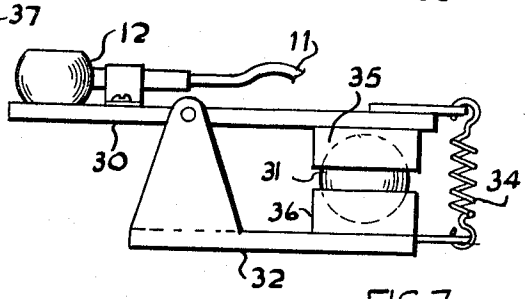

FIG. 7

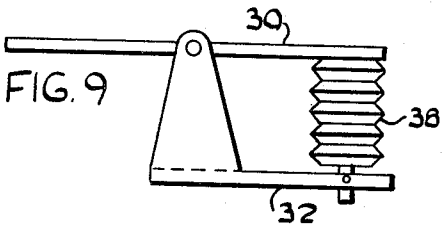

FIG. 9

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VEHICLE HEADLAMP ADJUSTING MEANS

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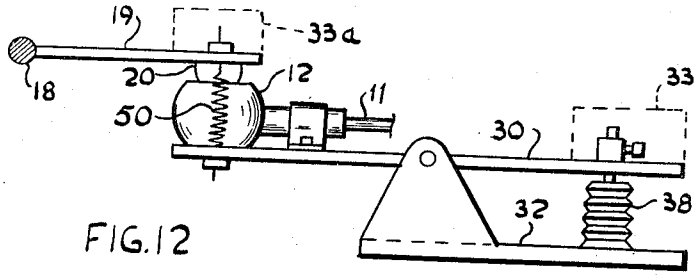

FIG. 12

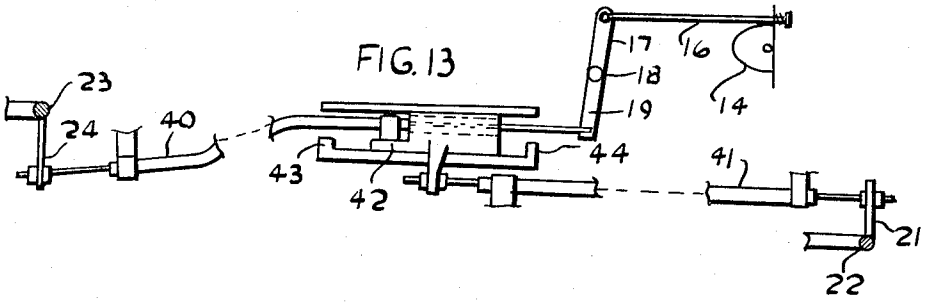

FIG. 13

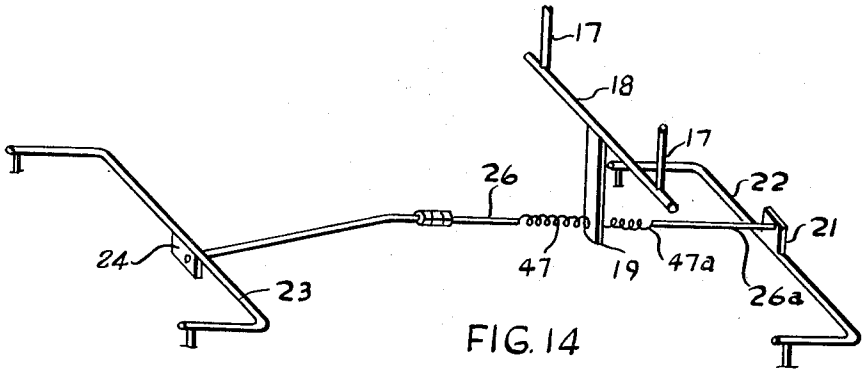

FIG. 14

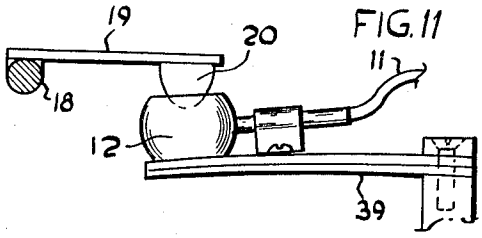

FIG. 11

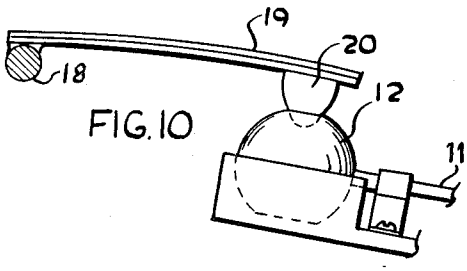

FIG. 10

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United States Patent Office

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Patented Apr. 25, 1967

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VEHICLE HEADLAMP ADJUSTING MEANS

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Filed Nov. 10, 1964, Ser. No. 410,140
15 Claims. (Cl. 240—7.1)

This invention relates to means for automatically adjusting the headlamps of a motor and like vehicle having the headlamps mounted on a body which is resiliently carried on wheels so that during darkness the light beams remain correctly directed with respect to a mean plane containing the wheel axes under varying and differently loaded conditions of the vehicle body. When the load on a vehicle body is disposed at different locations or positions, or when the vehicle is rapidly accelerated or braked, the rear or front (as the case may be) of the vehicle is forced downwardly and produces the undesirable and often dangerous effect of changing the mean angle of the light beams, emitted by the headlamps, relative to the road surface.

According to the invention the automatic headlamp adjusting means for a wheeled vehicle having a resiliently suspended body includes headlamps tiltably mounted on the body of the vehicle, actuating means associated with members of the vehicle subjected to movement relative to the body and a mean common plane containing the axes of the vehicle wheels on movement of the body relative to said plane, and devices connected to the headlamps and operated by the actuating means for tilting the headlamps, said actuating means being adapted to effect responsive tilting movement of the headlamps proportionately to uneven displacement of the body of the vehicle relative to the said plane.

The actuating means for tilting the headlamps may incorporate mechanical, electrical, hydraulic and/or pneumatic devices or systems or a combination of any one or more of such devices and/or systems.

With the headlamp tilting mechanism biasing means may be incorporated to return the headlamps to a prearranged position and against which means the actuating means is operative.

The member or members of the vehicle which are movable relative to the sprung and unsprung parts of the vehicle and adapted to control the actuating means, must be provided at least towards that end of the vehicle where sagging or downward movement of the vehicle body during loading always takes place. Preferably the actuating means is controlled by such movable members at the front and rear of the vehicle, as sagging or downward movement of the body at both ends is invariably experienced and usually to different extents. The extent of sagging at the front and rear is dependent on the distribution of the load carried by the vehicle and the suspension systems employed. The direction of headlamp tilting applied by the actuating means from the front of the vehicle is opposite to that from the rear of the vehicle so that, for instance, lesser sagging at the front than at the rear causes a smaller extent of tilting of the headlamps than would be effected by the actuating means controlled only by sagging at the rear.

The tilting mechanism of the headlamps provide crankarm or like means on which the actuating means is operative.

Mechanically operated actuating means may comprise rod or cable members coupled to the tilting mechanism for the headlamps and the members of the vehicle which perform movements relative to the vehicle body and the mean common plane of the wheel axes on loading of the vehicle. In the case of mechanical actuating means, the relatively movable member at the front of the vehicle is arranged to also operate on the headlamp tilting mechanism in a direction opposite to that of the actuating means operated from the rear of the vehicle and produces a counter action resulting in a tilting movement of the headlamps and of the light beams emitted by the headlamps proportionally to the difference in sagging of the vehicle body at the front and at the rear ends.

In the case of pneumatically or hydraulically operated actuating means, for imparting the tilting movement of the headlamps, a sealed conduit is employed containing a fluid and having deformable volume changeable elements for displacing such fluid along the conduit. The said elements are monted on the body of the vehicle and are engaged by or connected to a crank arm of the headlamp tilting mechanism and the relatively movable members connected to the sprung and unsprung parts of the vehicle. The arrangement is such that on inward depression or compression of one or more volume changeable elements, the fluid is displaced into another of such elements which is associated with the headlamp tilting mechanism for expansion of the latter element and movement, against biasing means, of the tilting mechanism to cause controlled tilting of the headlamps in proportion to the sagging of the vehicle body relative to the wheels. In the case where at least one volume changeable element is provided at the front and also at the rear, the effect of sagging of the front and rear of the body causes compression of the element at the rear and expansion (or permits substantially unobstructed expansion) of the element at the front, so that on equal sagging of the front and the rear of the body, no change in volume takes place in respect of the element at the headlamp tilting mechanism, while on uneven sagging of the front and rear of the body a smaller amount of expansion or contraction of the last mentioned element takes place than would be the case if only the rear or the front of the body moved downwardly.

In the case of electrically operated actuating means, use may be made of rheostats and a variable current responsive device, receiving electric current through said rheostat; said device is connected to the headlamp tilting mechanism and causes the tilting of the headlamps in proportion to the sum of the actions of the oppositely operating rheostats at the front and rear regions of the vehicle.

In the actuating means, whether mechanically, hydraulically, pneumatically or electrically operated, suitable devices or means should be incorporated to delay the resultant tilting of the headlamps in order to avoid immediate tilting of the headlamps so that relative movement of the sprung and unsprung parts of the vehicle, due to road irregularities, bumps or the like, can take place without causing tilting of the headlamps.

Instead of mounting the headlamps in pivotal fashion, only the reflector units (in which the bulbs are carried) may be pivotally mounted. In the case of sealed beam headlamps, the entire sealed beam units must be pivot-

Conveniently, the actuating means is operated from anti-roll bars or the like if provided on the motor vehicle, such bars being provided for the purpose of the invention with crank arms at central positions and of which the free end regions are connected to, or operative on, the actuating means.

The headlamps or the reflectors, arranged on or adjacent both sides of the front of the vehicle body, may be actuated from or may be mounted on a common rotatably oscillatable and transversely arranged bar, rod or shaft.

With the headlamp tilting arrangement according to the invention, means may be included to compensate for fluctuation in atmospheric conditions, such as temperature and atmospheric pressure, which may affect the operation of the invention and consequently the angle of the light beams relative to the road surface.

For the invention to be clearly understood and carried into effect, reference will now be made to the accompanying sheets of drawings in which:

FIGURE 1 is a diagrammatic view showing automatic headlamp beam adjusting means according to the invention;

FIGURE 2 is a fragmentary diagrammatic view showing a modified arrangement of the means according to the invention;

FIGURE 3 is a view similar to FIGURE 2 showing a further modified arrangement of the means according to the invention;

FIGURE 4 is a further view similar to FIGURE 2 showing a still further modified form of the invention;

FIGURE 5 is a view similar to FIGURE 1, showing yet another modified form of the means according to the invention;

FIGURE 6 is a fragmentary view showing the headlamp tilting mechanism according to the invention, applicable on all the arrangements and forms shown in FIGURES 1–5;

FIGURES 7, 8, 9, 10, 11 and 12 are fragmentary views showing modifications of the headlamp tilting mechanisms which all incorporate devices to compensate for changes in atmospheric conditions;

FIGURES 13 and 14 are diagrammatic views of mechanical means for automatically changing the light beams of motor vehicles when subjected to different loadings, also according to the invention.

Referring to FIGURE 1 of the drawings, reference numeral **1** denotes the rear axle of a motor vehicle on which the body is supported by semi-elliptical springs **2** between the front portions of springs **2** and chassis or body parts **3**, to which the springs **2** are pivotally connected, resilient material bulbous elements **4** are disposed. Said bulbous elements **4** are connected together by a non-expandable conduit **5**. Reference numeral **6** indicates the "wish-bone" suspension members at the front of the vehicle and reference numeral **7** the pivotally mounted control arms mounted in spaced relationship above said "wish-bone" suspension members **6**. Below the control arm **7**, compressible resilient material bulbous elements **8** are mounted for compression by downward motion of the control arm **8**. The bulbous elements **8** are connected together by a conduit **9**.

The conduits **5** and **9** are connected by a conduit **10** while from conduit **10** a branch conduit **11** extends which is connected to a further rigidly mounted expandable and compressible resilient material bulbous element **12**. In the conduit **11** a restricted passage forming element **13** is connected whereby the flow of the fluid to and from element **12** is retarded.

The headlamps **14** are provided with diametrically opposed pins or stub axles **15** which are pivotally received in suitable bearings on the vehicle body (not shown). The top portions of the headlamps **14** are connected

shaft **18** which is provided with a further crank arm **19**. Protruding from a face at the free end of crank arm **19**, is a knob-like member **20** having a substantially hemispherical end which pressingly engages onto the bulbous element **12**.

The headlamps **14** are biased by spring means to positions when the mean axes of the light beams, emitted by the lamps, are in the positions as would be required under substantially no loading or minimum loading conditions of the motor vehicle.

The fluid contained in the system, composed of the bulbous elements and the conduits, is preferably air and is sealed off in the system, advantageously, under atmospheric pressure.

On subjecting the vehicle to loading, the body moves downwardly relative to the unsprung parts of the vehicle, i.e., the wheels and axles, causing the springs **2** to move closer to the body or body parts **3** at the rear of the vehicle with the resultant compression of the bulbous elements **4** between the spring **2** and said body parts **3**. At the front of the vehicle, when subjected to loading, the "wish-bone" frames **6** and the control arm **7** swing upwardly, thus reducing the pressure on the bulbous elements **8**, which then expand. On loading of the vehicle, so that sagging of the vehicle body at the front and at the rear is equal, fluid is displaced from the bulbous elements **4** to the bulbous elements **8**. On sagging of the rear of the vehicle only, the displaced fluid, on compression of the bulbous elements **4**, is displaced along the conduit **11** to the bulbous element **12**. Expansion of the bulbous element **12** causes upward deflection of the crank arm **19** and partial rotation of the shaft **18**. Similarly the crank arms **17** are swung forwardly which movement is conveyed by the rods **16** to the top regions of the headlamps or headlamp reflectors **14** which are caused to tilt with the upper region forwardly thus causing the light beams, emitted by the headlamps, to tilt downwardly relative to a mean plane of the motor vehicle body.

The effective lengths of the crank arms **17** and **19**, the distance between the pivot positions and the position of engagement of each rod **16** with a headlamp **14** as also the extent of maximum compression and expansion of the bulbous elements are chosen and designed so that the angle of the light beams relative to the mean plane containing the wheel axes will remain constant under different loading conditions.

On subjecting the front of the vehicle to a greater load, causing sagging of the front of the vehicle body to a greater extent than at the rear, the bulbous elements **8** expand and the fluid is displaced from the bulbous element **12** thus causing the upper portions of the headlamps or headlamp reflectors **14** to be tilted rearwardly to raise the light beams relative to the vehicle body.

The provision of the restriction forming element **13** in the conduit **11** has the effect of retarding the reaction of fluid displacement to and from the bulbous element **12** in order that the system will not be responsive to spring deflection due to road irregularities and the like. Furthermore, such flow restriction means provides for slow tilting actions of the headlamps.

The bulbous elements **8** may be positioned below the "wish-bone" frames **6** if particularly desired, but it is preferable to mount such elements at a position where they are protected from dirt and flying stones as may be encountered during travelling.

By providing bulbous elements **4** and **8** on both sides of the vehicle, transverse tilting or rocking of the vehicle body will not affect the tilted position of the headlamps as the fluid is transferred from one side element to the co-acting element on the other side.

In the case of a motor vehicle provided with an anti-roll bar or the like at the front, the fluid displacement bulbous elements **8** are replaced by a single bulbous ele-

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