

Jan. 20, 1970

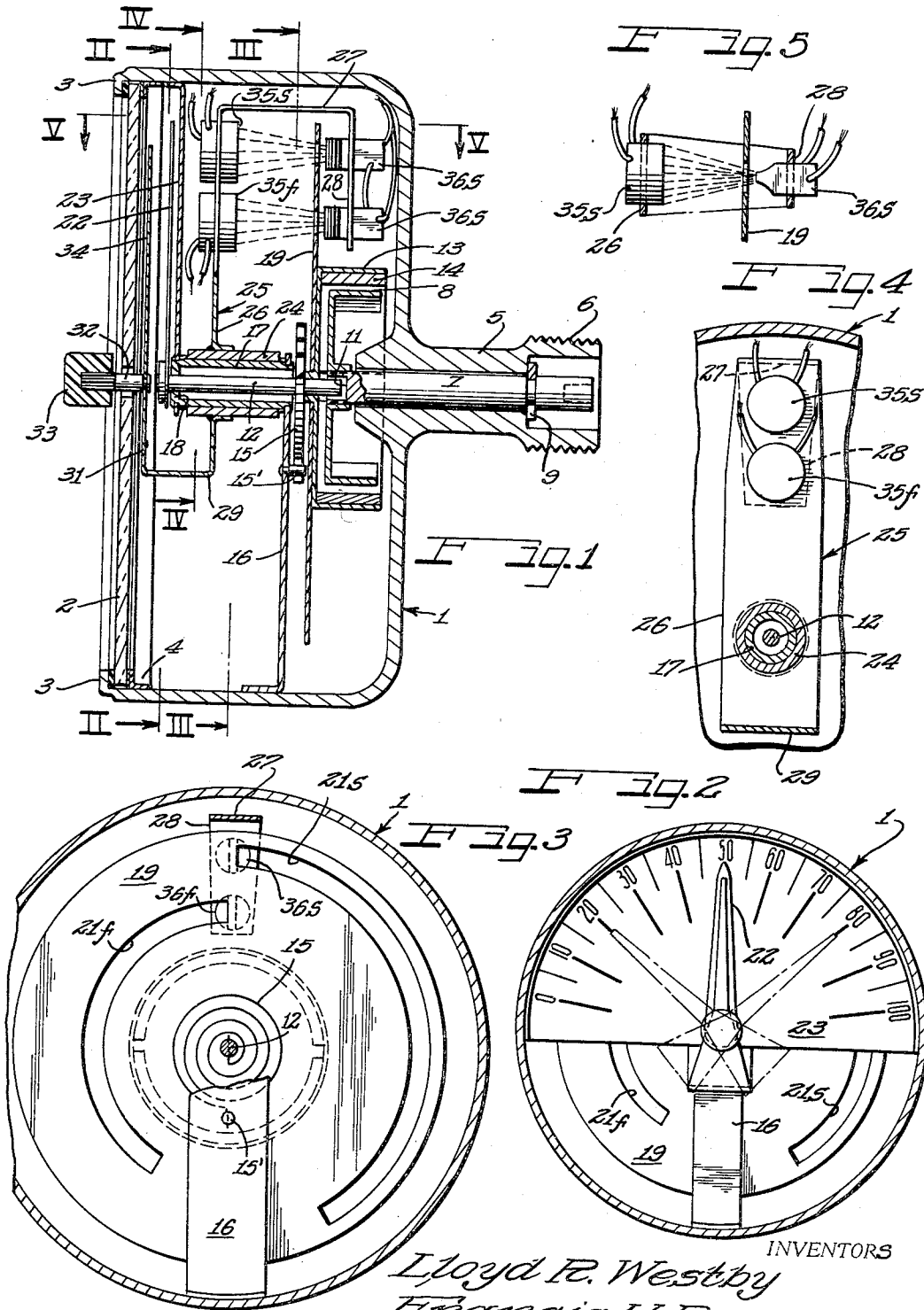
L. R. WESTBY ET AL

3,490,295

SPEED SENSING DEVICE HAVING POSITIONALLY ADJUSTABLE
SWITCH ELEMENTS

Filed Jan. 5, 1968

2 Sheets-Sheet 1



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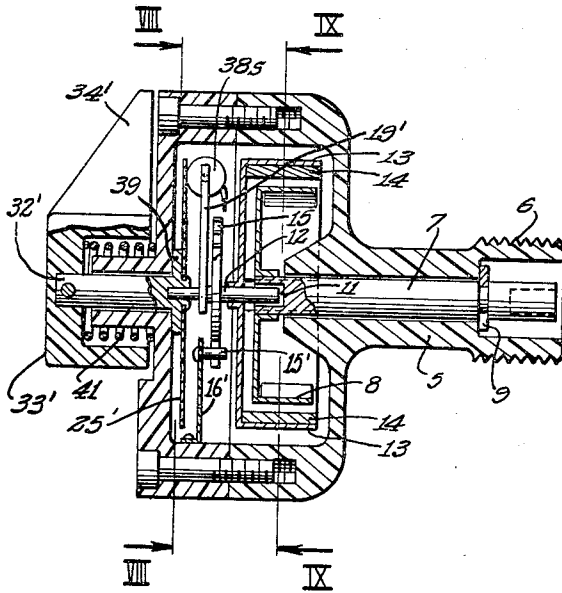


Fig. 6

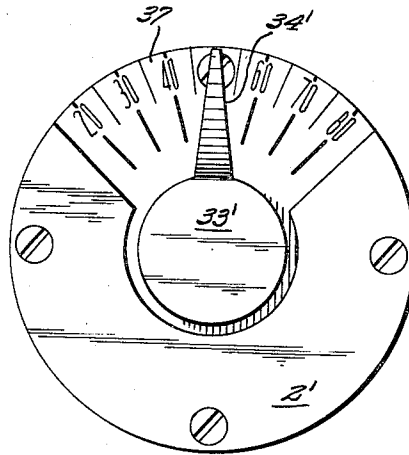


Fig. 7

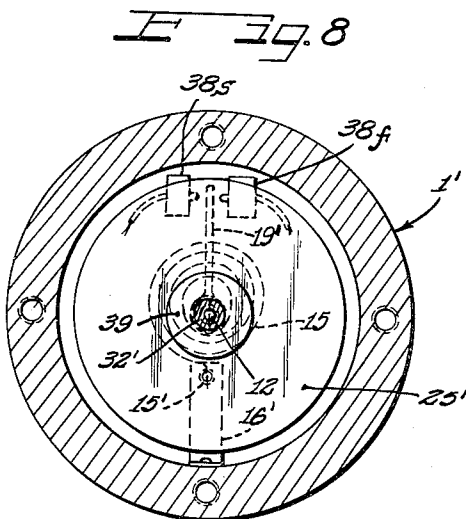


Fig. 8

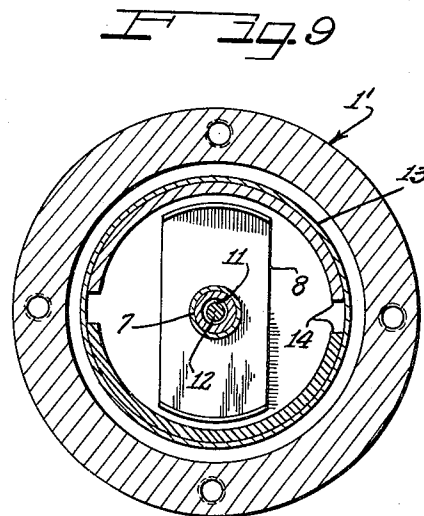


Fig. 9

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SPEED SENSING DEVICE HAVING POSITIONALLY ADJUSTABLE SWITCH ELEMENTS

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8 Claims

ABSTRACT OF THE DISCLOSURE

A sensing device for rotating members having a driving member, a pivotally movable spring biased driven member magnetically coupled thereto and positionally responsive to rotation of the driving member, the driven member having switch means cooperably therewith whereby said switch means is in one operative condition when said driven member is in a neutral intermediate position relative thereto, said driven member having respective positions at each side of and closely adjacent to said intermediate position with the switch means being arranged for actuation to second operative condition in response to the positioning of said driven member in either of such adjacent positions, by means of which sensing changes in either direction from said intermediate position are reflected by the corresponding operative condition of said switch means, said switch means being adjustably supported for pivotal movement about the axis of the driven member whereby said intermediate position may be selectively varied.

Cross references to related applications

The present invention is directed to a sensing device which is of the same general type as those illustrated in our co-pending applications Ser. No. 635,881 and 635,882 filed on May 3, 1967, with the present invention being directed to a sensing device which embodies a different form of effecting adjustment of the structure than those disclosed in the respective applications above referred to.

Background of the invention

The invention relates to a sensing device constructed to effect an electrical control function in response to the criteria sensed, and is particularly adopted for use in connection with an r.p.m. or speed sensing or controlling system, as for example, a vehicle speed control system.

The invention is of particular application in connection with electrical circuits which are to be responsive to changes taking place in the operation of a rotating element, as for example, to provide a corrective action in response to deviation from a desired operation. For the purposes of explanation, the invention will be described in connection with its application as a speed sensing device for a vehicle or the like wherein it is responsive to changes above or below a preset speed adjustment, and operative to suitably actuate switch means in dependence upon variation above or below the desired setting.

The invention has among its objects the production of a sensing device which is extremely simple, inexpensive to manufacture and fool-proof in operation, in particular, eliminating the use of adjustable springs and the like, as well as elements which are separable from the driven member whereby the device is capable of relatively simple calibration and may be accurately adjusted during operation.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

Summary of the invention

The invention is directed to a sensing device in which the driven member, the position of which corresponds to the function being sensed, is cooperable with switch means whereby in an intermediate position of the driven element the switch means is in one operative condition, for example, non-actuated, while in either of two positions at opposite sides of said intermediate position but closely adjacent thereto corresponding switch means is in another operational condition, for example, actuated, adjustment of the structure being accomplished by varying the operative position of the switch means. As a result, it is unnecessary to vary the tension of a spring biasing the driven member or to selectively position suitable actuating means on the driven member, which in turn would require means for effecting disconnection therebetween etc. The present invention thus readily adapts itself to the use of light responsive switch means with the driven member merely controlling the passage of light to the light responsive means whereby direct engagement of the driven member with switch means is not required. However, the construction also readily adapts itself to the use of mechanically actuated contacts as hereinafter described.

Description of the drawing

In the drawings wherein like reference characters indicate like or corresponding parts:

FIG. 1 is an axial sectional view through a sensing device embodying the invention

FIG. 2 is a sectional view taken approximately on the line II—II of FIG. 1;

FIG. 3 is a sectional view taken approximately on the line III—III of FIG. 1;

FIG. 4 is a sectional view taken approximately on the line IV—IV of FIG. 1;

FIG. 5 is a sectional view of the switching means taken approximately on the line V—V of FIG. 1;

FIG. 6 is a sectional view similar to FIG. 1 of a modification of the invention;

FIG. 7 is a front elevational view of the device illustrated in FIG. 6;

FIG. 8 is a sectional view taken approximately on the line VIII—VIII of FIG. 6; and

FIG. 9 is a sectional view taken approximately on the line IX—IX of FIG. 6.

Description of the preferred embodiments

Referring to the drawings, and more particularly to FIGS. 1—5, the sensing unit therein illustrated is enclosed in a housing, indicated generally by the numeral 1, having a front face defined by a glass plate 2 which is retained in place by a rolled bezel 3 or other suitable means, the glass being retained in operative position by a flanged ring 4 with the glass plate preferably being enclosed between respective gasket rings or the like.

The housing 1 is provided with an axially extending bearing sleeve 5, terminating at its free end in a threaded boss 6, in which bearing is supported a rotatable input shaft 7. Carried by the inner end of the shaft 7 and rotatable therewith is a paramagnetic armature 8 forming a driving member, the opposite end of the shaft 7 being suitably constructed for engagement with driving means, as for example having a square bore in its outer end adapted to receive a mating rotating member. Axial movement in an outward direction is prevented by the hub portion of the armature 8 and inward movement by a snap ring 9 seated in a cooperable peripheral groove in the shaft 7. The inner end of the shaft 7 is provided with a bore 11 forming a pilot bearing for one end of an output shaft 12 which is freely rotatable relative thereto.

Mounted on the inner end of the shaft 12 and rotatable therewith is a cup-shaped driven member which includes a generally cup-shaped member 13, having a pair of arcuate-shaped magnets 14 disposed at the inner surface of the peripheral flange of the member 13 which are co-operable with the armature 8 to effect a transmittal of torque from the input shaft 7 to the output shaft 12, the torque so transmitted being opposed by a torsion spring 15, illustrated as formed from a flat strip of spring stock, the inner end of which is attached to the shaft 12 and the outer end of which is anchored to a stud 15' which in turn is rigidly mounted on an upwardly extending bracket 16. Also rigidly secured to the bracket 16, at the side thereof facing away from the cup-shaped member 13, is a tubular sleeve or bushing 17 which is disposed in concentric relation with respect to the shaft 12 and provided at its free outer end with an inwardly extending flange 18 which forms an outboard bearing for the adjacent end of the shaft 12. Rigidly mounted on the shaft 12, and thus rotatable with the cup-shaped member 13, is a disc 19, of opaque material, having a pair of arcuate-shaped slots 21s and 21f therein.

It will be apparent that the armature 8 and cup-shaped member 13, carrying magnets 14, form a magnetic coupling between the driving shaft 7 and the driven shaft 12, rotation of the latter being opposed by the action of the spring 15. Thus the pivotal position of the disc 19 will depend upon the speed of the shaft 7, the higher the speed, the greater the coupling forces and thus the greater the rotative movement of the disc 19 in opposition to the spring 15 whereby the rotative position of the disc may be made proportional to the speed of the shaft 7, corresponding to the well known type of speedometer coupling mechanism. The structure thus far described may be employed as a part of a speedometer mechanism, in which case the free outer end of the shaft 12 may be provided with a speedometer needle 22, cooperable with a suitable dial face 23 illustrated as being graduated in increments of five m.p.h.

Carried by the sleeve 17 and rotatable relative thereto is a tubular member 24 which carries a generally S-shaped bracket, indicated generally by the numeral 25, having a radially extending portion 26 rigidly secured to the member 24, provided with a long arm terminating at its free end in a rearwardly extending portion 27 disposed parallel to the axis of the shaft 12, and in turn carrying a radially inwardly extending portion 28 which extends parallel to the portion 26. The opposite end of the latter forms a short arm terminating in an outwardly directed portion 29, disposed parallel to the axis of the shaft 12, which carries a radially inwardly extending portion 31 to which is secured a stub shaft 32 carrying an adjusting knob 33. The shaft 32 is disposed in alignment with the shaft 12 and rigidly secured to the portion 31 whereby the knob 33 may be manually grasped and rotated to correspondingly rotate the bracket 25 and with it the portions 26, 27 and 28 thereof. Also carried by the portion 31 is a setting pointer or hand 34 for indicating the relative positions of the bracket 25 with respect to the dial face 23.

Mounted on the portion 26 of the bracket 25 are a pair of light responsive cells 35f, 35s and disposed on the portion 28 of the bracket 25, in operative alignment with the respective light cells 35 are corresponding light sources 36f, 36s. As clearly illustrated in FIGS. 1 and 3, the slot 21f intersects the optical axis between the light source 36f and light cell 35f, while the slot 21s intersects the optical axis between the light source 36s and the light cell 35s. As particularly illustrated in FIGS. 3 and 5, the respective light sources 36 are constructed to produce a vertically elongated light beam, the operative width of which is substantially equal to or slightly less than the circumferential distance between the adjacent ends of the respective slots 21s, 21f while the height of the beam is at least equal to or greater than the radial width of the respective slots, as clearly illustrated in FIGS. 3 and 5.

In operation, the respective light systems and cooperable slotted disc form elements of switch means responsive to the position of the disc 19. Assuming for the purposes of illustration that the respective light cells 35 are operatively connected by relays or other suitable means to respective indicator lights, and the shaft 7 is rotating, when the disc 19 is rotated, responsive to the magnetic coupling between the shaft 12 and the shaft 7, to the position illustrated in FIGS. 1 and 3, neither light cell will receive light from its cooperable source and thus neither will be actuated to correspondingly actuate the associated indicator light. However, if the shaft 7 slows down, the disc 19 will be rotated slightly in a counter clockwise direction, as viewed in FIG. 3, permitting the slot 21s to expose the light source 36s and actuate the cells 35s. In like manner should the shaft 7 speed up, the disc 19 will be rotated slightly in a clockwise direction, in opposition to the spring 15 permitting the slot 21f to expose the light source 36f and actuate the cells 36f. Thus, the respective light cells 35 will remain nonactuated as long as the disc 19 is in its intermediate position illustrated in FIG. 3, but if it should rotate slightly in either direction to a closely adjacent position, the corresponding light cell will be energized. The relative position of the disc 19 and thus the speed of the shaft 7, at which neither of the light cells 35 are actuated may be readily selectively varied by rotating the tubular member 24 and thereby the bracket 25 and respective light systems, which may be accomplished manually by means of the knob 33. The selected position of the bracket 25 may be readily maintained by any suitable means, a simple arrangement being illustrated, in which the tubular member 24 and the sleeve 17 are provided with a sufficiently close fit that adequate friction will be established between the two members to firmly maintain the parts in adjusted position, but at the same time permit overcoming such frictional force by manual rotation of the knob 33.

It will be appreciated that with this construction the only additional member directly connected with the moving system is the disc 19 so that substantially no inertia is added to the system nor any drag, such as sliding contacts or other mechanical arrangements might impose. This construction also offers the advantage that it requires a minimum structure over that present in standard speedometer mechanisms, namely the disc 19, the bracket 25 and associated structure.

While the present construction offers particular advantages in connection with the use of light sensitive elements, it also enables the production of a very simple mechanism utilizing mechanically actuated electrical contacts. Such a construction is illustrated in FIGS. 6-9 in which the reference numeral 1' designates a housing structure having a front plate or member 2' provided with portion 37 formed with indicia illustrated as representing m.p.h. Rotatably supported in the member 2' is an adjustment or actuating shaft 32' which carries a knob 33' having a pointer or hand 34.

The shaft 7, similar to the construction illustrated in FIGS. 1-5 carries an armature 8, cooperable with the cup-shaped member 13, carrying arcuate magnets 14, secured to the output shaft 12 which is supported at its inner end in a pilot bearing comprising the bore 11 formed in the adjacent end of the shaft 7, and at its outer end in a bearing formed in the adjacent end of the shaft 32' whereby the shaft 12 is freely rotatable relative to the shaft 32' and the shaft 7. The shaft 12 and cup-shaped member 13 are suitably biased, with respect to the forces transmitted from the shaft 7 thereto, by the torsion spring 15, the inner end to a pin 15' mounted on the bracket 16'. Rigidly connected to the inner end of the shaft 32' and rotatable therewith is a disc 25', which generally corresponds to the bracket 25, and operatively supports a pair of contacts indicated generally by the reference numerals 38f and 38s, cooperable with a contact arm 19' carried by the output shaft 12. The relatively stationary

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contacts 38s and 38f are spaced apart a sufficient distance to permit the relatively movable contact arm 19' to be disposed therebetween, during normal operation, without contacting either of the relatively stationary contacts, but upon movement of the member 13 and with it the contact arm 19' in either direction out of its normal position, illustrated in FIG. 8, contact will be made with the corresponding contact 38s or 38f. Electrical connection with the movable contact 19' may be completed through the shaft 12, spring 15, pin 15' and bracket 16' to the casing 1'.

Operation of the construction of FIGS. 6-9 is similar to that illustrated in FIGS. 1-5 with the exception that contact is made directly between the contact of arm 19' and the corresponding relatively stationary contact 38s or 38f and in like manner the normal, nonactuated position of the contact arm 19' may be manually set to correspond with any desired rotated speed of the shaft 7 by rotating the knob 33' to pivot the disc 25' and with it the contacts 38s and 38f. Suitable means may be provided for retaining the adjustable parts in any desired position of adjustment, as for example, a spring 39 which applies outward pressure on the shaft 32' increasing the frictional contact between the outer face of the flange 41 on the inner end of the shaft 32' and the adjacent inner face of the member 2'.

It will be appreciated that this construction enables a relatively accurate adjustment of the sensing mechanism to any desired operation condition and at the same time enables the utilization of an extremely simple construction.

Changes may be made within the scope and spirit of the appended claims which define what is believed to be new and desired to have protected by Letters Patent.

We claim:

1. A sensing device for rotating members, comprising a rotatable driving member, a pivotally movable driven member, means operatively coupling said members whereby the driven member is positionally responsive to rotation of said driving member and spring means arranged to resiliently oppose movement of said driven member responsive to the action of said driving member, switch means comprising a pair of light sources and a light responsive cell for each light source, optically aligned therewith, means for supporting said light sources and said light responsive cells in fixed relation with respect to each other and in operatively stationary relation with respect to the pivotal axis of said driven member, said last mentioned means being constructed for predetermined pivotal adjusting movement about the axis of said driven member for selectively varying the operative location of an intermediate position, said switch means further comprising a light blocking member fixedly carried by and movable with said driven member and arranged to intersect respective optical axes of the aligned light cells and cooperable light sources in a predetermined manner in dependence upon the position of said driven member, said light blocking member, further, having a neutral intermediate position with respect to said optical axes in one operational condition, and respective positions at each side of and closely adjacent said intermediate position, in which said switch means is in respective different operational conditions, by means of which sensing changes of said light blocking member in either direction from said intermediate position are reflected by the operational condition of said switch means.

2. A sensing device according to claim 1, comprising in further combination a manually actuable member operatively connected to said supporting means for effecting manual adjustment of the elements of said switch means

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supported thereby, and means for operatively retaining such switch elements in any of their adjusted positions.

3. A sensing device according to claim 2, wherein said retaining means comprises a pair of frictionally engaged surfaces, disposed respectively on a stationary part of the device and on a member movable with movement of said supporting means.

4. A sensing device according to claim 1, wherein said cooperable member is constructed to intersect the optical axes of both light cells and cooperable light sources when said cooperable member is in its intermediate position.

5. A sensing device for rotating members, comprising a rotatable driving member, a pivotally movable driven member, means operatively coupling said members whereby the driven member is positionally responsive to rotation of said driving member, spring means arranged to resiliently oppose movement of said driven member responsive to the action of said driving member, switch means, including a first contact fixedly carried by and movable with said driven member, and cooperable with a pair of spaced contacts whereby said first contact has a neutral intermediate position between said pair of contacts, and respective positions at each side of and closely adjacent to said intermediate position in which said first contact is in engagement with a respective contact of said pair, by means of which sensing changes of said first contact in either direction from said intermediate position are reflected by engagement thereof with a corresponding contact of said pair, a member, mounted for selective pivotal movement about the axis of said driven member, on which said pair of contacts are supported in fixed relation with respect to each other and in operatively stationary relation with respect to the pivotal axis of said driven member, and means operatively engageable with said pivotally movable member for effecting adjustment thereof about the axis of said driven member for selectively varying the operative location of said intermediate position, and thus the rotative speed of said driving member at which the device is operative.

6. A sensing device according to claim 5, comprising in further combination a manually actuable member operatively connected to said pivotally movable member for effecting manual adjustment of the elements of said switch means supported thereby, and means for operatively retaining such switch elements in any of their adjusted positions.

7. A sensing device according to claim 6, wherein said retaining means comprises a pair of frictionally engaged surfaces disposed respectively on a stationary part of the device and on a member movable with movement of said supporting means.

8. A sensing device according to claim 7, comprising in further combination, spring means for urging the surfaces of said retaining means into frictional engagement.

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ROBERT SEGAL, Primary Examiner

U.S. Cl. X.R.

250-231; 340-263