Aug. 5, 1958 R. R. HAGER 2,846,538

SNAP ACTING SWITCH

Filed Dec. 28, 1956 2 Sheets-Sheet 1

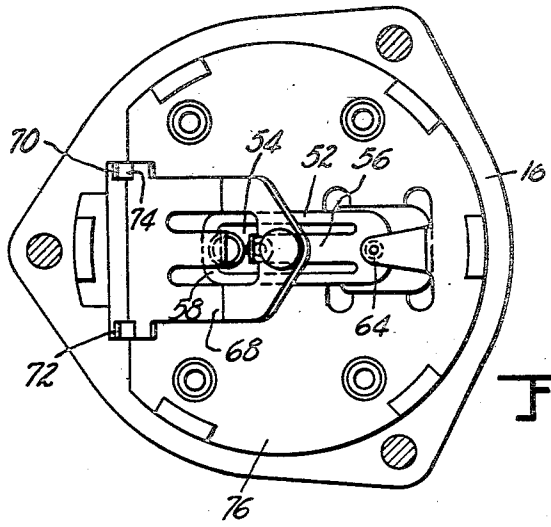


FIG. 2

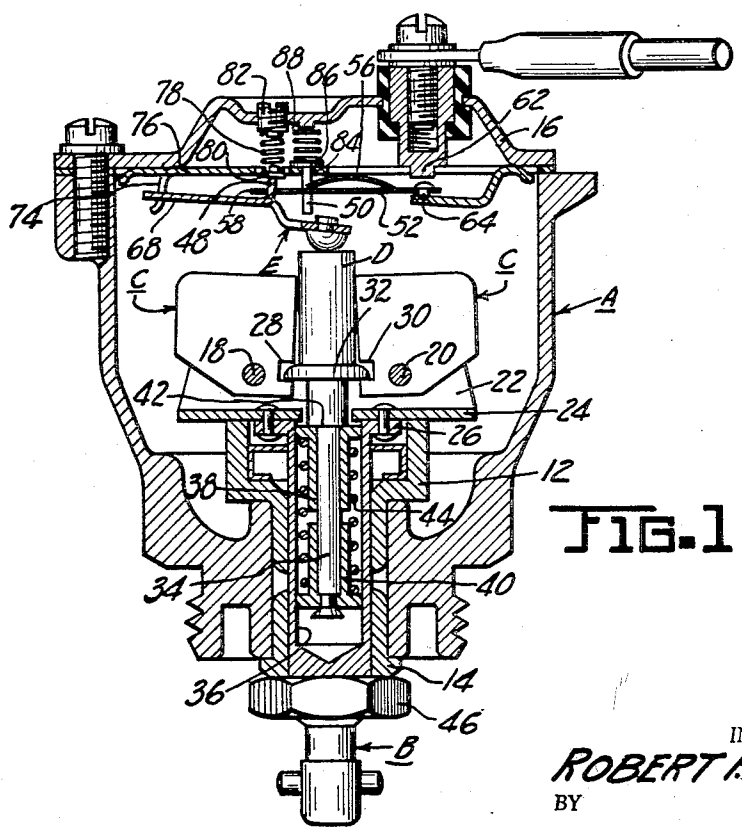


FIG. 1

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SNAP ACTING SWITCH

Filed Dec. 28, 1956 2 Sheets-Sheet 2

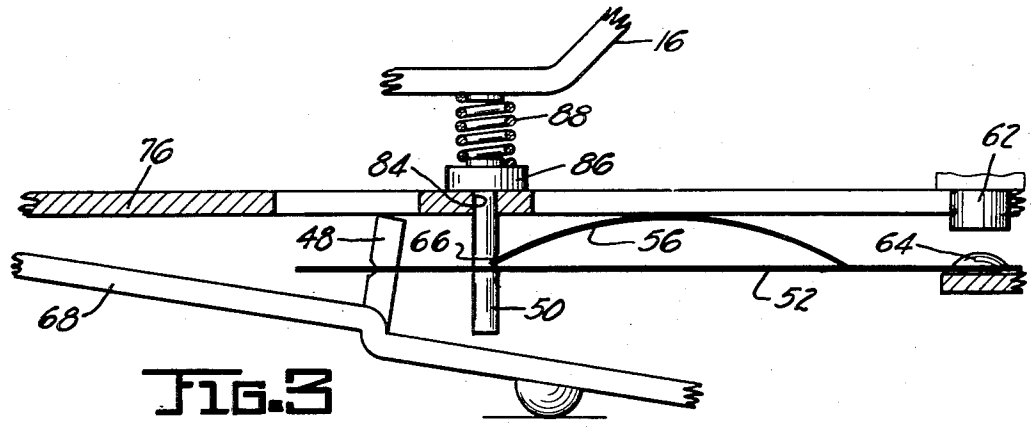


FIG. 3

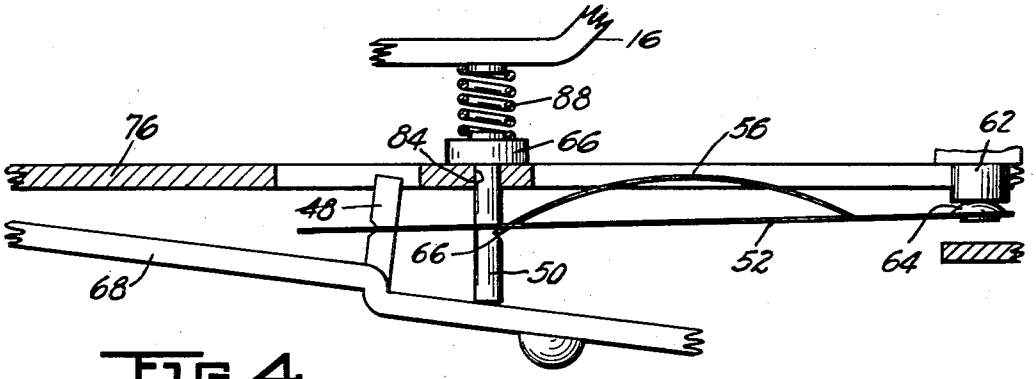


FIG. 4

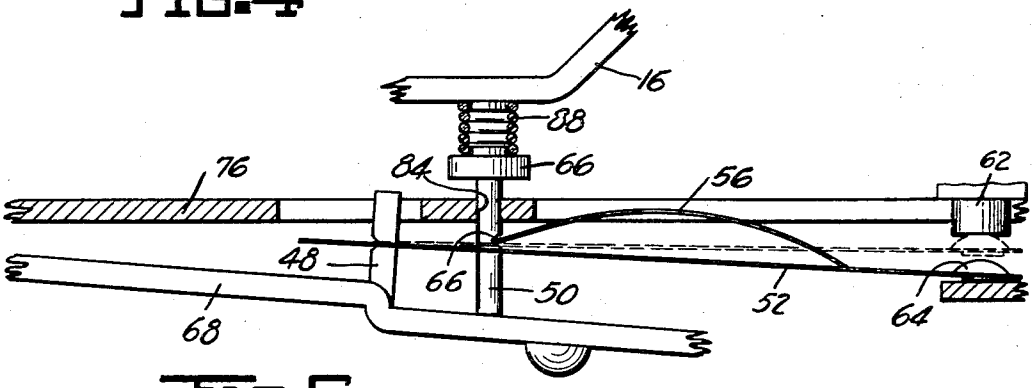


FIG. 5

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SNAP ACTING SWITCH

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5 Claims. (Cl. 200—67)

The present invention relates to snap acting switches, and more particularly to snap acting switches adapted to perform control functions at generally predetermined speeds.

An object of the present invention is the provision of a new and improved snap acting switch which upon movement of its control member in a given direction will cause its switch to snap from its normal position to a second position, and continued movement of the control member in the same direction will cause the switch to snap back to its original position.

A further object of the invention is the provision of a new and improved switch of the above described type which is simple and rugged in design, reliable and efficient in its operation, and yet economical to manufacture.

The invention resides in certain constructions and combinations and arrangement of parts, and further objects and advantages will be apparent to those skilled in the art to which the invention relates from the following description of a preferred embodiment described with reference to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a cross-sectional view of a two stage governor switch embodying principles of the present invention;

Figure 2 is a bottom view of the cover plate incorporating the switch mechanism shown in Figure 1;

Figure 3 is a fragmentary schematic view showing the switch mechanism in its normally open position;

Figure 4 is a fragmentary schematic view similar to Figure 3 but showing the switch mechanism at the end of its first stage of operation; and

Figure 5 is a fragmentary schematic view similar to Figures 3 and 4 showing the switch mechanism at the end of its second stage of operation.

The two stage governor switch shown in Figure 1 generally comprises a body member A having a rotatable shaft B journalled in an opening in the bottom of the body member A by suitable sleeve bearings 12 and 14. The rotatable shaft B carries a pair of what are commonly called "flyball weights" C adapted to provide axial movement to a control member D which in turn actuates a two stage electrical snap acting switch E mounted on the top cover plate 16 of the governor.

The flyball weights C are formed from a pair of generally square metal pieces which are pivoted as at 18 and 20 to the upturned legs 22, 22' (only one of which is shown) of a channel section 24 which is riveted to a flange 26 on the upper end of the rotatable shaft B. Each of the flyball weights C are provided with an inwardly facing slot 28 and 30 adapted to receive opposite sides of a flange 32 carried by the control member D. The lower end of the control member D is provided with a reduced diameter section 34 which projects down into a bore 36 in the upper end of the rotatable shaft B, and which section carries a pair of spaced sleeves 38 and 40 positioned in the bore. The lower sleeve 40 is suitably fixed to the lower end of the shaft B

and the upper sleeve 38 is biased into engagement with a shoulder 42 on the control member D as by a coil spring 44 interpositioned between the flanged sleeves. The outer edges of the flanged sleeves 38 and 40 are adapted to position the control member D within the bore 36, and are retained within the bore by means of inwardly projecting portions of the channel section 24 which overlie the upper end of the sleeve 38. The bottom end of the channel 24 is journalled or adapted to ride on the upper end of the sleeve bearing 12; and the entire rotatable assembly is locked in place by means of a nut 46 threaded into the lower end of the rotatable shaft B and tightened into engagement with a shoulder (not shown) to provide clearance with respect to the lower end of the sleeve bearing 14.

The switch structure E mounted on the top cover plate 16 generally comprises first and second generally vertically movable support members 48 and 50, and a switch blade 52 positioned at generally right angles to the support members. The switch blade 52 is formed from a generally rectangularly shaped stamped section of spring material—the center portion of which is notched out to provide an arcuately bowed spring section 56. One end of the opening 54 in the blade is slipped over the first support member 48 with the end closure portion 58 of the blade fitted into a suitable recess or groove formed in the outer edge of the first support member 48. The other end of the blade 52 is positioned in between a pair of vertically spaced contacts 62 and 64 and the blade is held in place by wedging the free end of the bowed spring section 56 into a receiving groove 66 formed in the second support member 50. The compressive forces thus produced in spring section 56 provide tension in the blade section 52 which snap the blade into engagement with either of the contacts 62 and 64 depending upon the relative position of the blade and spring portions 52 and 56. For the purposes of understanding the snap action feature of the switch, the integral connection between the spring section 56 and the blade 52 may be thought of as a pivotal one. With this assumption made, the spring may be considered to act on a line of force extending through its opposite end portions, and the blade 52 may be thought of as exerting tension on a line of force passing through its end portion 58 and its connection with the spring section 56. In the normal position of the switch, the free end of the spring 56 will be positioned by the second support member 50 above the blade 52, such that the line of force of the spring is above the line of force for the blade. The line of force for the spring therefore forces the blade downwardly into engagement with the contact 64. It will be seen that should the positions of the lines of force be reversed such that the line of force of the spring is beneath the line of force for the blade, an upward component will be produced upon the blade forcing it into engagement with the upper contact 62.

The first support member 48 is integrally formed as an integral part of an actuating member 68 one end of which is abutted by the top end of the control member D and the other end of which is pivotally supported from the cover plate 16. This pivotal connection is formed by means of a pair of laterally projecting knifed edged projections 70 and 72 carried by the actuating member 68 and which are positioned behind a downward projection 74 formed on a stamped plate 76 which is riveted to the underside of the top cover plate 16. The knifed edged projections 70 and 72 are held in engagement with the projection 74 by means of the compressive forces developed in the spring section 56.

The actuating member 68 is biased downwardly into engagement with the top end of the control member D by means of a coil spring 78 the lower end of which carries

a plug 80 which abuts the top end of the first member 48, and the top end of which is carried by an adjustment screw 82 threaded into the cover plate 16. The second support member 50 is also adapted for vertical movement and is formed by means of a headed pin the lower end of which is adapted to be engaged by the actuating member 68. The upper end of the second support member 50 is received in a guide hole 84 formed in the plate 76; and the head 86 of the pin or support member is held down into engagement with the top of the plate 76 by means of a coil spring 88 interpositioned between the plate 76 and the cover plate 16.

During operation of the two speed governor shown in the drawing, centrifugal force of the flyball weights C produces a rocking action of the weights about the pins 18 and 20 causing the flange 32 of the control member D to be moved upwardly. During nonrotating periods or during very slow rotating speeds of the shaft B, the parts of the switch will be in the positions shown in Figure 3 of the drawing. In this position the line of force of the spring will be above the line of force for the blade causing the blade to be held in abutment with the lower contact 64 of the switch. Sufficient clearance will normally be provided between the top of sleeve 38 and the inwardly projecting portions of the channel 24 to prevent the spring 44 from being compressed during the first stage of switch operation. During this stage of switch operation, downward force upon the control member D will be exerted solely by the coil spring 78; and this of course can be adjusted to provide a predetermined force which will be overcome by the force developed by the rotating flyball weights C at a predetermined speed of rotation. During this first stage of switch movement, the line of force for the blade will be moved to a position above the line of force for the spring causing the blade to be moved into engagement with the upper contact 62 as shown in Figure 4 of the drawing. In this position current flows through blade 52, actuating member 68, plate 76 and 16 to the body member A which of course is grounded. Further increase in the rotating speeds of the shaft B produces a second stage of switch operation during which the top sleeve 38 will have engaged the channel section 24 and the spring 44 will be compressed. At approximately the same time that the sleeve 38 engages the channel 24, actuating member 68 will also engage the bottom end of the second support member 50 to thereafter compress its associated coil spring 88. During this second stage of switch operation both the first support member 48 and the second support member 50 will be moved upwardly. Inasmuch as the second support member 50 is positioned farthest away from the pivotal support 74 of the actuating member 68, the second support member 50 will be moved upwardly at a faster rate than is the first support member 48. After a predetermined amount of upward movement of the support members, the line of force for the spring 56 will have been moved upwardly of the line of force for the blade causing the blade to snap down into engagement again with the contact 64. It will further be seen that the relative vertical movement of the two support members is favorably effected by the relative positions of the first and second support members and the contact 62 and 64. Inasmuch as the switch blade 52 will be pivoted about the upper contact 62 during the second stage of switch movement, a lesser amount of movement is required to change the relative positions of the lines of force of the spring and blade when this movement is delivered to the second support member than would be required if it were delivered to the first support member. Subsequent to this stage of switch operation, the sleeve 40 moves into engagement with the sleeve 38 preventing further vertical movement of the control member D.

While the invention has been set forth in considerable detail, I do not wish to be limited to the particular construction shown and described; and it is my intention to cover hereby all adaptations and modifications and uses

thereof which come within the practice of those skilled in the art to which the invention relates.

I claim:

1. A snap acting switch comprising: a body member, first and second support members mounted on said body member for generally parallel movement with respect to each other, a pair of abutments positioned to one side of said first and second support members, said abutments being spaced apart in the direction of said parallel movement, a blade extending generally transversely to and having a generally free pivotal connection to said first member and extending between said pair of abutments, a spring having first and second generally free pivotal connections with said second member and said blade respectively, said blade having a line of force generally passing through its pivotal connections to said first support member and said spring, and said spring having a line of force generally passing through its connections to said second member and said blade, said line of force for the spring normally being to one side of the line of force for the blade, and actuating means constructed and arranged to move one of the support members relative to the other until the line of force for the spring moves to the other side of the line of force for the blade, and continued movement of said means in the same direction thereafter moves the other of said support members until the line of force for the spring again returns to its original side of the line of force for the blade, whereby the blade is snapped from one abutment to the other and then back again upon continued movement in a given direction of said last mentioned means.

2. A snap acting switch comprising: a body member, first and second support members mounted on said body member for generally parallel movement with respect to each other, a pair of abutments positioned to one side of said first and second support members, said abutments being spaced apart in the direction of said parallel movement, a blade extending generally transversely to and having a generally free pivotal connection to said first member and extending between said pair of abutments, a spring having first and second generally free pivotal connections with said second member and said blade respectively, said blade having a line of force generally passing through its pivotal connections to said first support member and said spring, and said spring having a line of force generally passing through its connections to said second member and said blade, said line of force for the spring normally being to one side of the line of force for the blade, and actuating means constructed and arranged upon movement in a direction generally parallel to the support members to move one of the support members relative to the other until the line of force for the spring moves to the other side of the line of force for the blade and continued movement of said means in the same direction thereafter moves the other of said support members until the line of force for the spring again returns to its original side of the line of force for the blade, whereby the blade is snapped from one abutment to the other and then back again upon continued movement in a given direction of said last mentioned means.

3. A snap acting switch comprising: a body member, first and second support members mounted on said body member for generally parallel movement with respect to each other, a pair of abutments positioned to one side of said first and second support members, said abutments being spaced apart in the direction of said parallel movement, a blade extending generally transversely to and having a generally free pivotal connection to said first member and extending between said pair of abutments, a spring having first and second generally free pivotal connections with said second member and said blade respectively, said blade having a line of force generally passing through its pivotal connection to said first support member and said spring, and said spring having a line of force generally passing through its connections to

said second member and said blade, said line of force for the spring normally being to one side of the line of force for the blade, and an actuating member pivotally supported on said body member for movement generally in the direction of said parallel movement and constructed and arranged to during its initial movement in one direction move one of said members until the line of force for the spring passes over the line of force for the blade, and continued movement of the actuating member in the same direction thereafter moves the other of said support members until the line of force for the spring returns to its original side of the line of force for the blade, whereby the blade is snapped from one abutment to the other and then back again upon continued movement in a given direction of said last mentioned means.

4. A snap acting switch comprising: a body member, first and second support members mounted on said body member for generally parallel movement with respect to each other, a pair of abutments positioned to the opposite side of said second support member from said first support member and spaced apart in the direction of said parallel movement, a pivotal support on said body member spaced to the other side of said support members from said pair of abutments, a blade extending generally transversely to and having a generally free pivotal connection to one of said support members and extending between said pair of abutments, a spring having first and second generally free pivotal connections with the other of said support members and said blade respectively, said blade having a line of force passing through its pivotal connections to said one of said support members and said spring, said spring having a line of force generally passing through its connections to said other of said support members and said blade, said line of force for the spring normally being to one side of the line of force for the blade, and an actuating member pivotally connected to said pivotal support and overlying said support members, said actuating member being constructed and arranged upon initial movement in a given direction to move said first support member until the line of force for the spring passes to the other side of the line of force for the blade, and to thereafter during continued movement in said given direction move said second support member until the line of force for the spring returns to said first side of the line of force for the blade, whereby the blade is snapped from one abutment to the other and then back again upon continued movement in said given direction of said actuating member.

5. A snap acting switch comprising: a body member, first and second support members mounted on said body member for generally parallel movement with respect to each other, a pair of abutments positioned to the opposite side of said second support member from said first support member and spaced apart in the direction of said parallel movement, a pivotal support on said body member spaced to the other side of said support members from said pair of abutments, a blade extending generally transversely to and having a generally free pivotal connection to said first member and extending between said pair of abutments, a spring having first and second generally free pivotal connections with said second member and said blade respectively, said blade having a line of force passing through its pivotal connections to said first support member and said spring, said spring having a line of force generally passing through its connections to said second support member and said blade, said line of force for the spring normally being to one side of the line of force for the blade, and an actuating member pivotally connected to said pivotal support and overlying said support members, said actuating member being constructed and arranged upon initial movement in a given direction to move said first support member until the line of force for the spring passes to the other side of the line of force for the blade, and to thereafter during continued movement in said given direction move said second support member until the line of force for the spring returns to said first side of the line of force for the blade, whereby the blade is snapped from one abutment to the other and then back again upon continued movement in said given direction of said actuating member.

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