Aug. 23, 1955 R. A. HANSON 2,716,169

LEVEL SENSITIVE SWITCH

Original Filed May 16, 1950

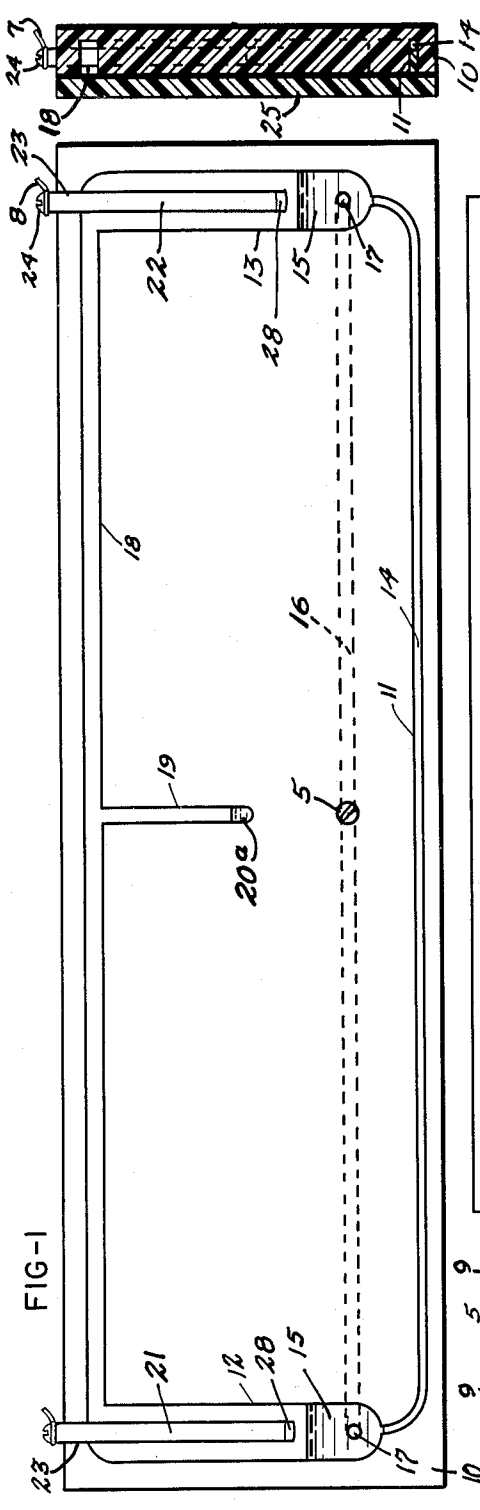


FIG-1

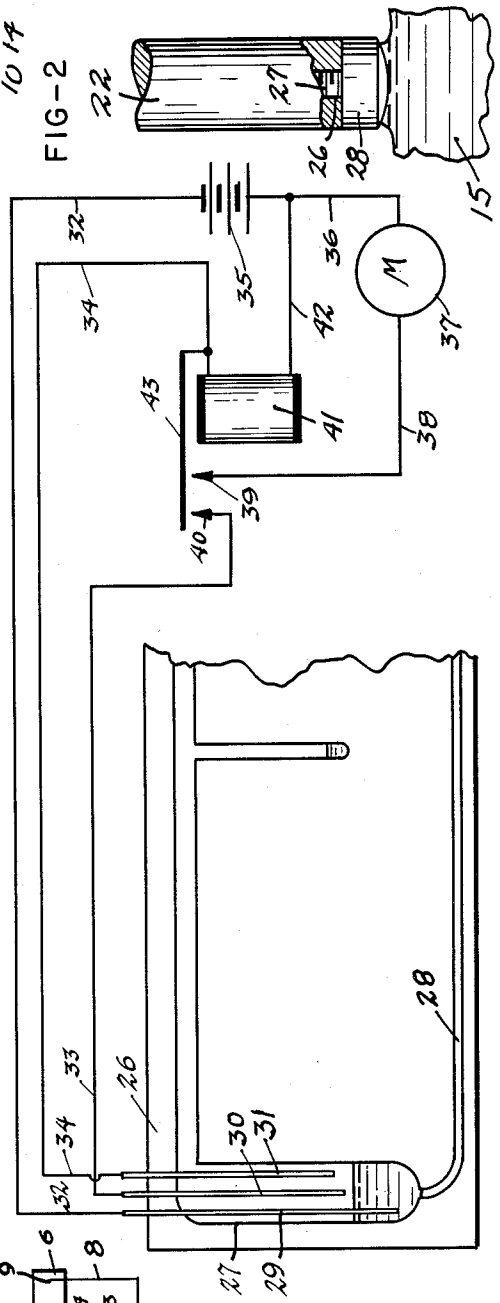


FIG-5

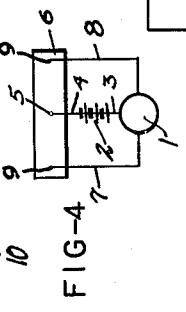


FIG-4

FIG-2

FIG-3

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LEVEL SENSITIVE SWITCH

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1 Claim. (Cl. 200—61.47)

This invention relates to switches and more particularly to a level sensitive switch of the type disclosed in my copending application Serial No. 162,156, filed May 16, 1950, now Patent Number 2,615,099, and of which the present application constitutes a division.

It is one object to provide a switch which is particularly adapted for use upon harvesters and other portable machines which should be kept substantially level while in operation, the switch being so constructed that it will remain open when the machine is substantially level and automatically close if the machine is tilted and remains in the tilted position a predetermined length of time.

Another object of the invention is to provide a level sensitive switch wherein mercury contained in pockets in the body portion of the switch is allowed to flow into and out of the pockets at such a slow rate of speed that closing of a circuit will be delayed and only take place after a machine has remained in a tilted position a considerable length of time.

Another object of the invention is to provide a delayed action switch wherein the body is formed with vertically disposed pockets into which terminal strips extend through upper ends thereof, outer ends of the terminal strips being connected with conductors and lower ends of the pockets being connected by a passage or opening of small diameter so that flow of mercury through the opening from one pocket to the other will be at a slow rate of speed and thus prevent closing of a circuit if the machine upon which the switch is mounted does not remain in a tilted position for a predetermined length of time.

Another object of the invention is to provide an improved terminal.

With these and other objects in view, the improved switch consists of a special construction and arrangement of parts illustrated in the accompanying drawings wherein:

Fig. 1 is a view showing one embodiment of the switch in side elevation with its cover plate removed.

Fig. 2 is a sectional view taken transversely through the switch with the lower plate in place.

Fig. 3 is an enlarged view of the lower portion of a terminal member.

Fig. 4 is a wiring diagram.

Fig. 5 is a view showing a portion of a switch of modified construction and a circuit with which it is used.

This improved switch, which may be called a delayed action switch, is intended for use upon harvesters and other portable machines which should be kept substantially level when in use but are subject to tilting movements which are liable to occur when a machine is driven across fields having furrows or other uneven places which will cause the machine to be tilted momentarily as the machine is driven across a field. When the tilting movements are momentary, it is not desired to have the circuit controlled by the switch closed but when sloping ground is encountered of sufficient length to cause the machine to be tilted for an appreciable length of time, it is desired to close the circuit and a motor energized so that an angularly adjustable portion of the machine will be tilted until it is restored to a horizontal position.

The machine has not been illustrated but in Figure 4 there has been shown a motor 1 with which a source of energy 2 is connected by a conductor 3 and by means of which motor the tiltable portion of the machine is moved to adjusted positions. A second conductor 4 connects the other side of the source of energy to a center contact 5 of the switch 6 and from opposite sides of the motor extend wires 7 and 8 which are connected with terminals 9 of the switch. When the wire 4 is out of circuit with both of the wires 7 and 8 the motor is shut off but if the machine tilts to a position which will cause the tiltable portion of the machine to move out of horizontal position a circuit will be closed through either wire 7 or wire 8, according to the direction in which the machine tilts and the motor energized to restore the tiltable portion to a horizontal position. Moving the machine onto level ground will close the circuit through the other conductor 8 or 7 and the tiltable portion will be restored to its initial position. The circuit is broken to shut off the motor when the tiltable portion is moved to a horizontal position.

The switch illustrated in Figures 1 and 2 has a body 10 formed of transparent non-conductive material, and this body is elongated and has flat side faces and edge faces. A groove or channel 11 is formed in one side face of the body near the lower edge thereof and this channel has upturned end portions which communicate with lower ends of vertically extending pockets 12 and 13 formed near opposite ends of the body. A tube 14 fits into the groove 11 and at its ends communicates with lower ends of the pockets so that mercury 15 filling the tube and lower portions of the pockets may flow through the tube from one pocket to the other. The tube is of small diameter relative to the diameter of the tubes and therefore the mercury will flow at slow speed through the tube. The terminal 5 consists of a screw or bolt mounted through an opening midway the length of the body. This screw engages a metal strip 16 extending longitudinally of the body and at its ends entering the pockets and making contact with the mercury, as shown at 17. Upper ends of the pockets communicate with ends of a groove 18 formed near the upper edge of the body and midway its length this groove communicates with a downwardly extending groove 19 provided to receive a reserve quantity of mercury 20^a.

In order to close a circuit there has been provided conductor strips 21 and 22 which are inserted into the pockets 12 and 13 through the small openings 23 leading from the upper edge face of the body. Ends of the wires 7 and 8 are connected with upper ends of the strips 21 and 22 by screws 24. The conductor strips extend downwardly in the pockets 12 and 13 and are of such length that their lower ends are spaced upwardly from the mercury in the pockets when the body is level and disposed horizontally. When the body is tilted in one direction or an opposite direction the mercury in one pocket makes contact with the contact strip therein and a circuit is closed through one side of the three wire circuit and the motor will be energized and not rotated in one direction and when the body is tilted in an opposite direction the motor will be rotated in an opposite direction. Therefore, tilting adjustment and return to the initial position may be accomplished. The fact that the mercury flows slowly through the tube 14 prevents mercury from quickly flowing from one tube into the other tube and contact with the strips 21 and 22 will not occur if a machine is only momentarily tilted by its wheels passing across rough spots in ground across which the machine is moving. The side plate 25 is removably secured so that it may be removed when repairs are necessary or replacement

of parts is necessary. By sliding the rods vertically through the openings **23** the distance between their lower ends and the mercury, when the body is level, may be adjusted and the distance the body must be tilted in order for the mercury to engage the rods thus controlled.

When the body is tilted to close a circuit it is desirable to have the mercury in good conductive engagement with the contact strips and when the body is returned to its initial position it is desirable to break engagement of the mercury with a contact strip without formation of a spark. Therefore, each of the contact strips **21** and **22** has its lower end formed with a threaded opening **26** to receive the threaded shank **27** of a cap or foot **28** formed of platinum which has an affinity for mercury. Provision of the foot causes a very good conductive engagement between the mercury and a contact strip and also prevents separation of the mercury from a contact strip until the body has been tilted to a position in which the mercury will quickly and suddenly move away from a contact strip with which it has been in engagement. Quick and sudden movement of the mercury away from a contact strip will very effectively eliminate formation of a spark and affinity of mercury and the platinum caps will prevent accidental breaking of a closed circuit while a machine is moving across a field.

In Figure 5 there has been shown a modified construction wherein the body **26** is formed at each end with a vertical pocket **27** with which an end of a tube **28** connects so that mercury may flow from one pocket into the other when the body is tilted vertically. In each pocket are mounted contact rods **29**, **30** and **31** which are of different lengths so that when the rod **29** has its lower end immersed in mercury in the pocket, the shorter rods **30** and **31** will have their lower ends spaced upwardly from the mercury when the body **26** is horizontal. The rod **30** has its lower end closer to the mercury than the lower end of rod **31**. All of the rods have their upper ends projecting from the upper edge face of the body and to them are secured wires **32**, **33** and **34**. The wire **32** is connected with the minus side of the battery **35**, to the plus side of which is secured a wire **36** leading to one side of the motor **37**. From the other side of the motor extends a wire **38** connected with a switch terminal or contact **39**, and to a companion terminal or contact **40** is secured the wire **33** leading from the contact rod **30**. When space between the contacts **39** and **40** is closed a circuit is closed and the motor

operates. The wire **33** is connected to one end of the coil of a relay **41** and to the other end of the coil is connected a wire **42** extending from wire **36**. The contact rod **29** is continuously immersed in the mercury and when the body **26** of the switch is tilted downwardly at one end, the mercury makes contact with the rod **30** and then with rod **31**. As soon as the mercury moves into engagement with rod **31** a circuit is closed through the coil of the relay **41** and the relay or electromagnet is energized and the armature bar **43** is moved into bridging engagement with the contact terminals **39** and **40** and the circuit is closed through the motor **58**. A leveling operation will then take place and when this is accomplished, the mercury will move out of engagement with the contacts **30** and **31** and the circuit through the relay will be broken and its armature returned to its original position and break the circuit through the motor.

Having thus described the invention, what is claimed is:

A delayed action switch comprising a body formed with vertical pockets adjacent its ends, there being a conduit extending longitudinally of the body and at its opposite ends communicating with lower ends of said pockets, mercury filling said conduits and lower portions of said pockets, a conductor strip extending longitudinally of said body and having opposite ends entering the pockets below the level of mercury therein, a screw mounted through said body transversely thereof and engaging said strip intermediate the length thereof to secure the strip to the body and having a head at one end for engagement with a conductor wire, contact rods disposed vertically and entering said pockets through upper ends thereof and having caps on their lower ends spaced upwardly from the mercury in the pockets when the body is horizontal, said contact rods having caps formed of platinum, one of said caps being engaged by the mercury when the body is tilted vertically, and connectors carried by upper ends of said rods for connecting conductor wires with the rods.

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