United States Patent [19]

O'Donald

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[45] **Oct. 15, 1974**

[54] **WATCH DISPLAY SWITCH**

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[52] **U.S. Cl.** ..... **58/23 BA,** 58/33, 58/50

[51] **Int. Cl.** ... **G04c 3/00,** G04c 23/12, G04b 19/30

[58] **Field of Search** ..... 58/23 BA, 33, 50

[56] **References Cited**

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Primary Examiner—George H. Miller, Jr.

[57] **ABSTRACT**

A tilt sensitive electrical switch wherein an asymmetrically balanced disc mounted on an axis causes electrical contact to be made when it is aligned in the desired activation region (plane); various embodiments are provided for causing electrical contact and for minimizing electrical energy dissipation.

5 Claims, 13 Drawing Figures

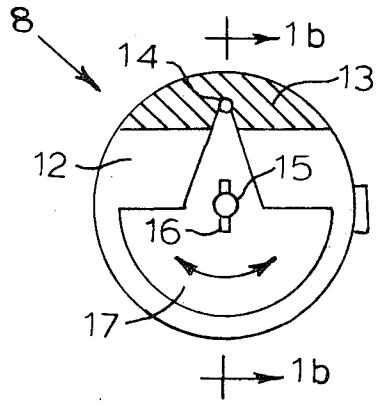


Fig. 1.

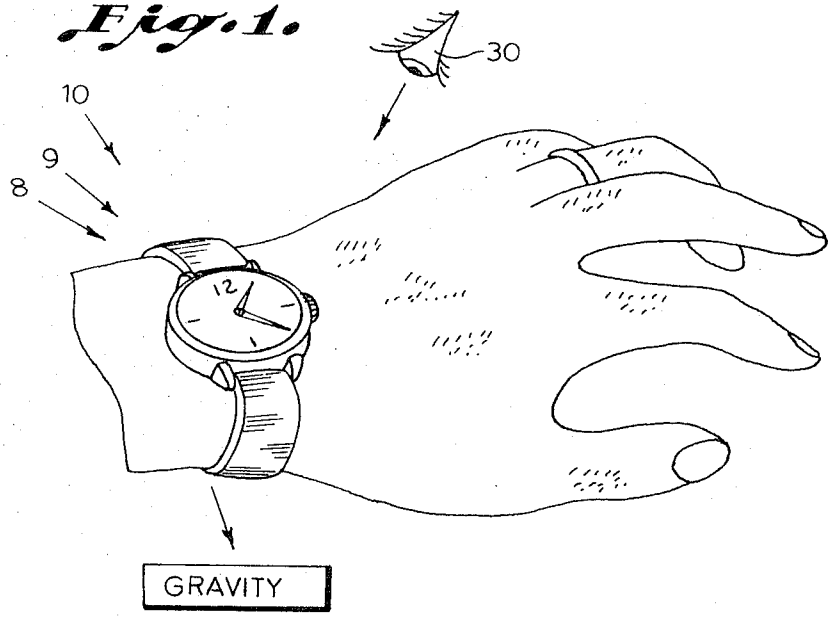


Fig. 1a.

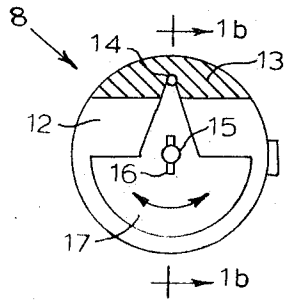


Fig. 1b.

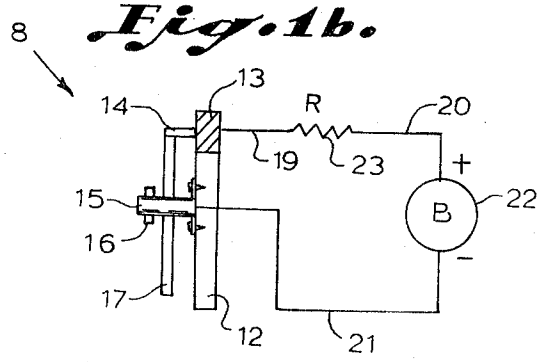


Fig. 1c.

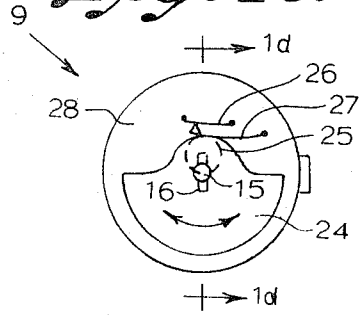


Fig. 1d.

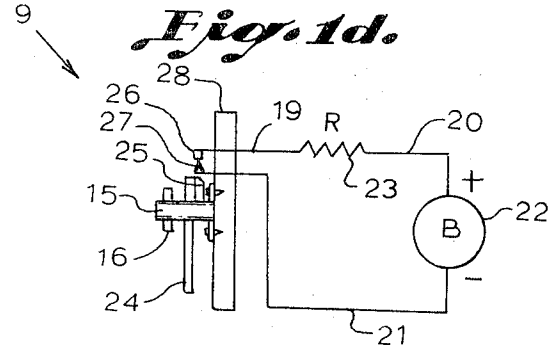


Fig. 2.



Fig. 2a.

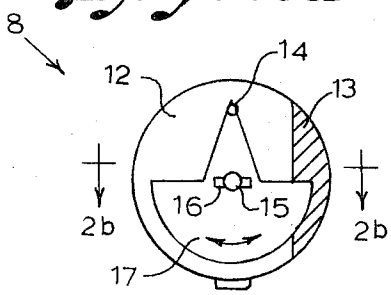


Fig. 2b.

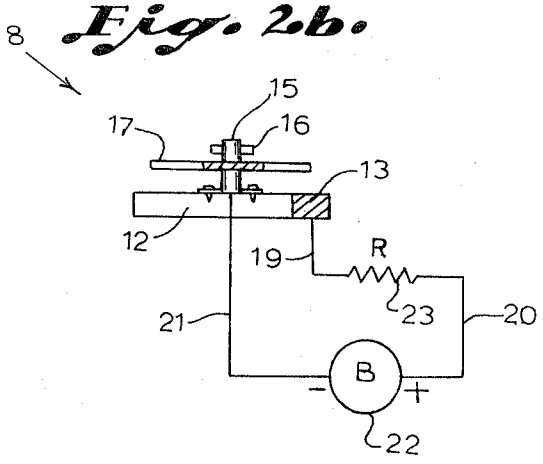


Fig. 2c.

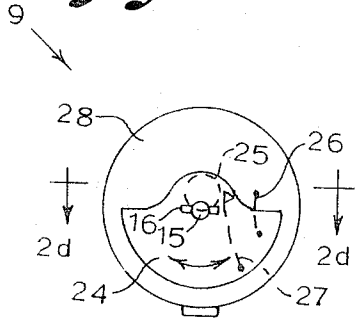


Fig. 2d.

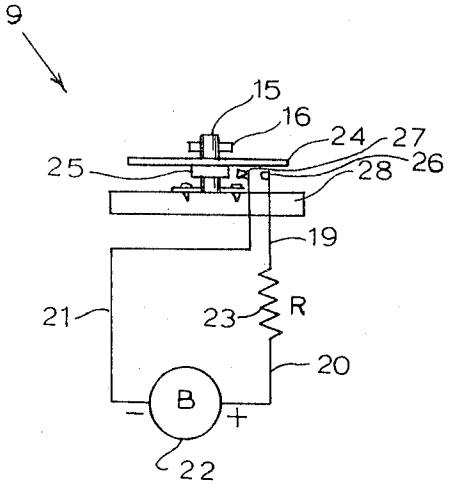


Fig. 3.

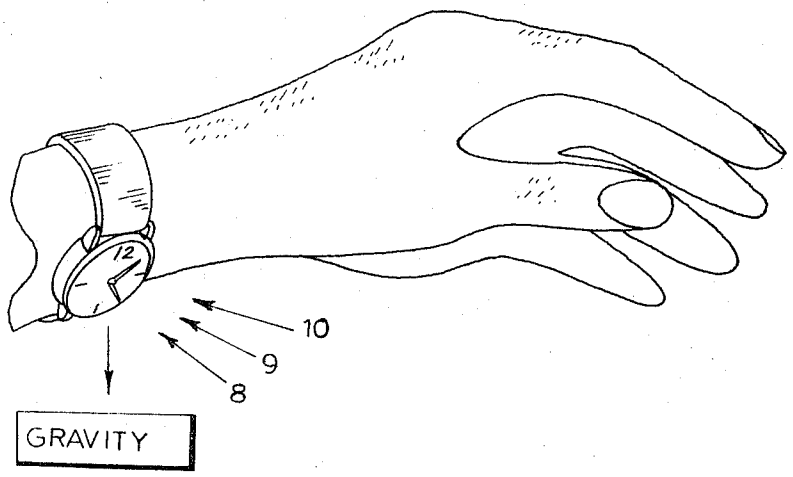


Fig. 3a.

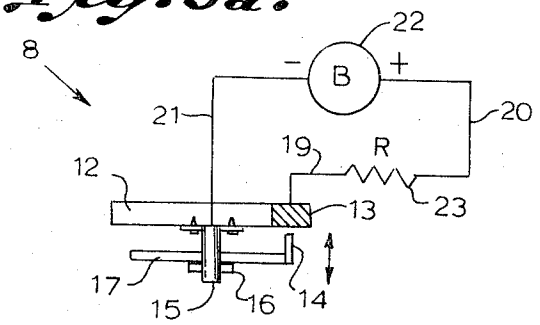
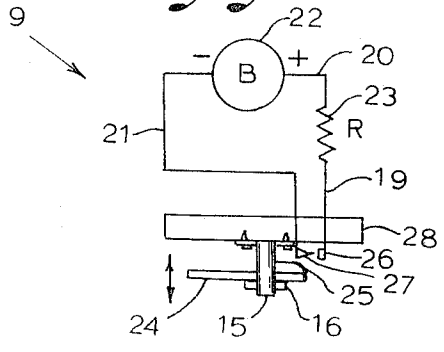


Fig. 3b.



WATCH DISPLAY SWITCH

FIELD OF THE INVENTION

This invention relates to a novel tilt-sensitive electrical switch configuration.

BACKGROUND OF THE INVENTION

Tilt-sensitive switches which open or close an electrical circuit upon appropriate tilting have long been known, especially mercury switches; however, there are several problems with such switches when their application is attempted in confined areas. One problem is that because of the nature of their materials they do not operate well in miniature form because the surface tension effects of small amounts of mercury are stronger than gravitational forces. Another problem is that even in miniature form their dimensions are not well suited to confined areas such as within an electronic digital display watch. An additional problem is that their activation region is generally symmetrical and not well adapted for asymmetrical applications. Also, a problem arises because there is little provision for minimizing dissipation of electrical energy. Finally, in the case of mercury switches, there is some difficulty in causing "clean" open and close switching when it is adapted to confined areas.

It is accordingly an object of this invention to provide a tilt sensitive switch wherein these problems are overcome or diminished. Other objects and several advantages of this invention will become apparent upon study of this disclosure, the appended claims and the drawing in which FIGS. 1A, B, C and 2A, B, C represent vertical and horizontal cross sectional views (open and closed configurations) of various embodiments of this invention.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the preferred embodiment of the invention as related to a watch shown with the switch in the activation region or position;

FIG. 1A is a schematic plan view of the preferred embodiment of the switch as shown in the switch closed or activated position by direct means;

FIG. 1B is a schematic side view of the preferred embodiment as referred to in FIG. 1A;

FIG. 1C is a schematic plan view of an alleviation embodiment of the switch as shown in the closed or activated position by indirect means;

FIG. 1D is a schematic side view of the embodiment as referred to in FIG. 1C;

FIG. 2 is a perspective view of a preferred embodiment of the invention as related to a watch shown in the deactivated region or position;

FIG. 2A is a schematic plan view of the preferred embodiment of the switch as shown in the open or deactivated position by direct means;

FIG. 2B is a schematic side view of the preferred embodiment as referred to in FIG. 2A;

FIG. 2C is a schematic plan view of the other embodiment of the switch as shown in the open or deactivated position by indirect means;

FIG. 2D is a schematic side view of the other embodiment as referred to in FIG. 1C;

FIG. 3 is a perspective view of a preferred embodiment of the invention as related to a watch shown in another deactivation region or position;

FIG. 3A is a schematic side view of the preferred embodiment of the switch as shown in another deactivation region or position by direct means; and

FIG. 3B is a schematic side view of the other embodiment of the switch as shown in another deactivation region or position by indirect means.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to the drawings and to FIG. 1A, a watch **10** is illustrated in an attitude to be read on the arm of a wearer held on the wrist by a band **9** in relation to an eye **30.** In particular, a half disc indicated generally as **17** is attached to axis **15** and mounted on base plate **12.** Electrodes consist of one static, **13,** and one dynamic, **14.** Dynamic electrode, **14** is fixed to half disc and moved as the disc is caused to move by orientation of the device and by gravitational force. Electrode **13** controls the activation region (depending on the portion of the base plate it covers) and is located such that as the half disc rotates the dynamic electrode **14** may contact electrode **13.** Electrode **14** is any of the conventional brushes (electrical) used such as carbon or copper. Electrode **13** is made of conducting material.

As shown the mounting plate is attached to the base plate **12** by means of two screws. There is also shown a schematic of a generalized electrical circuit. An electrical connection attached to the axis passes through the base plate to a power source **22.** When the switch is closed as in FIGS. 1A and 1B, current may flow through resistance R or **23** and through the switch via elements **13, 14** and **15.** The materials of the half disc, axis must be conductive or other provisions made for completing the circuit from electrode **14** to the static portion of the circuit.

Because of the friction required to make contact between dynamic **14** and static **13** electrodes, the half disc need be weighted slightly to generate enough force to compensate for energy loss due to friction.

FIGS. 2A and 2B show the device in an open circuit position. Here the device has been tilted causing the brush **14** to move from the electrode **13.**

FIGS. 3A and 3B are views where the device is oriented such that the base plate is in the top position and the base plate in the bottom position. For some special applications such as in an electronic display watch where the watch is worn on the underside of the wrist, provision is made to minimize energy dissipation and to prevent activation when the watch is upside down. This embodiment consists of an extension of axis **15** with a retaining pin **16.** This extension permits the disc **10** and dynamic electrode **14** to become axially displaced by gravitational force from the static electrode **13** thereby preventing activation.

FIGS. 1A, 2A, and 3A illustrate activation by direct means. FIGS. 1C, 1D, 2C, 2D and 3B describe an indirect means to cause activation. Referring now to FIG. 1C, an eccentric **25** is fixed to the axis **15** to cause electrical contact rather than a dynamic electrode. This configuration has the advantage of less friction and therefore requires less weight and bulk in the half disc that would otherwise be required to overcome this friction.

In FIG. 1C the half disc **24** is mounted on a base plate **28** by means of an axis **15** and mounting plate and screws. An eccentric is fixed to the disc and rotates as it does.

Electrode 27 rides along the eccentric under spring tension. In the circuits closed position the eccentric pushes the electrode 27 and causes it to come into contact with electrode 26, a spring band, thereby closing the circuit. The vertical view 1D also shows a schematic of a generalized electrical circuit. One electrode 27 is connected to a power supply, battery B, 22 and it to a resistance R. The circuit is completed by connecting the resistance to electrode 26.

The open position is illustrated in FIG. 2C. Here the eccentric has been rotated by the disc such that the electrode 27 no longer contacts the electrode 26 by virtue of the spring pressure that always keeps the electrode 27 riding along the eccentric. The shape of the eccentric controls the activation region.

For the special case described above where it is desired that there be no activation when the device is upside down, the eccentric is tapered on the lower side and the axis 15 is extended slightly above the disc. When upside down, the weight of the disc and eccentric slips to the top of the axis and is retained by the pin 16 and the electrode 25 rides down the tapered eccentric opening the circuit even though the disc is in the position shown in FIG. 1C.

The FIGS. 1C and 1D illustrate an indirect means of actuation; similar means would include the use of gears. Lack of specific mention herein does not exclude the use of the same within the spirit of this invention.

Other General Embodiments

While the device illustrated above is referred to as a switch, it does not need actually conduct a controlling current. It generally acts as a sensor and detects the position where activation is desired.

Ancilliary electronic circuits are desirable to be used in conjunction with the device to regulate any voltage fluctuations inherent to the specific design, to control activation time and to filter out "false" signals or noise. Such electronic circuits are well known in the industry.

The designs illustrated are intended to convey only general concepts. Specific elements may be substantially altered and still remain within the scope of this invention. For example, the base plate need not be of the relative size shown in the figures and indeed could be relatively small. Even more significant is the use of a design having essentially the ones shown. While there would require some minor variations of the detailed elements, such a device would remain within the scope of this invention.

What is claimed is:

1. A wrist watch including in combination, a circuit comprising a switch means in series with a power source and a light emitting means, said switch means including a fixed arm and a movable arm, means mounting said movable arm and effective to close the switch means by moving the movable arm into engagement with the fixed arm when the watch is in one attitude and effective to open the switch means when not in said attitude.

2. The device as set forth in claim 1 wherein a rotatable member comprising a half disc is carried on said means mounting and said movable arm is carried by said half disc.

3. The device as set forth in claim 1 wherein said means mounting comprises a rotatable half disc and cam means on said half disc and said movable arm comprises a spring biased electrode in engagement with said cam means and effective on rotation of said half disc to be brought into and out of engagement with said fixed electrode.

4. The device as set forth in claim 1 wherein said means mounting said movable arm includes a shaft, an axially displaceable half disc rotatably journaled on said shaft and said means mounting said movable arm being effective to move said arm axially relative to said fixed electrode in response to gravity forces.

5. The device as set forth in claim 1 wherein said means mounting comprises asymmetrically weighted plate rotatably journaled on the watch such that when the axis is tilted from the vertical position, the plate will rotate to a gravity induced first position and upon a change of attitude, be rotatable into a second position, said asymmetrical weighted plate carrying said movable arm and effective to close the switch means when in the second mentioned position.

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