

July 28, 1970

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3,522,398

ELECTROPNEUMATIC PANEL SWITCH

Filed Nov. 13, 1967

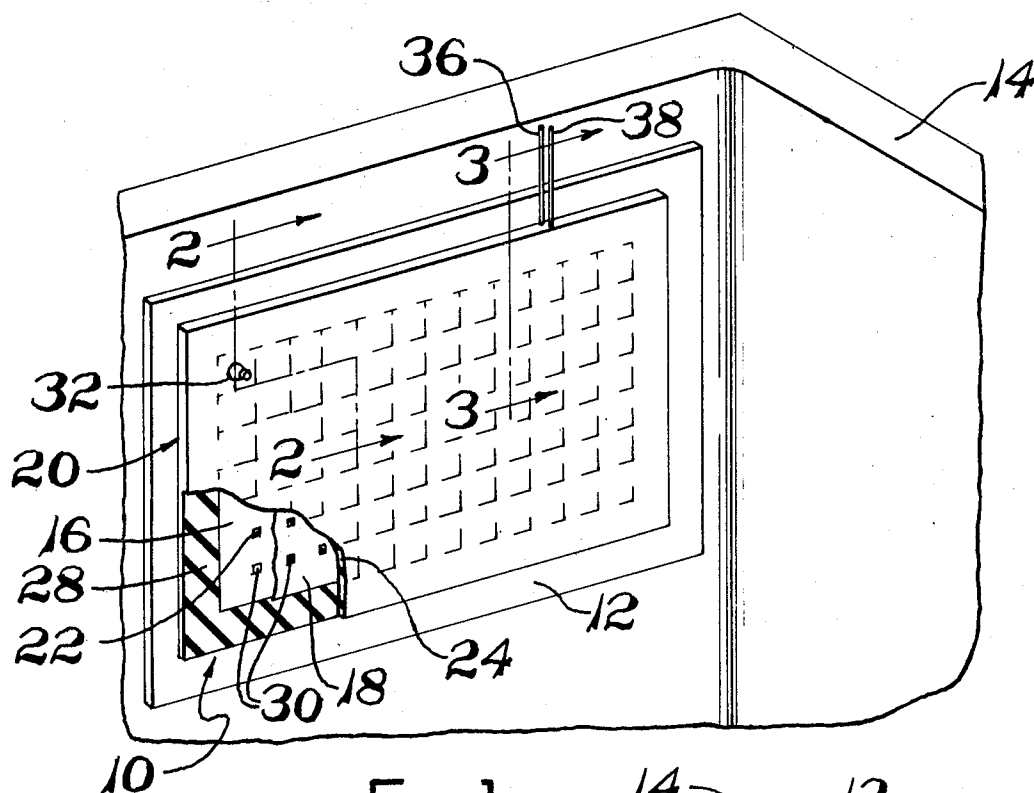


FIG. 1

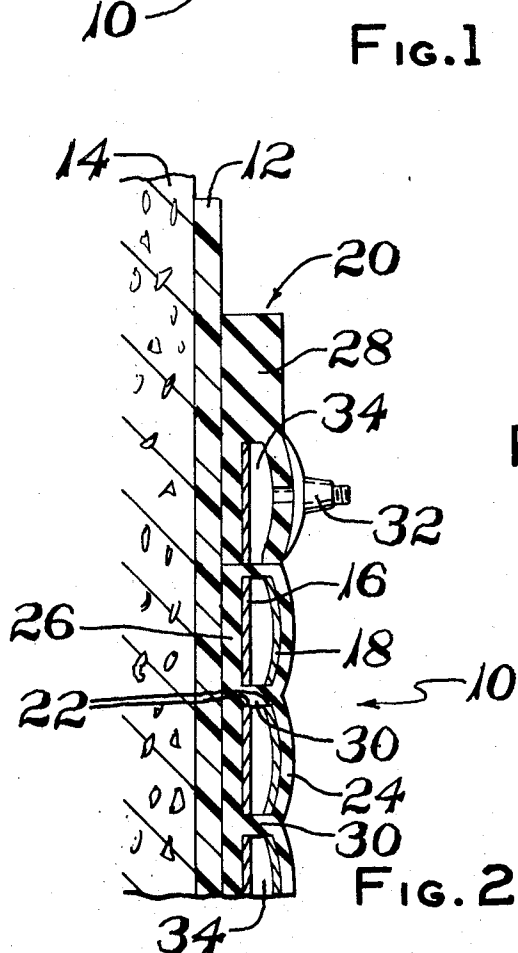


FIG. 2

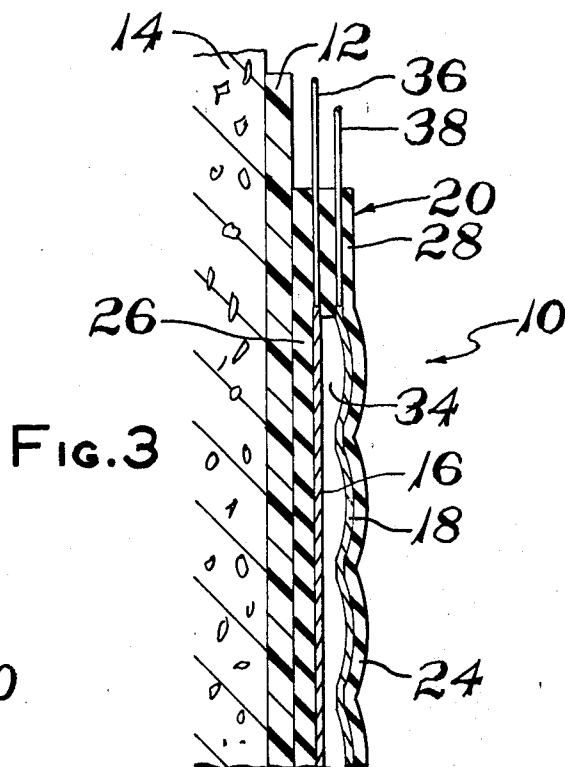


FIG. 3

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ELECTROPNEUMATIC PANEL SWITCH

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Filed Nov. 13, 1967, Ser. No. 682,007

Int. Cl. H01h 3/14

U.S. Cl. 200—86

4 Claims

ABSTRACT OF THE DISCLOSURE

An electropneumatic panel switch featuring a pair of parallel conductive foils mounted to the opposing inner walls of an inflatable elastomer body and normally held in a spaced open switch relationship by the inflation of the elastomer body, and further featuring interconnecting tie-in elements throughout the panel switch providing the fully inflated panel switch with a generally "quilted" configuration of substantially uniform thickness over the entire switch contact surface.

BACKGROUND OF THE INVENTION

This invention relates to pressure responsive electropneumatic switches and more particularly to an electropneumatic panel switch that is especially suitable for use in the timing of swimmers in swimming meets.

In the past, the individual swimmer's racing time in competitive swimming meets was determined by individual judges using their eyesight and stop watches. It is readily apparent that this system entertains human error and depends to a considerable degree on the alertness and abilities of the individual judges.

More recently, pressure sensitive contact devices have been installed at the end of each individual swim lane. These pressure sensitive devices are then electrically connected to a timing mechanism. As the swimmer finishes his race he contacts the pressure sensitive device at the end of his lane thereby automatically recording his time on the timing mechanism.

The problems involved in providing a pressure sensitive contact device at the end wall of a swimming pool include generally the need for a device having a large switch contact surface. The switch contact surface of the device must span the lane width and be of sufficient height to allow the swimmer to contact the timer at any point along the end wall of his lane. The device must provide for the recording of the slightest contact by the swimmer at the end of the pool. On the other hand, the pressure switch must be insensitive to the waves and hydrostatic forces of the pool water.

A pressure sensitive switch used for the timing of swimmers is disclosed in the Parkinson patent, U.S. 3,230,325. This type of switch relies on a pressure balance between a nonconductive spacing liquid in the switch and the pool water to maintain the switch in an open circuit condition. Consequently, the utility of these types of switches is generally limited to underwater uses. Moreover, the total weight of these types of switches when filled with a liquid may further limit the usefulness of these switches in other applications.

SUMMARY OF THE INVENTION

The panel switch of this invention utilizes a pneumatic limiting system to provide a lightweight panel switch that can be readily transported and installed.

The electropneumatic panel switch of this invention provides for positive open circuit operation in any environment. Therefore, the switch of this invention may be used in any application requiring a large switch contact area.

The electropneumatic panel switch of this invention

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further provides a structure that permits the panel switch contact area to be of almost any size, within manufacturing limitations, without loss of pressure sensitivity or control over the entire contact area. Moreover, the panel switch can have a very thin overall thickness across the entire contact area, thereby assuring that the swimming pool panel switch would not substantially reduce the length of the competitive swimming lane.

According to this invention, the foregoing advantages are provided by an improved electropneumatic panel switch including a pair of spaced conductive foil sheets molded within an elastomer body in a quilted arrangement, a pneumatic system for holding the conductive foils in a spaced relationship whenever the panel switch is open, and electrical lead lines for transmitting the closing of the panel switch to an independent timing mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a perspective view of an electropneumatic panel switch mounted on the end wall of a swimming pool.

FIG. 2 is a cross section of the electropneumatic panel switch along the section lines 2—2.

FIG. 3 is a cross section of the electropneumatic panel switch along the section lines 3—3.

DETAILED DESCRIPTION

The electropneumatic panel switch 10 shown in FIG. 1 is mounted to a backing plate 12 on the end wall of a typical swimming pool 14.

The panel switch 10 includes an inner conductive foil 16 and an outer conductive foil 18 mounted within an elastomer body 20 as shown in FIG. 1. In the preferred construction, these conductive foils are thin sheets of copper. Each of these conductive foils 16 and 18 includes a patterned series of holes which are generally referred to in this specification as the foil holes 22, 22. The conductive foils 16 and 18 are assembled and molded within body 20, with the respective holes 22, 22 of each of the foils in a generally axially aligned position relative to each other. The body 20 generally includes an exterior wall 24, an interior wall 26, a solid peripheral margin 28, and a plurality of elastic tie-in connections representatively referred to in this specification as tie-in elements 30, 30. These tie-in elements 30, 30 extend through each pair of axially aligned foil holes 22, 22 and connect the inner walls of body 20 at spaced intervals in the manner shown in FIG. 2. These tie-in elements 30, 30 provide the panel switch 10 with a generally "quilted" configuration whenever panel switch 10 is inflated.

The panel switch 10 further includes an inflation valve 32 in communication with the interior 34 of switch 10 as shown in FIG. 2. In the preferred construction, the valve 32 is attached to one of the smaller "quilted" squares at one corner of the panel switch 10 in the manner shown in FIG. 1. The resultant stiffness of this particular "quilted" square of exterior body wall 26 makes it difficult to maintain an open circuit spacing in this square. Therefore, conductive foil 18 does not extend under the "quilted" square containing valve 32.

The conductive foils 16 and 18 are electrically connected to a separate timing mechanism (not shown) by the electrical lead lines 36 and 38, respectively, in the preferred manner shown in FIG. 3.

In fabrication of panel switch 10, the thin conductive foils 16 and 18 may be adhesively bonded to two separate larger uncured sheets of an elastomer material, preferably a suitable rubber compound. These uncured sheets of rubber generally form the interior and exterior walls 26 and 24, respectively, of body 20. These separate sheets are joined together so that the unbonded faces of the con-

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ductive foils 16 and 18 are in contact with each other with their respective foil holes 22, 22 in approximate axial alignment. This assembly is then cured in a suitable mold. During curing the elastomer material fills the foil holes 22, thereby forming on final cure the elastic tie-in elements 30, 30. The cured margins of these elastomer sheets provide the solid peripheral margin 28 that seals the interior portion 34 of body 20.

In operation, the panel switch 10 is inflated by a suitable inflatable device thereby forcing the external wall 24 outwardly in the manner shown in FIGS. 2 and 3, resulting in a spacing of the conductive foils 16 and 18 and an open circuit between lead lines 36 and 38. The panel switch 10 may be maintained in an open circuit condition with only low pressure. The required pressure is determined by the depth to which the switch will be used and any forces resulting from the turbulence of the water. The panel switch 10 and mounting plate 12 are attached to one end wall of swimming pool 14 with panel switch 10 in its inflated open circuit condition.

The electrical lead lines 36 and 38 are connected to a timing mechanism, many of which are known to the art and any one of which would be satisfactory.

In a swimming meet, the swimmer at the end of his race touches the exterior wall 24 of panel switch 10 at the end of his lane. This contact at any point along the "quilted" exterior wall 24, excluding the quilted exterior wall at inflation valve 32, causes the outer conductive foil 18 to come in contact with the inner foil 16, thus closing the electrical circuit of lead lines 36 and 38 thereby automatically recording the swimmer's contact on the timing mechanism.

I claim:

1. An electropneumatic panel switch comprising a generally inflatable body having an inner wall portion and an outer wall portion a plurality apertured conductive foil attached within said body on the inner wall of said body and a second parallel plurally apertured conductive foil attached within the body in the outer wall of said body, means for attaching said inner wall portion to said outer wall portion in spacially opposed relationship wherein

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said attaching means extend in axially aligned relation through said apertured conductive foils, means for positive inflating of said body so that said parallel conductive foils normally assume a spaced relationship wherein the switch is in an open circuit condition, and means for connecting said foils into an electrical circuit to provide a closed circuit whenever said foils come in contact in response to a force acting against the outer wall of said inflatable body.

2. An electropneumatic panel switch according to claim 1 wherein said body includes a plurality of positive and integrally connected elements extending through axially aligned apertures in said opposing conductive foils to retain the exterior of the outer wall portion in open circuit condition when inflated.

3. An electropneumatic panel switch according to claim 1 wherein said body includes a plurality of positively integrally interconnected elements extending through axially aligned apertures in said opposing conductive foils to retain the exterior of the outer wall portion in open circuit condition when air pressure inflated by positive air pressure means.

4. An electropneumatic panel switch according to claim 1 wherein said body includes a plurality of positively integrally interconnected elements extending through axially aligned apertures in said opposing conductive foils to retain the exterior of the outer wall portion in open circuit condition when air pressure inflated by positive air pressure means, said positive pressure effectively holding said opposing conductive foils in open circuit condition against ambient and environmental forces.

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D. SMITH, JR., Assistant Examiner

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,522,398 Dated July 28, 1970

Inventor(s) WAYNE K. HEIMANN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 35 (claim 1, line 2 in application file), "flat" should be inserted before "inflatable".

Column 4, line 8 (claim 1, line 14 in application file), "sadi" should read "said".

SIGNED AND
SEALED

OCT 27 1970

(SEAL)

Attest:

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Attesting Officer

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Commissioner of Patents