United States Patent

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[54] **APPARATUS USING RADIATION SENSITIVE SWITCH FOR SIGNALLING AND RECORDING DATA**
1 Claim, 3 Drawing Figs.

[52] **U.S. Cl.** **250/214,** 307/311, 250/229
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[50] **Field of Search** 250/221, 222, 239, 229, 206, 214; 307/311, 117

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ABSTRACT: An underwater data signalling and recording system which includes an underwater switch in the form of a light source, a photocell, and means for occluding the light source. A modified Schmitt trigger circuit is responsive to the switch to fire an SCR which drives indicating and recording means.

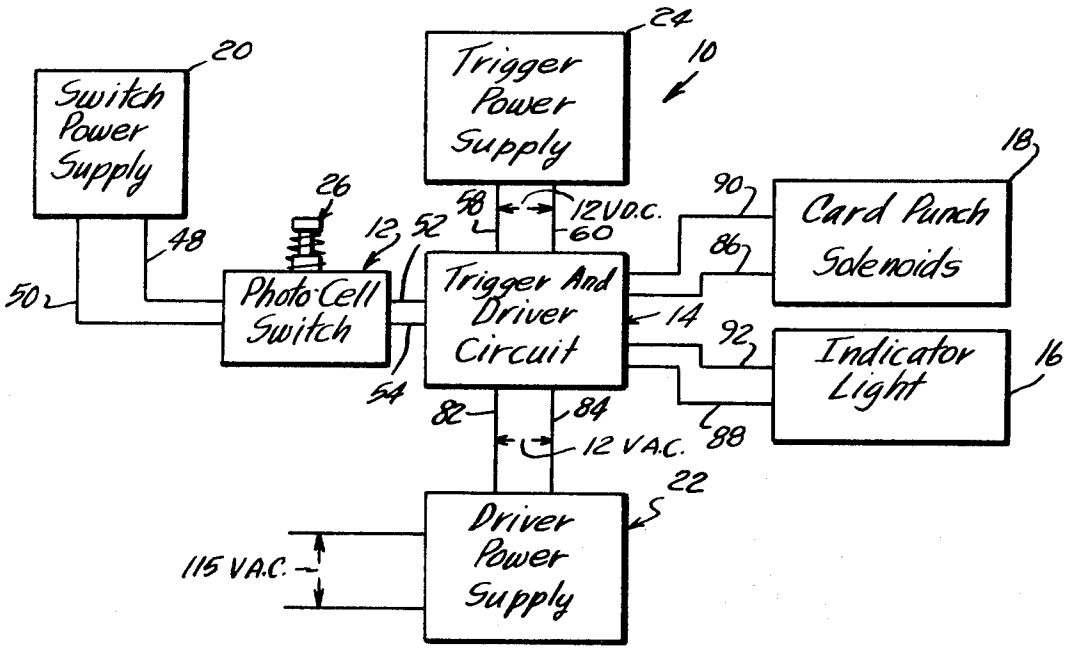


Fig. 1

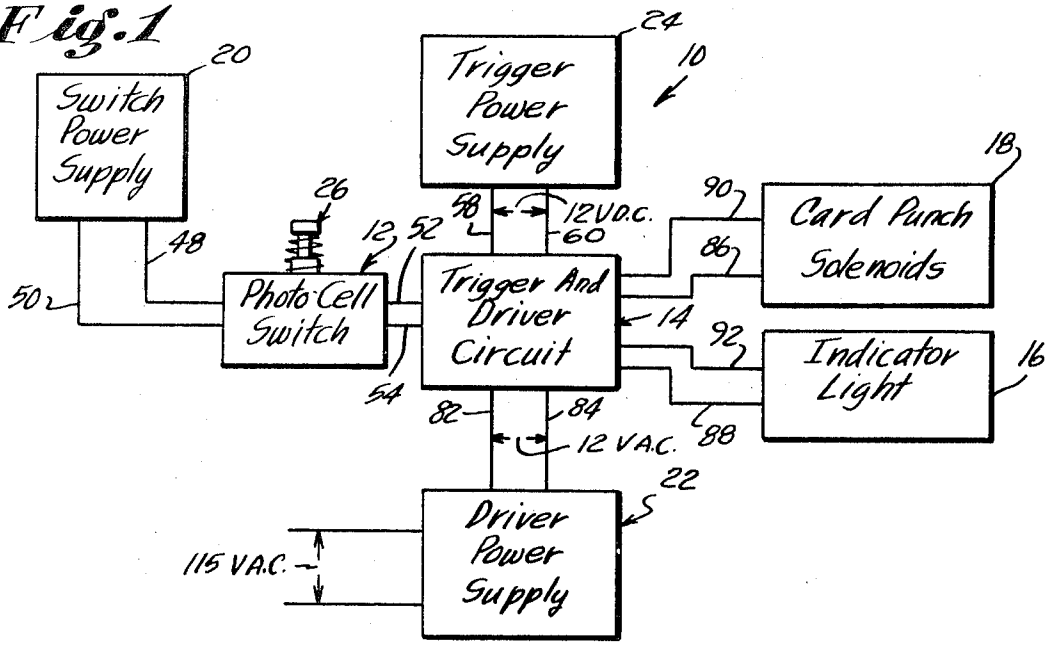
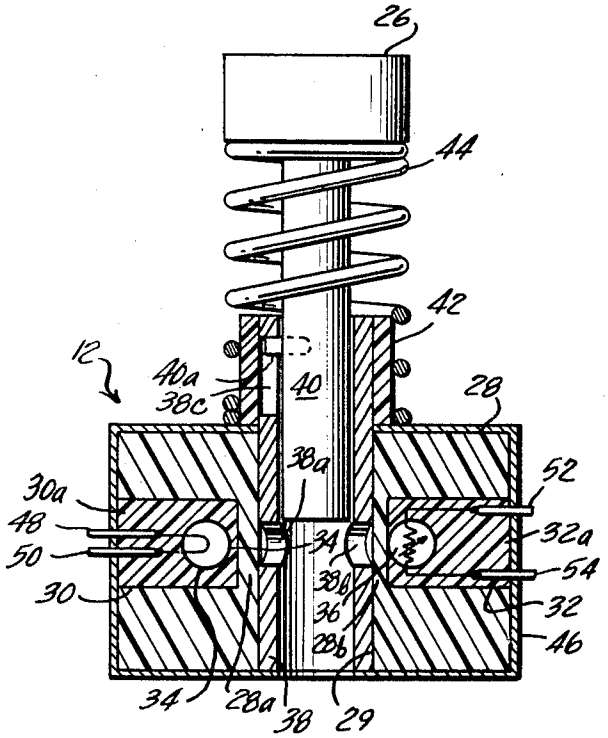


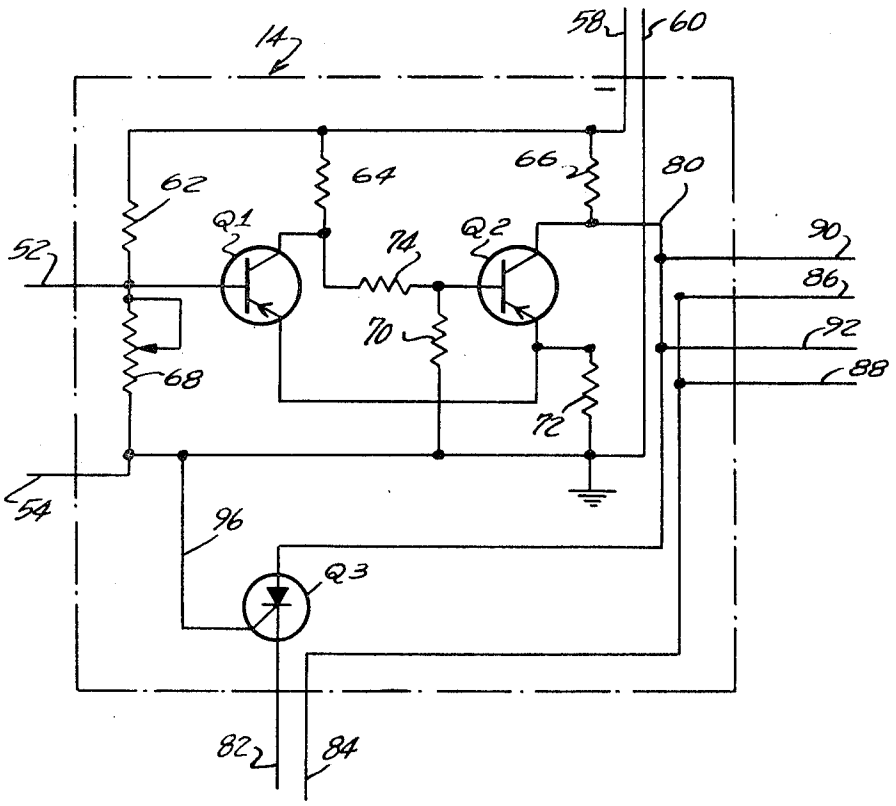
Fig. 2



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Fig. 3



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APPARATUS USING RADIATION SENSITIVE SWITCH FOR SIGNALLING AND RECORDING DATA

BACKGROUND OF THE INVENTION

This invention relates to data collection and indicating means and more particularly to novel apparatus whereby data regarding underwater tests or observations by divers can be reliably transmitted to a surface station for visual display and/or recording as on punched cards or the like.

Heretofore electrical signalling of the type concerned has employed potted mechanical switches which have been prone to leak or to hang as water pressure increased. Moreover, control of indicator lights and/or card punching solenoids requires the use of more electrical current that is desirable to control directly through the use of remote switches located underwater.

BRIEF SUMMARY OF THE INVENTION

With the foregoing in mind, it is a primary object of this invention to provide an improved data collecting and indicating system which is reliable for use in collecting data from divers making underwater tests or observations, particularly at substantial depths.

It is another object of this invention to provide a novel data collecting and indicating system comprising a novel circuit which is a variation of a Schmitt trigger circuit including an SCR (silicon controlled rectifier) for driving a recording means, such a card punching solenoid, and an indicating lamp or light.

Yet another object of the invention is the provision of a novel photocell switch means for actuating the trigger and circuit mentioned above, which switch means comprises a light source and a photocell contained in a watertight body or housing, and a manually operable plunger or shutter for selectively occluding the light source whereby changes in the photocell resistance applied to the driver circuitry will effect desired indication and/or recording.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be further said to reside in certain constructions and combinations of parts whereby the foregoing objects and advantages are achieved as well as others which will become apparent from the following description of a preferred embodiment when read in conjunction with the accompanying sheets of drawings forming a part of this specification, and in which:

FIG. 1 is an illustration in block form of a data collecting and indicating system embodying the invention;

FIG. 2 is a sectional view of the switch portion of FIG. 1; and

FIG. 3 is a schematic illustration of the trigger and driver circuit of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the form of the invention illustrated in the drawings and described hereinafter there is provided a system **10** for recording and indicating data regarding underwater tests or observations made by a diver. The system **10** comprises a photocell switch **12**, which may be carried by a diver to remote, underwater locations, a trigger and driver circuit **14**, an indicator light **16**, card punch solenoids **18**, and associated power supplies **20**, **22**, and **24**.

The photocell switch, later described in more detail, comprises a pushbutton **26** which the diver may push, for example upon the occurrence of an observed event, thereby causing the trigger and driver circuit **14** to energize the indicator light **16** and one or more card punch solenoids **18** forming part of a conventional data compiling apparatus.

Referring now to FIG. 2, the photocell switch **12** comprises a body **28** of transparent material such as one of the well-known acrylic plastics which can be cast or molded and machined. The body **28** is bored to provide a cylindrical central cavity **29** therethrough. The body **28** is further bored from opposite ends, along an axis normal to the axis of cavity **29**, to provide recesses **30**, **32**, on either side of the cavity **29**, leaving wall portions **28***a*, **28***b* between that cavity and the recesses. An incandescent lamp **34** is disposed in the recess **30** and retained adjacent wall **28***a* by a suitable water resistant potting material **30***a* such as epoxy resin or silicone material. A photocell **36** is disposed in the recess **32** and retained adjacent wall **28***b* by a similar potting material **32***a*.

A sleeve **38**, formed of a suitable opaque material such as stainless steel is disposed in the cavity **29**, preferably with a press fit. The sleeve **38** has defined therein apertures **38***a*, **38***b*, aligned with the lamp **34** and photocell **36**. One end portion of the sleeve **38** extends beyond the body **28** and has an axially extending slot **38***c* defined therein.

A plunger **40**, also formed of an opaque material such as stainless steel, is reciprocably received in the sleeve **38** in the cavity **29**. The plunger **40** is limited in its reciprocal movement by a pin **40***a* extending from the plunger **40** into the slot **38***c* of the sleeve **38**. The pin **40***a* is conveniently retained by a collar **42** of resilient material around the protruding end portion of the sleeve **38**. The plunger **40** carries the pushbutton **26** at its distal end and is resiliently urged or biased outwardly of the body **28** by a spring **44** to a normal position determined by the pin **40***a* and the slot **38***c*. In this normal position, light from the lamp **34** is free to travel directly to the photocell **36** via the walls **28***a*, **28***b* and apertures **38***a*, **38***b*. However, pushing the button **26** and plunger **40** inwardly of the body **28** causes the plunger to move in the sleeve **38** in cavity **29** and act as a shutter which occludes the lamp **34** as seen by the photocell **36**.

Because the sleeve **38** in cavity **29** is open to surrounding water, plunger **40** is always operable without regard to increases or decreases in hydrostatic pressure about the switch **12**.

It has been found desirable to apply to the exterior surfaces of the switch body **28** an opaque coating **46** of paint or the like to prevent false signals from the switch **12** when used at shallow depths where penetrating sunlight may reach the photocell **36**.

The lamp **34** is connected by conductors **48** and **50** to the switch power supply **20** which may conveniently be in the form of a battery of suitable voltage carried by the diver.

The photocell **36** is connected by conductors **52**, **54** to the trigger and driver circuit **14** which will now be described with reference to FIG. 3.

In that view it will be seen that the trigger portion of the circuit comprises transistors Q1 and Q2 the operating voltage for which is derived from the power supply **24** via conductors **58**, **60**. The conductor **58**, representing a negative voltage is connected by a resistor **62** to the base of Q1, a resistor **64** to the collector thereof, and a resistor **66** to the collector of Q2. The conductor **60**, representing a positive voltage or nominal ground, is connected by a variable biasing resistor **68** to the base of Q1, by a biasing resistor **70** to the base of Q2, and by a common emitter resistor **72** to the emitters of Q1 and Q2. The collector of Q1 is coupled by a resistor **74** to the base of Q2.

The photocell **36** is connected by conductors **52**, **54** in parallel with resistor **68**, and is of a type which offers a relatively high resistance in the absence of light, and a low resistance when subjected to light. With the plunger **40** in its illustrated position, light from lamp **34** traverses the cavity **29** and maintains the photocell **36** at a low state of resistance. In this initial condition Q1 is operating in a conductive condition and Q2 is at cutoff. Now, if the plunger **40** is moved to its dotted line position shutting off light to the photocell, the resistance thereof is changed. This alters the base/emitter bias relationship sufficiently to cause Q1 to change conductivity regeneratively to cutoff. Simultaneously Q2 changes state from a cutoff condition to a conductive condition.

Change of Q2 to a conductive condition generates a trigger pulse at the collector thereof which is transmitted via a con-

ductor 80 to the anode of an SCR Q3. The SCR Q3 controls the application of 12 volt AC power from the power supply 22 to the card punch solenoids 18 and the indicator light 16.

To this end, Q3 has its cathode connected to one AC power supply conductor 82, the other such conductor 84 being connected by conductors 86 and 88 to the solenoid 18 and indicator light 16, respectively. The solenoid 18 is further connected by conductors 90 and conductor 80 to the anode of Q3, while the light 16 is connected by conductors 92 and 80 to the anode of Q3. The control electrode of the SCR Q3 is connected by a conductor 96 to the ground conductor 60 to complete the circuitry.

When the mentioned pulse is applied via conductor 80 to the anode of Q3, the SCR becomes conductive or "fires" and the AC circuit between power supply 22 and the solenoid 18 and indicator 16 is completed. When the pushbutton 26 is released, the transistors Q1 and Q2 reverse their states terminating the pulse to Q3 permitting it to turn off at the next appropriate half-cycle from the AC power supply.

The variable resistor 68 may be adjusted as necessary to suit operating conditions such as murky water or the like which will enter the switch cavity 29.

While the system 10 has been describing as comprising a single switch 12, single trigger and driver circuit 14, single solenoid 18 and indicator light 16, it will be understood that a plurality of such systems may be combined in a larger signalling and/or recording system.

I claim:

1. A system for signaling and recording data from an underwater environment, said system comprising in combination:

a photocell switch including a body, a light source in said body, a photocell disposed in said body to normally be subjected to light from said source, and actuator means for occluding said light source;

electrically energizable indicating and recording means;

trigger and driver circuit means connected to said switch and responsive to changes in resistance of said photocell to control energization of said indicating and recording means;

said trigger and driver circuit means comprising a Schmitt trigger circuit having the resistive condition of said photocell as a controlling input, said trigger circuit being responsive to a predetermined photocell resistance to generate an output pulse;

a silicon controlled rectifier responsive to said pulse to complete an energizing circuit to said indicating and recording means;

said Schmitt trigger circuit being of the two transistor, common emitter type; and

said silicon controlled rectifier having its anode connected to the collector of one of the Schmitt trigger transistors and to one side of said indicating and recording means, the cathode of said silicon controlled rectifier being connected to a source of AC power, and the control electrode of said silicon controlled rectifier being connected to the emitters of said transistors through a common emitter resistor.