United States Patent

Sharki et al.

[15] **3,698,003**

[45] **Oct. 10, 1972**

[54] **RECORDER ALARM SYSTEM**

[72] Inventors: **Martin J. Sharki; Charles J. Mazoch,** both of Houston, Tex.

[73] Assignee: **Dresser Industries, Inc.,** Dallas, Tex.

[22] Filed: **Sept. 28, 1970**

[21] Appl. No.: **76,141**

[52] **U.S. Cl.**.....**346/17,** 250/231 R, 340/266, 346/1

[51] **Int. Cl.**.....**G01d 13/26**

[58] **Field of Search**.....250/231 R, 230, 234; 346/17; 324/96; 340/266

[56] **References Cited**

UNITED STATES PATENTS

3,349,245 10/1967 Hosker.....250/231

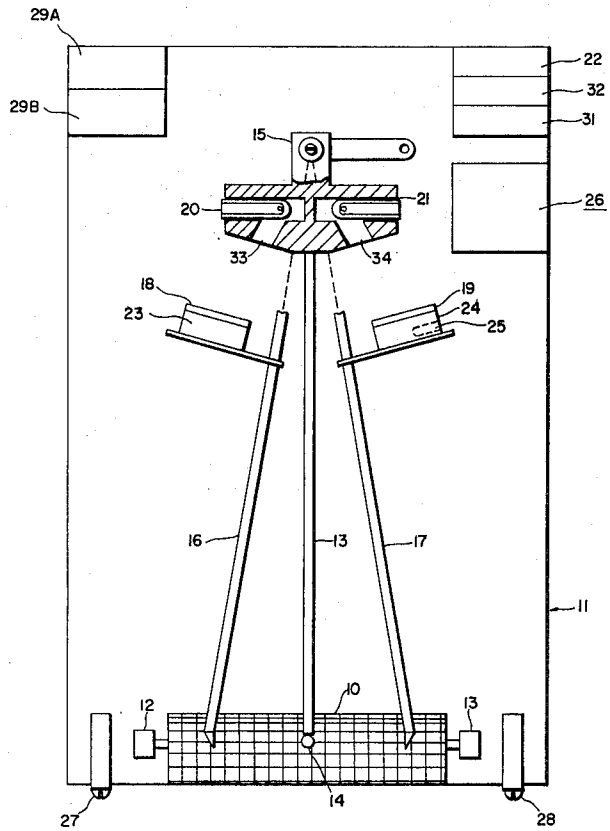
Primary Examiner—Joseph W. Hartary

Attorney—Robert W. Mayer, Thomas P. Hubbard, Jr., Daniel Rubin, Raymond T. Majesko, Roy L. Van Winkle, William E. Johnson, Jr. and Eddie E. Scott

[57] **ABSTRACT**

A recorder alarm system includes a light source mounted on the pen arm. Photovoltaic cells are mounted on adjustable set arms. Heaters maintain the photovoltaic cells at a constant temperature. The intensity of the eight source may be varied by adjustment of a potentiometer.

9 Claims, 2 Drawing Figures



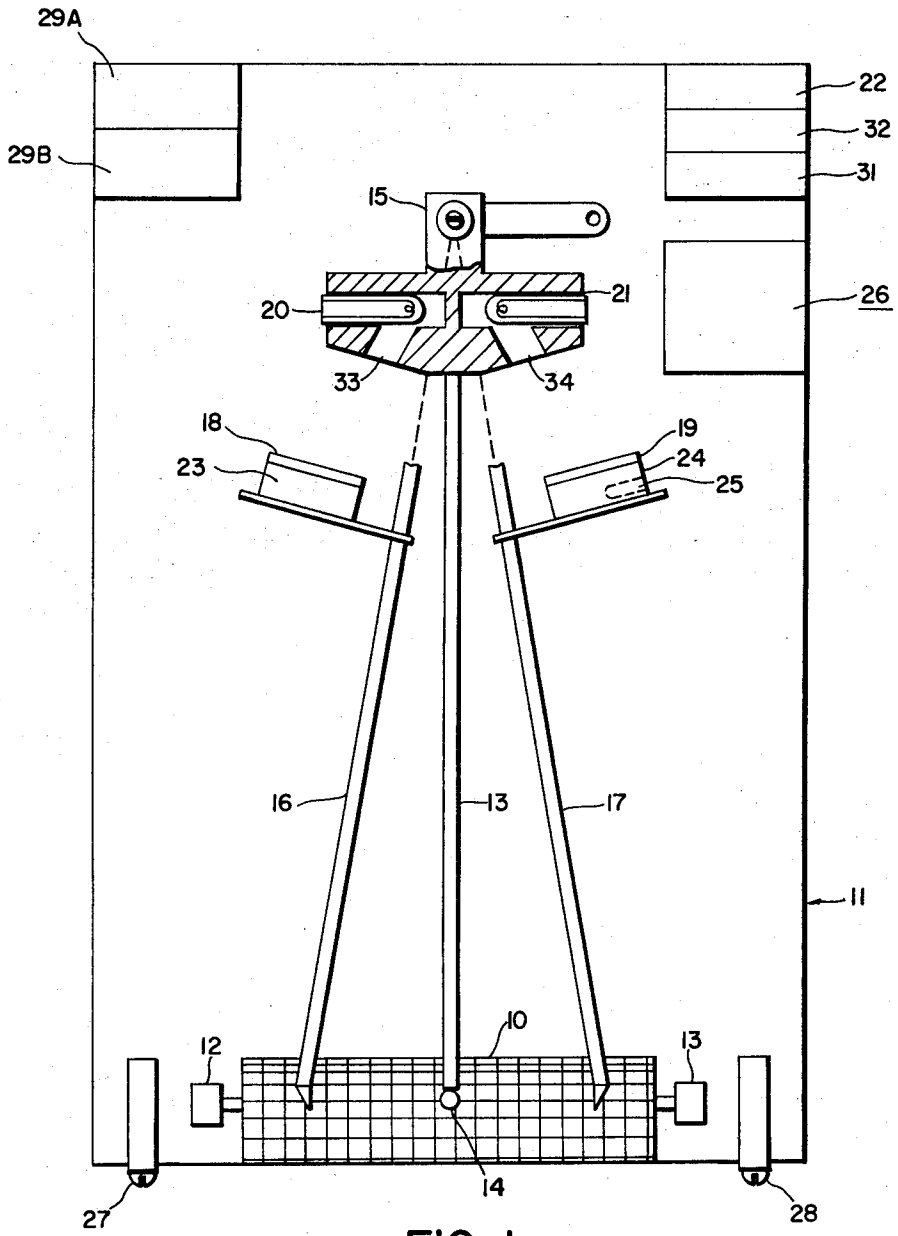


FIG. 1

INVENTOR
MARTIN J. SHARKI
CHARLES J. MAZOCH

Eddie F. Scott

ATTORNEY

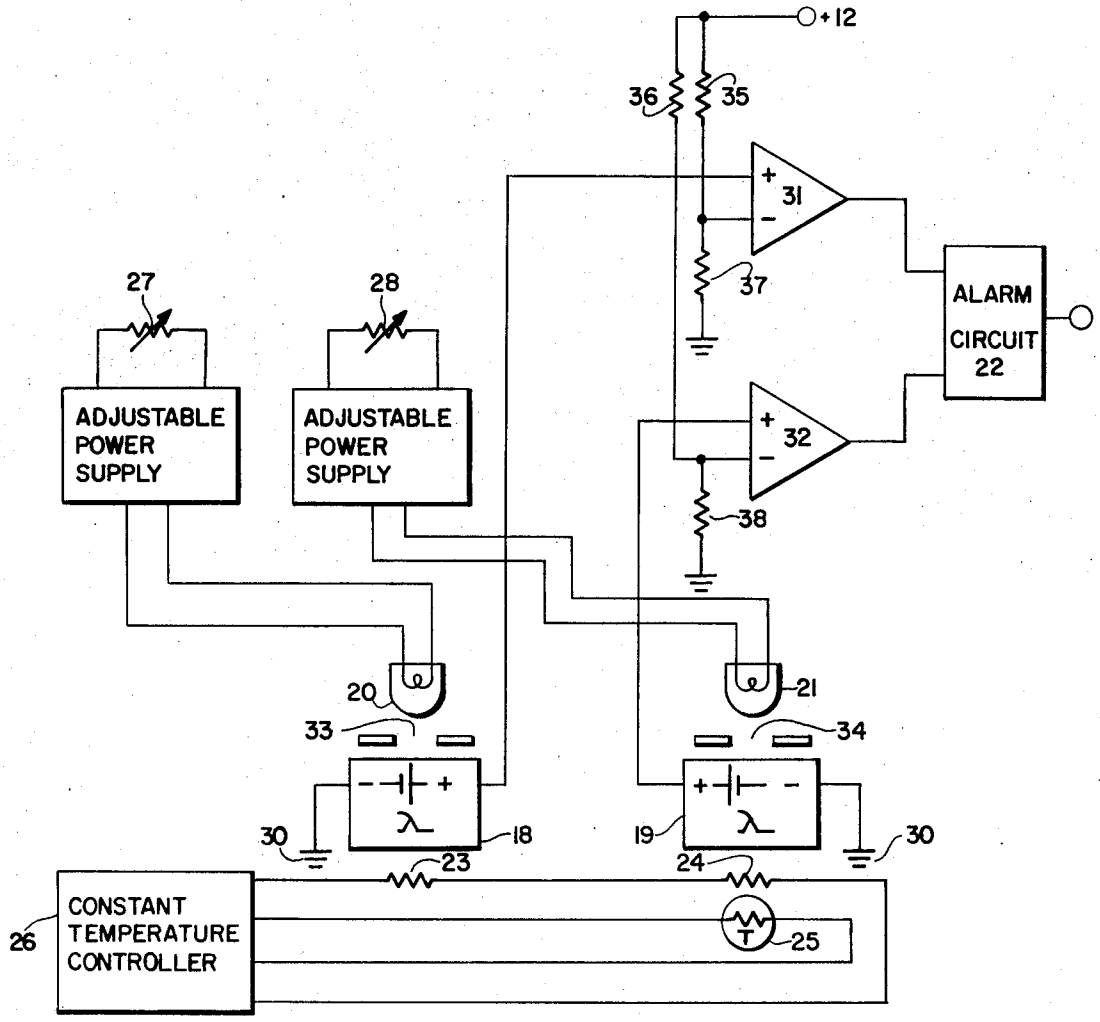


FIG. 2

INVENTOR
MARTIN J. SHARKI
CHARLES J. MAZOCH
Eddie E. Scott
ATTORNEY

RECORDER ALARM SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a recording system and more particularly to an alarm system for a recorder.

Monitoring of various drilling parameters is desirable during the drilling of oil and gas wells. Examples of the various parameters that need to be monitored are mud pit volume, mud weight and percentage mud flow at the flow line. In addition to monitoring the drilling parameters, it is desirable for the system to include an alarm that will be actuated when any of the drilling parameters exceed or fall below preset limits. The set points for these limits should be easily adjustable and not require dismantling of the system. Adjustment of the set points is preferably made from the front of the alarm recorder.

The system should be easily adjustable and provide a high degree of precision in adjustment of the set points. Because of the difficulties encountered with purely mechanical adjustments, it is desirable to include adjustment other than purely mechanical. The operation of the system should be uniform throughout varying environmental conditions.

DESCRIPTION OF THE PRIOR ART

Recorders and alarm systems of the prior art have not included the precision, uniformity and adaptability desired. The prior art systems have required dismantling before the standard adjustments could be made. Operation of the prior art systems was not uniform over the wide temperature ranges.

SUMMARY OF THE INVENTION

The present invention provides an alarm system for a recorder in which one or more set points for the alarm are easily re-set by an operator and which may be brought into accurate calibration with the recording arm by varying the intensity of a light source mounted on the movable pen arm. The set point arms may be adjusted from the front of the instrument. In addition, the intensity of the light source mounted on the pen arm is adjustable from the front of the instrument. The temperature of photovoltaic cells mounted on the set point arms is maintained constant. The alarm set points may be coordinated with the pen arm calibration by moving the pen arm to coincide with any given set point position and varying the intensity of the light source until the portion of its beam which reaches the photovoltaic cell at that position is just enough to activate said cell sufficiently to cause the relay to operate.

It is therefore an object of the present invention to provide an improved alarm system for a recorder.

It is a further object of the present invention to provide a recorder alarm system including a light source mounted on an elongated pen arm and photovoltaic cells mounted on adjustable set point arms.

It is a still further object of the present invention to provide a recorder alarm system including means for maintaining the photovoltaic cells at a constant temperature.

It is a still further object of the present invention to provide a recorder alarm system that may be calibrated by adjusting the intensity of the light source.

It is a still further object of the present invention to provide a method of calibrating a recorder alarm system.

The above and other objects and advantages will become apparent from a consideration of the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a recorder alarm system constructed in accordance with the present invention.

FIG. 2 is an electrical circuit diagram of the recorder alarm system shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1, a single pen recorder alarm system is shown. It is to be understood that the present invention may be embodied in a recording system utilizing a multiplicity of pen arms used for recording various parameters; however, the single pen arm system is shown for simplicity in illustration. A movable roll of recording paper **10** is positioned on a base **11**. The roller holding paper **10** is rotatably mounted by having its end portions positioned in receiving bearings **12** and **13**. The roller is driven by a suitable motor (not shown). A recording pen arm **13** includes a marking device **14** at one end. The marker **14** contacts paper **10** and as the paper is drawn past marker **14**, a record of the parameter to be recorded is obtained. The position of pen arm **13** is controlled by a conventional recording element **15** that receives the incoming signal to be recorded. It can be appreciated that the incoming signal controls the position of pen arm **13** thereby locating marker **14** relative to the scale on paper **10**.

It is desirable to know when the signal to be recorded exceeds a predetermined high value or falls below a predetermined low value. To accomplish this, adjustable set point arms **16** and **17** are provided. The set point arms extend to the front of the instrument and may be positioned at any desired location relative to the scale on paper **10**. A pair of photovoltaic cells **18** and **19** are attached to set point arms **16** and **17** respectively. Movement of set point arms **16** and **17** governs the position of photovoltaic cells **18** and **19**. A pair of light bulbs **20** and **21** are positioned on pen arm **13**. When pen arm **13** has moved to a point that coincided with one of the set points, the light from one of the bulbs will strike the corresponding photovoltaic cell. For example, assume that set point arm **16** denotes the high set point. When pen arm **13** coincides with this set point, light from bulb **20** will strike photovoltaic cell **18**. The photovoltaic cell **18** actuates an alarm **22**.

The output of photovoltaic cells generally varies with temperature. In order to eliminate this possible source of error, heaters **23** and **24** are mounted on photovoltaic cells **18** and **19** respectively. A thermistor **25** measures the temperature near one of the photovoltaic cells and supplies a signal representing temperature to a variable power supply **26**. The variable power supply **26** supplies an amount of power to heaters **23** and **24** to maintain the temperature of photovoltaic cells **18** and **19** constant. By maintaining the temperatures of photovoltaic cells **18** and **19** slightly higher than the highest ambient temperature in which the unit will be operated, a constant temperature system is provided.

The intensity of light from bulbs **20** and **21** may be varied. Potentiometers **27** and **28** allow the electric current from power source **29A** or **29B** respectively, to be varied thereby controlling the intensity of the light source. This allows the alarm set point system to be coordinated into calibration according to the method of the present invention.

Referring now to FIG. **2**, an electrical diagram of the alarm system of FIG. **1** is shown. Light from a source **20** mounted on the pen arm passes through an aperture **33** and strikes the photovoltaic cell **18** as the pen arm nearly coincides with the set point arm, with the maximum total light striking the sensitive area of the cell when the light source, aperture, and cell are exactly aligned. A potentiometer **27** allows the intensity of light source **20** to be adjusted by varying the amount of power from power source **29A**. In a similar manner, light from source **21** will strike photovoltaic cell **19** when the pen arm and set point arm for that photovoltaic cell coincide. Also, the intensity of source **21** may be varied by adjustment of potentiometer **28**. Although the light source is shown mounted on the pen arm, it can be appreciated that the light source could be mounted on the set point arms and the light sensitive elements mounted on the pen arm.

When the negative terminals of the photovoltaic cells **18** and **19** are connected to a common ground **30**, enough light from the source strikes the photovoltaic cell **18**, for example, the voltage output of the cell increases the voltage on non-inverting positive input (+) of the voltage comparator **31** to a level above that on the negative terminal, which activates a relay in the alarm circuit **22** to provide visual and/or audio alarm signals. Similarly, enough light through aperture **34** from source **21** on cell **19** will cause a sufficient change in voltage on the non-inverting positive input (+) of the voltage comparator **32** to cause the relays in the alarm circuit to provide the alarm signals. Since the resistance of resistor **35** is very much greater than that of resistor **37**, the bias at the negative terminal is quite low and a very low output from photovoltaic cell **18** is sufficient to invert the bias of the comparator, and activate the alarm circuit.

The very low voltage output requirement provides excellent voltage stability in spite of temperature changes in the cell. Further temperature stability is provided by a means such as the constant temperature circuit in which a thermistor **25** senses the temperature near the photovoltaic cells and causes the constant temperature controller **26** to adjust the power to the heaters **23** and **24**. The temperature at the thermistor is properly kept slightly above the highest anticipated normal ambient temperature.

The following method of adjustment is used to coordinate the sensitivity of the set points to the calibration of the pen arm of the recorder shown in FIGS. **1** and **2**. Photovoltaic cells are known to change sensitivity with time and to differ one from another, and periodic set point calibration may be necessary. In addition, it may be necessary to replace various elements in the set point system and adjustment will then be required again. The pen arm **13** is positioned near the midpoint of the scale on paper **10** by adjusting the input signal to the recorder. Set point arm **17** which is used as a high set point indicator is positioned to coincide with pen arm **13**. Potentiometer **28** is adjusted to reduce the intensity of light source **21** until the light energy which reaches cell **19** through aperture **34** is low enough that the alarm circuit is not activated and then adjusted the opposite direction just enough to again activate the alarm. The set point arm is then moved to the desired high set point position. Likewise, set point arm **16** is moved to coincide with the pen arm **13**, and potentiometer **27** is adjusted to decrease the light energy from source **20** on photovoltaic cell **18** until the alarm is inactivated and then to increase it until the alarm is just activated. Set point arm **16** is then moved to the desired low set point position. As a recheck of the adjustment, the signal input to the recorder may then be varied to move the pen arm down to the low set point and then up to the high set point and the accuracy of the adjustment is confirmed by operation of the alarms.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A recorder alarm system, comprising:
- an elongated pen arm, having a marking end; means for moving a recording material past said marking end;
- means for moving said pen arm in response to an input signal;
- a light source mounted on said pen arm;
- means for controlling the intensity of said light source;
- an elongated set point arm;
- means for moving said set point arm;
- a light sensitive element positioned on said set point arm for receiving light from said light source when the light source is positioned proximate said light sensitive element; and
- an alarm that is actuated when said light sensitive element receives sufficient light from said light source.

2. The recorder alarm system of claim **1** including a second elongated set point arm, means for moving said set point arm and a light sensitive element positioned on said set point arm for receiving light from said light source when the light source is positioned proximate the light sensitive element on said second elongated set point arm.

3. The recorder alarm system of claim **2** including means for maintaining the light sensitive elements at a constant temperature.

4. For a recorder having an elongated pen arm with a marking end and means for moving a recording material past said marking end, an alarm system comprising:
- a light source mounted on said pen arm;
- means for controlling the intensity of said light source;
- one or more elongated set point arms;
- means for moving said set point arms;
- light sensitive elements positioned on said set point arms for receiving light from said light source when the light source is in approximate alignment with said light sensitive elements; and
- an alarm that is actuated when said light sensitive elements receive sufficient light from said light source.

5. The alarm system of claim **4** including means for maintaining the light sensitive elements at a constant temperature.

6. For a recorder having an elongated pen arm with a marking end and means for moving a recording material past said marking end, an alarm system comprising: a light sensitive element mounted on said pen arm, one or more elongated set point arms, means for moving said set point arms, light sources positioned on said set point arms, means for controlling the intensity of said light sources and an alarm that is actuated when sufficient light from said light source strikes said light sensitive element.

7. The alarm system of claim 5 including means for maintaining the light sensitive element at a constant temperature.

8. A method of adjusting a recorder alarm system having a light source on a pen arm and movable light sensitive elements electrically connected to an alarm, comprising:

positioning the pen arm proximate one of the light sensitive elements to allow light from the light source to strike the light sensitive element, thereby energizing the alarm;

decreasing the intensity of said light source until the alarm stops;

increasing the intensity of said light source until the alarm is again energized; and

positioning said light sensitive element at a predetermined limit point.

9. A method of adjusting a recorder alarm system having a light source on a pen arm, movable light sensitive elements on set point arms that will be actuated when the pen arm with the light source moves proximate one of said light sensitive elements and an alarm that is energized when one of said light sensitive elements are actuated, comprising: adjusting the intensity of the light source mounted on the pen arm so that when the pen arm and a set point arm are coincident, the portion of the light striking the light sensitive element is just enough to cause a response from the element sufficient to energize the alarm and provide an alarm signal.

* * * * *