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"AN ELECTRONIC CONTROL DEVICE FOR AUTOMATICALLY CONTROLING CATHODIC OR ANODIC POTENTIALS FOR THE PROTECTION OF ELECTRICAL EQUIPMENT/INSTALLATIONS".

COUNCIL OF SCIENTIFIC AND INDUSTRIAL REBEARCH, Rafi Marg, New Delhi-110001, India, an Indian registered body incorporated under the Registration of Societies Act(Act XXI of 1860).

The following specification describes the nature of this invention.

PRICE: TWO RUPEES

160088

This is an invention by Kummattithidal Santhanam RAJAGOPALAN, Holavanahally Narayana Rao VENKOBA RAO, Subbiah GURUVIAH, Narayanaswamy KRITHIVASAN, Sivaswamy BIRLASEKARAN, Mugundu Mohanram GURUMOORTHY and Swaminathan KRISHNAN, Scientists of Central Electrochemical Research Institute, Karaikudi-623006, Tamil Nadu, India and all Indian Citizens.

This invention relates to improvements in or relating to electrochemical protection.

Hitherto it has been proposed to use devices such as magnetic amplifier, inter relay circuits for automatic controls.

This is open to the objection that such controls available are not very sensitive and precise and also involves cumbersome and complicated circuits with moving parts which require constant maintenance. In addition, they are very costly and are not flexible for both cathodic and anodic protection techniques and operate only on A.C.

The object of this invention is to obviate these disadvantages by developing desirable automatic SCR control unit for monitoring and controlling the potentials in both cathodic and anodic protection techniques working on either D.C. or A.C. input supply.

To these ends, the invention broadly consists in incorporation of an electronic SCR-DC switch, which will switch on/off the d.c. power (drawn from a lead acid battery charged by solar source) or A.C. power source by comparing the electrode potential, both anodic and cathodic under the present required protection potential value for any system. A highly stable operational amplifier accurately senses the electrode potential and the present potential, thereby sends out a signal for triggering the SCR.

The advantages of the invention are that;

1. the variation of electrode potential from the pre set potential is $\pm$ 3 mV only for both cathodic and anodic protection,
2. the change over from cathodic to anodic and vice versa can be effected with a band switch,

3. the unit is highly reliable for continuous working,
4. the unit can be employed for wide range of current requirement for electrochemical protection,
5. all the components for this unit are indegenously available and can easily be fabricated,
6. the cost of the control unit is very low for mass production and
7. can be very much useful for field applications.

The following typical examples are given to illustrate the invention.

Example 1

Unpainted mild steel panel of size 5 cm x 7.5 cm immersed in 3% NaCl solution at room temperature with graphite as the auxiliary, electrode was cathodically protected for a duration of 6 1/2 hours by maintaining a potential of -0.82 V Vs SCE.

Example 2

Unpainted mild steel panel of size 15 cm x 10 cm immersed in 3% NaCl solution at room temperature with graphite as the auxiliary electrode was cathodically protected for a duration of 7 hours by maintaining a potential of -0.82 V Vs SCE.

Example 3

Uncoated mild steel pipe of 1.25 cm diameter and 15 cm length sealed at both ends and immersed in 3% NaCl solution at room temperature with graphite as the auxiliary electrode was cathodically protected for a duration of 7 hours by maintaining a potential of -0.820 V Vs SCE.

Example 4

Painted mild steel panel (Red oxide) of size 15 cm x 10 cm immersed in 3% NaCl solution at room temperature with graphite as the auxiliary electrode was cathodically protected for a duration of 48 hours by maintaining a potential of -0.820 V Vs SCE.

160088

Example 5

Stainless steel specimen of area 6.25 square cm. immersed in 20% sulphuric acid at room temperature with platinum as the auxiliary electrode was anodically protected for a duration of 96 hours by maintaining a potential of + 0.102 V Vs SCE.

Dated this 13/1 day of January 1983

(I.M.S. MAMAK)
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160088

THE PATENTS ACT. 1970

COMPLETE SPECIFICATION

(Section—10)

" AN ELECTRONIC CONTROL DEVICE FOR AUTOMATICALLY CONTROLING CATHODIC OR ANODIC POTENTIALS FOR THE PROTECTION OF ELECTRICAL EQUIPMENT/INSTALLATIONS".

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg, New Delhi-110001, India, an Indian registered body incorperated under the Registration of Societies Act (Act XXI of 1860).

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed :—

5

160088

This is an invention by Kummattithidal Santhanam Rajagopalan, Holavanahally Narayana Rao Venkoba Rao, Subbiah Guruviah, Narayanawamy Krithivasan, Sivaswamy Birlasekaran, Mugundu Mohanram Gurumoorthy and Swaminathan Krishnan, Scientists of Central Electrochemical Research Institute, Karaikudi-623006, Tamil Nadu, India and all Indian citizens.

This invention relates to an electronic control device for automatically controlling the potentials in cathodic and/or anodic protection of electrical equipments/installations. These find extensive application in chemical industries, petroleum refineries, marine structures for, protection of equipments as well as pipelines, carrying oil, solutions, water, either cathodically or anodically.

Hitherto it has been proposed to use devices such as magnetic amplifier, inter relay circuits, servomotor controls, and SCR controlled units of recent origin operating only on A.C. for cathodic protection on industrial scale and costly and sensitive potentiostats on a laboratory scale for anodic protection.

By using these devices the controls available for cathodic protection are not very sensitive and precise, involves complicated circuits with moving parts requiring constant maintenance, protection against voltage surges and short circuits for reliable operation. Also they are very costly and operate only on A.C., making them non-portable for use in isolated locations. No such industrial controls are available for anodic protection for long term operation.

The main object of this invention is to develop and fabricate an electronic control device for automatically controlling the potentials either for cathodic or anodic protection installations by operating a band switch and working on either D.C. from battery or A.C. input power supply.

It has been found that a silicon controlled rectifier controls the amount of battery DC or Ac power input by switching the current on/off at a fast proportional rate depending on the error between the preset and structure potential automatically, thereby monitoring the output current, to control the desired protective potential.

The device is for automatically controlling the potentials in cathodic protection and anodic protection installations, with either battery DC or AC power supply wherein the electronic control unit consisting of an electronic SCR-DC switch, by comparing the electrode potential either anodic or cathodic, as selected by band switch under the pre-set required protection potential value, displayed by the digital panel meter by operating the SPDT switch for any system, the difference between the preset potential and electrode potential being sensed accurately by a highly stable operational amplifier, thereby sending the signal for triggering on/off the current by the controlling blocks, monitors the required protection potential.

The device of this invention thus comprises of a voltage comparator for comparing the electrode potential with a pre-set required protection potential displayed by the digital panel meter and sends the triggering on/off signals to the SCR-DC for

monitoring the protection potential by sending the required power.

The assembly and operation of the device is further illustrated with reference to the accompanying drawings.

The electronic control device of the present invention consists of an SCR switch (1) for switching on and off the battery DC /AC power supply (2) a voltage comparator (8) for comparing the electrode potential (3) with a pre set required protection potential (5) a displayed by a digital panelmeter (6) The and operated by the single pole double throw (SPDT) switch (7). The selection of the cathodic and anodic potentials is effected by means of a band switch (4) . For any system the difference between the pre-set potential and the electrode potential being sensed accurately by the highly stable operational amplifier (8) thereby sending a signal for triggering on/off, the current by the controlling blocks(9) and (10) Which monitors the required protection potential.

The electronic control device works on D.C. power supply from battery (2)The ON signal from "On controlling block" 9 switches on the SCR (1) and the OFF signal from "Off controlling block" 10 applies a reverse potential for forced commutation, the rate of switching being proportionally controlled depending upon the difference between the electrode potential (3) and the set potential (5).

The electronic control unit can be powered by a lead acid battery charged by familiar sources such as solar energy, wind mills,

diesel generators and the like.

According to the invention, there is provided an electronic control device for automatically controlling cathodic or anodic potentials for the protection of electrical equipments/installations comprising a voltage comparator means (8) for comparing the anodic or cathodic electrode potential of the equipments/installation, one of the input terminals of the comparator being connected to the equipment/installation to be protected the other terminal being connected to a set potential (5) to preset the protection potential of the installation/ equipments at desired level which is displayed in a digital panelmeter (6) by operating a single pole double throw (SPDT) switch (7)the two connections being made through a band switch (4) which selects the type of protection, the out put of the set potential is connected to the input of an electronic control blocks (9&10) the outputs of which are connected to a SCR switch (1) for putting the power, on and off.

According to a feature of the invention the control unit works on the current supplied either DC from a battery or AC input power supply.

According to another feature of the invention selection of the cathodic and anodic protection control unit is done by means of a band switch.

The electronic control unit when incorporated in the circuit with DC from battery or rectified DC from AC power supply for cathodic protection or anodic protection is found to maintain the

otential automatically within ± 3 mV with reference to the set otential.

he following typical examples are given to illustrate the nvention.

Example -1

he electronic control unit was connected to a system of painted ylindrical mild steel tank, (epoxy polyamide) of size 100cm ht x 50cm dia containing 3% sodium chloride solution at room temperature with graphite as anode. The tank was cathodically protected by the control unit which maintained the protective potential at -0.820 volts with respect to saturated calomel electrode by automatically monitoring within ± 3 mV variation for a period of one month.

Example 2

The electronic control unit was connected to a system of cylindrical stainless steel tank of nickel chromium ion alloy (type 304) of size 80cm ht x 20cm dia containing 20% sulphuric acid at room temperature with graphite as cathode. The tank was anodically protected by this control unit which maintained the protective potential at + 0.102 V with respect to copper/copper sulphate electrode by automatically monitoring the potential within ± 3mV variation, for a period of one month.

The main advantages of the invention are as follows:

1. The electronic control unit monitors the electrode potential with reference to the pre-set potential within ± 3mV either for cathodic or anodic protection.

2. The change over from cathodic to anodic and vice versa can be effected by band switch.

3. The control unit is highly reliable for continuous working with short circuit protection and inherent over voltage surge protection.

4. The control unit can be employed for a wide range of current requirements for electrochemical protection.

5. The control unit can be easily fabricated with components available indegenously.

6. The cost of the control unit is very low and amenable for mass production.

7. The control unit can be very much useful for field applications.

8. The change over from mains supply to direct current supply is automatic when the main fails.

11

We Claim:

160088

1. An electronic control device for automatically controlling cathodic or anodic potentials for the protection of electrical equipments/installation comprising a voltage comparator means (8) for comparing the anodic or cathodic electrode potential of the equipments/installation (3) one of the input terminals of the comparator being connected to the equipments/installation to be protected the other terminal being connected to a set potential (5) to preset the protection potential of the equipment/installation at a desired level which is displayed in a digital panel meter (6), by operating a single pole donble throw (SPDT) switch (7)the two connections being made through a switch (4) which selects the type of protection, the out put of the set potential is connected to the input of an electronic IC control blocks (9 & 10), the outputs of which are connected to a SCR switch (1) for putting the power, on and off.

2. An electronic control device as claimed in claim 1 wherein the power source is either DC from a battery or AC input power supply.

3. An electronic device for automatically controlling cathodic or anodic potentials for the protection of equipment/installation substantially as herein described and illustrated.

Dated this 25th day of Jan 1984

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COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

12

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No. OF SHEETS :- 1.
SHEET No. :- 1.

APP. NO.

COMPLETE SPECIFICATION

160088

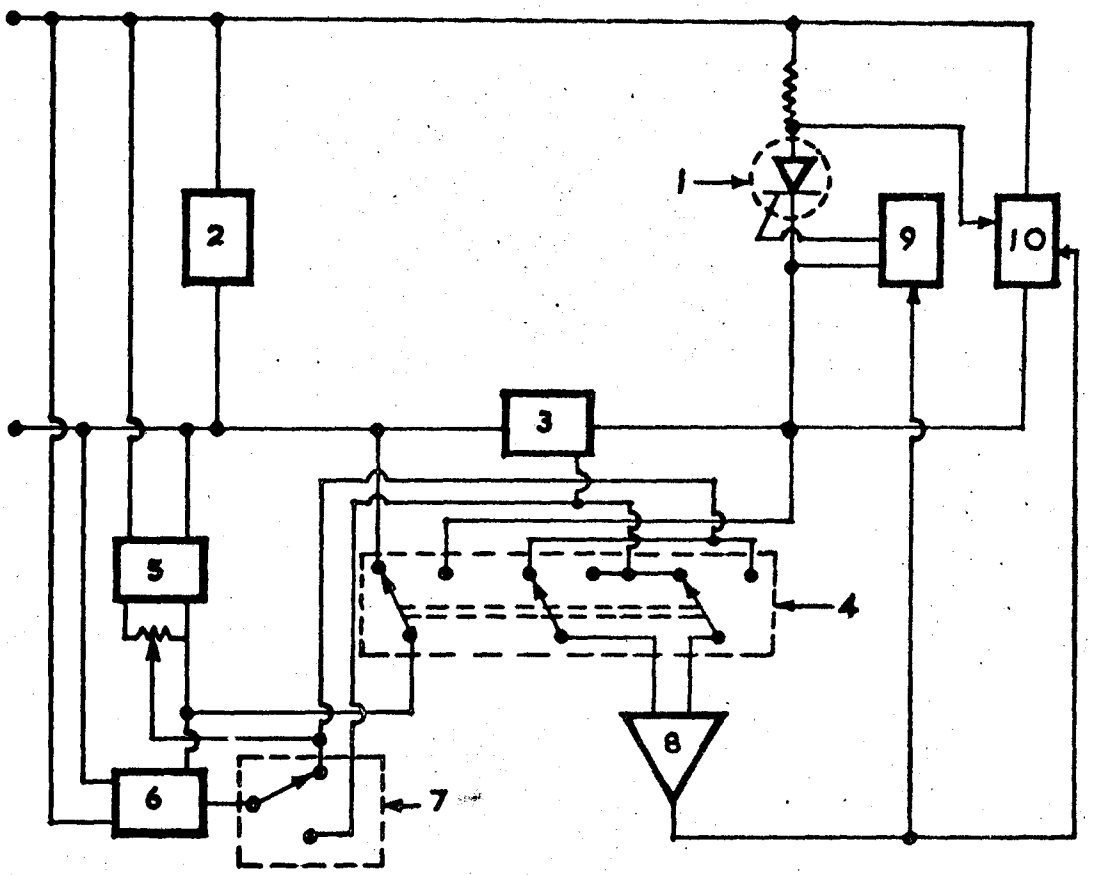

FIG. 1.

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