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(54) Title: REMOTE MONITORING DEVICE FOR DISPOSAL CONDUCTOR CONDITION OF THE OVERHEAD TRANSMISSION LINE

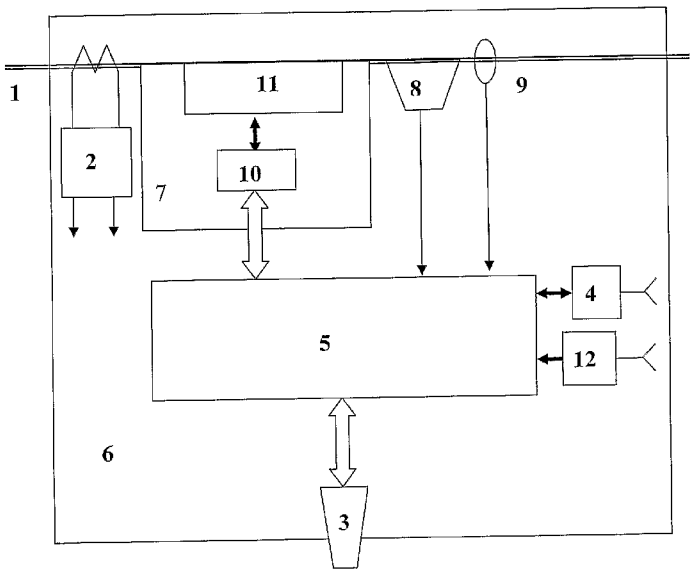


Fig. 1

(57) Abstract: The invention relates to electric power engineering and can be applied for monitoring the condition of overhead transmission line (OHL). Technical result of the invention is the higher monitoring reliability and timely detection of unacceptable condition of conductor in controlled OHL span. The device monitors the condition of OHL conductor (1) and comprises power block (2), ultrasonic or laser range meter (3), unit (4) for wireless data transmission to remote terminal, and processing block (5). Block (5) is connected with range meter (3) and unit (4). Range meter (3) is oriented towards earth or other facilities located under conductor (1). Unit (4) is executed in the form of interface node between block (5) and common cellular telephone channel. Processing block (5) is connected with ice signaling indicator (7), temperature sensor (8) of conductor (1) and current sensor (9) of conductor (1). Signaling indicator (7) is executed in the form of transceiver for 10 encoded high-frequency signals which is connected via linear interface to conductor 1 through connection node 11, and via digital interface to block 5. Such design of signaling indicator 7 enables to equip the device with receiver for 12 standard time signals, eg. satellite global positioning system signal receiver connected to processing block 5.

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Remote monitoring device for disposal conductor condition of the overhead transmission line

Technical area

The invention relates to electric power engineering and can be applied for monitoring the condition of overhead transmission line (OHL) conductors with further transfer of monitoring results to data collection center (eg. dispatch office or control center of power network company).

State of the art

The most important parameters to be monitored during operation of the OHL include conductor clearance (minimum conductor distance to the earth or facilities located under conductors). Conductor clearance below standard value (established for OHL with certain class of voltage) is considered as a dangerous state requiring the implementation of actions to eliminate the causing factor , such as conductor creep, excessive current load, inadmissible ice-loading or dangerous conditions of surface under conductor.

It is known about device for OHL conductor position control which comprises an electronic device – taheometor – located near controlled OHL span. This device combines the functions of theodolite and range meter, and provides measurement of angles and distances without the usage of reflectors [Patent RU2294289, IPC H02G 7/00, 2007].

The drawback of this device is its maintenance inconvenience due to the necessity to move the device and the maintenance staff along the OHL route.

It is known about a monitoring device for OHL that includes the housing configured to be mounted directly to OHL conductor, power unit, and in-housing processing block connected with conductor temperature sensor and wireless data transmission unit [Patent RU2222858, IPC H02J 13/00, 2002]. In this case the conductor clearance is defined by means of calculation using the

conductor temperature data received into device, and the known thermal elongation of this type of conductor. This device is taken as a prototype.

Prototype drawback is an indirect nature of conductor clearance assessment without taking into account the actual conditions of surface in controlled OHL span, and insufficient assessment performance due to the need in additional calculating operations using the conductor temperature data.

Disclosure of the invention

The object of the invention is elimination of mentioned drawbacks.

Technical result of the invention is higher monitoring reliability and timely detection of unacceptable conductor condition in controlled OHL span .

The subject of the invention is a remote monitoring device for overhead transmission line configured to be mounted directly to the conductor of overhead line. The remote device comprises a power unit, a range meter r located to provide for the possibility of orientation towards earth under conductor, wireless unit for data transmission to surface terminal, and processing block connected with range meter and wireless data transmission unit.

The invention has developments and elaborations including the following:

- wireless data transmission unit is designed as interface node between processing block and common cellular telephone channel;
- device is equipped with conductor temperature sensor connected to processing block ;
- the device is equipped with conductor current sensor connected to processing block ;
- the device is equipped with ice accretion signaling indicator with output connected to processing block;
- ice (or wet snow) signaling indicator is executed in the form of encoded high-frequency (HF) signal transceiver connected to OHL conductor

through linear interface , 3and to processing block through digital interface, the processing block being designed to enable the measurement of time interval between transmission and receiving of encoded HF signals;

— device with ice signaling indicator is equipped with standard time signal receiver, eg. satellite global positioning system signal receiver connected to processing block;

Embodiment of invention including its developments and elaborations

Fig.1 shows exemplary embodiment of invention including its developments and elaborations.

The device shown in Fig.1 monitors the condition of OHL conductor 1 and comprises power block 2, ultrasonic or laser range meter 3, unit 4 for wireless data transmission to remote terminal, and processing block 5. Block 5 is connected with range meter 3 and unit 4. Range meter 3 is oriented towards earth or other facilities located under conductor 1. Unit 4 is executed in the form of interface node between block 5 and common cellular telephone channel. Block 5 is executed on the basis of programmable microprocessor controller. The device shown in Fig.1 is placed into the common housing 6 mounted on conductor 1.

Fig. 1 also shows:

— ice signaling indicator 7 with output connected to processing block 5;

— temperature sensor 8 of conductor 1 and current sensor 9 of conductor 1, both connected to block 5.

As shown in exemplary embodiment of invention in Fig 1, signaling indicator 7 is executed in the form of transceiver for 10 encoded high-frequency signals which is connected via linear interface to conductor 1 through connection node 11, and via digital interface to block 5. This design of signaling indicator 7 gives the possibility to equip the device with the receiver

for 12 standard time signals, eg. [4]satellite global positioning system signal receiver connected to processing block 5.

Power block 2 can be executed, for example, as a rechargeable battery equipped with charging unit operating from controlled OHL current (as shown in Fig.1) and/or solar battery.

The device operates as follows.

Device housing 6 is mounted onto conductor in one of OHL spans.

Range meter 3 orientation towards earth or other objects located under OHL conductor is ensured, for example, if housing 6 with range meter 3 is mounted so as to allow free rotation around conductor 1, and the device gravity center is shifted towards range meter 3.

In order to define conductor clearance (clearance to earth or surface facilities under conductor), range meter 3 controlled by block 5 will send ultrasonic or laser pulses towards earth, receive the reflected signals, and define the corresponding clearance (conductor clearance to earth).

The direct measurement of conductor clearance by means of range meter built into the proposed device mounted on OHL conductor allows to monitor the changes of conductor clearance caused by both the conductor elongation, and changed surface conditions (eg., trees, bushes, permanent or temporary illegal installations in OHL span). This provides for the reliable and quick detection of dangerous conductor clearance reduction.

As an option, the device can have temperature sensor 8 of conductor 1 and current sensor 9 of conductor 1. Both sensors are connected to block 5.

When running OHL in heavy ice regions, it's required to control the inadmissible conductor elongation caused not only by conductor thermal elongation due to high current load, but also by mechanical conductor extension due to unacceptable ice deposits. The personnel actions in the first case shall be aimed at the reduction of line current, and in the second case – at OHL disablement and conductor heating (by means of current loads or ice melting facilities).

Therefore the device used in heavy ice regions can be supplied with ice signaling indicator 7 with output connected to block 5.

The data received by the measurement of conductor clearance with range meter 3, by the control of ice formation with alarm unit 7, by the measurement of conductor temperature with sensor 8, and by the measurement of conductor current sensor 9 will be transmitted to block 5 for further processing and wireless transmission to remote terminal installed, for example, in dispatch office or control station of power system.

Data transmission is performed by means of unit 4 executed in the form of interface node (modem) between block 5 and common cell telephone network whose range of coverage includes the device installed on conductor.

Ice signaling indicator available in the proposed device can be executed in the form of transceiver 10 connected through digital input-output (interface) to block 5, and through linear (signal) input-output (interface) to conductor 1 via connection unit 11 (eg. blocking capacitor). Such design of signaling indicator 7 allows to monitor ice formation jointly with similar device mounted on the other side of controlled area by means of defining the delay of encoded HF signal propagation by OHL conductor between devices. For this purpose the processing block 5 is executed so as to count the time interval between sending HF signal into conductor 1 and receiving HF signal from conductor 1. If HF signals are transmitted and received on different ends of conductor 1 controlled section, then time synchronization required for delay measurement can be performed by means of standard time signal receiver 12 connected to block 5, eg. from satellite navigation system (GPS or GLONASS). The details of ice control process based on the measurement of delay related to encoded HF signal propagation in OHL conductor are disclosed in patent [Patent RU 2378751, IPC H02G 7/16, 2009].

CLAIMS

1. Remote monitoring device for overhead transmission line configured to be mounted directly to overhead line, comprising power unit, range meter located to provide for the possibility of orientation towards earth under conductor, wireless unit for data transmission to remote terminal, and processing block connected with range meter and wireless data transmission unit.

2. Device of claim 1 with the unit for wireless data transmission to ewmote terminal is executed in the form of interface node between processing block and common cell telephone channel.

3. Device of claim 1 which is equipped with conductor temperature sensor connected to processing block.

4. Device of claim 1 which is equipped with conductor current sensor connected to processing block.

5. Device of claim 1 which is equipped with ice signaling indicator with output connected to processing block.

6. Device of claim 5 with ice signaling indicator is executed in the form of encoded HF signal transceiver connected via linear interface to overhead line conductor, and via digital interface to processing block which is executed to enable the measurement of time interval between transmitting and receiving of encoded HF signals.

7. Device of claim 6 which is equipped with standard time signal receiver, eg. satellite global positioning system signal receiver connected to processing block.

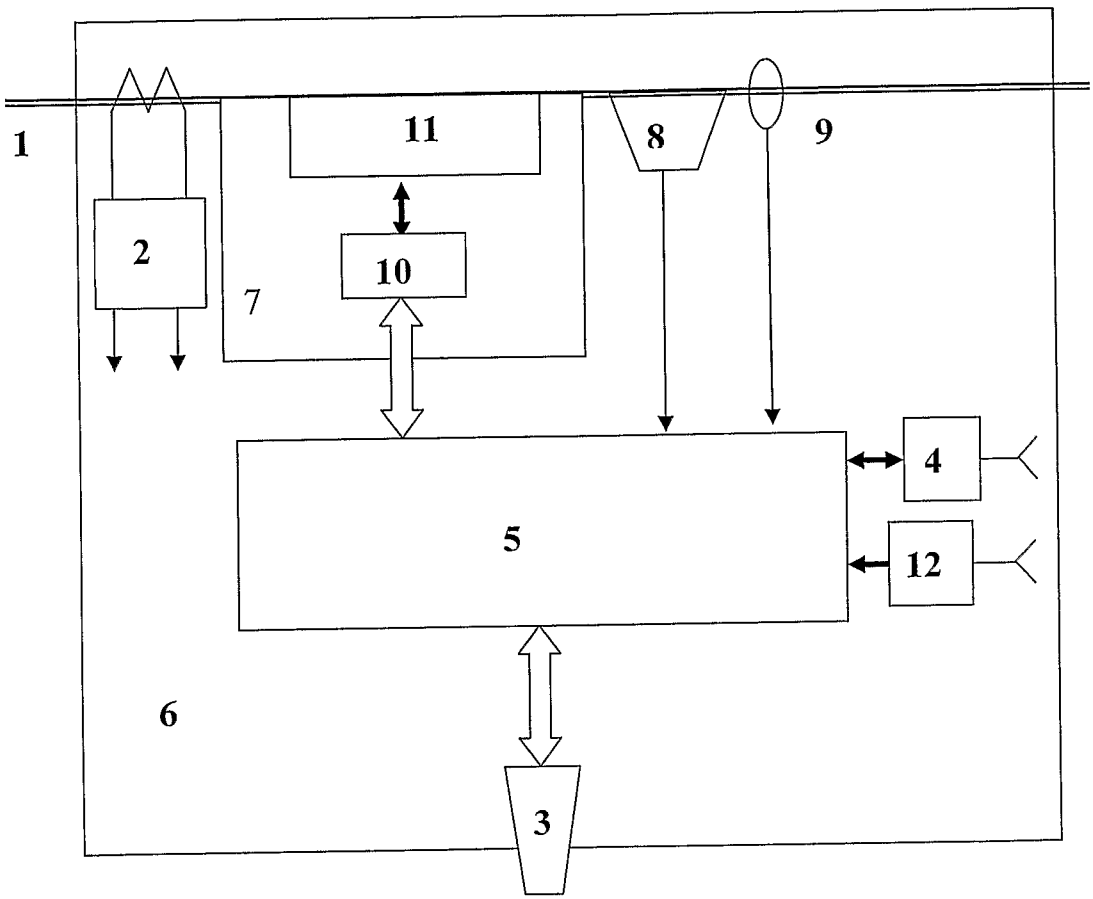


Fig. 1