

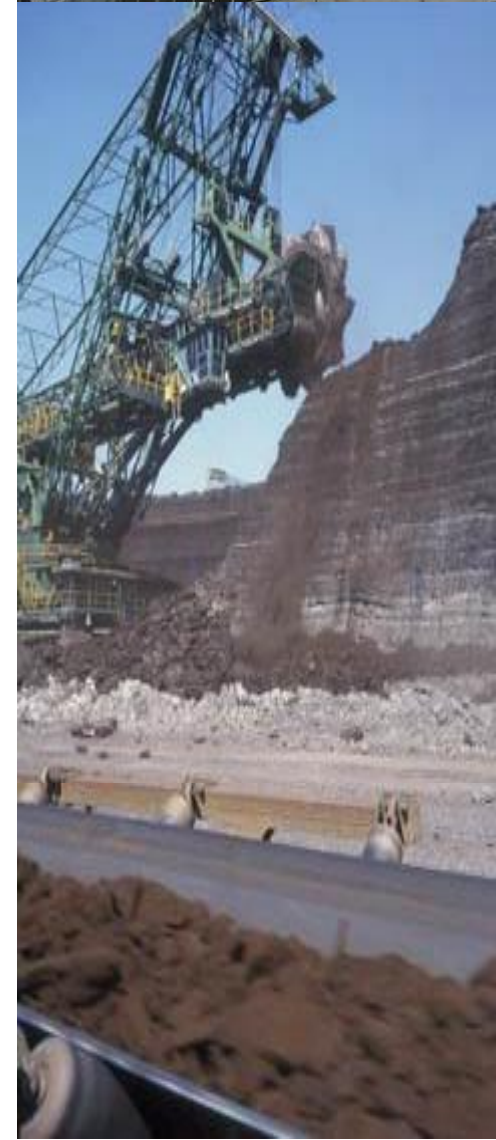
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## **INTRINSICALLY SAFE ELEMENTS OF THE HETMAN ALARM-DISPATCH-BROADCAST SYSTEM**

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**Summary:** The following paper describes the design and principle of operation of the intrinsically safe part of the HETMAN Alarm-Broadcast System. The spark-proof section of the HETMAN system includes the JANTAR telephone signalling devices, the KORAL mining telephones with a dialling keypad and an LCD, intrinsically safe barriers. Attention has been paid to new facilities and additional functions fulfilled by the new intrinsically safe devices.



## **1. Introduction**

In most deep mines it is required to use the intrinsically safe telephone communication systems:

- corporate telephone system,
- dispatcher telephone system,
- dispatch-alarm-broadcast system.

A new solution of dispatch-alarm-broadcast system is the HETMAN [1] system. The commutation part of the HETMAN system is the modified DGT MILLENIUM telephone exchange [1]. The modification includes:

- modification of subscriber translation boards TA 16NN,
- development of a new digital dispatch console with a touch screen,
- development of a new software for the DGT MILLENIUM exchange dedicated to the Hetman system.

The HETMAN system intrinsically safe part comprises with:

- MSI intrinsically safe barriers - individually for each KORAL underground telephone set and JANTAR telephone signalling device,
- Intrinsically safe JANTAR telephone signalling devices,
- Intrinsically safe KORAL underground telephone sets.

The KORAL intrinsically safe mining telephone is a simplified version of the JANTAR telephone without a battery set, ALARM button and lacks the alarm-broadcast functions.

## **2. HETMAN System Underground Intrinsically Safe Subscriber Devices**

The intrinsically safe JANTAR telephone signalling device is shown on Figure 1.



Figure 1. Intrinsically safe JANTAR telephone signalling device

The JANTAR signalling telephone device in addition to elements typical for each telephone set, has the following additional elements have been used:

- battery (with a charging system) to ensure the required volume of voice alarm signals;
- extended dialling keypad (up to 20 buttons + the alarm button) including attendant console and dispatch direct call buttons;
- optional second input system (for a back-up line);
- external data acquisition system.

The specific keys of the extended keypad have the following functions:

- D - dispatch console operator calling in normal mode;
- A - attendant console calling;
- switching the telephone into a "loud speaking" mode;
- C - lower volume (in the "loud-speaking" mode);
- K - cancel - instead of hanging up the receiver to initialise a new connection;
- R - redial - last number redial;
- F- flash
- T - time - speaking clock - when pressed, the user can hear the current time in a loud-speaking mode without taking the receiver off the hook.

The JANTAR telephone signalling device fulfils the required functions of:

- a terminal device (telephone) of a intrinsically safe corporate communication system,
- a terminal (signalling) device of a dispatch-alarm-broadcast communication system.

The JANTAR telephone signalling device has the following additional features:

- Stainless steel casing,
- Extended dialling keypad with an ALARM button,
- Highlighted dialling keypad - the keypad is highlighted permanently in JANTAR telephone signalling devices (equipped with local batteries) and in KORAL

underground intrinsically safe telephones without a local battery - the power consumption of a diode highlighting system and an electronic clock on the front panel does not exceed 30 mW,

- Large, permanently highlighted LCD clock located on the telephone front panel (displaying hours and minutes) synchronized with the exchange,
- more effective earphones (1 for loudspeaking conversation and 2 for broadcasting call and alarm signal),
- No mechanical HOOK, the telephone set input circuit is switched by the permanent magnet on a reed switch inside the casing,
- Display of the call time on LCD.
- Display of the number selected from the dialling keyboard.
- CLIP function.
- strengthened dialling keyboard with a very long mechanical life (over 10000000 operations).
- remote programming the telephone and the telephone signalling device,
- better ergonomic features of handset,
- extra microphone on the front of the JANTAR set.
- clearly visible, separately located (not on the integrated keypad) red alarm dispatch call button.
- special hermetic connection box in the lower part to connect a supply line, sensors and actuators,
- Quick way of opening the connection box by means of eccentric screw locks.
- Signalling of unauthorized opening of the telephone signalling device and the connection box to the dispatcher.

One of the very important features of the HETMAN system is that dispatcher can control the JANTAR or KORAL device, regardless of the handset status (i.e. whether the microtelephone is properly placed on the hook or not). If the handset has not been properly placed on the hook, the telephone is still available to the dispatch console operator. The operator may hang the handset up in the so called "remote" mode and send all the appropriate messages or alarm signals to the device. It is particularly important for the proper functioning of the dispatch alarm broadcast system in a mine in case that the handset is hanged up improperly.

### **3. MSI Intrinsically safe barrier.**

The MSI intrinsically safe barrier is an interface between a exchange subscriber line and a intrinsically safe circuit to a intrinsically safe JANTAR signalling telephone device. It fulfils the following functions:

- the voice signal is transmitted in both ways;
- transmitting the off hook signal to exchange,
- conversion of ring to voltage polarity reverse in intrinsically safe line (criterion of the subscriber call signal emission),
- transmission of FSK signals (for CLIP and time signal).

Figure 3 shows a block diagram of the MSI intrinsically safe barrier. On the exchange side the barrier functionally reproduces a telephone set, and contains of:

- ring signal detector,
- off hook circuit,
- detector of voltage from exchange.

When the call signal is detected the voltage polarization on the MSI barrier output terminals is reversed. Power to the intrinsically safe telephone is supplied from a DC/DC transformer converter. For reason of the presence of the converter, EMC filters are necessary.

In order to reduce the TR1 transformer core saturation a system of constant TR1 transformer neutralization has been applied.

#### 4. Data transmission

An additional functionality of the HETMAN system is the possibility of data transmission from the telephone (JANTAR or KORAL) to a computer on the dispatcher room) and from the computer to the telephone.



Figure 2. KORAL telephone signalling device

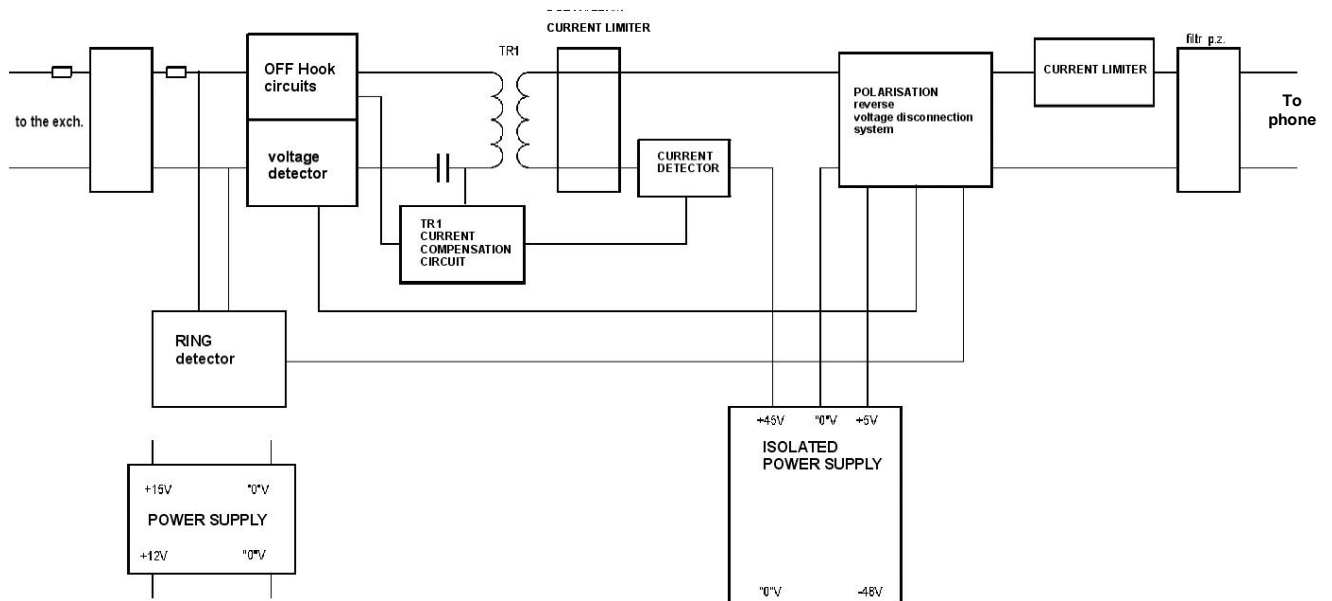


Fig. 3 MIS intrinsically safe separation unit - block diagram.

## **5. Conclusion.**

The JANTAR telephone signalling device and its simplified KORAL version (without battery and alarm button) may be made in intrinsically safe and non intrinsically safe versions. They offer many new functional properties that are of particular importance in the technical environment conditions of the mining underground. The lack of or poor telephone set illumination often hinder localization of the set and the proper number selection. The LCD will substantially improve the comfort of miners' work. In some mines, almost 10% of all calls are connections to the attendant console asking for the current time.

*This paper was prepared during certification tests conducted in the Certification Unit at the Chair of Mining Electrification and Automation of the Silesian Technical University in collaboration with the HETMAN system creators.*

## **References**

1. Brzeski K., Dzierżko J., Wojcieszekiewicz Ł., Wojaczek A.: HETMAN - A New Alarm-Broadcast System for Mining Establishments. Conference Materials ATI'2005, Szczyrk, June 2005.



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