

DYNAMIC INVESTIGATION OF PRESSURE ACTIVATED FIRING PIN FOR MINE-EXPLOSIVE DEVICES

Drage Petreski¹, Elenior Nikolov², Andrej Iliev³, Mitko Bogdanovski⁴

Abstract

In this paper we are going to present the improvements of the dynamic method for examining the membranes of landmines firing pin. The application of the modern measuring equipment provides and allows easy repeatability of a large number of trials of physical processes for which there are not enough theoretical knowledge.

The use of more sophisticated measuring instruments in the existing performed measurement line with adapted device for lighters examination provides an opportunity for even more sophisticated criteria to be used for determining the membranes' quality, which are the subject of our experimentation. The processing of the digitized signal from the process of breaking, gives much more reliable results in terms of resolving hypothetical analytical equations from the theory of elasticity. This work on the problem of the firing pin, gave a right platform for designing a new device for simulation of the pressure effect on the firing pins in order to improve their standardized quality production.

Key words: measuring line, device for firing pin examination, membrane, signal amplifier, analog / digital convertor, software.

1. Introduction

Until recently, examination of lighters in general are made with the static test and deduce the results showed that already produced the corresponding fuse is activated or not according to the prescribed strength of landmine action. Subject to a specific examination of the fragile membranes lighters anti-tank mine-4. The role of the membrane is said to exert control land action on mine that it was designed. From the strength point of view it should resist the random forces with intensity lower than anticipated, and to fall instantly in a fraction of a second under the influence of projected nominal or greater load. When it should be possible to smooth the initial breakthrough combustible mixture.



Fig.1 Membrane a lighter of anti-tank mine

Dynamics test methods are not prevalent, so that the basis of this paper is using the device for dynamic testing of lighters. The following elements constitute the necessary unity of the measuring line dynamic testing of membranes lighters.

- Device for testing of lighters for land mines;
- inductive provider (sensor);

- the signal amplifier (conditioners);
- AD (analog-digital) card;
- computer and software.

2. Measuring instruments

In order sizes of the process followed to register with acquisition hardware they need to be converted into standard electrical quantities (eg voltage: from 0 to 10 V, or electricity: from 0 to 20 mA). So are necessary instruments to perform measurements of non-electrical sizes. The advantages of electric sizes before mechanical and others: the possibility for remote transmission of data, high adaptability, high accuracy and sensitivity, the ability to easily and large amplification, own high frequency, the possibility for simple presentation and archiving of signals. The instruments for electrical measurements of non-electrical quantities are composed of two main parts: the sensor (inductive converter-provider) and a signal amplifier (stabilizer). Inductive converter is used units feature a primary sensor element and an essential element of measure circuit. It performs the transformation of measured size in some other primary electrical size (resistance, capacity, voltage, electricity, etc.).

Inductive converter displacement measured in mm of the lever mechanism of the device testing of lighters have taught as an electrical output analog signal of voltage in the mV of the signal amplifier.



Fig.2 Appearance inductive converter type 10 W

The electrical signals output from the inductive converter-provider to customize and improve entry analogue-digital card through a device called a signal amplifiers. Their function is: amplification of weak signals, signal filtering, isolation between inductive converter-provider and analogue-digital card, power passive sensors, signal linearization, transformation of the electrical signals, complete of the measuring bridge, temperature compensation, multiplexing, etc.

Amplifier MGC system used in the realization of the experimental section as the input signal amplifier which is supplied by inductive converter which is produced in the German company Hottinger Baldwin Messtechnik HBM Electrical measurement of mechanical quantities. Input signal amplifier which is supplied by inductive converter is the order of magnitude mV, while the same signal in the amplifier, out of the system as an output signal of order of magnitude to 10 V.

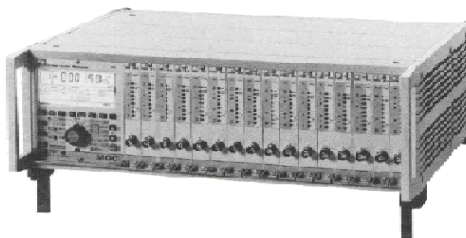


Fig.3 View of amplifier system used for the realization of the experiment

3. Analogue-digital card

Acquisition hardware in the form of a card that is built into the computer on his bus which achieved easy installation and fast communication with the computer. In the following sub acquisition hardware will mean analogue-digital card. The main function of the analogue-digital card is to accept analog voltage signal from the sensors (inductive converter) or conditioners (signal amplifier), to transform into digital form and hand over the computer for archiving or further processing. This is

accomplished by electronic circuits in which analog inputs are selected with the multiplexer to pass through amplifier, circuit to hold and analogue-digital converter, whose output of the digital signal is sent to the computer.

4. New measuring instrument Spider 8, as an alternative to analogue-digital card and amplifier

Spider 8, is an electronic multi-PC, a unit of measurement for parallel, dynamic measurement and data processing by computer. Measurement supported by a personal computer (PC) has a significant role along with computers with measuring devices that are smaller and cheaper. Spider 8 provides design and economical solution for systems containing many components. They are usually located partly in computer and partly outside, which is wire linked and should be configured in the shape of the measuring system. With Spider 8, all that is necessary for measurement is adjusted in the compact body of no more Notebook computer.

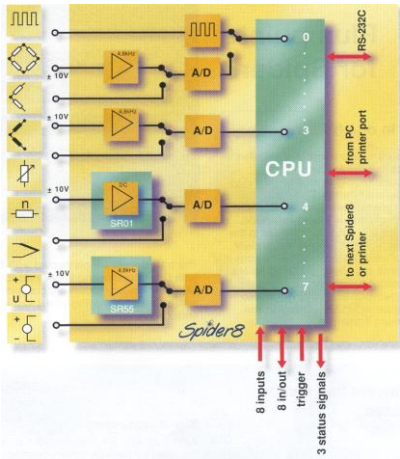


Fig.4 Scheme of input output connections of the measuring device Spider 8

No switches, potentiometers or ports for connection and configuration of analogue-digital card with input/output addresses, the level of interruption or DMA channel also no longer required. Spider 8 simply is connected via the printer port between PC and printer, and then immediately ready for use. Each channel in Spider 8 allows the existence of a passive provider, amplifiers, filters and their analogue-digital converter. All analogue-digital converters operate synchronized and allowing measurements to 9600 per second on any channel with a resolution of 16 bit. The base unit houses four frequency platforms from 4,8 kHz and capable of universal application of the Spider 8 for measuring force, displacement, pressure and other mechanical variables using a measure of load and inductive transducers. Alternatively, two channels can be used as frequency or pulse meters to increase or angular disassemble. There are sixteen digital inputs and outputs, along with an external trigger input, features Spider 8. It can be extended to 8 channels on a single device, or a total of 64 channels.

Signal processing can be performed using the accompanying software but can be done and easy export of data in MS Excel where previously there had already developed applications for the distinctive purpose, as our analysis of the dynamic testing of membranes for lighters.



Fig.5 Prospectus preview of Spider 8

5. Conclusion

The paper shows the improvements of the dynamic method for examination of the membranes of lighters for land mines. The application of modern measuring equipment we provide and allow easy repeatability of a large number of trials of physical processes are not enough theoretical knowledge.

During the preparation of the paper, it was necessary to create certain conditions as a necessary factor for the successful execution of experimental trials and implementation of labor. Emphasis was given to the provision of technical equipment and its properly connection that will provide accuracy, correctness and functionality for activating the lighter in real or actual conditions. The following equipment provides an opportunity for better and more sophisticated criteria for determining the quality of the membranes that were the subject of experimentation. Getting a digital signal from the process of breaking the membranes gives results that are much more accurate and more reliable in terms of solving some equations of the theory of elasticity.

The application of modern measurement methods and instruments provides us with easy repeatability and allows a large number of trials of physical processes for which there is not enough theory knowledge.

Lighter in its construction has little brittle membrane no precise intensity characteristics.

The theory of fracture can not explain the change of resistance which occurs due to differences in thickness of the membranes expressed in tenths of a millimeter. Also lean on leverage on the lighter and place the impact of suppressed axis of lever mechanism of the device for examination of lighters no are always on the same axis, and they affect the moment of breaking tank lighter.

Discontinuity increasing burden of activating the device gives no precise knowledge about the minimum force necessary to break the membrane. Because electric registration of the whole process of movement of the lever mechanism is the ideal medium for the analysis of the results of the examination.

6. References:

- [1] Complete Measurment Solutions, HBM Product Catalogue, 2000.
- [2] Operating Manual Spider8, HBM 2002.
- [3] Softver catman 4.0, HBM 2002.
- [4] Young J.P., Lovell P.A., Introduction to Polumers, II nd Edition, Chapman and Hall, London, UK, 1996.
- [5] Станковиќ К.Д., Физичко техничка мерења – сензори, Београд, 1997.
- [6] Hottinger baldvin messtechnik, Operating manual Amplifier system MGC, Darmstadt, 1996.
- [7] Hottinger baldvin messtechnik, Induktive Wegaufnehmer (Acceleration Tranducers), Darmstadt, 1995.
- [8] Doebelin E., Measurement Systems, New York, 1990.
- [9] Ristic L., Measyrement Systems, New York, 1990.
- [10] Blasting in Ground Excavations and Mines, B. Singh, P. Pal Roy, R. B. Singh and A. Bagchi, May 1993.
- [11] Rotary Drilling and Blasting in Large Surface Mines, B.V. Gokhale, December 2010.