



MINE BLASTING PROCESSES OPTIMIZATION STAGES OF DIGITAL TECHNOLOGY OF DETONATORS

Assistant teacher at Nukus Mining Institute: **Yeshmuratova Amangul Artikbayevna**

Student of Nukus Mining Institute: **Kulmuratova Aliya Janabay qizi**

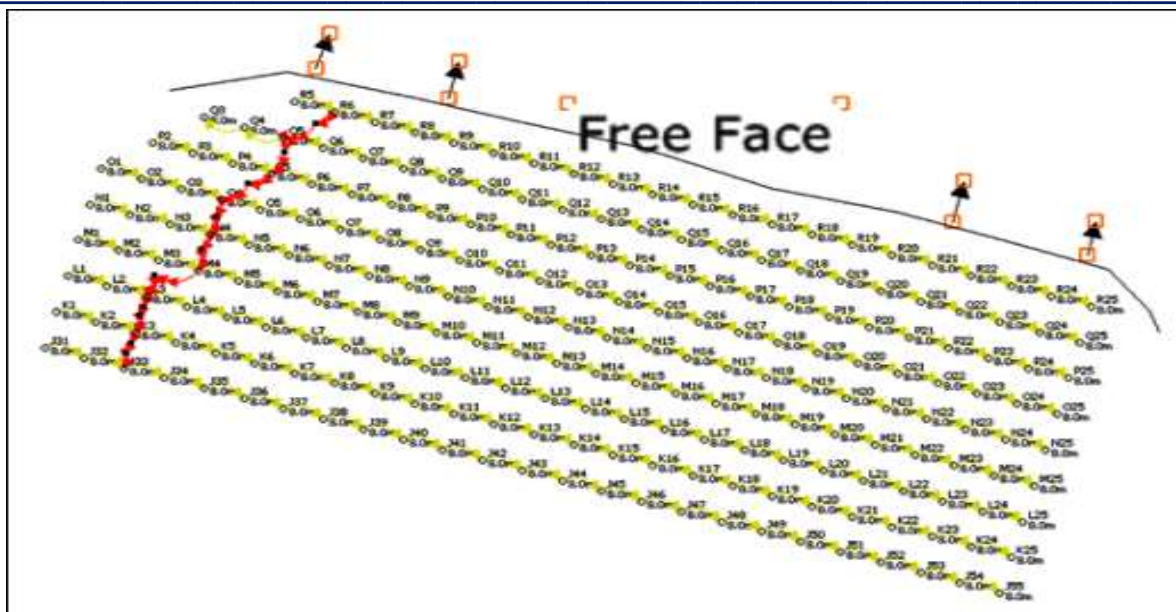
Student of Nukus Mining Institute: **Maulenov Nurlibek Axmet o'g'li**

Master of Karakalpak State University: **Otemisov Ulugbek Sarsenbay o'g'li**

Article history:	Abstract:
Received: 8 th November 2022 Accepted: 8 th December 2022 Published: 11 th January 2023	To improve the efficiency of blasting operations in mines taking into consideration the upgrading of equipment used to charge blastholes as well as application of high-productive mining equipment of new generation. The method of explosive destruction is also widely used in hydraulic engineering, transport and other types of construction. More than 60% of the volume of minerals in mining is extracted with the help of explosion energy, and the volumes of rock mass separated and displaced by explosions amount to millions of cubic meters per year. It has been determined that both sticked and bulk emulsion explosives of Detonator-PP-2 type as well as new options of charging facilities have following technological characteristics: availability of unique space-saving designs of two-component piston dosing pumps of double-action EE components; sufficiently high efficiency of blasthole charging being up to 60 kg of EE/min; ease of service and maintenance; rather long overhaul period of EE components as for the dosing pump as well as cheapness of attachable equipment; availability of both electronic and visual means to control EE preparation and charging.
Keywords: blasting operations, emulsion explosives, equipment, portable charger, charging machines, safety, explosives, electric detonator, non-electric initiation systems, computer numerical control, disk video drive; scalable vector graphics.	

INTRODUCTION

From plain detonators and safety fuse to Electronic blasting system, the commercial blasting has made a rapid stride. In Uzbekistan, mining and other industries initially took a while to accept Electronic Blasting Systems (EBS). Currently, underground mining is characterized by drastic worsening of mining and geological conditions, strict requirements as to labour protection, environment and the entrails of the earth, and vital activity security within a zone of mining objects. The system devices contained transmitter block, which are containing computer monitoring software and Internet modem. The other one is receiver block which is included explosive circuit and their components (i.e., a digital component mobile phone, ICs, and detector). To control the operation steps process used software program written with C++ language. The system was successfully built and designed. Besides that, it could capabilities of components set in the designed circuit. Moreover, the circuit and their components were operated carefully according to program sequence. The results are achieved the general objectives of the research. Also, it was match standards, specified in national standards for performances and appearances of such devices. Methods to prepare producing blocks by means of access ramps make it possible to improve mechanization level of mining operations, blasting operations and non-productive operations; delivery of rock mass, materials and equipment; safe and comfortable way for workforce to leave faces; and to improve the control over ventilation and other technological processes. That is why the improvement of blasting operations in mines while using emulsion explosives and taking into consideration upgrading of extraction equipment, intensification of production processes with the use of self-propelled high-productive mining equipment of a new generation are the scientific and practical problems to be solved urgently. An explosive is a chemical compound, or a mixture of compounds, initiated by heat shock, impact friction, or a combination of these conditions. This, to crush natural resources rocks, which is one of the most accessible and a major basic raw materials. Once explosive material initiated, it decomposes very rapidly in a detonation which could produce a rapid release of heat and large quantities of high-pressure gases. The gases produced expand rapidly with sufficient force to overcome confining forces, i.e., the rock surrounding a borehole.



A total of 521 detonators were detonated during the first blasting operations at the Tebin Buloq mine located on the territory of the Republic of Uzbekistan. Dzhaksimuratov.K and O'telbayev.A employees of the Nukus Mining Institute at the Navoi Mining and Technology University witnessed the mining process. Miners are lost their lives due to a methane and coal dust explosion. An explosion or a mine collapse will result in immediate traumatic injuries or fatalities, whereas a prolonged exposure to coal or silica dust can result in debilitating and fatal consequences for miners over the years in the form of lung diseases. In mining as well as in other hazardous industries, various safety measures exist and can be acted upon to modify the exposure to the inherent risks involved in industries, and promote safety. Various safety factors are considered in installing an explosionproof equipment (also called Ex-equipment) in a hazardous area because of the presence of flammable materials like various gases or vapors, dust particles, or fibers which cause ignition and thus hamper the safety. Accordingly, it is very important to protect operators mining areas by installing a new electrical circuit to ensure safety in development of mineral fields. The prime source of energy initiating devices (detonators), are falling into three basic types (i.e., electric, electronic, and non-electric). In comparison with electric and electronic detonator systems. Electric detonators are traditional systems have been in use in the mining industry for many decades and it's come in several types with the most common being the low firing current variety. The paper applies the integrated research technique involving the analysis of activities aimed at the improvement of the efficiency of blasting operations in mines with the help of emulsion explosives. The technique takes into consideration the improvement of equipment to charge blastholes as well as the use of highly productive mining equipment of a new generation, underground investigations and experimental investigations according to both standard and innovative procedures. Consequently, blasting is the main process, as it establishes the efficiency of all subsequent mining and processing processes. The use of an explosion makes it possible to shorten the design construction time by several times, as well as to reduce the labor intensity and cost of hydraulic structures, transport and other types of construction work many times over. This establishes the scientific interest that is expressed in the questions of the physics of the action of an explosion in rocks, methods of transferring the energy of an explosion to a rock¹. One of the main factors determining the quality of rock crushing is the reliability of operation of the initiation means used in a given time interval. It is known that ensuring the timing of the explosion of some charges or parts of the charges leads to an improvement in the quality of crushing. Unfortunately, the means of initiation do not entirely meet the demand for a reliable holding of the value of the delay interval. Due to the scatter of deceleration values, the moments of operation of adjacent stages of deceleration of short-delayed detonators and pyrotechnic relays can partially overlap, as a result of which simultaneous explosions of several adjacent wells and even rows of wells are quite true, which leads to camouflage, lining, worsening the quality of crushing, the increase in the seismic effect of the explosion and such unpleasant consequences as failures of the explosion.

MATERIALS AND METHODS.

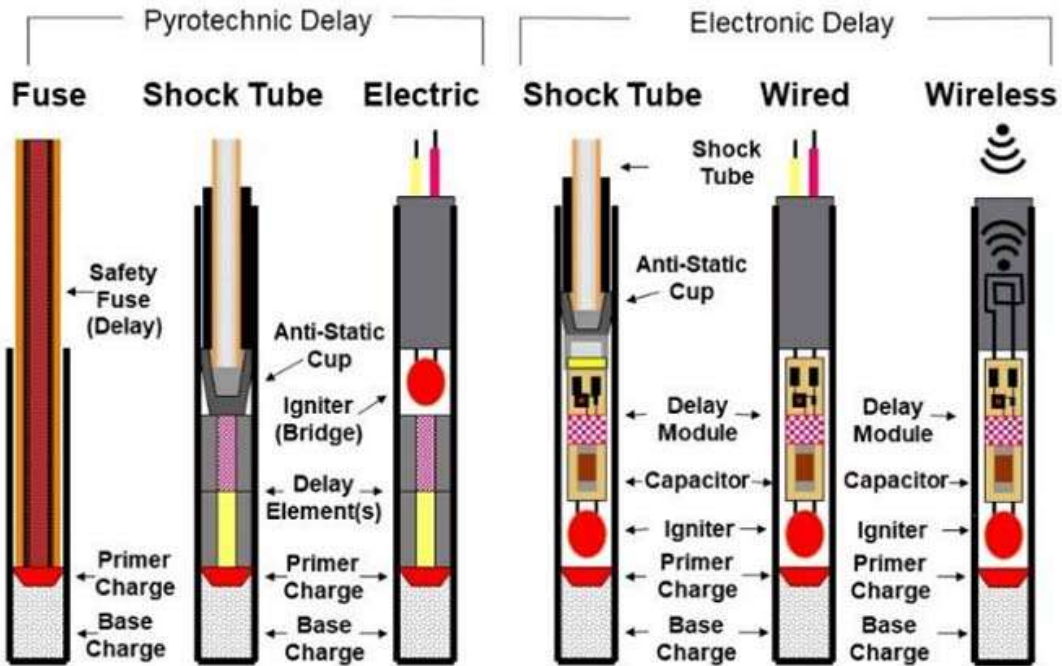
Explosives are generally divided into individual chemical compounds and mechanical compounds. An individual group of the same explosives usually consists of an atom or group of atoms whose molecules are not stable enough to react chemically to form a new, more stable molecule. The molecule of a chemical compound combines with the combustible elements of oxygen atoms by means of a nitrogen atom to form an inert compound with respect to carbon, oxygen, and hydrogen atoms. It explodes when it is sufficiently compressed and its molecules collide.

THE STRUCTURE OF THE PLACEMENT OF THE EXPLOSIVE SUBSTANCE IN THE MINE.

A live-primer is run through within a central part of the stick end by means of a plain detonator; after that, the latter is put in the end part of the live-primer. A loop is thrown to keep vertically for electrical system. In the context of

non-electric system, the stick is rounded with the help of a cord or adhesive tape. If boreholes are loaded with the use charging devices, to prevent a contact between explosives and the well rocks ("into-sleeve" charging), a primer with Ukrainit-P EE is placed "out of sleeve". It is not recommended to use a primer with Ukrainit-P EE without a sleeve while charging dry boreholes with explosives, which temperature is higher than 45°C. In this method used more than 2Km long of copper wires to initiate the detonators. Although, copper wires have excellent electrical and thermal conductivity. But, it is difficult to use the sequential process of explosive detonator in this method, which is very complicated.

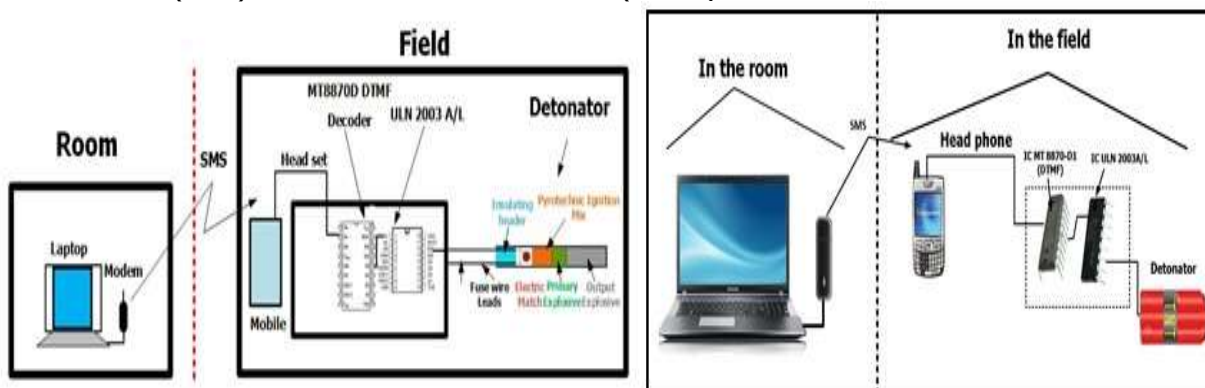
Basic Detonator Construction



Their difficulty is come from costing, risking, and increasing the operation time of the work in the mining place. While, electronic detonators systems are new and continually advancing digital technology for the initiation of blasts in mining operations. Of these, it is better designed mining explosive circuit, by used electronic components to initiate the explosive detonator. Recently, used wireless communication to control signal and explode the detonators. The wireless communication is used to protect mineral operators in mining fields. Accordingly, in installed mining electronic circuit, it better to use wireless communication to control signal, and ensure safety in development of mineral fields. The design ed circuit have some benefits compared with others methods. Such as: control the mining process more safety, saving time, and reducing money because it is cheaper compared to the price of 2Km copper wires. Also, by used designed circuit, can control and initiate more than one detonator in a different position at same time.

TRANSMITTER

The transmitter was including two components or devices as: The first part of the system is a computer (TOSHIBA, processor Intel Pentium dual core and have RAM 2 gigabyte.), which was programmed by used C++ language. The computer was connected with internet modem (3G SIM card) from Sudani Company which use to send accurate (code) as SMS to the exclusive circuit (mobile).



Picture.1 Detonator signals

DETONATOR RECEIVING SIGNALS

The designing comprises major components are shown in picture (1). The IC (ULN2003 A/L), the part is used as an amplifier for MT8870-D1 -DTMF signals and send the new signal immediately to the fuse or detonator. The output signal is capable of sinking 500 mA and will withstand at least 50V in the OFF state. Output signal may be paralleled for higher load current capability. The ULN2003A/L is high voltage, high current Darlington arrays each containing seven open collectors Darlington pairs with common emitters. Each channel rated at 500 mA and can withstand peak currents of 600 mA. Suppression diodes are included for inductive load driving, and the input is pinned opposite the output to simplify board layout. The four versions interface to all common logic families.

RESULTS AND DISCUSSION

As mentioned earlier, this study intends to design of mining explosive system, that's applied in blasting, and their performance in minerals field, considering the operators safety, As mentioned earlier, this study intends to design of mining explosive system, that's applied in blasting, and their performance in minerals field, considering the operators safety, tune in the mobile head set. After a while, the signal trace the circuit wire to IC MT 8870-D1 and reached pin number(2). Digital detonators have been proved very efficient regarding enhancing the performance of blasting. The accuracy, precision, flexibility and methodology of electronic detonators offer enhanced safety, improved productivity and lesser environmental impacts. The improved productivity is in the form of fragmentation control, extraction of blast geometries and preservation of the integrity of the in-situ rock mass. Lesser environmental impacts in the form of less ground vibration, lesser fly rocks, less air overpressure generation. It has also found acceptance in underground tunnelling, with outstanding improvements in terms of advance and overbreak control and has been delivering unique ore recovery and productivity benefits in mass mining. The digital detonator offers an effective and smart tool for flexible initiation sequences to provide new and creative solutions to the mining and construction industry which was never possible before. The signal is obtained weak, then, it sent to decoder built in the IC. As we know the MT-8870D-1 is a full DTMF Receiver that integrates both bands splits filter and decoder functions into a single 18-pin. Moreover, the filter section of IC MT-8870D-1 uses switch capacitor technology for both the high and low group filters and dial tone rejection. IC MT-8870D-1 decoder uses digital counting techniques to detect and decode all 16 DTMF tone pairs into a 4-bit code. Consequently, the coded signal was transferred through MT-8870-D1 pin (Q4) to the fourth item in the electronic circuit, which is IC (ULN 2003 A L) at pin number (1). This IC are used as amplifier item to treat and amplify the signal that is come from IC MT-8870-D1 pin Q4, and send the treated signal (output signal) through in (16) to the last component (fuse/detonator). Furthermore, the output signal voltage is capable of sinking 500 mA, and will withstand at least 5 V in the OFF state. Beside that, the output signal current may be paralleled for higher load current capability. Finally, the detonator are ignited and initiated the explosive material. All process were and started controlled used a software programmed and written with C++ language. Which is used to guide and determine the number of pin in (IC MT-8870-D1), should be uses (such as: Q1, Q2, Q3, and Q4. or uses all in one step). Test results show application of mining explosive circuit can effectively enhance the safety over the mining areas and provide reliable guarantee to ensure orderly development of mineral resources and to protect human and property safety of citizens in these areas. These simple results were obtained (because we are concentrating on the small part of the re-search), which can be taken as practical evidence making usable to controlling in mining explosions. This project is similar to many another project successfully applied in mining industrial.

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