

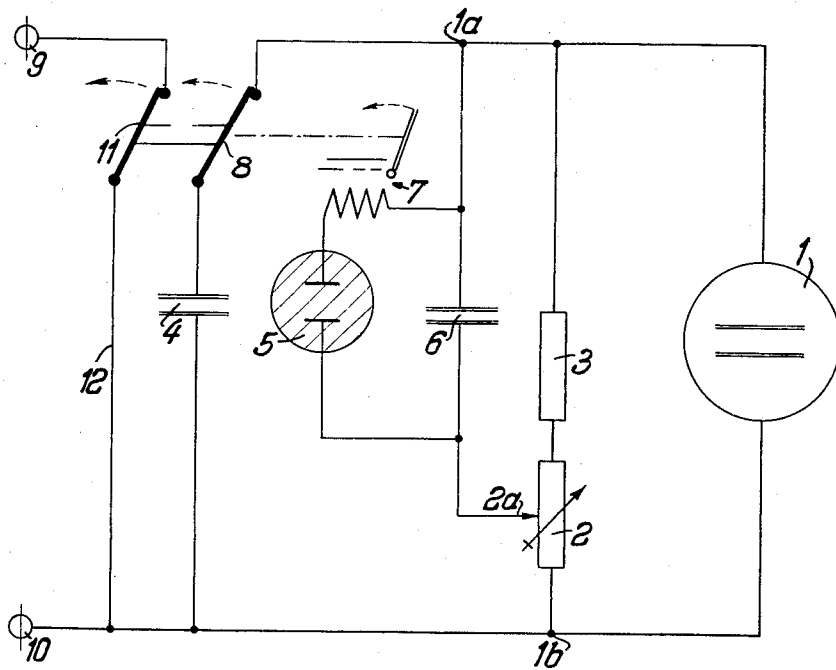
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CAPACITOR BLASTING DETONATING MACHINE

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CAPACITOR BLASTING DETONATING MACHINE

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3 Claims. (Cl. 317—80)

My invention relates to electric detonators as used particularly in mines for priming electrical detonating fuses, wherein a capacitor is first charged by a direct current supply, and subsequently discharged by a timing chain. The conventional capacitor detonating machines are equipped with condensers made of paper or impregnated paper, with stringent insulation requirements in order to avoid loss of the charge during the period of switching for the discharge by the timing chain.

The official regulations prescribe, that the electric detonator has to operate with an ignition-impulse of 5 milliwatt/sec. during a maximum period of 4 milliseconds. The ignition impulse can be transmitted to the timing chain only in case the machine is in the position to perform it, by utilizing inserted time- or power-switches, which bring about the ignition of the fuses independent of errors.

The subject of the invention is a capacitor blasting detonating machine being arranged permanently regenerable, wherein the discharge of the fuses results automatically by way of, for example, a glow lamp and an electromagnetic relay which operates when the glow lamp reaches its ignition potential, characterized by a slide-wire potentiometer and a resistor arranged parallel to a capacitor used for supplying the firing voltage whereby the firing circuit consisting of the glow lamp, the capacitor and the relay, is switched parallel to the tap of the potentiometer, and the firing device connects a switch to the firing lead.

The accompanying drawing is an electrical schematic diagram of such a capacitor blasting detonating machine. Referring to the drawing, it can be seen that a direct-current-voltage-generator 1, which can also be a battery, a spring-loaded generator etc. is connected directly to the fusing capacitor 4 by means of the switch 8. Parallel to the condenser 4 a voltage divider is mounted, consisting of a resistor 3 and a potentiometer 2 having a tap 2a. Between the supply conductor 1a and the variable resistance tap 2a of the potentiometer there is arranged a glow discharge tube-firing device, consisting of the glow lamp 5, the condenser 6 and the relay 7. This firing device operates in the following manner: When the glow lamp ignition tension U_z between the switching points 1a and 2a is reached, the glow lamp ignites and discharges the condenser 6, which is also charged to this voltage, via the glow lamp 5 and the relay 7. In this manner, the coil of relay 7 is operated. The switch 8 is operated by the armature of relay 7, illustrated in the no-impulse position of the relay. 9 and 10 are the two connector blocks for the primer firing circuit.

The condenser 4 is charged by the direct current source 1. In this manner the condenser voltage corresponds always to the voltage across the voltage divider 2, 3, but it can reach only the voltage value which corresponds to the ignition voltage of the glow discharge tube plus the voltage across the lower portion of the

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potentiometer 2. Where the ignition voltage $U_z=75$ volts, the condenser 4 can reach only 75 volts max. voltage when the tap 2a of the potentiometer is connected directly to the switch point 1b. After the ignition voltage, for instance 75 volts, is reached, the relay switches, and the condenser, which has also been charged to 75 volts is discharged by the connection of the switch 8 to the firing lead. When the tap 2a is connected directly to the junction point 3a and the resistors 2 and 3 are equal, the max. attainable potential between 1a and 1b is, as is well-known, equal to $2 \times U_z$. In this case, the condenser 4 is discharged when it has reached twice the ignition voltage, or 150 volts. By variation of the voltage divider conditions, for instance by having resistor $2=2 \times$ resistor 3 the max. potential attainable by condenser 4 would be $3 \times U_z$.

The current passing through the relay winding 7 and the ignited tube 5 operates the switch 8 and connects the capacitor 4 to the connector blocks 9 and 10, so that the capacitor 4 can be discharged through the timing chain.

The invention is advantageous due to the automatic operating and exponential switch 8 operating in connection with the voltage divider and firing system, which permits a discharge by the timing chain only when the charge on the capacitor 4 equals a sufficient fusing impulse. As the capacity of the condenser 4 and the voltage are kept constant during the fusing moment by the specified automatic switching arrangement, the ignition impulse consequently also remains constant, as it depends on the capacity and the voltage. It is assumed that the fusing impulse available at the fuse plus the voltage drop due to specified line resistances between the capacitor detonating machine and fuses is equal to the ignition impulse supplied by the capacitor detonating machine.

A further advantage of the invention lies in the opportunity of providing the variable potentiometer 2 with a scale for choosing the size of the firing impulse in accordance with the number of fuses to be detonated by the impulse. The scale can be calibrated, for instance according to the number of fuses. With the tap 2a on the potentiometer 2 adjusted closer to the point 1b, the ignition potential of the glow lamp will be reached earlier and the condenser 4 will not be charged to its maximum impulse when the tube 5 ignites.

Since the capacitor 4 is continually recharged, it is not important that the condenser have high insulation characteristics. Therefore a very small electrolyte condenser can be used, which is advantageous with regard to price, volume and weight. The same is true of the condenser 6.

The relay 7 is arranged to connect the capacitor 4 to the terminals 9 and 10 by means of the switch 8 only during the positive time of 4 milliseconds. Before and after the ignition switching the firing lead can be shorted by the short-circuiting switch 11 being connected with the breaker 8. The relay 7 can be set to a max. operating period of 4 milliseconds by the well-known time delay devices or the limited time of discharge of the condenser 6.

Instead of the relay 7 there can be used as well a super-quick primer pellet with an explodable priming charge, by which the mechanical work for the operation of the switch or switches is done by the propelling power of the prime charge, for instance, by use of a cylinder-piston-system.

What I claim is:

1. In a blast detonating apparatus, in combination, at least one pair of output terminals adapted to be connected to an electrical detonating device for applying

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a firing impulse thereto; a capacitor connected in circuit with said output terminals; energizing means connected in circuit with said capacitor and adapted to charge said capacitor to a firing voltage to be applied across said output terminals; switching means connected in circuit between said output terminals, said energizing means and said capacitor, said switching means being movable between a charging position wherein said capacitor is charged by said energizing means and a discharging position wherein said capacitor is connected to said output terminals; and a control circuit connected in circuit with said energizing means and said capacitor and including a control member for moving said switching means when current flows therethrough, a parallel combination of a glow discharge tube and a condenser connected in circuit with said control member for initiating current flow through said control member when a preselected discharge potential is applied across said glow discharge tube and said condenser, and voltage adjusting means connected in circuit between said energizing means and said glow discharge tube for preselecting the potential to be applied by said energy means to said capacitor whereby a firing impulse at a preselected voltage through discharge of said capacitor is initiated through said control member moving said switching means between said charging and said discharging positions there-

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of only when said preselected potential is applied to said glow-discharge tube.

2. A blast detonating apparatus as set forth in claim 1, wherein said voltage adjusting means include voltage divider means comprising a series-combination of impedances connected in circuit with said energizing means, one portion of said series-combination being connected in parallel with said parallel-combination whereby the ratio between said preselected discharge potential applied across said glow-discharge tube, on one hand, and the potential applied to said capacitor, on the other hand, is predetermined.

3. A blast detonating apparatus as set forth in claim 2, wherein said series-combination of impedances comprises a fixed impedance portion and a variable potentiometer whereby said ratio is adjustable between preselected limits as desired.

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