# NASA TECH BRIEF

*NASA Headquarters*



## A High-Speed Spectograph Shutter

### The problem:

In some investigations requiring photographic recording (high-intensity plasma studies for instance), it is often impossible to predict exactly when the event to be photographed will occur. In practice, advance indication of an event which requires an exposure time of 10 to 200 $\mu$s may occur from 100 to 200 $\mu$s before the event. Present methods of photographing such events are unreliable, or cause distortion and loss of resolution.

### The solution:

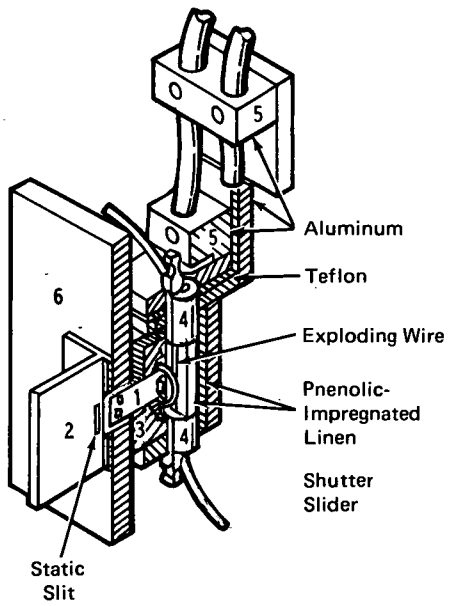
A high-speed, event-triggered shutter uses exploding wires as the driving force. It provides exposure times of 8 to 150 $\mu$s without distortion or loss of resolution.

### How it's done:

The experiment is designed so as to cause the event of interest to trigger a thyraton pulse generator in the shutter system. The thyraton pulse activates a spark-gap switch between three charged capacitors and the exploding wire. As the current pulse explodes the wire, the gases formed drive an adjacent disk in the manner of a piston. Attached to the disk is an aluminum slider with one or more exposure slits. The slider is stopped when the disk strikes a sturdy aluminum block. The accompanying figures depict a cutaway view of the shutter (Figure 1) and a diagram of the electric circuit (Figure 2).

Some advantages of this shutter over those already in existence are:

1. It can operate in a close-open-close mode or can frame several events of 8- to 150-$\mu$s duration..
2. A beam splitter placed behind the static-slit assembly (Figure 1: 1.) allows the use of more than one camera.
3. Each frame in a particular series may be conveniently varied in exposure time and spacing. This can be done independent of other frames in the series.
4. Delay between the initiating signal and the first exposure does not exceed 100 $\mu$s.
5. In the "open" position, the shutter transmits light over a wide wavelength range, as opposed to most electrotropic shutter devices.




1. Shutter slider,
2. Static-slit Assembly,
3. Breech,
4. Electrodes for Securing Wire,
5. High-voltage connections, and
6. Stop for Shutter Slider and Mounting Bracket.

Figure 1. Cutaway View of Shutter Ready for Firing.

(continued overleaf)

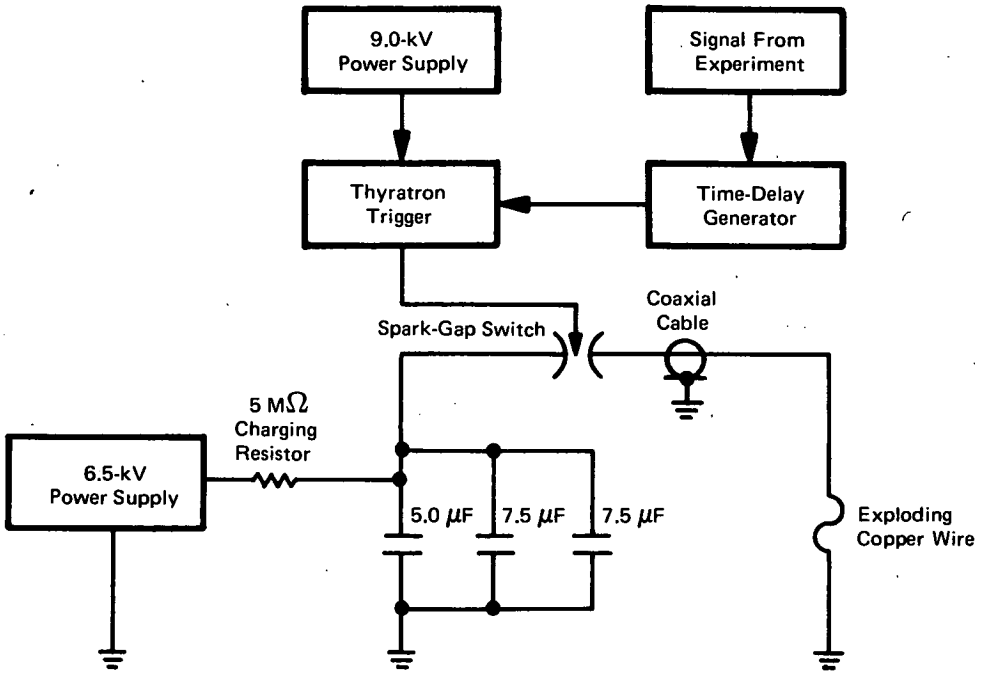



Figure 2. Schematic Diagram of the Electrical Circuit.

**Note:**

The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.95)

Reference: NASA CR-72660 (N70-25512), A High-Speed Spectrograph Shutter.

**Patent status:**

NASA has decided not to apply for a patent.

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