NASA TECH BRIEF

John F. Kennedy Space Center

An Automatic Lightning Detection and Photographic System

The problem:

Each second, on the average, lightning strikes one hundred times in different areas around the globe. This common phenomenon has been studied for centuries by men who eventually developed means of protection against it. While present technology has developed a number of devices to be used for the study of lightning, it is still difficult to photograph lightning at will.

The solution:

An electronically controlled camera is now capable of photographing lightning automatically.

How it's done:

A conventional 35-mm camera, enclosed in a housing, and a lightning detection circuit are the basic parts of the system (see Figure 1). The camera is equipped with a fish-eye lens to view the sky horizon to horizon. Its film advance is motorized so that, each time the shutter operates, the motor advances the film automatically by one frame. To protect it from weather, the camera is placed in a fiberglas housing and covered by a clear plastic dome. The dome supports a small 24-hour clock which is also photographed to indicate the time of day when exposures are made. Aimed vertically skyward, the camera is activated by a signal generated by an electronic circuit every time lightning strikes in the general vicinity.

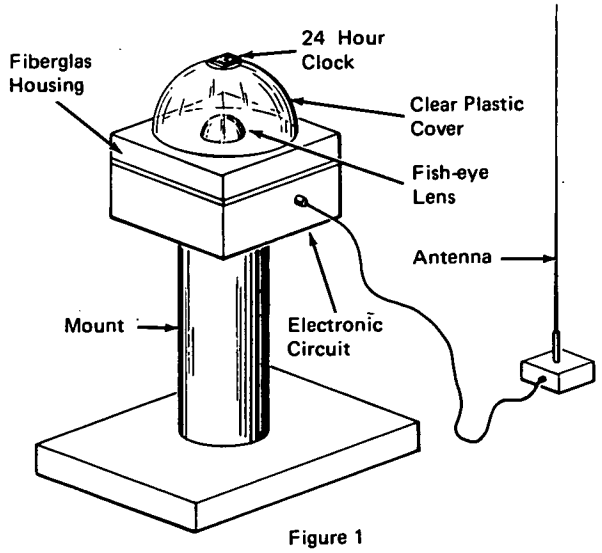

Figure 1

The circuit (see Figure 2) detects lightning by means of an antenna which picks up spherics (atmospheric radio disturbance) signals. Every time lightning strikes, the signal is fed through a voltage divider (resistors R_1 and R_2). Output of this voltage divider is connected to a differentiator consisting of capacitor C_1 and resistor R_3. The differentiator operates as a high-pass filter and rejects dc signals caused by corona current and slowly varying static fields. Coupled to the differentiator is a low gain amplifier A_1 whose input and output are, respectively, tied to two overvoltage protection circuits each containing two back-to-back zener diodes. The amplified signal is fed into a monostable multivibrator the output of which is controlled by the second multivibrator through feedback. The trailing edge of the pulse from the first multivibrator triggers the second one which delays the output of the first for sufficient time to allow the camera to advance the film by one frame. To activate the shutter, the multivibrator output is again amplified (A_2) and fed to the relay coil which energizes and turns on a 12-volt dc power supply. The dc power supply then operates the shutter.

In use, the camera is loaded with a 250-frame 35-mm film. Each exposure, when taken, records a small image of the 24-hour clock which indicates the time when the lightning struck. The azimuth of each lightning bolt is determined by examining the photographs for known land features in the surrounding area. Two camera systems must be used, however, to establish the distance to each lightning bolt by triangulation.

(continued overleaf)

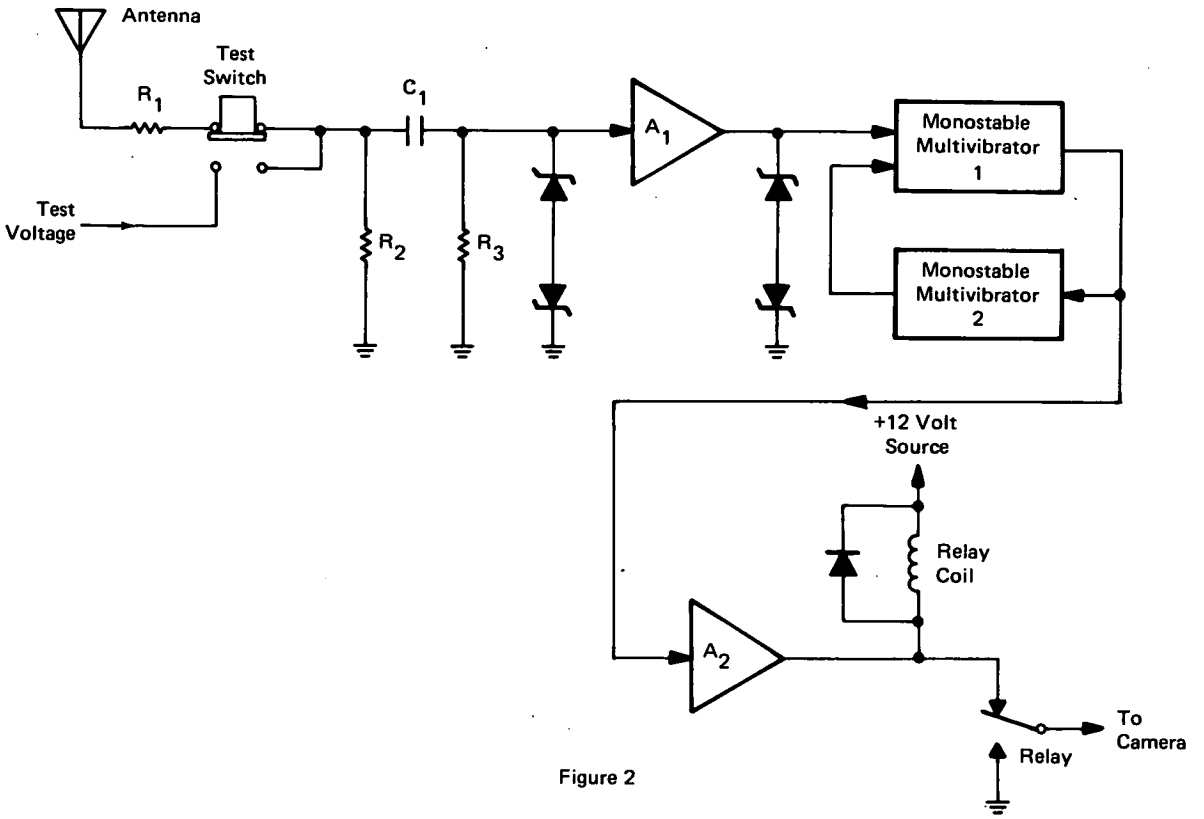

Figure 2

Note:

Requests for further information may be directed to:

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Reference: B73-10043

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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