TECHNICAL NOTE

AN AUTOMATED PNEUMATIC SHUTTER RELEASE
FOR TIME-LAPSE PHOTOGRAPHY

Time-lapse photography is often useful in the laboratory. Movie cameras are used for periodically photographing a subject's orientation to the apparatus or for periodic records of accumulated responses on recording equipment. Variable-speed movie cameras rarely have a speed below four frames per second. Motor-driven attachments, which allow periodic single-frame fixed-time exposures, tend to be expensive (\$300 or more), bulky, and noisy. Most movie cameras do, however, have manual single-frame externally timed exposure, instantaneous internally timed exposure, and remote shutter release as options available at nominal cost. These features offer other opportunities for external automatic control.

In an attempt to make a shutter release for movie cameras that had flexibility for external control, solenoids mounted on the camera were tried initially. However, they proved to be too noisy, and their strong mechanical action was a danger to the internal mechanisms of the camera. The pneumatic device diagrammed below proved to be much more desirable. It consists of a Marvel Airflow-aquarium pump (Magnus Mfg. Co.), bleed valve, pressure tank and gauge, solenoid air valve, heavy gauge rubber tubing and cylinder (DeGroff) fitting to the camera. The pump, bleed valve, pressure tank and gauge can be purchased at most aquarium and pet shops for less than \$30.00. It develops up to 15 psi (10.3 N/cm²) pressure. The solenoid valve is available at plumbing supply houses for \$10.00. The tubing and cylinder can be purchased at any photographic supply house for about \$15.00.

The principle of operation is simple. In the shutter-closed condition, the solenoid valve (4) is normally closed. The pump (1) builds a constant air pressure in the pressure tank (2) which is regulated by the setting of the bleed-valve needle (3). In the shutter-open condition, an electrical pulse opens the solenoid valve (4) allowing air to force the cylinder (5) with its attached plunger against the shutter release of the camera (6). The plunger shaft screws into the shutter release button like any standard remote shutter releaser. The cylinder's operation provides a steady pressure to the shutter release and compensates for bounce due to slight expansion of the rubber tubing and opening of the solenoid valve. It also contains an air hole to allow cylinder retraction after air pressure is cut off by the solenoid valve.

This device works with any movie camera that contains standard fittings for a remotely controlled shutter release and timed exposure control. It allows timed operation of the camera in three modes: (1) timed mo-

tion picture film strips; periodic, (2) timed or (3) instantaneous single framed exposures. In the latter two cases the speed of repetition should be limited to about two frames per second for good accuracy, to allow for cylinder retraction and operation of the film advancing mechanism in the camera.

The system also works with still cameras and other cinematic shutter devices, *e.g.*, tachistoscopes. Presumably it could be used also to replace solenoids in other apparatus where its mechanical and noise characteristics make it more desirable.

The main advantages of the system are: (1) safety—the bleed valve allows pressure control on the camera's shutter release; (2) cost—about \$55.00; (3) versatility—the solenoid valve can be connected to standard programming apparatus for both periodic fixed-time exposures or timed exposures ranging from a fraction of a second to several days; (4) little noise—the main mechanism can be placed up to 20 ft away from the camera; (5) reliability—the system has been used in several experiments without a failure.

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