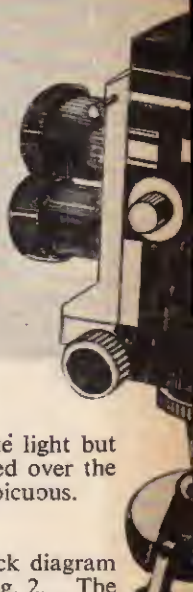
A LIGHT OPERATED CAMERA TRIGGER



By A. FOORD

THERE are frequent occasions when one would like to trigger some apparatus into operation without being present to operate it oneself. Examples of some applications are burglar alarms, counting circuits, photography, and so on.

In photography, a birdwatcher is a special case. All too often the bird, or indeed any animal, can be heard, but one has to wait patiently for some time before it will show its face. In the time it takes to set up a camera to photograph the subject, it could have vanished as unexpectedly as it appeared.

What is required, then, is some device that could be set up in the field ready to trigger the camera without undue loss of time. Such a device is described here and was designed to fulfil the following requirements, bearing in mind the use of the photo-electric principle of breaking a light beam.

1. To respond to the fast or slow movements of birds or animals.
2. To be unaffected by very slowly changing external light, such as daylight.
3. The distance between the light source and the triggering unit had to be as great as possible to avoid the animal scenting the photographer.
4. The unit should be lightweight, portable, and have low power consumption.
5. As most animals are sensitive to white light but not to red, a dark red filter was placed over the light source to render the beam inconspicuous.

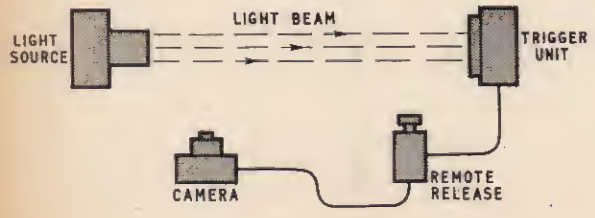


Fig. 1. Diagram of the camera trigger set-up

SHADOW TRIGGER

The system used is illustrated in the block diagram Fig. 1. The complete circuit is given in Fig. 2. The drop in light intensity on the photocell, caused by the shadow of the subject, is used to trigger a monostable multivibrator. A low power lens, such as found in a watchmaker's eyeglass, was found to be suitable for directing the light onto the photocell, in this unit a phototransistor TR1. The eyeglass can be obtained quite easily through large well stocked toolmerchants.

Transistors TR2 and TR3 comprise the multivibrator, and TR4 operates the relay.

Consider at some instant that TR1 is illuminated. When the unit is switched on TR3 will conduct, since its base is returned via R7 to the negative rail. Thus TR3 collector-emitter voltage will be almost zero, and TR2 and TR4 will be cut off. The circuit will remain in this state indefinitely unless compelled to change by an externally applied signal. If the light beam is cut, a negative going pulse will be applied to TR2 base, making TR2 conduct and produce a positive pulse at its collector. This pulse is applied via C2 to the base of TR3, cutting it off. A negative pulse appears at TR3 collector and is applied to TR4 base; TR4 conducts to pull in the relay.

The circuit is now in the second of its two possible states: TR2 conducting, TR3 cut off, but will not remain in this state for long because C2 (which was charged up when it conducted the pulse from TR2 to TR3) immediately begins to discharge through R7 and the output circuit of TR2. As C2 discharges, TR3 base becomes less positive until TR3 conducts again. The circuit is now back in the stable state.

In brief, when the beam is interrupted, the unit changes from its stable state (TR3 conducting; TR2, TR4 cut off) to an unstable state (TR3 cut off; TR2, TR4 conducting) and operates the relay. The duration of the latter condition is given by $t = 0{\cdot}69 R_7 C_2$ seconds.

COMPONENTS . . .

Resistors
R1 18kΩ
R2 3·9kΩ
R3 120kΩ
R4 150kΩ
R5 3·9kΩ
R6 15kΩ
R7 39kΩ
R8 3·9kΩ
R9 4·7kΩ
All 10%, ½ watt carbon

Capacitors
C1 8μ elect. 15V
C2 8μF elect. 15V
C3 0·002μF paper or polyester

Transistors
TR1 OCP71 (phototransistor)
TR2, 3, 4 OC201 (3 off)

Diodes
D1, 2, 3 OA81 (3 off)

Relay
RLA 185Ω 6V type MH2 (Keyswitch Relays)

Miscellaneous
BY1 Battery 6 to 12V
M1 Meter 0–1·5mA f.s.d.
JK1, PL1 Jack with two break contacts and plug
Sockets for wander plugs (2 off)
S1 Single-pole, on/off, toggle switch
Light source (bicycle lamp)
Red filter (Ilford No. 608)
Component tagboard, 10 pairs of tags
Diecast box 6¾in × 4¾in × 2¼in or similar
Watchmaker's eyeglass
Battery retainer and clips
Insulation board, s.r.b.p., 4in × 3in

For the values shown the relay hold-in time is about 0·2 seconds. If this time is not sufficient (in any particular case) it may be increased by increasing the value of C2.

It is usually desirable for the unit to operate with the minimum of time lag, the addition of C3 gives appreciable feedback at high frequencies, and ensures that the rectangular pulses generated at the collectors of TR2 and TR3 are sharp edged, so that the monostable changes state rapidly.

The complete light operated camera trigger control

SIMPLE TO MAKE

The diode D1 may be any small signal type, while D3 prevents the high back e.m.f. from the collapsing magnetic field of the relay from damaging TR4. D2 is inserted to prevent damage if the battery connections are accidentally reversed. Relay RLA could be any 6V type requiring up to 30mA to operate it (see components list).

The construction used for the unit would vary according to the needs of the constructor; a diecast box is ideal for this to exclude unwanted light. Fig. 3 shows the tagboard wiring and tagboard component positions. The photograph shows the layout in the box, this will depend to a large extent on the focal length of the lens used. The one in the prototype has a 2in focal length.

For a lens of short focal length the phototransistor can be mounted on the back of the box as shown, with the lens mounted in a hole in the box lid. The trigger unit is connected to one of the remote camera releases available commercially, these usually consist of a solenoid released plunger, operated from a battery when a contact is made.

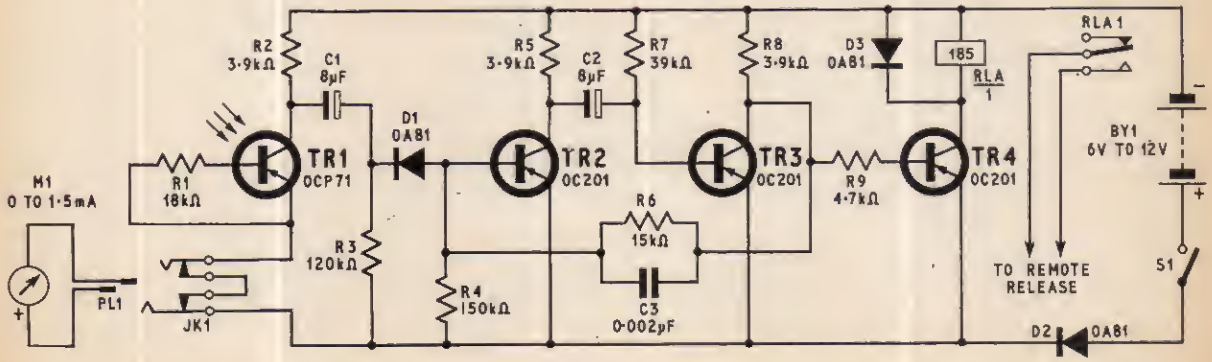


Fig. 2. Complete circuit of the trigger unit

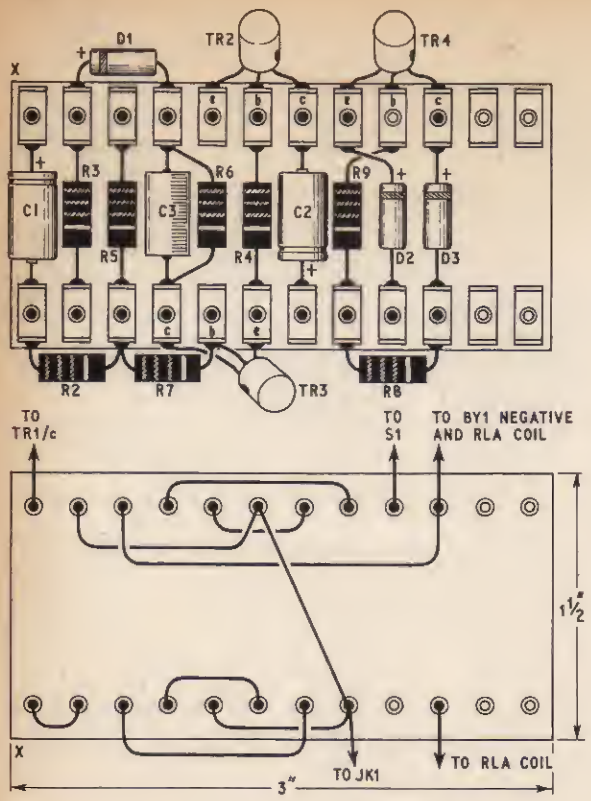


Fig. 3. Component layout and wiring of the tag board in the trigger unit

The meter M1 in series with TR1 is for setting up, and is externally connected via a jack JK1, with break contacts to short the jack when not in use.

The phototransistor is mounted as shown in the photograph so that the emitter junction is facing the lens. This can be seen through the glass envelope and recognised as the side of the base (square piece) with the largest "blob".

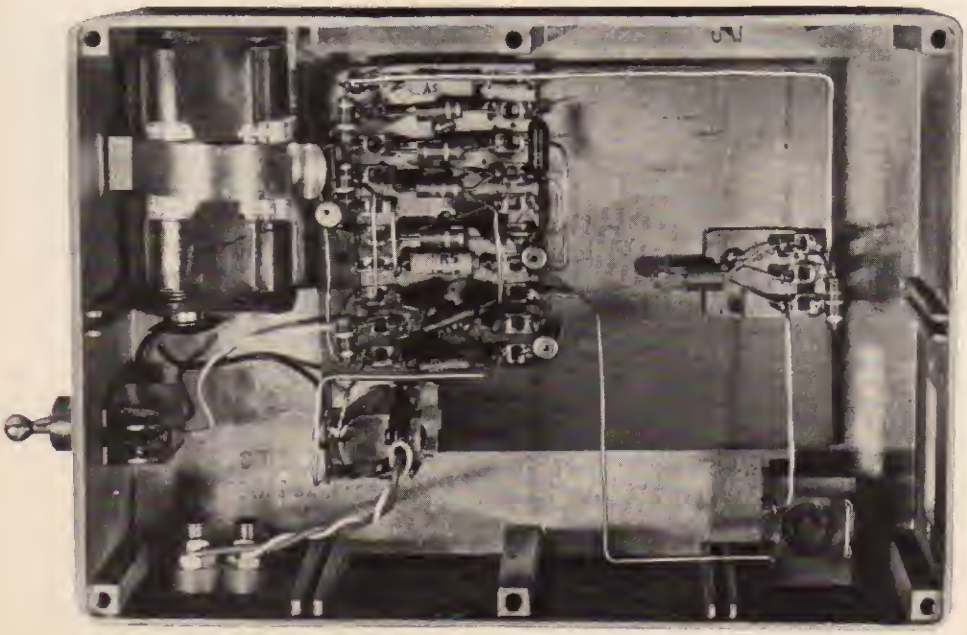
SETTING UP PROCEDURE

Using an ordinary bicycle front lamp, reliable operation can be achieved with a beam length of over 40ft without the filter, and 20ft with the filter. The light source and trigger unit are mounted on camera tripods. The light source should not be run from a.c. supplies, otherwise unreliable operation will result.

Point the light source in the required direction and switch on. Arrange the trigger unit in the path of the light beam and switch on; the leads to the remote release should not be connected at this time.

Swing the trigger unit vertically and horizontally until M1 reads a maximum. Lock the trigger unit in this position; the light is now focused on TR1. For reliable operation M1 should read at least 0·5mA. There is no point in providing enough light to give more than 1mA current, so the intensity of the light source should be adjusted according to the range required.

Remove the meter from JK1. Now, by passing the hand through the light beam you should hear the click of the relay. The output sockets can be temporarily connected to an ohmmeter, or a series bulb and battery, to ascertain that the relay is actually switching. If all is in order, connect the remote release to the trigger unit and all is ready for photographing, provided the camera is aimed at the light beam, where the subject will be. ★



Interior view of the trigger unit showing layout of all components and interconnecting wires. Note the positioning of the phototransistor must line up with the lens mounted on the lid.