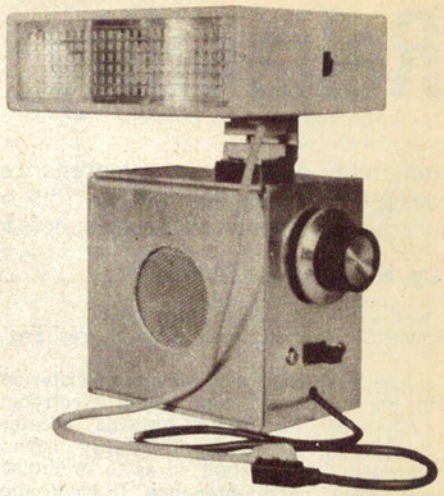
SOUND TRIGGERED PHOTO-FLASH



Here is a simple and easily built little unit which will trigger an electronic flash gun in response to a sound or noise. Because of its high sensitivity it can be used to obtain dramatic stop-motion shots and a variety of other photographic tricks.

by W. LANGLEY

Many readers will have an interest in photography as well as in electronics and the device described here will enable some interesting and unusual shots to be taken. The total cost of building the sound triggered flash unit described here is not high and money will not be wasted even if only a few shots are attempted. Note that this device is only suitable for electronic flash guns and although it should be possible to arrange for the SCR to apply a voltage to a flash bulb, this has not been tried.

Those who have commented on the unit have suggested that it could have applications as a burglar alarm; the sensitivity can be set to such a level that a flash will be produced by the noise made by a burglar. This should certainly be a strong deterrent and it has few of the disadvantages of the conventional type of bell-type burglar alarm since accidental triggering will not be so objectionable or so serious. If this is attempted a mains power supply giving 9V DC will be needed for the trigger unit as the batteries will not last all that long under continuous operation.

The sensitivity of the unit is variable over a considerable range, a feature very necessary for a device of this type.

The complete circuit is shown in figure 1 and is basically a DC coupled amplifier. Instead of a conventional microphone, a small high impedance loudspeaker is used in reverse as the transducer. This is very sensitive and rather cheaper than a microphone. However, this has to be coupled to a low impedance input to provide a decent match and so it is connected to the emitter of a common-base transistor configuration. The typical input impedance of such a stage is about 50 ohms and so a good match is achieved; there is also high voltage gain in such a stage.

R1 acts as the collector load and the signal is applied directly to the base of TR2 which is arranged as a conventional common-emitter amplifier. Base bias for Tr1 is taken from the emitter of Tr2 via R2. C1 stabilises the base voltage of Tr1 and C2 decouples R3, so preventing negative feedback from reducing the gain. By arranging the base bias for the first transistor in this way, DC stabilisation is achieved.

The collector load of Tr2 is VR1, a 100ohm wirewound potentiometer; by varying this the bias level for the third transistor is controlled and this effects the sensitivity. If the value of VR1 is very low, Tr3 will only conduct when relatively high currents pass through it. If VR1 is set to such a level that Tr3 is nearly conducting, the slightest increase in current will switch it on.

The collector load of Tr3 is R5 and it is the voltages developed across this that control the operation of the circuit.

PARTS LIST

1 Case, as described.
1 Loudspeaker, 25-80 ohm miniature type.
1 Slider switch, on-off.
1 Miniature 9V battery and connector lead.

RESISTORS

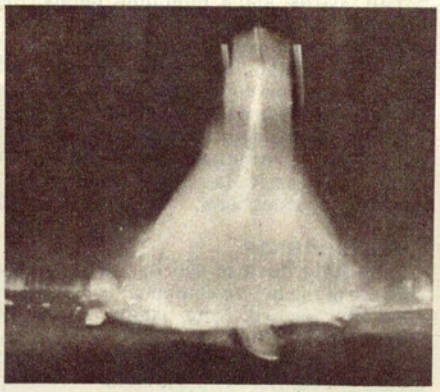
All 1/8, 1/4 or 1/2 watt, 5 or 10% type.
1 x 47 ohm, 1 x 330 ohm, 1 x 470 ohm, 1 x 1K, 1 x 10K, 1 x 68K 1 x 100 ohm wirewound pot.

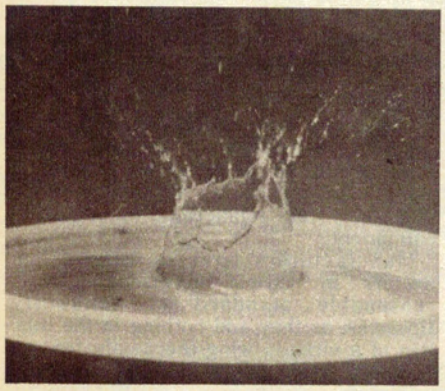
SEMICONDUCTORS

2 x BC169C or similar.
1 x 2N3702, TT608, 2N3638A or similar.
1 x CRS1/05, C106B2, BT100A/300R, 2SF106 or similar.

CAPACITORS

2 30uF 10VW electrolytic.





These experimental shots taken using the prototype illustrate its action. Top left shows a champagne cork leaving the bottle, the "pop" triggering the flash. Top right is a light bulb at the instant of shattering. Bottom left is the splash of a ball hitting water, while the final shot is of a balloon in the process of bursting after falling on some pins. Note that the top is still in its stretched shape.

The potential at the collector of Tr3 is applied to the gate of the SCR via R6.

With VR1 set at the correct position, Tr3 will only conduct sufficiently on high peaks of sound and in some ways it is acting as a limiter.

The switch contacts of the flash gun must be wired the correct way around across the SCR. If there is any doubt about which is positive (which connects to the anode) this can be measured using the volts range of a multimeter.

With insufficient potential applied to the gate of the SCR, this device acts as a very high resistance across the flash trigger connections. However its resistance falls to practically nothing as soon as the potential on the gate reaches the necessary level.

When a sound wave of the required level strikes the cone of the loudspeaker, a small potential is developed in the speech coil causing Tr1 to conduct more which in turn causes Tr2 to pass more current, increasing

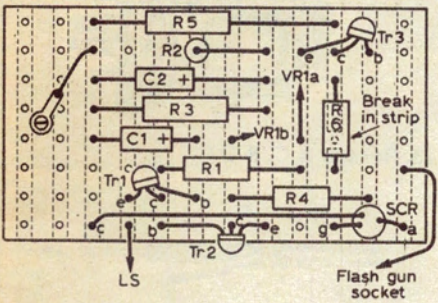


Figure 2: The component layout, on Veroboard. The long wire connecting to the SCR cathode should be sleeved.

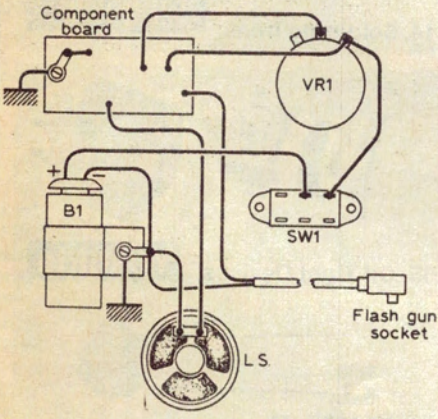


Figure 4: Overall wiring details.

the potential across VR1. As VR1 forms part of the base-emitter circuit of Tr3, as soon as the potential in that circuit exceeds about 0.6V (silicon transistors are used here), Tr3 conducts causing the voltage at the junction of R5 and R6 to rise to or above the critical level and the SCR is switched on. And this is equivalent to closure of the normal camera contacts; i.e., it triggers the flash unit.

One of the characteristics of the SCR is that it remains on even if the gate triggering voltage is removed and it can only revert to its high resistance state when the potential across the anode and cathode (marked a and c in figure) is removed. The potential is removed when the flash occurs and so the SCR automatically reverts to its non-conducting state.

The 9V supply is provided by a small PP3

battery which is quite sufficient to operate the trigger unit.

The majority of the components can be mounted on a small piece of Veroboard, 0.15in. matrix, 12 x 8 holes, the copper conductor strips running across the short way. Clearance is provided at one end to allow for the fitting of an aluminium angle bracket which holds the component board inside the chassis. Only one break in the conductor strip is necessary, this being underneath R6. The layout is shown in figure 2.

Five connections are needed to the component board. One is provided by a short wire fitted with a solder tag which connects to the negative strip. This solder tag fits under the mounting screw and this provides the negative supply line. There are four other connections and Veropins can be inserted to provide these. Two of these go to VR1, one to the loudspeaker and the fourth directly to the flash gun socket.

The circuit can be built into a small aluminium chassis fitted with a drop in lid. The size is not of course critical, though the dimensions shown in figure 3 are about

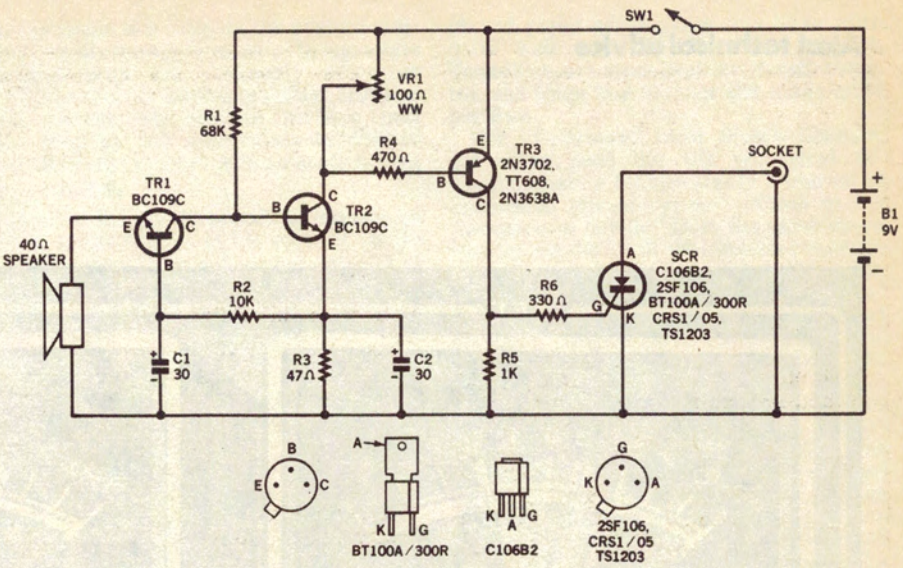


Figure 1: The circuit of the flash trigger unit. Tr1, Tr2 and Tr3 form an amplifier which triggers the SCR in response to a sound.

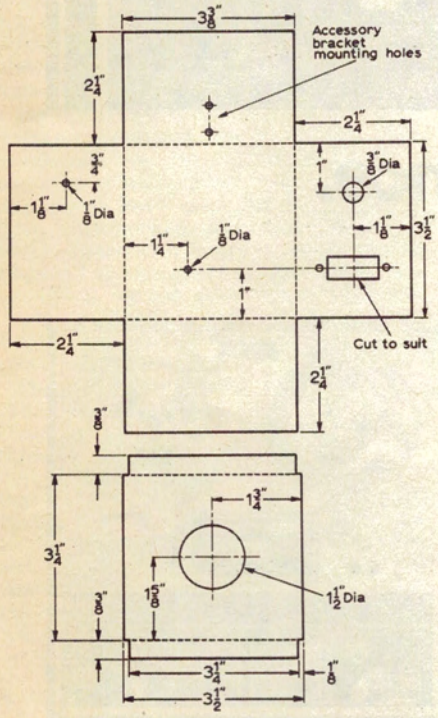


Figure 3: The metalwork details.

right. The loudspeaker is mounted on the lid and the whole lot glued using Araldite or some similar adhesive. The siting of the on-off switch and VR1 can be seen from the drawings and the photographs. A solder tag should be fitted to the chassis to provide the common negative point; this is best fitted on the screw holding the battery clamp which can be cut out from some scrap aluminium of thin gauge.

The top of the chassis can be fitted with a photographic accessory clamp; these are available from photographic suppliers. They are provided with very small screws without nuts and the simplest way of fitting this is to drill two very small holes and self-tap the screws into these.

I have found that the 3mm. co-ax sockets which are used for flash fittings are rather hard to buy; if these are available or can be purchased one could be fitted to the chassis as the output socket. The author used an extension lead fitted with both male and female sockets. One end was cut off and the loose wires soldered inside the chassis. The connector then runs out through a hole, providing a longish lead to which to connect the flash gun lead. This can be seen from the photograph.

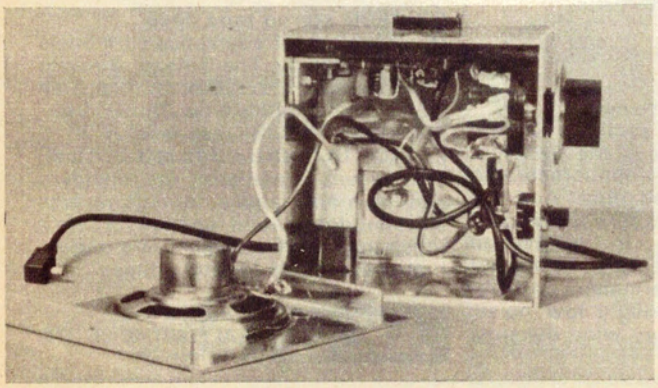
A calibrated knob should be used for VR1. Note that VR1 must be a wire wound type; the original use of a carbon track type was a failure and the positive action of a wire wound type is much preferable.

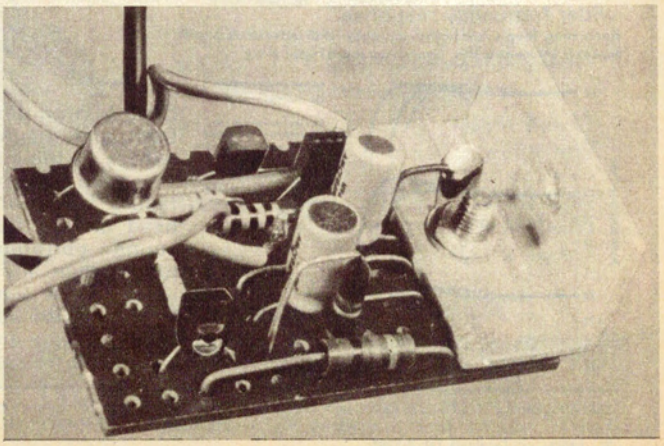
The uses of such a device are many and varied. The action of operation is extremely rapid and the slight delay from the making of the sound to the actual flash is not electronic but solely due to the time taken for the sound waves to reach the unit. The closer the unit to the sound source, the less the delay.

Those who are experts in photography will not need any advice on how to use this device but for those with less expertise, operation should be a follows.

All subjects should be photographed in subdued light — the darker the better. The flash gun should be charged up and a dummy run made, if this is practical, this will ensure that the sensitivity control is correctly set. If a dummy run is not practical it should be possible to estimate the approximate loundness of the sound that will be produced and the hands can be clapped to provide a sound of roughly equal loudness. Normal movement and conversation are quite possible without any danger of the flash being accidently triggered except on the most sensitive settings.

When all is ready the flash gun should be charged, the shutter of the camera opened, the sound made and the shutter closed. Obviously the shorter the shutter remains open the better.





Above and at right are views of the interior of the unit and the wiring board.