TECHNIQUES AND EQUIPMENT

EXPLODER BOX FOR DETONATOR-LAUNCHED CANNON NETS

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The use of electrical detonators as the explosive for the launching of cannon nets has made the use of this technique much more simple and usually far cheaper than the much more complicated firing systems which have been used in the past. The basic circuit is similar to that used for flash units and we have gradually modified the design over the last several years so that the one which is described here (see circuit diagram page 51), is considerably more efficient than earlier models, giving a shorter charging period (usually not very important) and a much longer battery life. The size of the storage capacitor C3 should be chosen to suit the particular layout used; the specification recommended is suitable in the great majority of cases.

The casing into which the unit is built can be bought as a standard unit from any electronics supplier and should be obtained after the unit has been built and the required dimensions determined. The type shown suits very well but a much smaller one could be used if preferred.

Circuit Description

The circuit consists of an oscillator, a step-up transformer, an output rectifier and high voltage capacitor. C2, TR1, R1 and transformer windings W1 and W2 form an oscillator. This oscillator induces a high voltage in winding W3 which is rectified by diodes D1-D4 and is fed to capacitor C3 which is charged to approximately 100 volts. The neon lamp N1 indicates when the fully charged state has been reached. S1 is a lockable key switch which is an additional safety feature preventing unauthorised use. S2 is the switch that sets the oscillator in motion causing C3 to charge up. A safety feature is included so that the operator needs to keep S2 depressed while firing the cannon, which is done by depressing S3.

The component values are not critical and are readily obtainable

in most countries. C3 might pose a problem in some areas. Capacitors used for photo-flash circuits can be used as well as certain motor-start capacitors. It is important to observe the voltage rating which should not be lower than 125 volts.

Windings W1, W2 and W3 form a transformer that is wound on two torroidal (doughnut shaped) ferrite rings. The two rings are placed on top of each other, and are about 2-3 cm in diameter. The actual type is not critical. Any ferrite torroid of this approximate size will work. Types to avoid from the cost point of view are the high frequency R F types. Cost should not exceed about R2 (approximately U.S.$2,00 or 4,5 Deutsch Mark), for both rings.

Layout of the circuit is not critical but good insulation practice should be observed at the high voltage side. In the printed circuit (page 52) a bridge rectifier is used instead of the IN 4004 diodes. Several different types of bridge rectifiers are available having a diameter of 1-1,5 cm. A 400 P.I.V. rectifier should be used. Current rating is low and 1 amp is more than adequate. Virtually any neon lamp can be used. Those that have a series resistor supplied with them (sometimes inside the plastic holder) should have this replaced with a 10k ,25 watt resistor.

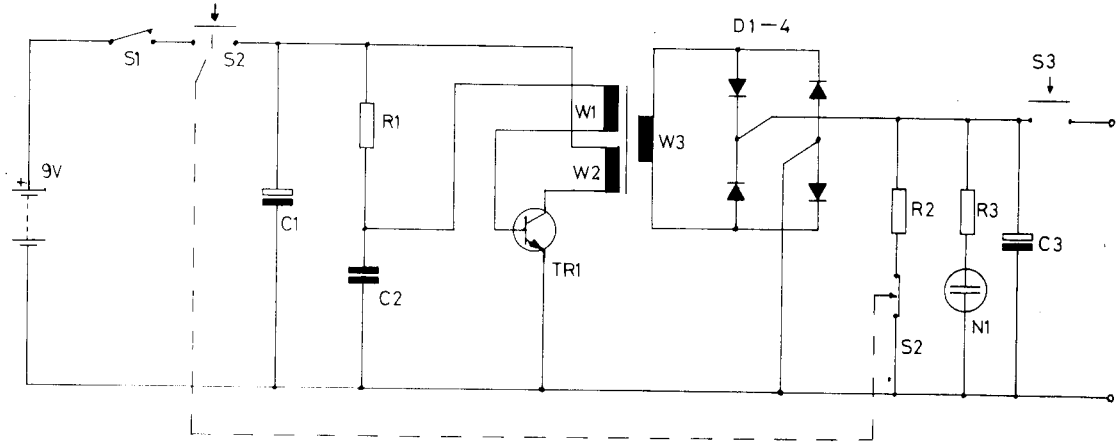
Winding the transformer

The transformer torroid rings are placed one on top of the other and held together with a piece of insulation tape wound around the outer circumference.

The secondary (120 turns) windings are now 'pile wound' covering 1-1,5 cm of the outer circumference of the torroids. 'Pile winding' means piling the turns on top of each other, i.e. careful winding of the turns one next to the other without criss-crossing is not needed. Winding the secondary is most easily achieved by first winding the wire on a piece of cardboard about 8 cm by 1 cm with V notches cut in both ends. This card is then fed through the torroid unwinding the wire from the card onto the torroids. Enamelled copper wire of approximately 30 S.W.G. should be used for the secondary winding. When the secondary winding is complete it can be secured by using epoxy (or similar) cement. Care should be taken to leave enough wire free at both ends for connecting up.

Windings W1 and W2 can be wound using thin plastic covered 'hook-up' wire. The wire, including its plastic insulation, should have about 1 mm diameter and preferably be multi-stranded. The actual position of these two coils relative to coil W3 will vary and can be adjusted for best results.

EXPLODER BOX CIRCUIT



COMPONENT LIST

S1	Single pole – single throw key switch	R1	10 k 0,25 W	W1	1 turn
S2	Double pole-double throw push-button	R2	10 k 1 W	W2	10 turns
C1	10 µF 10 volt electrolytic	R3	10 k 0,25 W	W3	120 turns
C2	0,1 µF	D1—4	1N4004	N1	NE-2 neon lamp
C3	150 µF 150 volt electrolytic	TR1	2N3055	S3	Single pole - single throw push - button

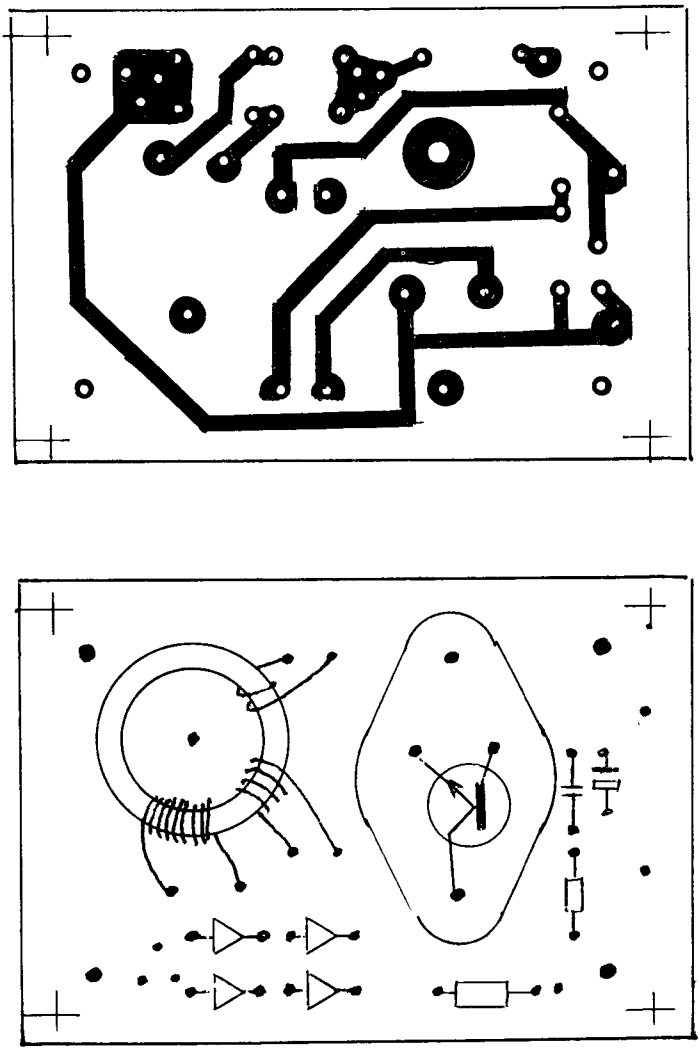


Diagram of printed circuit design

Final wiring up and testing

Before final mounting the circuit must be tested for proper operation. For this purpose the transformer is not yet clamped or glued to the circuit board. C3 is left disconnected.

The components should now be checked to see that each one is wired in correctly. Attention should be given to the correct wiring of the transistor and the right polarity wiring of capacitor C1 and diodes (or bridge rectifier) D1 - D4.

When everything has been checked, switch on S1 and press S2. A high frequency whine should be heard from the transformer, and neon lamp N1 should light up. If this does not happen, reverse the connections from W1 to C2 and the base of TR1. Sometimes the high frequency whine will not be heard as the frequency of oscillation is higher than the frequency limit of human hearing. If this test checks out alright, connect C3 observing the correct polarity of connections. Switch on S1 and press S2. The neon lamp will stay off for a period of time and then come on. The frequency of oscillation will be lower with C3 connected and this can, in most cases, be distinctly heard. A good time rate for C3 to charge up and cause the neon to light up is about 10 seconds or less. When the neon lights up it means that C3 is fully charged and ready for firing the detonators.

The fastest charging rate can be obtained by experimenting with various positions of W1 and W2. This can be done by merely sliding the windings along the torroid. (N.B. These windings should not be too tight). Generally an increase in frequency as the coils are moved indicates an increase in efficiency and thus a faster charging rate.

The actual mounting of the transformer can be left to the individual's discretion. A simple method is to merely glue it to the circuit board. A suggested method is shown in the photograph. Everything in the exploder box including the battery should be mounted firmly and not allowed to shift around when carried. The output from C3 is connected to two terminals (usually banana sockets) via S3.

Using the exploder box

The actual positioning and setting up of the cannon net is beyond the scope of this article; however, certain points need to be observed when using the exploder box.

The wire connecting the exploder box to the detonator should be

short-circuited on both ends before unwinding from the reel. The wire should be unwound and laid out before connections are made. The detonator should be connected first and the exploder box last. Under no circumstances should this order be reversed.

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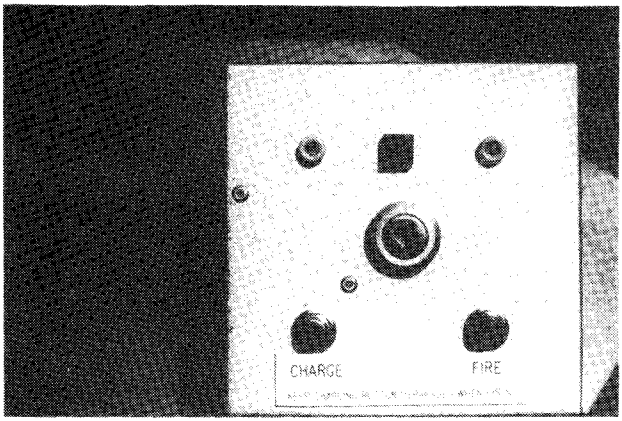

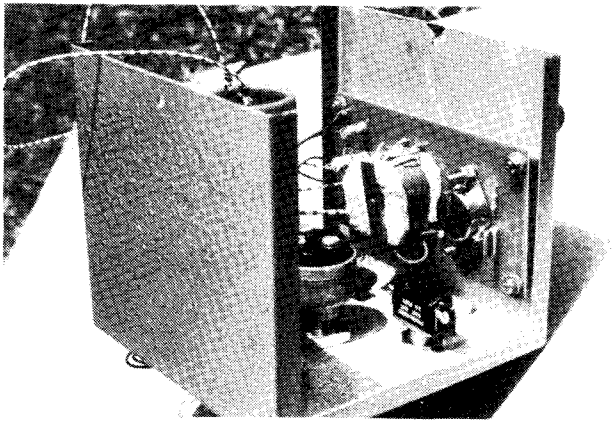

Detail of exploder box construction