REV706 TLITE 2 inch Spark Tesla Coil with Timer

Modified as per schematics below

Low cost and interesting project generates a continuous spark discharge with a variable rate of current. Operates from a 12-volt wall adapter or battery for portable use or science project where outlets may not be available. Device has a built in timer allowing a setting of off and on times. This property provides excellent desk or bar pieces where it will automatically turn on for several seconds and recycle, surprising those in the area as unit generates this visual and noisy display.

Construction involves minimal electronic experience. Expect to spend around $45.00 for this rewarding and interesting conversation piece with most parts readily available. Those that are special including a printed circuit board may be obtained through **www.amazing1.com**

Circuit Theory

Fig 2 shows a high dc voltage being produced by a blocking oscillator circuit consisting of transformer (T1) being switched on and off by transistor (Q1). Current thru the primary *(I)* rises as a function of Et/L (when Q1 is on) where E is the applied voltage, in this case 12 VDC, and L is the primary inductance of T1. This rise in current induces a voltage in the feedback winding further holding Q1 on due to supplying base current thru resistor (R2) and speed up capacitor (C2). When the core of T1 saturates because of high primary dc voltage, the induced base voltage goes to zero turning off Q1. This condition results in a reverse voltage induced in the secondary forward biasing diode (D1) and charging capacitor (C3, 4). When the charging capacitor reaches the break over voltage of the SIDAC (around 300 volts) it now turns on dumping the energy stored in the capacitor into the primaries of pulse transformers (T2, 3). This energy causes a rapid rise in current “forward” inducing the high voltage output pulses required for the lightning display. You will note there are two pulse transformers connected out of phase (reversed connected) relative to one another. This approach generates twice the output of that possible from one transformer now being in excess of 50,000 volts! You will note switch (S1) controls primary power. Switch (S2) selects display texture. The base of Q1 is the control port for the output of current sink Q2 controlled by switch (S3)

Construction Steps

1. Identify all parts and pieces and verify with bill of materials.

2. Insert the components starting from one end of the perforated circuit board and follow the locations shown on fig 6 using the individual holes as guide. Use the leads of the actual components as the connection runs. The dashed lines indicate these. It is a good idea to trial fit the larger parts before actually starting to solder.

If you are using the ***printed circuit board*** as shown fig 3&4, simply insert the parts as identified and solder the pads.

Always avoid bare wire bridges, globby solder joints and potential solder shorts. Check for cold or loose solder joints.

Pay attention to polarity of capacitors with polarity signs, and all semiconductors. The transformer position is determined using an ohmmeter as instructed on fig 3 insets. **Note the SIDAC may have two or three pins. Only the outer ones are used and may connect in either way, as part is not polarized.**

3. Cut strip and tin the wire leads for connecting to S1, 2, 3 and solder in. These leads should be 4 to 5" long.

4. Fabricate the PLATE section from a 6 x 2 1/4 x .06 piece of plastic. This is the base plate for mounting and gluing T2, 3 pulse coils/transformers.

5. Prewire T2, 3 as shown fig 3 at the separation distance of 2". Use short pieces vinyl wire to extend these leads. Splice in 5" leads for interconnecting to board.

6. Carefully position the wired up pulse coils assembly to the plastic PLATE and secure with silicon rubber cement (RTV-room temp vulcanizing). Jig in place to hold in position as cement sets. It is important to keep these coils straight for aesthetics.

7. Attach the discharge electrode wires using wire nuts. Do not solder to the output pins as excessive heat can internally damage T2, 3.

8. Preconnect in the pulse coil assembly to the board as shown. Connect in the wall adapter using the wire nuts observing proper polarity.

Electrical Pretest

9. Separate ends of discharge wires to approx 2" Preset trimmer pots to midrange and slider switches S1, 3 to "off".

10. Turn “on” S1 and note a discharge occurring between the pulse coils. Change the position of the toggle switch S2 and note discharge texture changing. Identify the switch position for heavy or light spark display.

11. Turn on S3 and note display cycling on and off at an approx rate 100 sec on/100 sec off. These times are dependently variable over a wide range. Our suggested setting is 10 sec on and 100 sec off. Device can be left on continuously with these low duty cycle settings.

Final Assembly

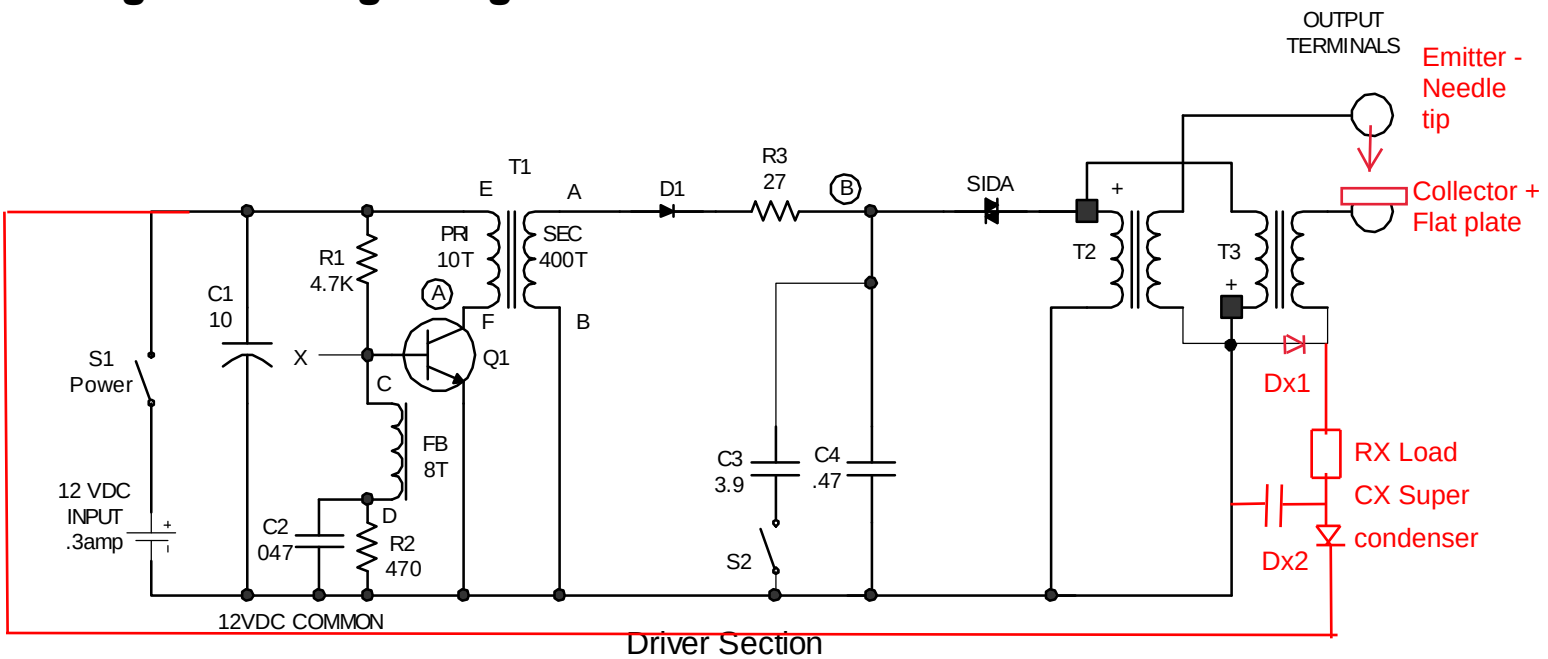
12. Fabricate the enclosure from a 6 1/2 x 6 x .06 inch piece of plastic as shown fig 5.
You may use a clear or colored piece for this part. Fold down the sides 2” along the 6” dimension. This should leave a 2 ½”. Fabricate holes for T2, 3 observing proper alignment with glued plate assembly as in prior step. Fabricate remaining holes for switches, power leads and trim pot access holes.

13. Glue in pulse coil assembly or use two small screws at end sections as shown fig 5. Use RTV silicon rubber to hold the assembly board from fig3 in place. Mount controls and dress wire leads for a neat appearing assembly.

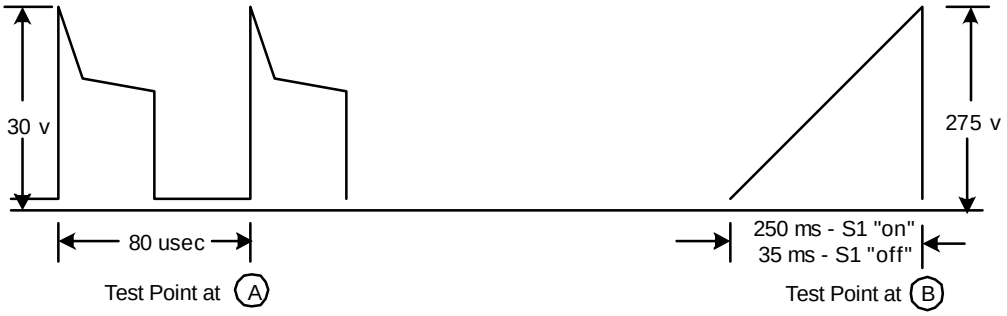
14. Verify operation and preset controls for desired spark display and cyclic timing.

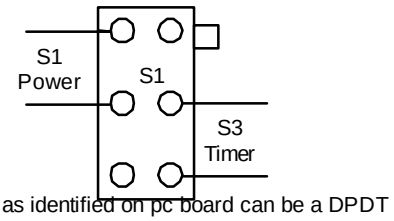
		TLITE Tesla 2" spark coil	
Ref#	**Qty**	**Description**	**DB#**
R1		4.7 1/4 Watt carbon film resistor (yel,pur,red)	
R2,8	2	470 1/4 Watt carbon film resistor (yel,pur,br)	
R3		27 OHM 1/4 Watt carbon film resistor (red,pur,blk)	
R4,6	2	1M Trimmer resistor vertical mount	
R5,7	2	10K 1/4 Watt carbon film resistor (br,blk,or)	
C8		100 MFD 25 V electrolytic capacitor vertical mount	
C6		220 MFD 25 V electrolytic capacitor vertical mount	
C7		.01 MFD 50 V disk ceramic capacitor	
C1		10 MFD 25 V electrolytic capacitor vertical mount	
C2		.047 MFD 50 V polyester capacitor Marked 2A473 on green body	
C3		3.9-4 MFD 350 V polyester capacitor	
C4		.47 MFD 250 V polyester capacitor	
Q1		MJE3055 NPN Transistor TO220	
Q2		NPN PN2222 GP Transistor	
I1		555 DIP Timer	
D1		IN4007 1KV rectifier diode	
SIDAC		300 V Sidactor switch Marked K3000 See text	SIDAC
T1		Switching square wave transformer 400V	TYPE1PC
T2,3	2	25 KV Pulse transformers	CD25B
S1,2,3	3	SPST 3 Amp toggle or slider switch or both	
PB1		5 X 1.5 .1grid perf circuit board	
PCTLITE		Optional printed circuit board replaces PB1	PCTLITE
WR20B	36"	#20 Vinyl stranded hookup wire-black	
WR20R	36"	#20 Vinyl stranded hookup wire-red	
WR20BUSS	18”	#20 Buss wire	
WN1	2	Small wire nuts #71B	
WN4	2	Large Hi 4 wire nuts usually yellow	
SW1/NU1	2	6-32 X ½” screws and nuts	
EN1		Enclosure 6 1/4 x 6 x .062 plastic - fabricated per fig 5	
PLATE		2 1/4 X 6”x .062 plastic partition	
TAPE		6 X 1 X .125 double sided sticky tape	
12DC/.3		12 volt dc .3 amps wall adapter	12DC/.3

Fig 2 Tesla Lightning Generator Schematic

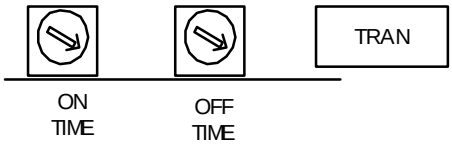


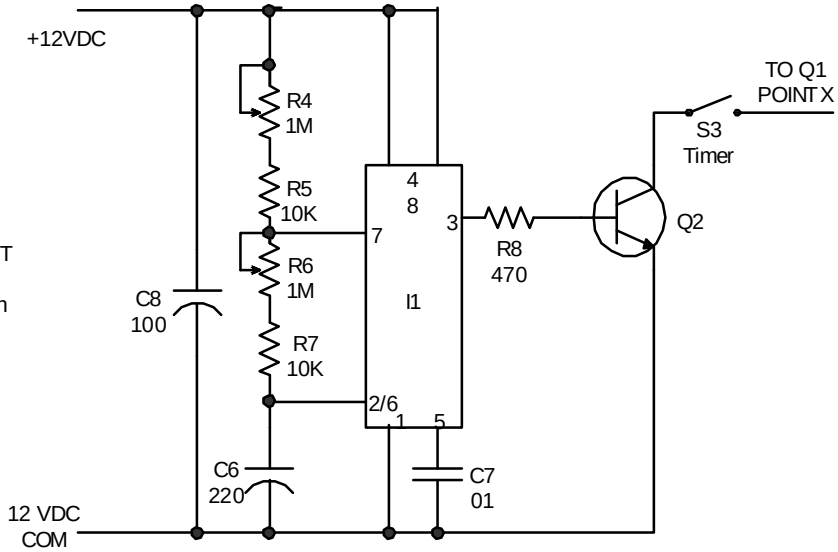
Driver Section





S1 as identified on pc board can be a DPDT small slider switch. However it is suggested to use two SPST switches with leads so they can be mounted to panel for easy access. This is shown on these plans





Timer Section

Fig 3 Assembly Board

1. All leads are #20 vinyl "unless marked otherwise
2. Coils are shown on T1 for circuit clarity
3. See fig xxxx for foil connections on underside of board.

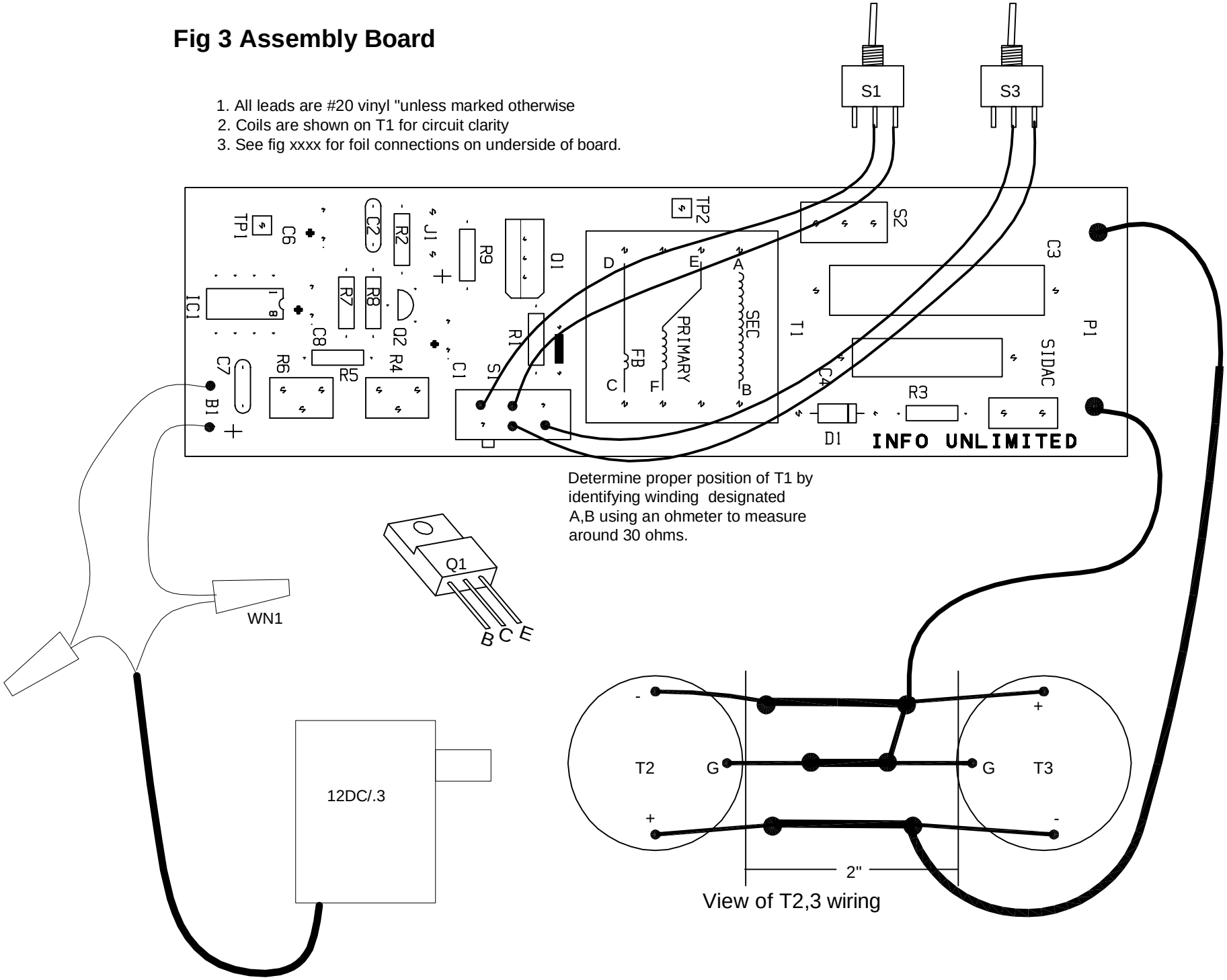


Fig 4 PC Board Pad and Foil Layout

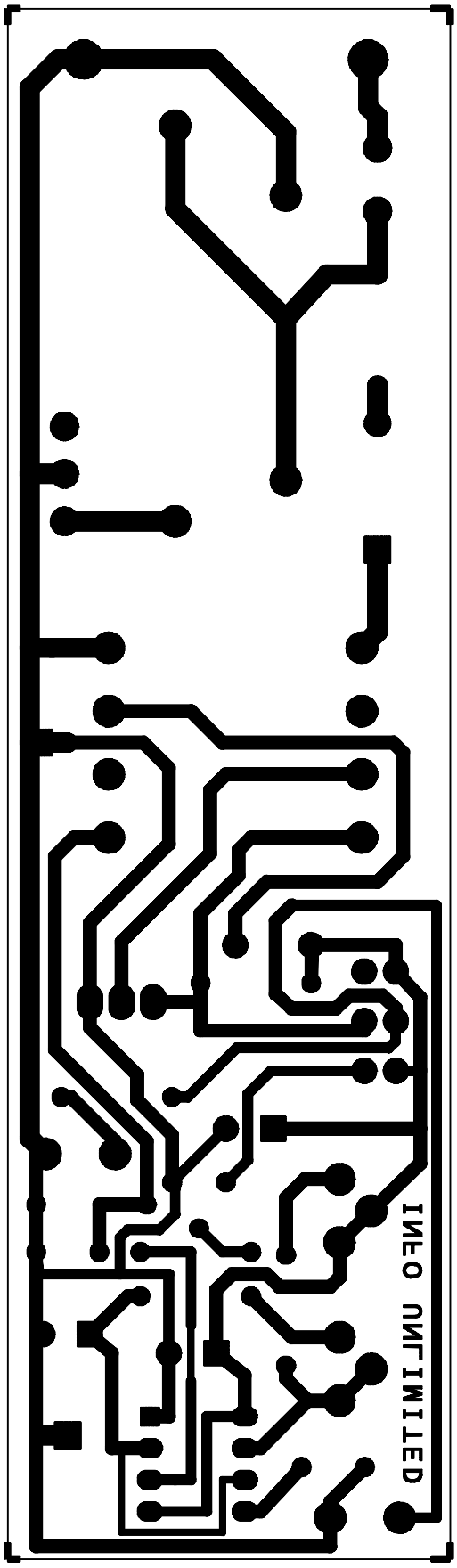
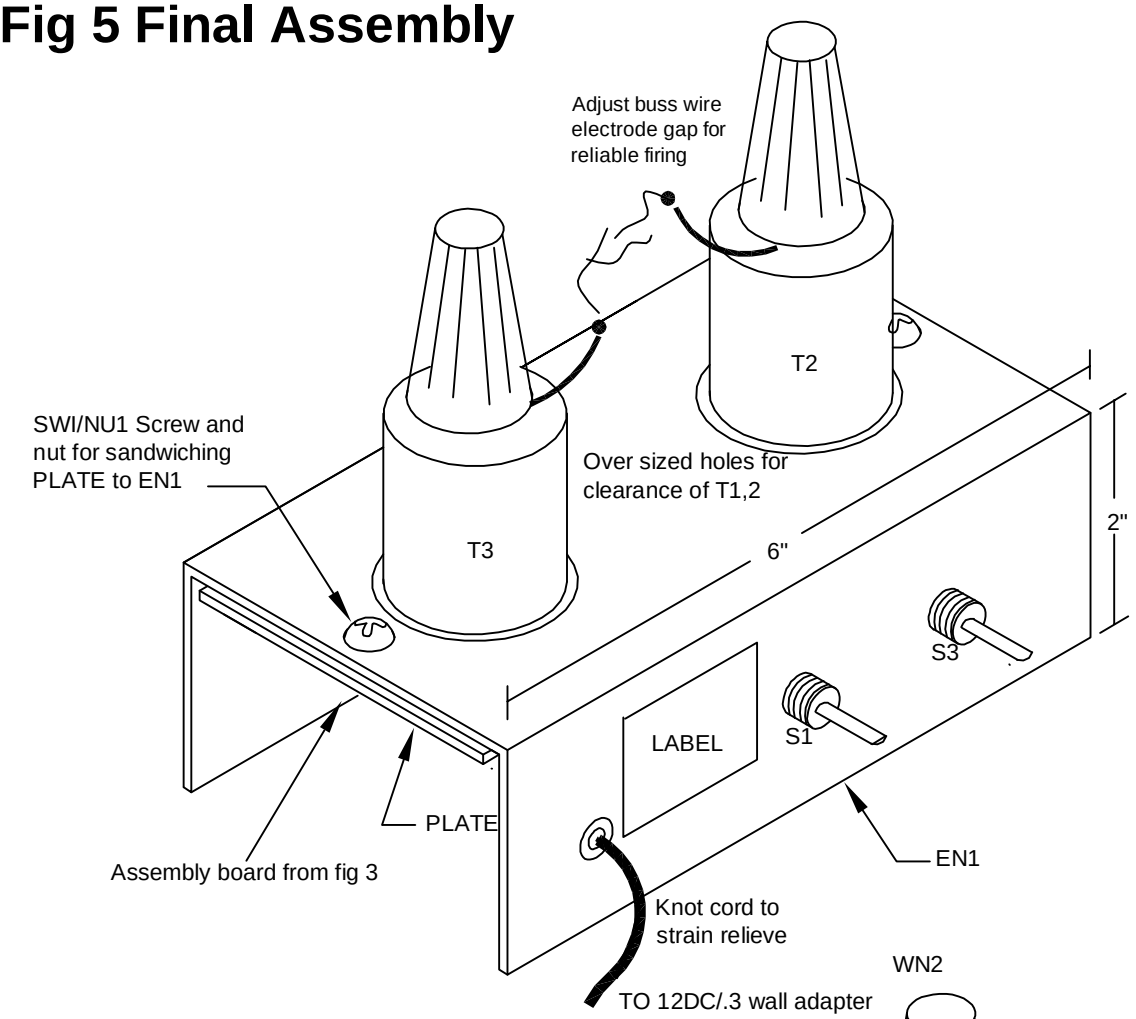
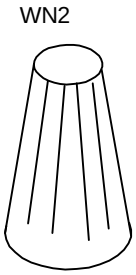


Fig 5 Final Assembly



Final assemble by sliding the coil assembly through the slightly oversized holes in enclosure EN1. Secure via two screws as shown. The assembly board is placed on the PLATE section and secured via two sided sticky tape. Access for setting the timer is from the opposite side and it is suggested to drill access holes.



Twist several turns of #20 buss wire around the output pins as shown. Use a HI4 wire nut (usually yellow) to secure connection. Do not solder to these pins

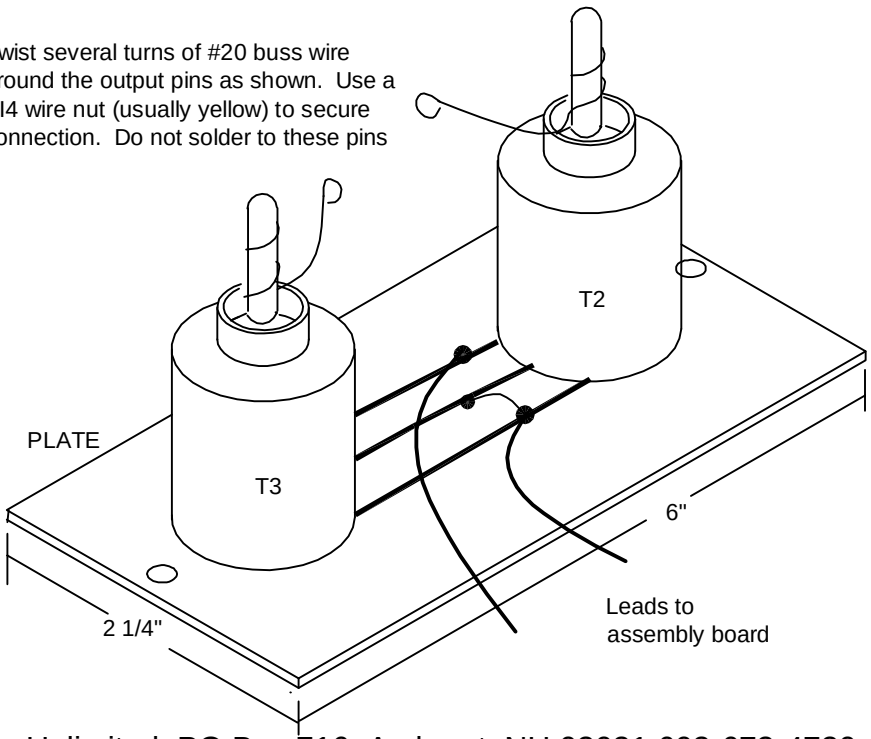
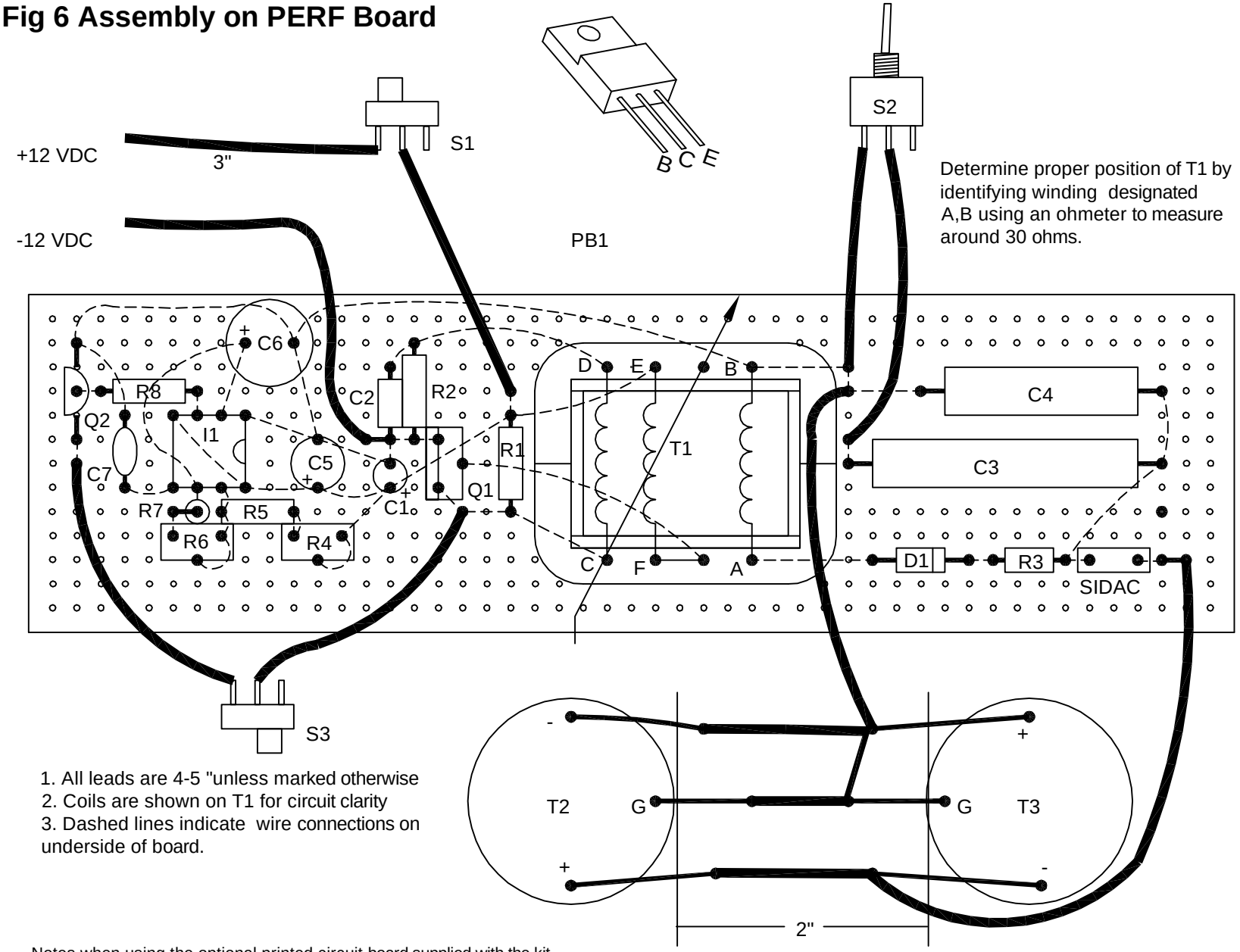


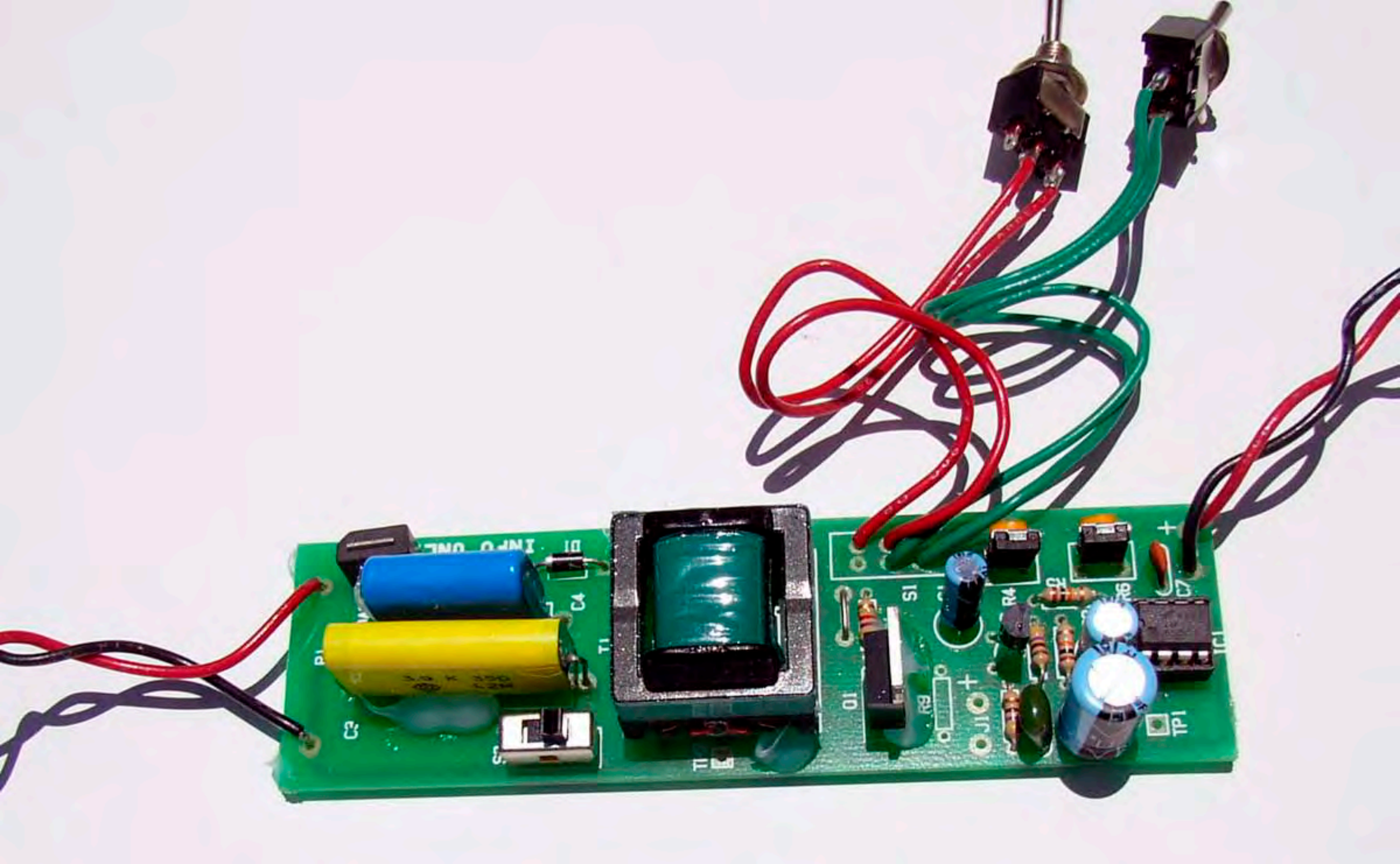
Fig 6 Assembly on PERF Board



Notes when using the optional printed circuit board supplied with the kit.

1. The cut corners shown on the silk screened Q1 is the base pin "B" end of the part.
2. R4 and D2 shown on the schematic are mounted between J1 and S1-(For recharging the battery only)
3. Disregard the silk screen for T1 on this project. You can determine the output winding by measuring approximately 9 ohm using an ohmmeter.

4. Switch S1 may be a SPST for this project as it only switches the battery power



C4
T1
S1
R4
C7
Q1
R9
TP1