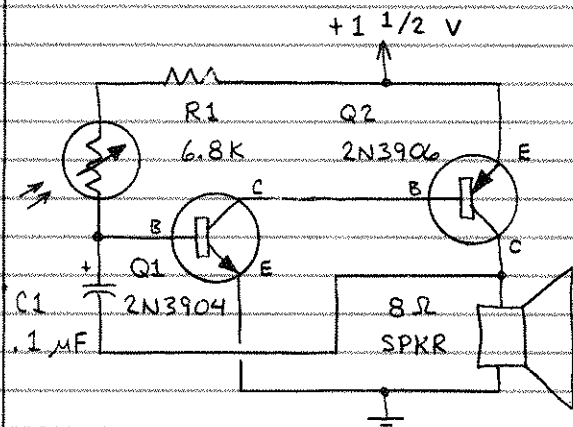
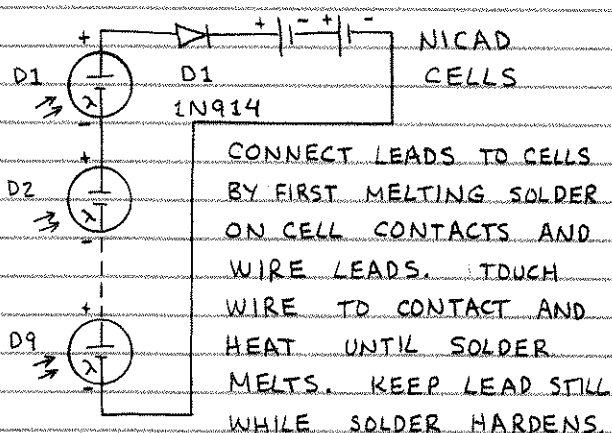


□ AUDIBLE LIGHT PROBE



THIS IS AMONG THE MOST ENTERTAINING CIRCUITS IN THIS BOOK. VARIOUS PNP AND NPN TRANSISTORS CAN BE USED FOR Q1 AND Q2. THE TONE FROM THE SPEAKER INCREASES IN FREQUENCY AS THE INTENSITY OF LIGHT ON THE PHOTORESISTOR INCREASES. VERY SENSITIVE! TRY THIS: OPERATE CIRCUIT IN A DARK ROOM UNTIL TONE SLOWS TO A SERIES OF CLICKS. THEN SHINE BEAM FROM FLASHLIGHT ON THE PHOTORESISTOR...

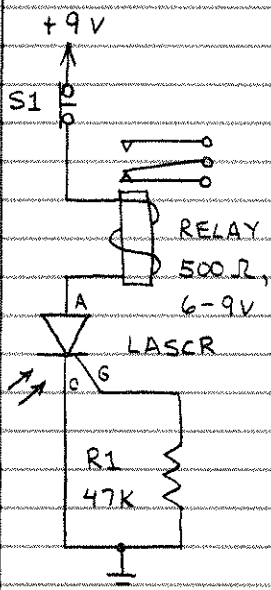
□ SOLAR CELL BATTERY CHARGER



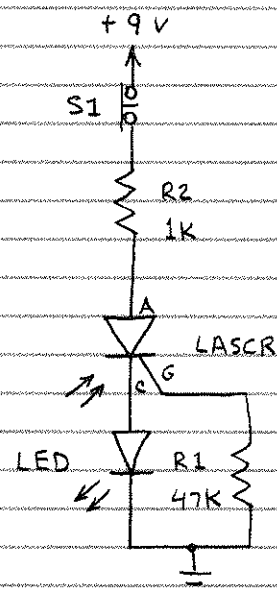
USE NINE CELLS TO CHARGE TWO NIKADS. CURRENT FROM SOLAR CELLS MUST NOT EXCEED MAXIMUM CHARGING RATE FOR NIKADS! YOU CAN MONITOR CURRENT BY CONNECTING MULTIMETER BETWEEN NIKADS AND D1. INSERT SERIES RESISTOR OR REMOVE SOLAR CELL TO REDUCE CURRENT. D1 KEEPS NIKADS FROM DISCHARGING THROUGH SOLAR CELLS (WHEN DARK). SOLAR CELLS ARE FRAGILE. SOLDER AND MOUNT WITH CARE.

□ LIGHT ACTUATED LATCHING CIRCUITS

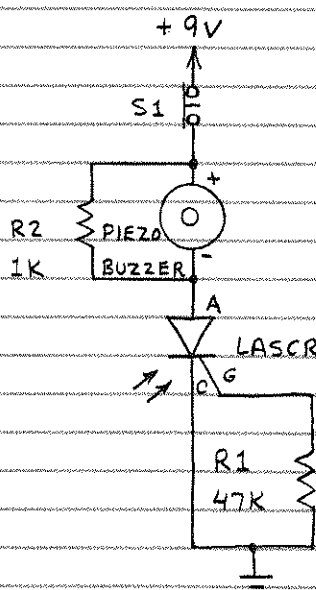
1. RELAY



2. LED (OR LAMP)



3. BUZZER



THESE CIRCUITS ARE ACTUATED BY LASCR LIGHT. OPEN (MAY VARY) S1 TO SWITCH LASCR OFF. SOME LASCRS ARE MORE LIGHT SENSITIVE THAN OTHERS. MOST WILL TRIGGER IN RESPONSE TO LIGHT FROM CAMERA STROBE (XENON FLASH UNIT).

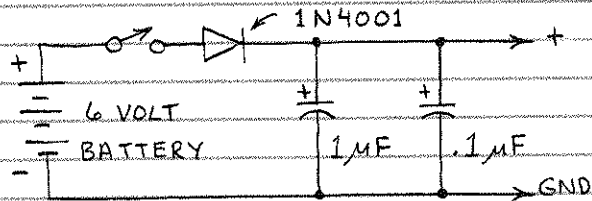
DIGITAL IC CIRCUITS

DIGITAL ICs ARE VERY EASY TO USE. HERE'S A SELECTION OF TTL AND CMOS CIRCUITS:

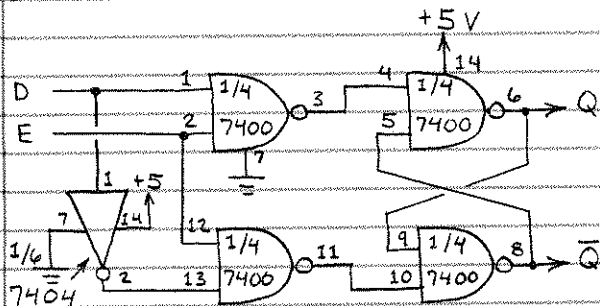
TTL CIRCUITS

□ OPERATING REQUIREMENTS

1. POWER SUPPLY MUST NOT EXCEED 5.25 VOLTS. SEE PAGE 125 OR USE:
2. INPUTS MUST NOT EXCEED +5.25 V.
3. INPUTS SHOULD ALWAYS GO SOMEWHERE (NOT LEFT "FLOATING").
4. FORCE OUTPUTS OF UNUSED GATES "H" TO SAVE POWER. (EXAMPLE: UNUSED "NAND" - MAKE ONE INPUT H.)
5. AVOID LONG WIRES IN CIRCUITS.
6. CONNECT 1 TO 10 μ F CAPACITOR ACROSS POWER LEADS WHERE THEY ENTER CIRCUIT.
7. CONNECT 0.1 μ F CAPACITOR ACROSS POWER PINS OF EACH TTL CHIP IN MULTI-CHIP CIRCUITS.
8. REMEMBER, TTL USES MUCH MORE CURRENT THAN LS OR CMOS.

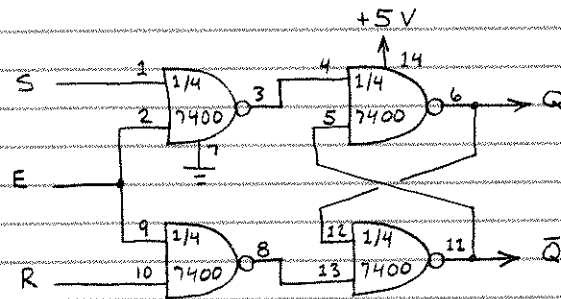


□ "D" FLIP-FLOP



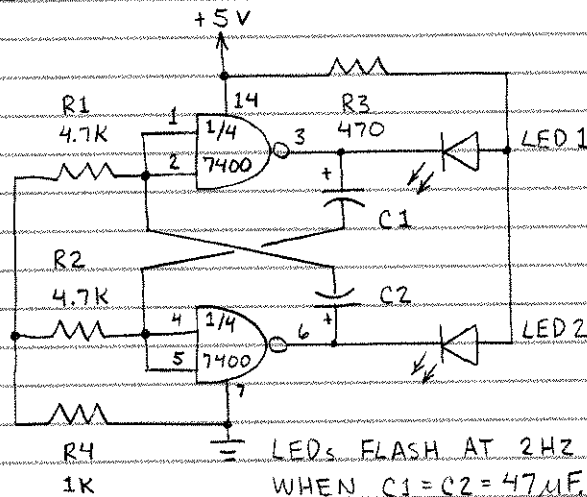
Q = D WHEN ENABLE (E) IS HIGH.
NO CHANGE WHEN E IS LOW.

□ CLOCKED "RS" FLIP-FLOP

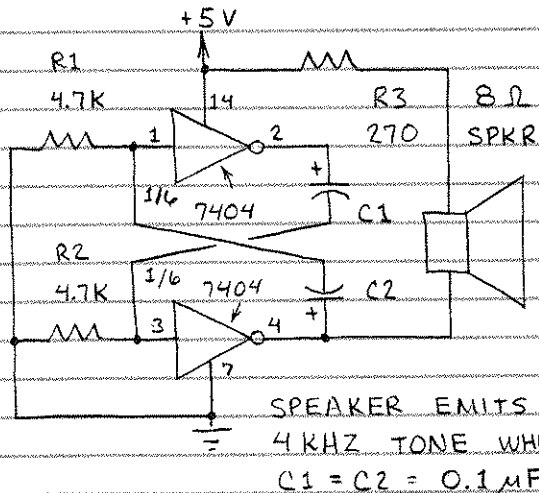


FUNCTIONS AS "RS" FLIP-FLOP WHEN
ENABLE (E) IS HIGH.

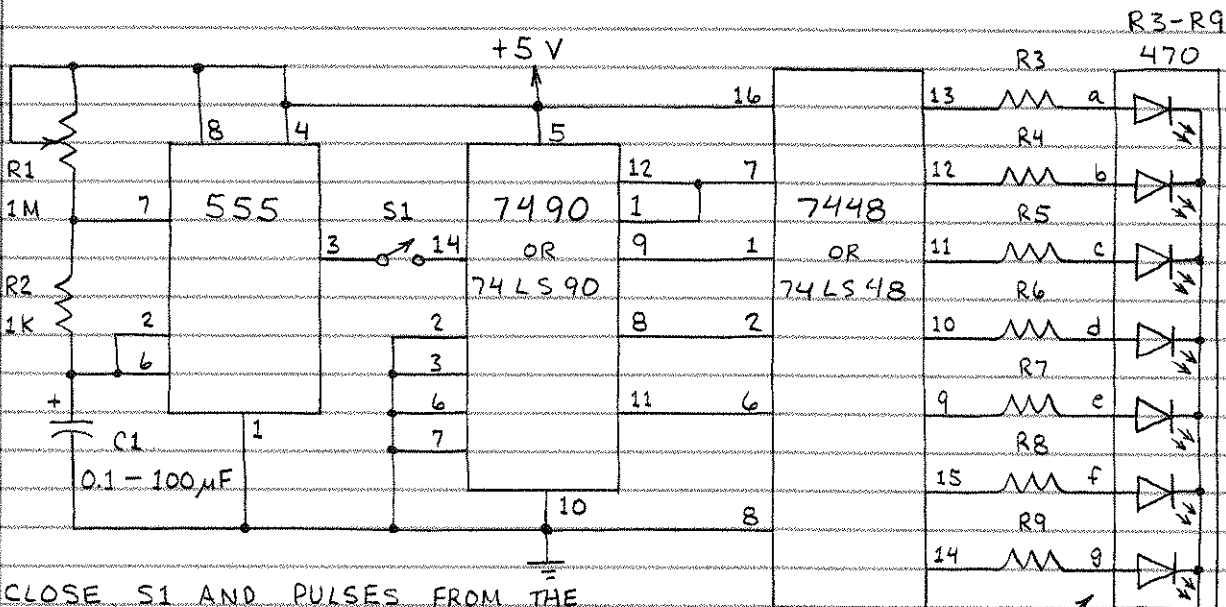
□ DUAL LED FLASHER



□ TONE GENERATOR

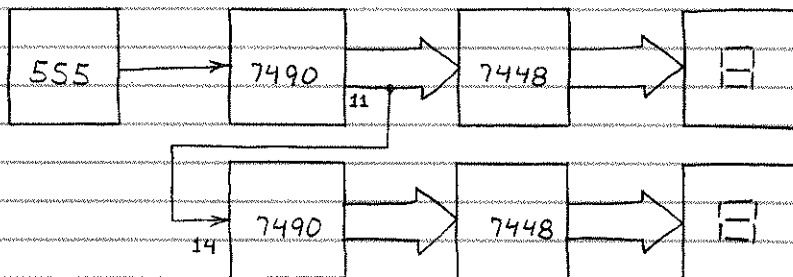
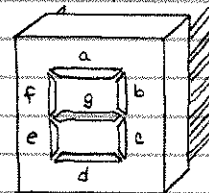


☐ 0 TO 9 SECOND (OR MINUTE) TIMER



CLOSE S1 AND PULSES FROM THE 555 WILL BE COUNTED BY THE 7490. THE 7448 CONVERTS THE BCD OUTPUT FROM THE 7490 INTO 7-SEGMENT DIGITS ON AN LED DISPLAY. ADJUST R1 AND C1 FOR DESIRED PULSE RATE. TO ADD ADDITIONAL DIGIT:

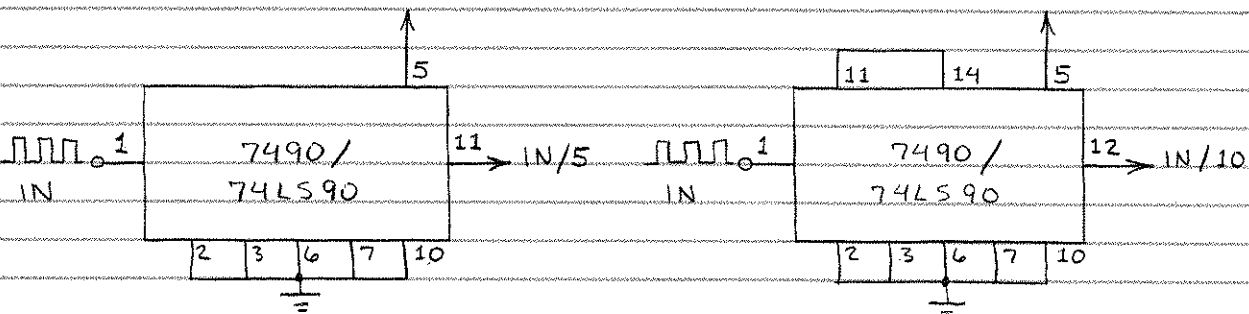
COMMON CATHODE 7-SEGMENT DISPLAY



HINT:
THIS BASIC CIRCUIT WILL COUNT PULSES FROM OTHER CIRCUITS. ELIMINATE 555 AND APPLY PULSES (5 VOLTS MAXIMUM) TO 7490.

☐ DIVIDE-BY-5 COUNTER

☐ DIVIDE-BY-10 COUNTER



DIVIDES INCOMING "TRAIN" OF PULSES BY 5. OK TO USE AT INPUT OF CIRCUIT ABOVE.

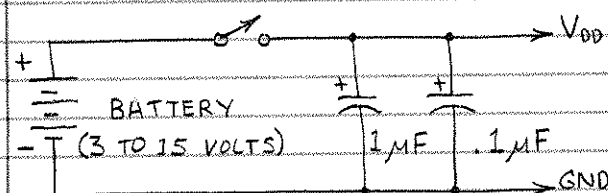
DIVIDES INCOMING "TRAIN" OF PULSES BY 10. OK TO USE AT INPUT OF CIRCUIT ABOVE.



CMOS CIRCUITS

□ OPERATING REQUIREMENTS

1. THE POSITIVE POWER TO A CMOS CHIP (V_{DD}) CAN RANGE FROM +3 TO +15 (OR +18) VOLTS. USE POWER SUPPLIES ON PAGE 125 OR A BATTERY (BEST):

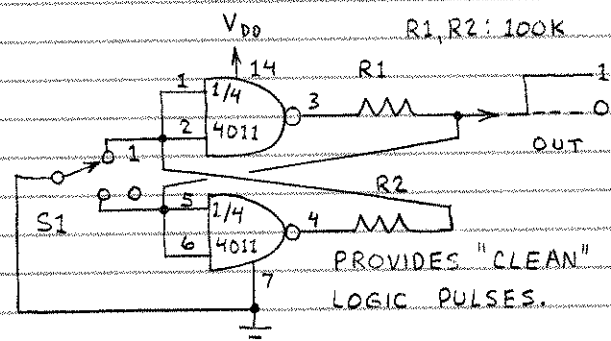


2. INPUTS MUST NOT EXCEED V_{DD} .
3. ALL UNUSED INPUTS MUST GO TO V_{DD} OR GND ($\frac{1}{2}$).
4. NEVER APPLY AN INPUT SIGNAL TO AN UNPOWERED CMOS CIRCUIT.

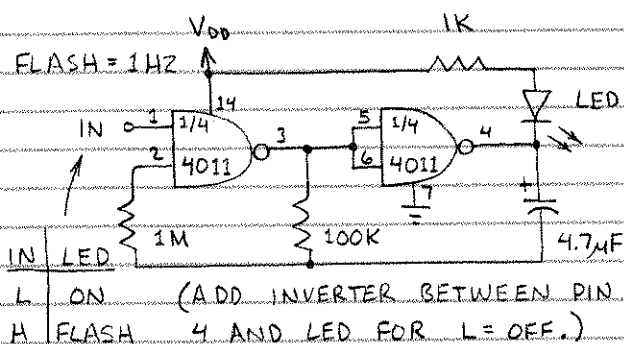
□ HANDLING PRECAUTIONS

1. PLACE CMOS ICs PINS DOWN ON AN ALUMINUM FOIL SHEET OR TRAY WHEN THEY ARE NOT IN A CIRCUIT OR PROPERLY STORED.
2. NEVER STORE CMOS ICs IN NONCONDUCTIVE PLASTIC "SNOW," TRAYS, BAGS OR FOAM. PLUG THEM IN CONDUCTIVE FOAM OR FOAMED PLASTIC WRAPPED IN ALUMINUM FOIL.
3. AVOID USING AN AC LINE POWERED IRON TO SOLDER PINS OF CMOS ICs. USE IC SOCKETS, WIRE-WRAP OR BATTERY POWERED IRON.
4. DRAIN STATIC CHARGE ON YOUR BODY BY TOUCHING GROUNDED OBJECT.

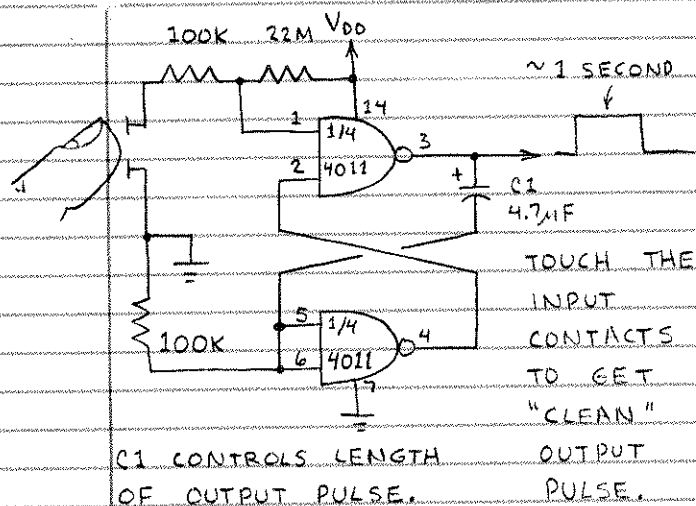
□ BOUNCELESS SWITCH



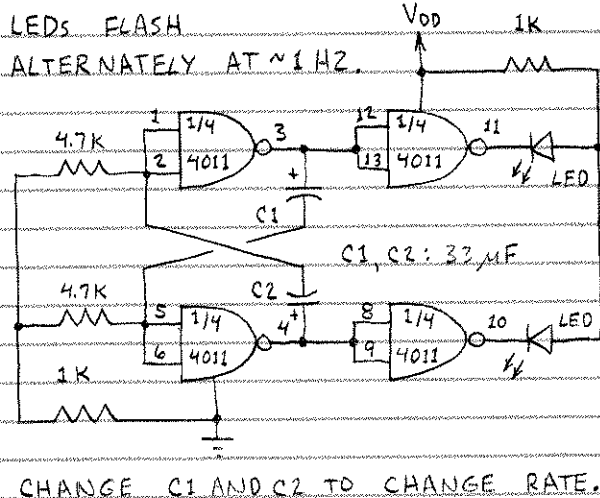
□ SINGLE LED "GATED" FLASHER



□ "ONE-SHOT" TOUCH SWITCH



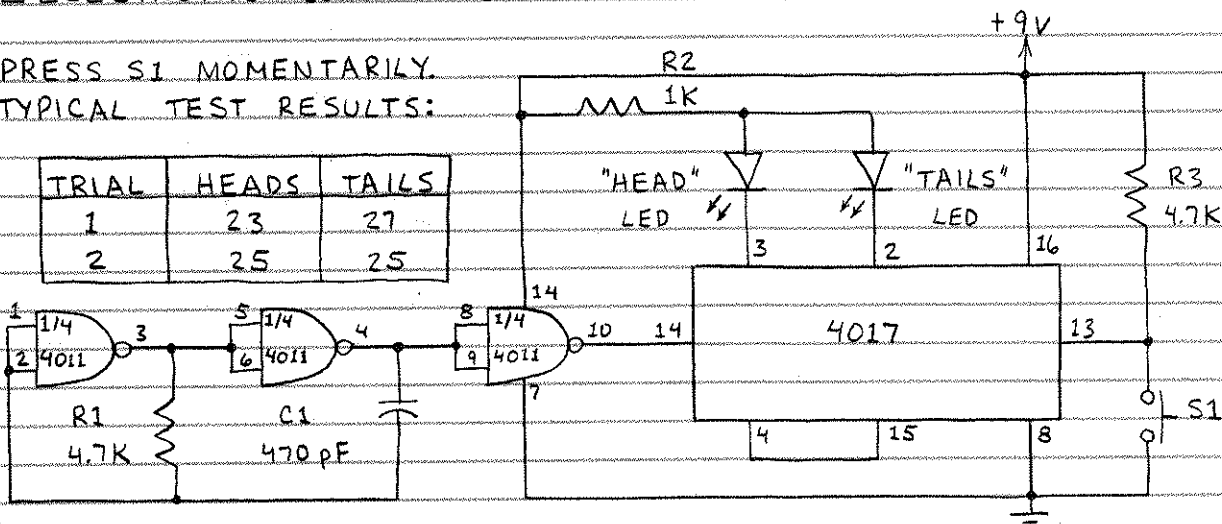
□ DUAL LED FLASHER



□ ELECTRONIC COIN TOSSER

PRESS S1 MOMENTARILY.
TYPICAL TEST RESULTS:

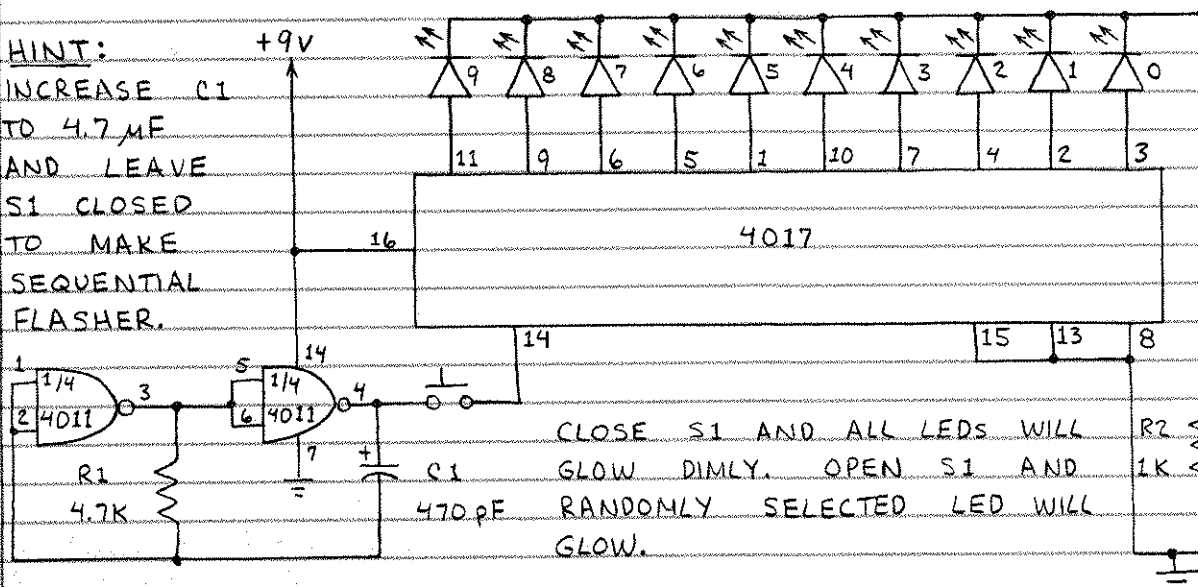
TRIAL	HEADS	TAILS
1	23	27
2	25	25

☐ RANDOM NUMBER GENERATOR

LED READOUT ARRAY

HINT:

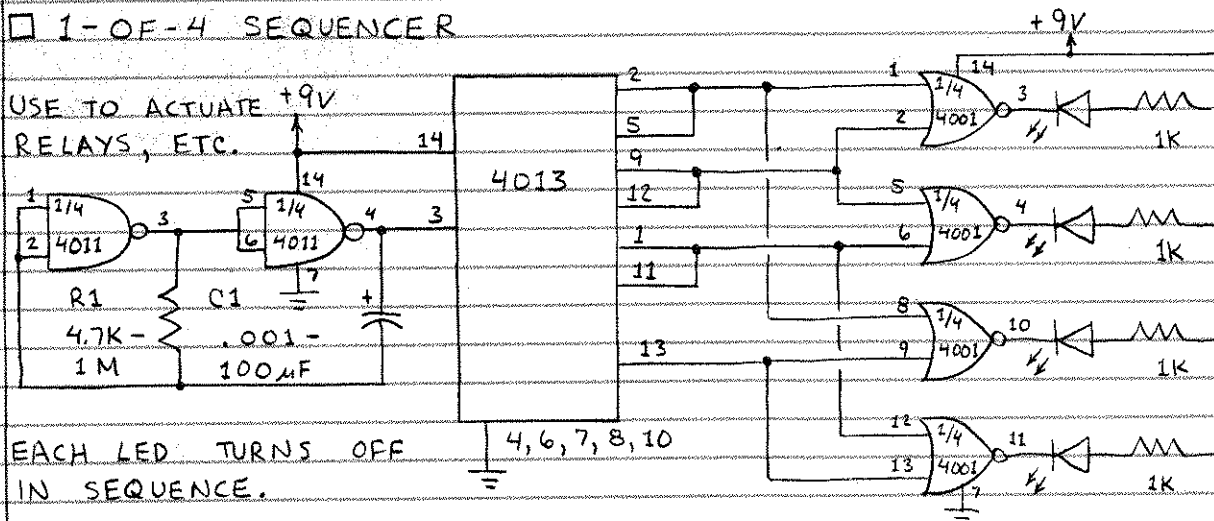
INCREASE C1
TO 4.7 MF
AND LEAVE
S1 CLOSED
TO MAKE
SEQUENTIAL
FLASHER.



CLOSE S1 AND ALL LEDS WILL GLOW DIMLY. OPEN S1 AND RANDOMLY SELECTED LED WILL GLOW.

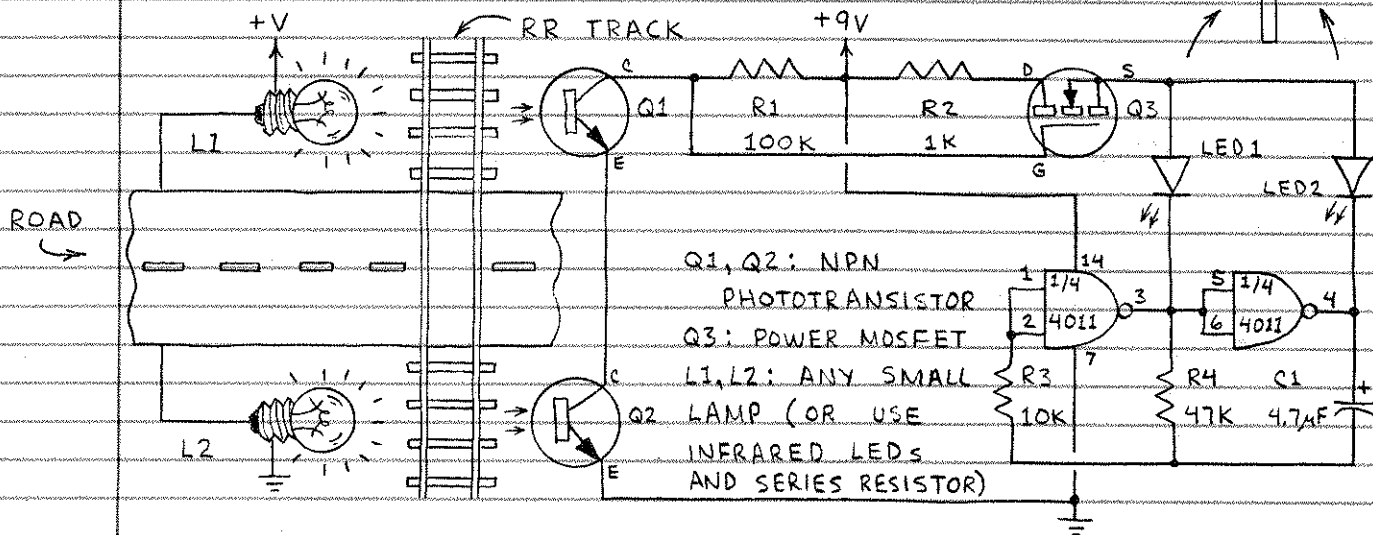
□ 1-OF-4 SEQUENCER

USE TO ACTUATE +9V
RELAYS, ETC.



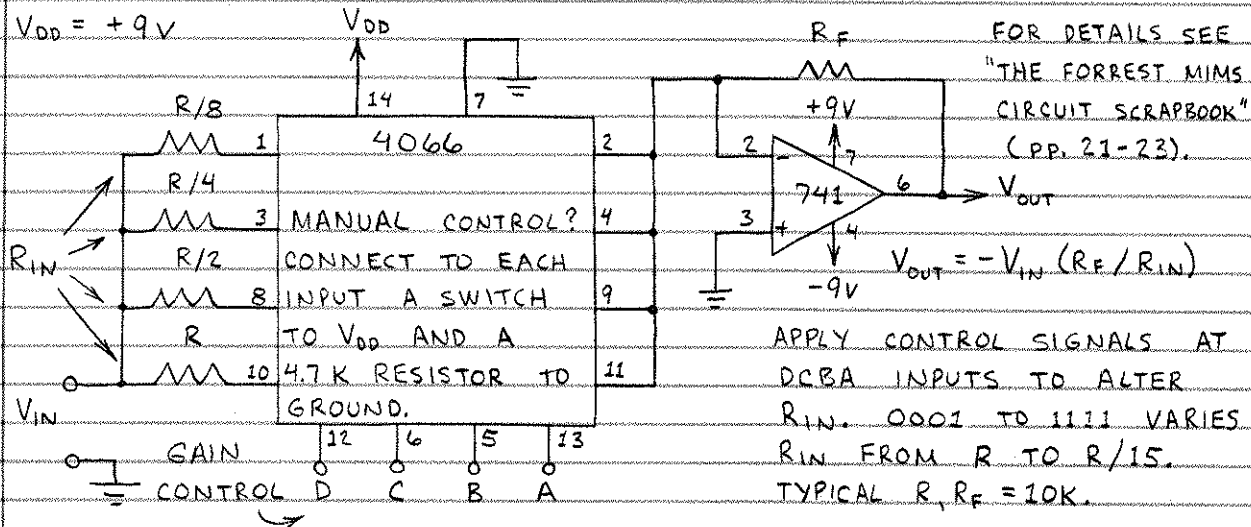
EACH LED TURNS OFF
IN SEQUENCE.

MODEL RAILROAD CROSSING FLASHER LIGHTS

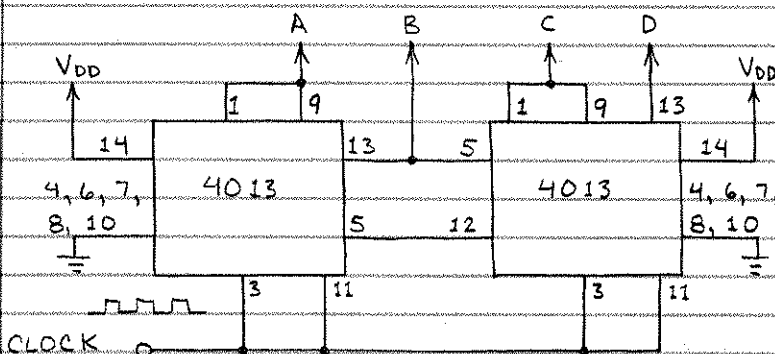


LEDs FLASH ALTERNATELY WHEN TRAIN BREAKS LIGHT BEAM TO EITHER Q1 OR Q2. LEDs CONTINUE FLASHING UNTIL TRAIN PASSES. SHIELD Q1 AND Q2 FROM ROOM LIGHTS WITH 1" HEAT SHRINK TUBING.

PROGRAMMABLE GAIN OPERATIONAL AMPLIFIER



ALL ON - ALL OFF SEQUENCER



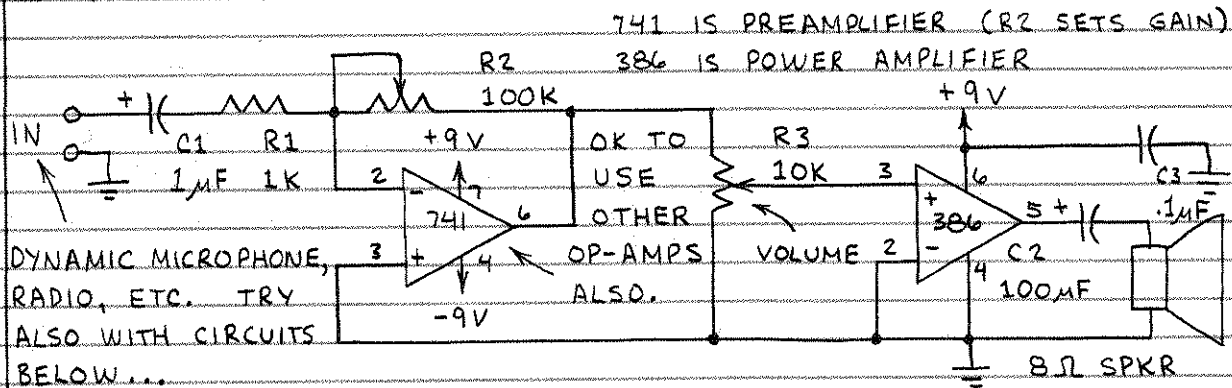
ALL OUTPUTS GO LOW, THEN HIGH, IN SEQUENCE (A...B...C...D...A...B... ETC.). USE WITH LEDs FOR EYE-CATCHING DISPLAY. FOR "BUCKET-BRIGADE" OPERATION, CONNECT PIN 5 OF FIRST 4013 TO PIN 13 (NOT 12) OF SECOND 4013.

LINEAR IC CIRCUITS

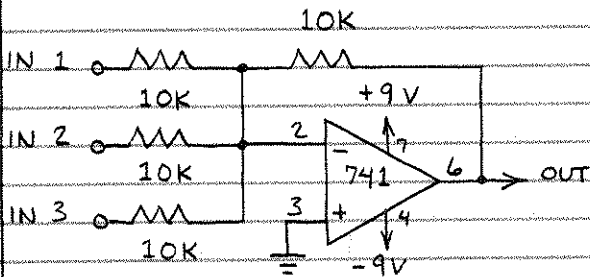
YOU CAN MAKE AN AMAZING VARIETY OF CIRCUITS WITH LINEAR ICs. HERE ARE A FEW OF THE MANY POSSIBILITIES:

OPERATIONAL AMPLIFIER (OP-AMP) CIRCUITS

□ AUDIO AMPLIFIER

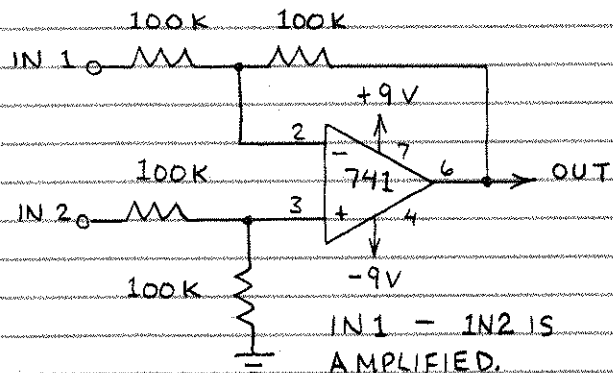


□ MIXER



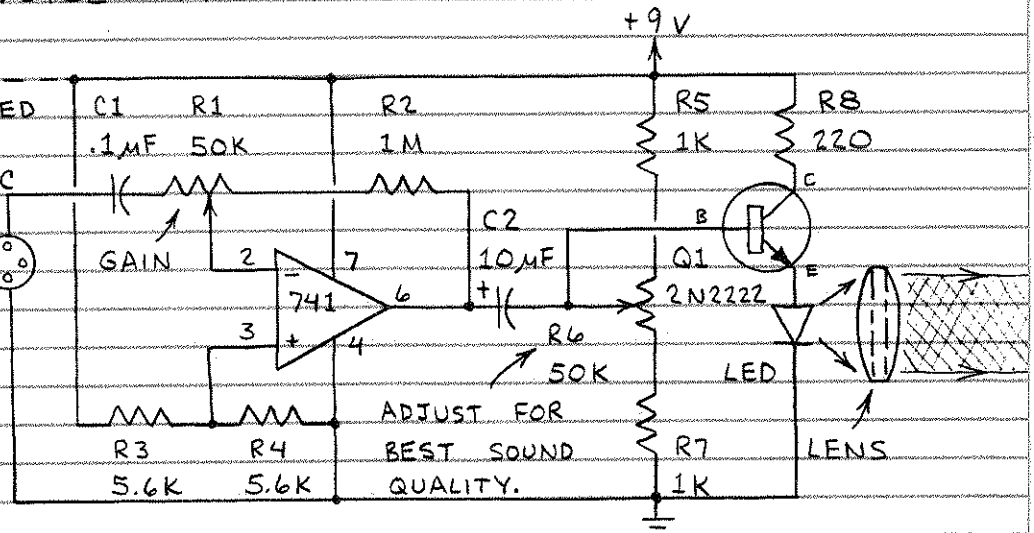
SEVERAL SIMULTANEOUS INPUTS.
USE WITH AUDIO AMPLIFIER ABOVE.

□ DIFFERENCE AMPLIFIER



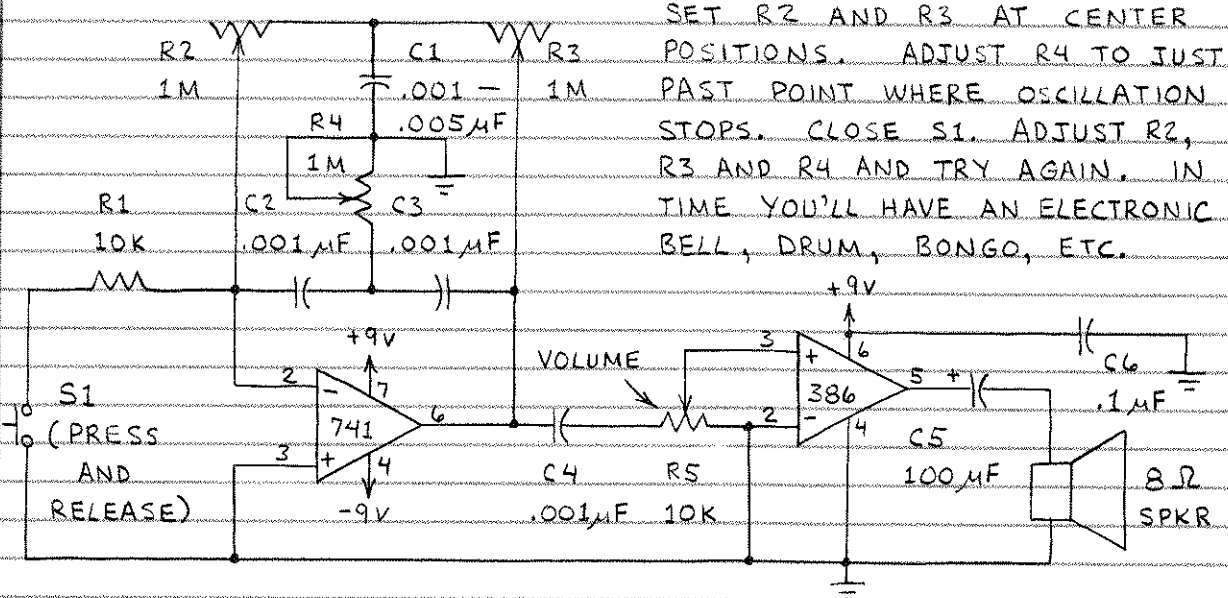
□ LIGHTWAVE VOICE TRANSMITTER*

MIC IS CRYSTAL OR ELECTRET*
MICROPHONE. *RED LED IS INFRARED TYPE. USE LENS TO FOCUS LIGHT FROM LED INTO NARROW BEAM. TO TEST, PLACE RADIO EARPHONE NEAR MICROPHONE. ADJUST R1 AND R6 FOR BEST RECEIVER SOUND.

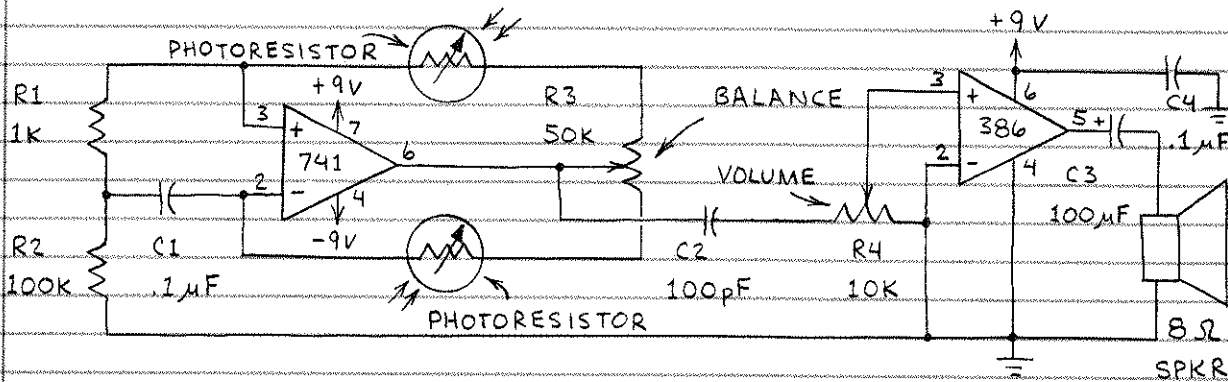


* SEE "THE FORREST MIMS CIRCUIT SCRAPBOOK" (PP. 35-42).

□ PERCUSSION SYNTHESIZER (BELL, DRUM, ETC.)

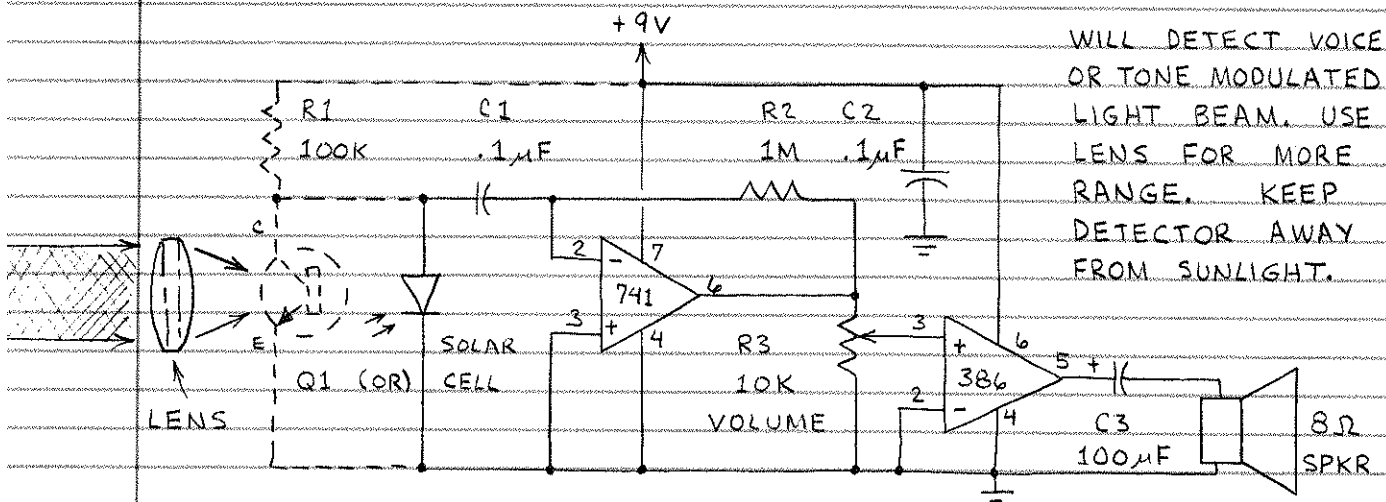


□ LIGHT SENSITIVE UP-DOWN TONE GENERATOR



TAKE THIS CIRCUIT AND A FLASHLIGHT INTO A DARK ROOM...

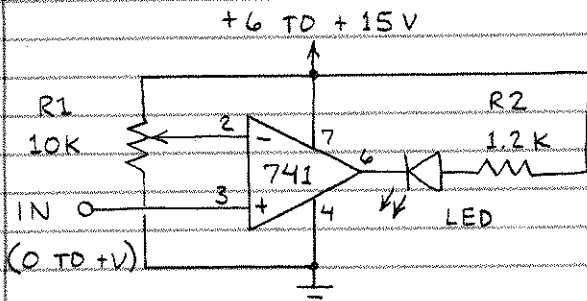
□ LIGHTWAVE COMMUNICATIONS RECEIVER



DETECTOR: USE R1 AND Q1 OR SOLAR CELL, (Q1: PHOTOTRANSISTOR)

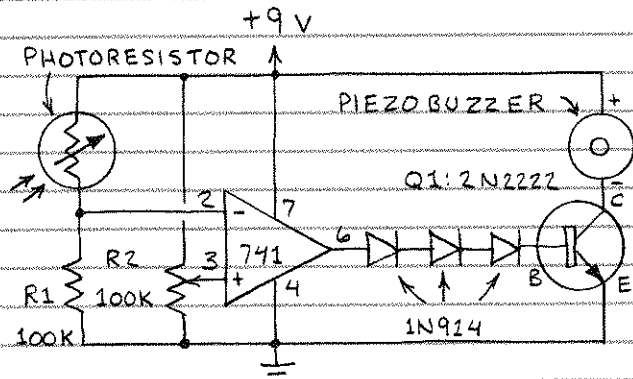
COMPARATOR CIRCUITS

VOLTAGE MONITOR



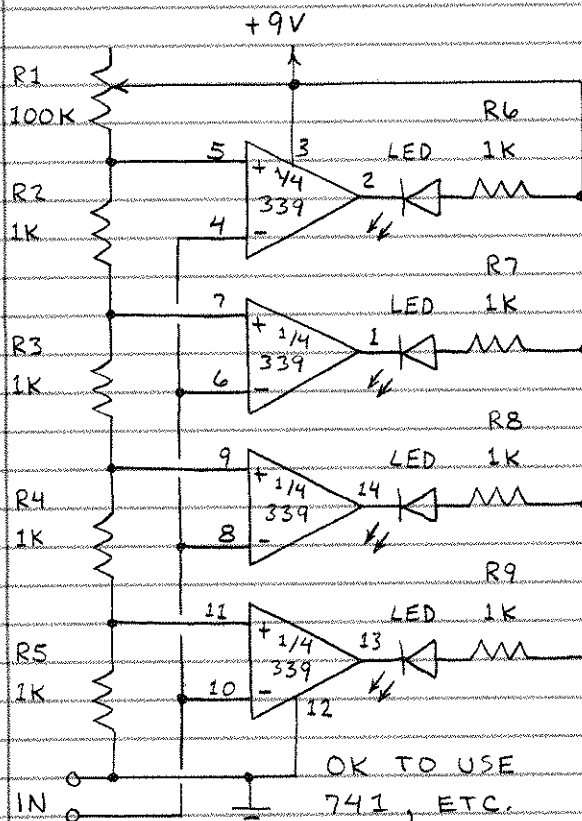
WHEN THE INPUT VOLTAGE IS 0, THE LED GLOWS. THE LED SWITCHES OFF WHEN THE INPUT VOLTAGE RISES TO A LEVEL DETERMINED BY R1. EXCHANGE CONNECTIONS TO PINS 2 AND 3 TO REVERSE OPERATING MODE.

LIGHT LEVEL INDICATOR



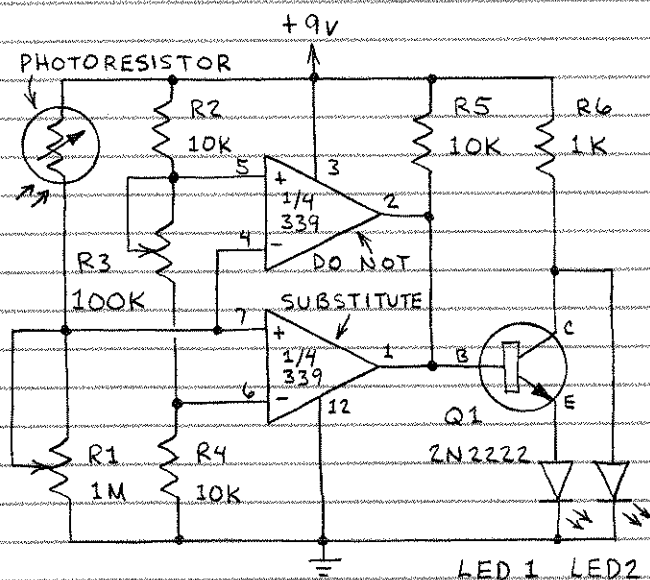
BUZZER SOUNDS WHEN LIGHT FALLS TO LEVEL DETERMINED BY R2. REVERSE CONNECTIONS TO PINS 2 AND 3 TO SOUND TONE WHEN LIGHT INCREASES.

BARGRAPH VOLTAGE INDICATOR



LEDs GLOW IN SEQUENCE AS INPUT VOLTAGE RISES. R1 CONTROLS SENSITIVITY.

"WINDOW" COMPARATOR



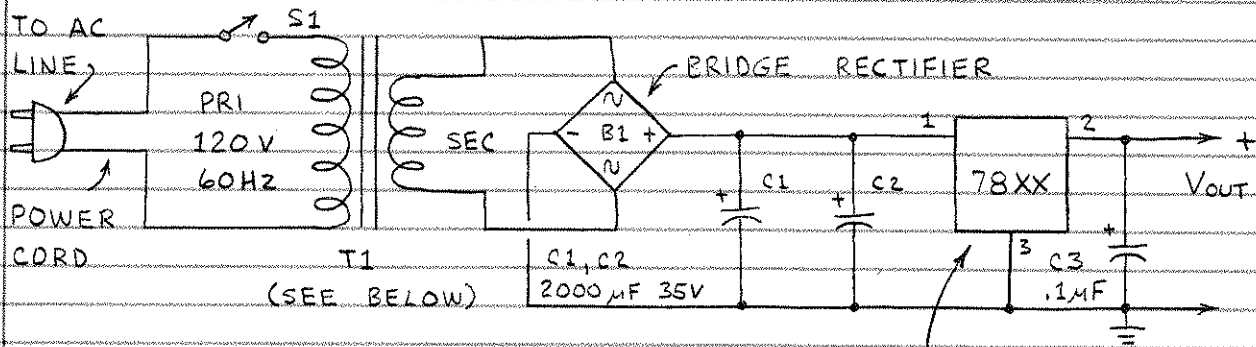
SET R1 TO CENTER POSITION. TURN OFF LIGHTS AND ROTATE R3 JUST PAST POINT WHERE LED 2 GLOWS. CIRCUIT WILL THEN RESPOND LIKE THIS:

(R1 & R3 CONTROL RESPONSE)

	DARK	—————>	LIGHT
LED 1 =	OFF	<-- ON -->	OFF
LED 2 =	ON	<-- OFF -->	ON

VOLTAGE REGULATOR CIRCUITS

□ FIXED OUTPUT LINE POWERED SUPPLY



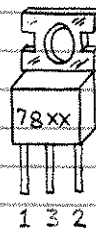
THIS BASIC SUPPLY WILL DELIVER UP TO 1.5 AMPERES AT THE RATED OUTPUT IF PROPERLY HEAT SUNK. YOU MUST USE A TRANSFORMER RATED AT THE PROPER VOLTAGE AND CURRENT. THE REGULATOR WILL "SHUT DOWN" IF THE CHIP BECOMES OVERHEATED. FOR BEST RESULTS APPLY SILICONE COMPOUND BETWEEN TAB AND HEAT SINK. ALL CONNECTIONS TO THE AC LINE MUST BE INSULATED OR ENCLOSED!

REGULATOR IC

7805 = 5 VOLTS

7812 = 12 VOLTS

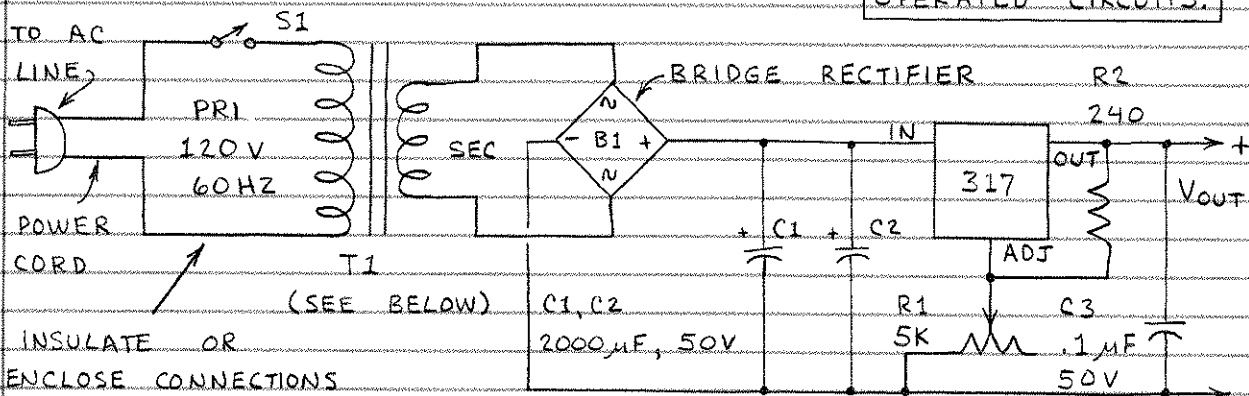
7815 = 15 VOLTS



HEAT SINK
TAB

1 - IN
2 - OUT
3 - GROUND

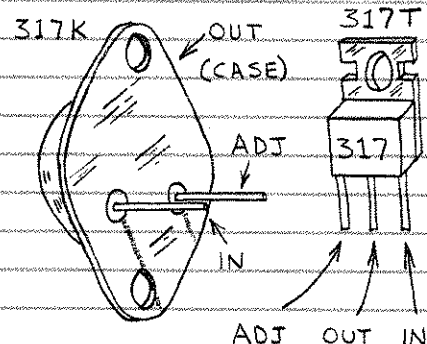
□ VARIABLE OUTPUT POWER SUPPLY



INSULATE OR
ENCLOSE CONNECTIONS

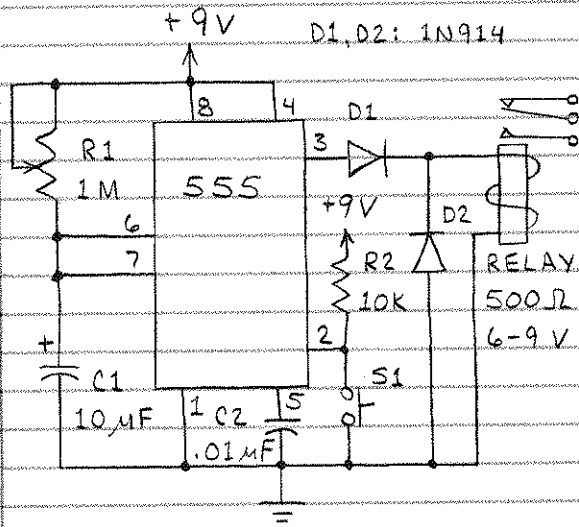
CAUTION: AC LINE
OPERATED CIRCUITS.

THIS ADJUSTABLE SUPPLY WILL DELIVER FROM 1.2 TO 37 VOLTS AT UP TO 1.5 AMPERES. R1 CONTROLS V_{OUT} . (IF V_{OUT} DOES NOT GO TO 1.2 VOLT MINIMUM, R1 MAY NOT BE ABLE TO ACHIEVE SUFFICIENTLY LOW RESISTANCE.) T1 SHOULD HAVE 25 VOLT (OR HIGHER) SECONDARY AND BE RATED FOR 2 AMPERES OR MORE.



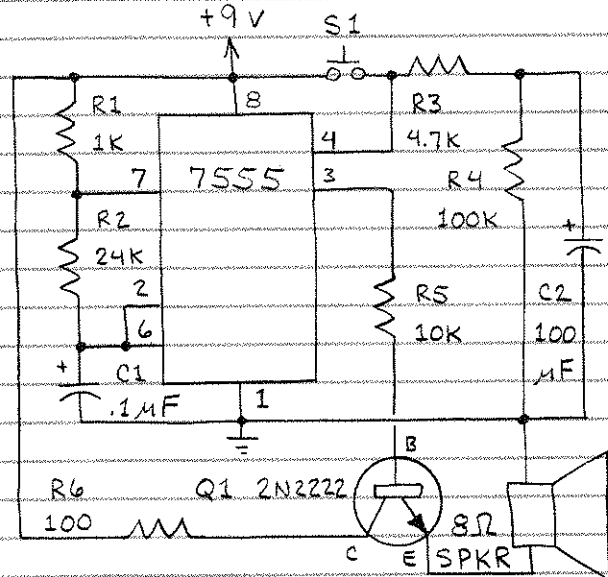
TIMER CIRCUITS

□ BASIC TIMER



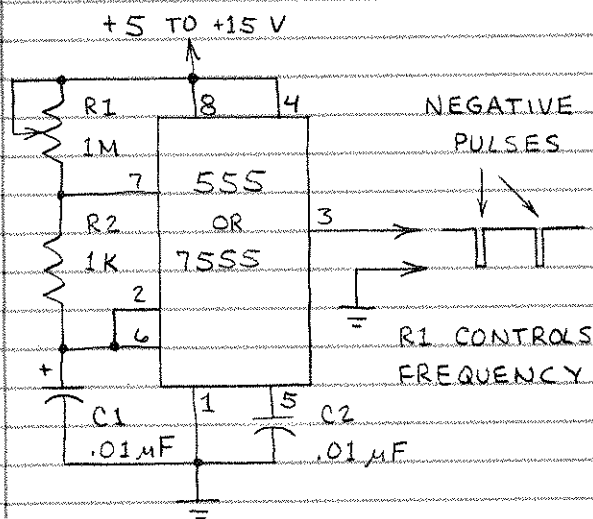
PRESS S1 MOMENTARILY TO START TIMING CYCLE. RELAY WILL BE ACTUATED (PULLED IN) UNTIL CYCLE IS COMPLETE. R1 AND C1 CONTROL LENGTH OF TIME DELAY. USE VERY LARGE VALUE FOR C1 TO GET LONG DELAYS. CIRCUIT WILL RESPOND TO LOGIC PULSES, TOO.

□ TONE BURST GENERATOR



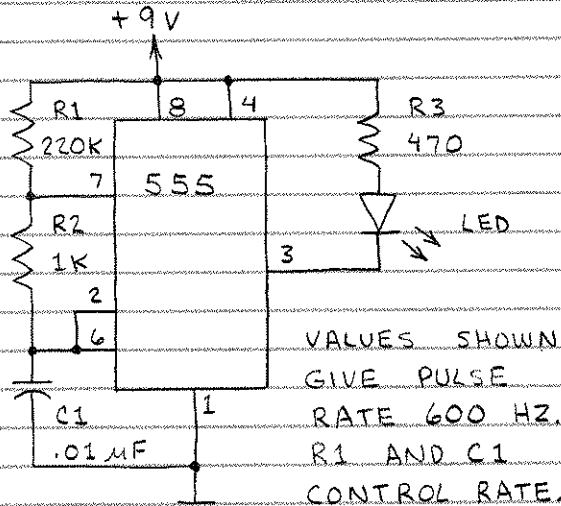
PRESS S1 AND THE SPEAKER EMITS A TONE. RELEASE S1 AND THE TONE CONTINUES FOR SEVERAL SECONDS. C2 AND R4 CONTROL DELAY. C1 CONTROLS FREQUENCY. (USE 7555 ONLY. 555 USES TOO MUCH CURRENT.)

□ PULSE GENERATOR



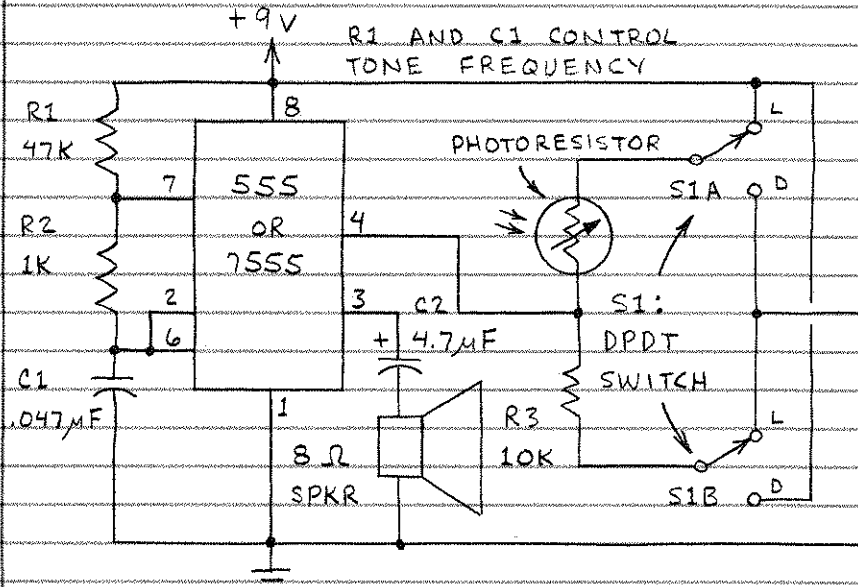
USE TO SUPPLY PULSES TO DIGITAL LOGIC CIRCUITS, ETC.

□ LED TONE TRANSMITTER



USE TO TEST LIGHTWAVE RECEIVERS.

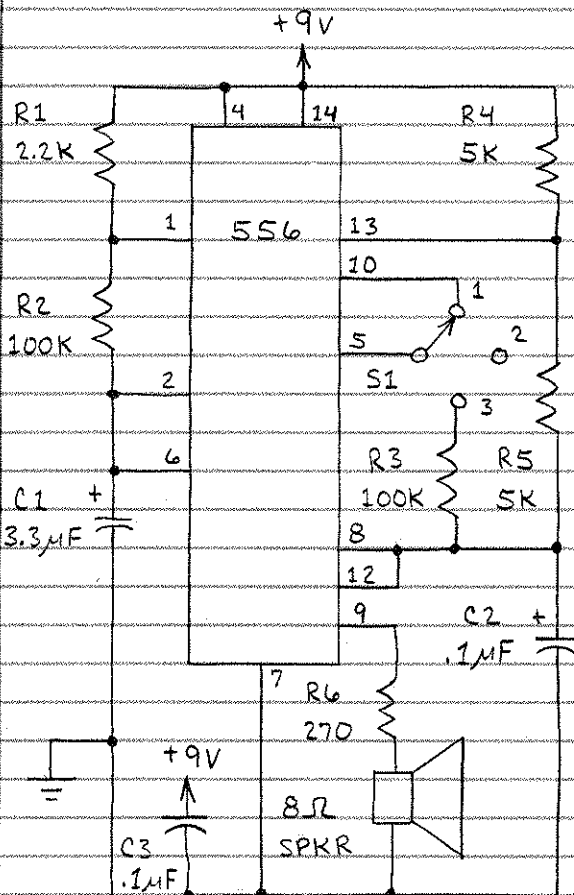
□ LIGHT / DARK DETECTOR



WHEN S1 IS IN POSITION "L," THE SPEAKER EMITS A TONE WHEN LIGHT ILLUMINATES THE PHOTORESISTOR. WHEN S1 IS IN POSITION "D," THE SPEAKER EMITS A TONE WHEN THE PHOTORESISTOR IS NOT ILLUMINATED.

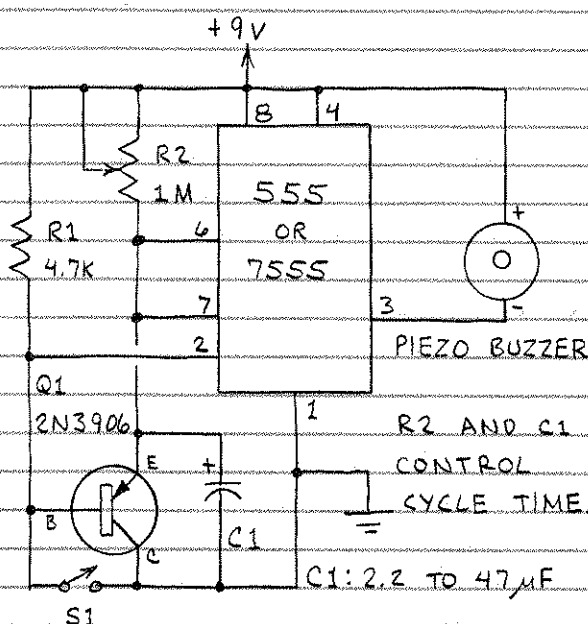
□ 3-STATE TONE GENERATOR

□ EVENT FAILURE ALARM



S1:

- 1- TONE BURST
- 2- STEADY TONE
- 3- TWO TONE



WHEN POWER IS APPLIED, THE 555 ENTERS A TIMING CYCLE. UNLESS S1 IS CLOSED BEFORE THE CYCLE ENDS, THE PIEZO BUZZER SOUNDS. THE CYCLE CAN BE RESET ANY TIME BY CLOSING S1. NOTE: S1 CAN BE REPLACED BY A SIGNAL FROM AN EXTERNAL CIRCUIT.

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