PHASER PAIN FIELD GENERATOR

THE FOLLOWING SET OF CONSTRUCTION PLANS DESCRIBE A POTENTIALLY POSSIBLE HAZARDOUS DEVICE TO HUMANS AND ANIMALS AND MUST BE TREATED WITH CAUTION. Remember, just because you do not hear this energy does not mean it is not affecting you. When testing always direct transducers towards accoustical absorbing material such as accoustical board, etc.

If at any time your head or neck feels swollen or you feel light headed or sick to your stomach, it is an indication that you are being affected. Some times you may experience a continuous ringing in the ears even after the device is turned off.

High powered ultra-sonics have been known to have the capabilities of damaging hearing, affecting mental states and in extreme cases, causing brain damage. Very high powered ultra-sonics can be SUPER HAZARDOUS if not used with discretion. The described device in these plans are intended as a laboratory source of moderate powered accoustical ultrasonics. It can be used to control rodents by disrupting their metabolic functions, forcing them into the open from hiding places; studying rodent behavior and other controlled scientific functions.

It is only suggested as a possible potential intrusion deterrent. It is to be clearly underst-od that the device is not intended to be used on humans. We at SCIENTIFIC SYSTEMS in no way encourage the use of this device for human exposure and strongly advise all safety precautions to be exercised.

The information and specifications are purchased at buyer's risk only. The literature we sell is usually based on well know scientific facts and general knowledge and are written by experienced graduate scientists, but we assume no responsibility or liability for informational accuracy or reliability or infringements upon patents or proprietary information or the use of use information for unlawful or illegal purposes. Projects and plans for projects are developed or constructed at Buyer's risk only. Since fabrication is out of our control, we will not guarantee operation or proper function. We are not liable or responsible for personal injuries, property damage, infringements of the law or delayed delivery of merchandise as a result of information or plans we supply.

The unit can be used as a property protection device by proper placement and installation of the transducers at certain points in the area to be protected. Because of the relative newness of the product, little can be said about the effective area per transducer for this type of application. The difference in hearing from one animal to another also presents a problem in determining a hard, fast rule of installation.

The designer of these plans suggests two transducers per 1000 square feet, so placed as to direct maximum energy toward the suspected entry point. This serves as starting points and will no doubt require more energy if there are many accoustical absorbing materials in the area and vice-versa. It must be understood that the device in this application may not always present a problem of pain to the intruder but will not doubt create a paranoia situation scaring him away having never been exposed to a device such as this before. Please note that our model PPG1 as described inside the front cover is more suited to this application.

INTRODUCTION

Please note before constructing this device the potential possible hazards involved. Ultrasonics at very high accoustical levels are known to be dangerous to humans if overly exposed, possibly producing brain damage. It is therefore, extremely important that adequate accoustical shielding of the operator and his immediate surroundings be capable of attenuating these waves down to a safe level. You will note that the directional characteristics of a system such as this becomes more pronounced at the higher frequency end. Proper safety precautions are a necessity and must be heeded to their fullest both in construction and using. Therefore, the builder and alternate user must be aware of the potential consequences of this device and must treat it the same way he would a laser, high voltage power supply, X-rays, radioactivity, micro-waves, etc. Many devices have useful purposes, but in the wrong hands can create hazards and be a nuisance in the users surroundings. Because of this reason, we cannot offer the device to the general public with the exception of authorized law enforcement agencies and proven responsible individuals in completed form. This particular design at present is under contract in a similar package to several law enforcement agencies both home and abroad. Therefore, these plans will no doubt be unavailable to the general public such as was the case with the electric dart guns, etc., within a year, without proper permits and licensing.

The following plans show how to construct a moderately high powered, variable sweep frequency, ultrasonic accoustical generator capable of handling the equivalent of 400 watts of resultant power obtainable from an equivalent conventional dynamic transducer system. This is possible due to a recently developed piezoelectric tweeter speaker developed by MOTOROLA. These devices produce six times the accoustical output obtainable from conventional dynamic methods for the same required driving power. This feature allows the use of relatively light-weight, low powered equipment to obtain these high accoustical energies enabling portable, light weight and hand-held use. The device described is directional and offers the options of adding up to sixteen transducers either in an array for high sonic densities or placement in individual locations for large area coverage. Effective animal or rodent control with a device such as this is the result of automatically varying the frequency so these animals cannot develop a tolerance (such as deafness, immunity) to it. Many fixed frequency ultrasonic devices lose their effectiveness after several weeks because of this immunity problem.

APPLICATIONS

Application of this device, other than laboratory uses are mainly in the fields of animal and pest control. Certain rodents when exposed will go into a frenzy, sometimes causing brain hemmoraging, vomiting, decreases in mating urges, slowing down of metabolic functions. etc. All of these results are of course related to species of animals, frequency setting of the device and of course, wave intensitites being directly related to distances from the device.

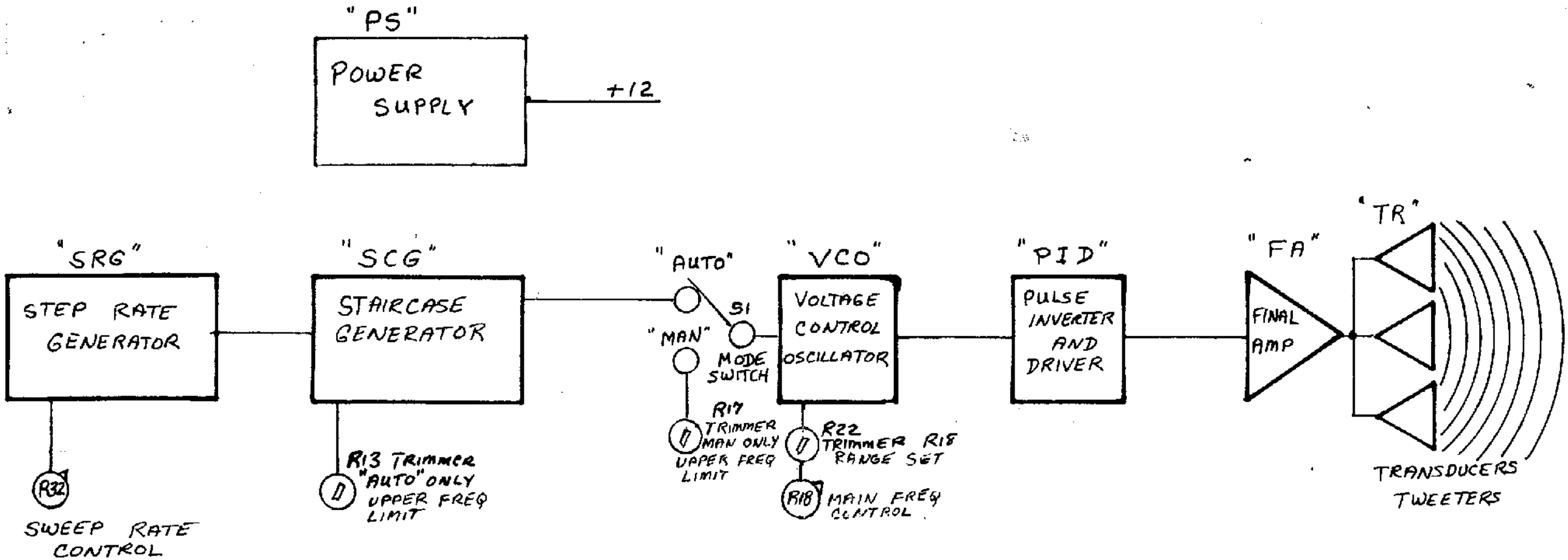
Typical area for use of this device are food storage areas, waste areas, or where ever animals such as rats and rodents are a problem. Also, note that these devices should be safety interlocked, automatically being turned off when areas are entered by humans. Other known uses of this device are control of crowds and demonstrations by law enforcement personnel. The French Police have been known to use such a device for breaking up unauthorized groups of potentially unruly people.

It should be understood that certain people are affected more than others, some to a point where they will vomit, experience severe headaches and cranial pains. Some people will experience severe pain in the ear, teeth, lower head, etc. Statistically, women and younger children are many times more sensitive to this device than average male adults. With this in mind, the builder must exercise consideration when testing and using the device as many people will not be aware of the source of this pain or uncomfortable feeling and attribute it to a headache or other physical ailment. Also, certain people are affected mentally to a point of actually losing their tempers completely or becoming extremely quick tempered. Some people will experience a state of extreme anxiety when overly exposed. Therefore, consideration must be used at all times when testing or using this or similar devices.

It should also be noted that construction using the tweeters in an array configuration is more hazardous to people than the individual placement of these tweeters when used to control a large area for rodent and pest infestation. The array approach produces high sound pressure density occuring on axis of the array.

BRIEF DESCRIPTION OF OPERATION

We shall now proceed to give a brief description of the electronic circuitry referencing the "Block Diagram" layout. The device is essentially a high-powered source of ultrasonic accoustical energy of a frequency constantly varying between preset low and high limits at an operationally adjustable sweep rate when operated in the "Auto" mode. "Manual" mode allows presetting a continuous frequency to a fixed value and also the lower limit at the swept frequency when in the "Auto" mode. PLEASE NOTE THE ABBREVIATIONS OF THE BLOCK DIAGRAM STAGES AS THEY WILL BE USED FROM HERE ON IN. An array or individually located tweeter transducers (TR) of from 4 to 16 are driven by a transformer coupled final amplifier (FA) consisting of two Class B operated power transistors mounted on a heatsink. These transistors are driven by a pulse driver and inverter (PID). this stage is driven by a voltage control oscillator (VCO) with an adjustment for the lower frequency limit. The VCO is driven by either a varying DC level generated by the Stair-case generator (SCG) in the "Auto" mode or an adjustable DC level termed "Manual Frequency Control" (MFC). These two functions are selected by the "Mode" switch. The SCG also contains the adjustment for the upper frequency limits of the VCO. The SCG is driven by the Step Rate Generator (SRG) that determines the rate of frequency sweep between the preset "Auto" limits. The SRG is controlled by the sweep control rate (SCR).



SYSTEM BLOCK DIAGRAM

The power supply for this device can be any medium duty source of batteries developing 12Vdc. Plans show the use of 8 - 1½ "D" cells of the nickel cadmium variety connected in series for 12 volts. The Nicads are easily changed and reusable. Batteries may be replaced by a battery eliminator or conventional power supply capable of 2 amps at a low ripple rate.

PLEASE REFER TO ASSEMBLY BOARD PICTORIAL (SHEET B) AND SCHEMATIC FOR STEPS 1 - 26.

The construction steps to this device will be divided into sections, each containing assembly steps, circuit theory and functions. Note, use component leads for wiring whenever possible.

I. STEP RATE GENERATOR (SRG)

1. Layout the 2.5" x 5" piece of perfboard as shown in sketch. Use Sheet B for component interconnection sketch aid.

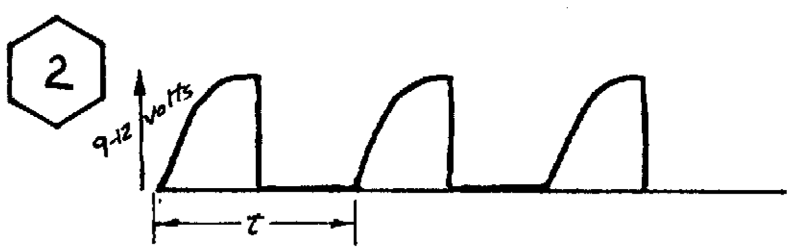
2. Insert and wire R1, R2, R3, R4, C1, C2, Q1, Q2, and C3 as shown. Observe polarity of C1 and C2 and position of Q1 and Q2.

3. Insert the three leads (J,K,M) , each about 12" as shown to R32A and R32B (SWEEP CONTROL RATE). Use holes in perfboard for strain relieving of these wires. Tape together and wire to R32A & B as shown in schematic.

4. Check wiring and soldering for errors and quality.

5. Apply 12Vdc to respective points and measure. Observe test points (2) with scope as shown in test patterns #2. Vary R32B and note frequency varying from 10 to 100 pps.

6. Verify correct operation and proceed to next step.



Pulse rep. VARIABLE VIA R32AB
FROM 10 ms to 100 ms

THEORY OF STEP RATE GENERATOR (SRG)

This circuit is nothing more than a free running multi-vibrator consisting of an astable switch with Q1 and Q2 switching from an "off" to "Saturating" mode producing a square wave output of voltage equal to approximately VCC (+12V).

This circuit performs as follows: Q1 (for reference sake) starts to conduct causing its collector voltage to decrease consequently producing a negative voltage via C1 at the base of Q2 completely "off". C1 now must discharge through R32A and R4 to a point where the base of Q2 will cause conduction repeating this sequence of events through C2 and the base of Q1. You will note that the wave form may be deteriorated at the high rep rate end. This is due to the charging time of C1 and C2 through R2 and R3 respectively. The dual pot R32A and B Determines the discharge time of C1 and C2 consequently the pulse rep rate.

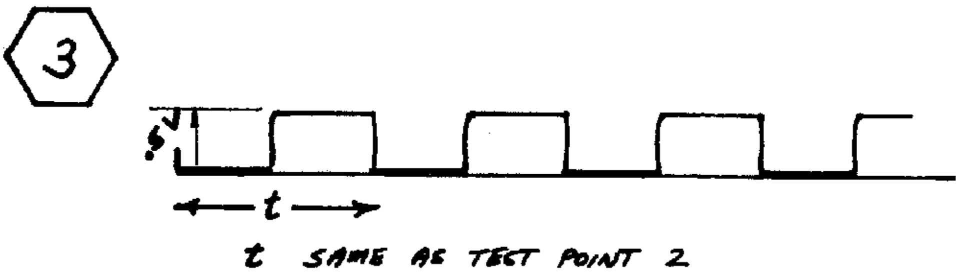
7. Drill extra holes for pins of I1 and arm of R13 in perfboard.

8. Insert and wire I1 and other related components, R5, R6, R7, R8, R9, R10, R11, R12, R13, D1 and C4. Observe polarity and position of D1 and [illegible] Wire and solder as shown. Mount C5 under board as shown.

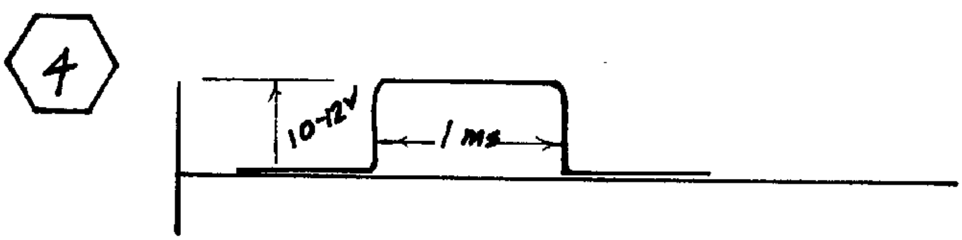
9. Insert and wire D2 and C6 and connect +12 and ground buss lines together with SRG section. Note that D6 provides protection of I1 and I2 from reversed polarity during testing.

10. Check wiring and soldering for errors remembering that mistakes may cost you the I1 intergrated circuit.

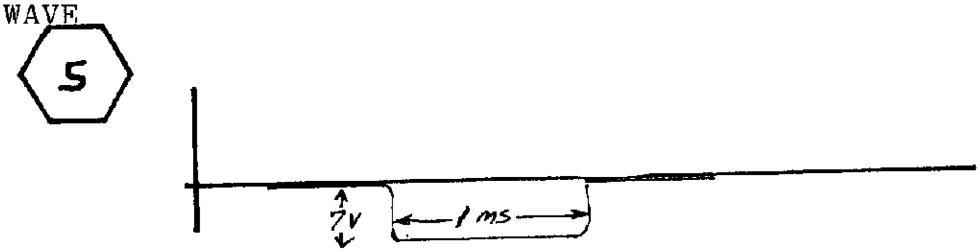
11. Connect 12 volts as in Step 5 and observe test points 3,4,5, & 6 as shown. Set R32AB at midrange.



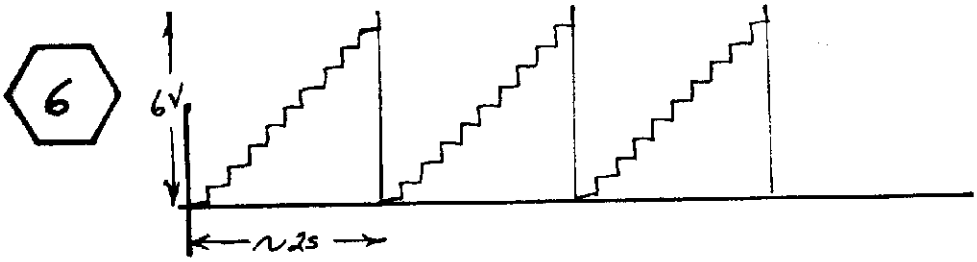
THIS IS THE STEP VOLTAGE TO I1A AND DETERMINES THE RATE OF STAIRCASE GROWTH. NOTE THE WAVE FORM BEING CLIPPED DOWN TO .5V DUE TO THE INPUT OF THE AMPLIFIER I1.



SCHMIDT OUTPUT PULSE
THIS PULSE IS THE RESET PULSE FOR THE STAIRCASE GENERATOR AND OCCURS WHEN THE STAIRCASE GROWS TO ABOUT 75% OF THE 12 VOLTS VC OR ONCE EVERY SWEEP. THIS IS THE OUTPUT OF THE SCHMIDT DISCRIMINATOR I1B. IT IS TRIGGERED BY I1C CONNECTED AS A COMPARATOR SAMPLING THE OUTPUT LEVEL AT PIN 4, I1A. IT MAYBE NECESSARY TO EXTERNALLY TRIGGER THE SCOPE FOR A CLEAR PICTURE OF THIS WAVE.



COMPARATOR OUTPUT PULSE
THIS MEASUREMENT IS UNNECESSARY IF WAVE FORM PICTURES 4 & 6 ARE OK INDICATING THE SCG STAGE IS PERFORMING CORRECTLY. IF NECESSARY, EXTERNAL TRIGGERING WILL BE REQUIRED - Use PIN 9 of I1B.

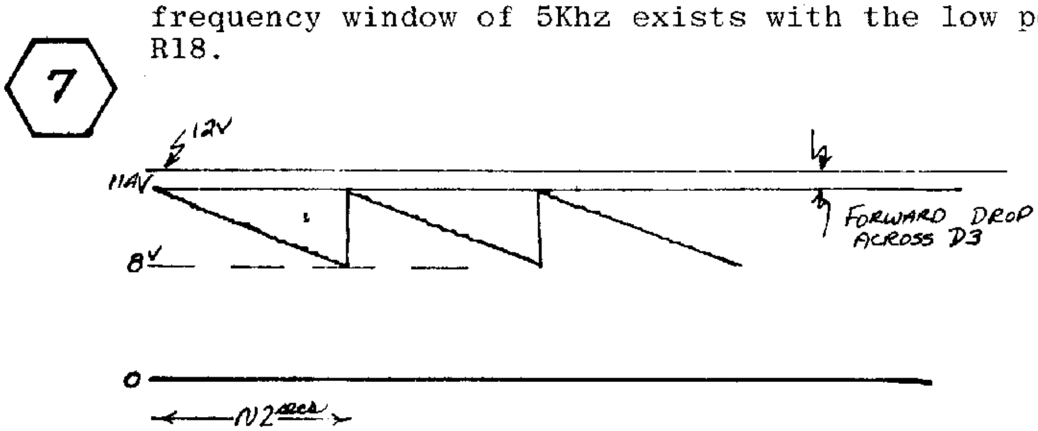


INVERTED VCO CONTROL VOLTAGE - THIS IS THE INVERTED STAIRCASE FOR CONTROLLING THE VCO. YOU WILL NOTE THAT IT ALWAYS STARTS AT 11.4 VOLTS AND RAMPS DOWN TO SOME VALUE PRESET BY R13. DIODE D3 SUPPLIES OFFSET AND PREVENTS PIN 5 OF THE VCO FROM APPROACHING THE VALUE VC 12V AND CONSEQUENTLY LOCKING UP. THE RAMP OUTPUT OF Q3 IS FAIRLY LINEAR OVER THE REQUIRED RANGE OF SWEEP VOLTAGE.

19. Preset R22 to midrange and connect scope to testpoint 8. This point is the pulse output of the VCO and should be constantly varying along with the staircase ramp voltage noted at test point 7. It is this varying frequency that is amplified and used to drive the transducers of this system. When in the "auto" mode of S1 you will note that this frequency value is constantly varying between certain limits at a sweep rate determined by R32B. When in the "manual" mode of S1, the VCO frequency output is adjusted by R18, "Manual Frequency Control" and does not vary or sweep back and forth.

20. To adjust the upper and lower frequency limit, perform the following: Adjust R32 for slowest sweep rate. Determine limits in this case, 10Khz to 25Khz. Observing test point 8;

A. Preset all trimpots midrange, R18 full CW (highest frequency).
B. Sweep switch to "auto".
C. Set R22 to 20Khz-50 usec Low end.
D. Set R13 to 25Khz 40 usec High end, sets frequency window.
E. Set sweep switch to manual.
F. Set R17 to 20Khz (50 usec).
G. Check range of R18 Low end to less than 10Khz both auto & Manual. You will note that when in the "Auto" sweep position that a frequency window of 5Khz exists with the low point being set by R18.

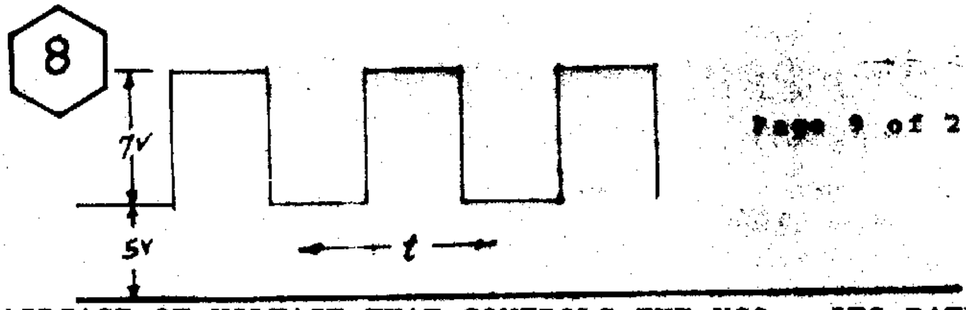


VCO OUTPUT WAVESHAPE - THE ABOVE WAVESHAPE VARIES FROM t=100 usec to 50 usec OR A CORRESPONDING FREQUENCY OF FROM 10KHZ TO 20KHZ, depending on Step 20 adjustments. NOTE SYMETRY OF THIS WAVESHAPE.

VOLTAGE CONTROLLED OSCILLATOR (VCO)

This circuit is the heart of the device. It determines the operating

REQUIRED - USE PIN 9 of I1B.



STAIRCASE OUTPUT
THIS IS THE RAMP OR STAIRCASE OF VOLTAGE THAT CONTROLS THE VCO. **ITS RATE** OF OCCURENCE IS THE SWEEP RATE OF THE SYSTEMS GENERATING LOW TO HIGH FREQUENCIES. NOTE THAT THESE INDIVIDUAL STEPS BECOME LESS PRONOUNCED WITH FASTER SWEEP RATES.

THEORY OF STAIRCASE GENERATOR (SCG)

This circuit utilizes a quad operational amplifier where three of these circuits are used - the other remains as a spare.

The first amplifier I1 functions as an intergrator where the current pulses from the step rate generator are intergrated and held on C4 It is this voltage that builds up in a staircase fashion (hence the name of the circuit, etc), a step at a time determined by the step rate generator (SRG). Discharging C4 is necessary to reset the circuit and again start from the bottom of the staircase and resetting at this upper limit. This is accomplished by amplifier I1C functioning as a comparator, sampling the staircase level when it reaches approximately 75% of 12-volts and triggering a Schmidt descriminator consisting of I1B that resets I1A through blocking diode D1 and resistor R6 commencing the sequence once again. The Staircase voltage variation produced at pin 4 of I1A is used as the control voltage of a "Voltage controlled oscillator", VCO.

III. VOLTAGE CONTROLLED OSCILLATOR (VCO)

12. Drill extra holes in perfboard for I2, and arms of R17 and R22.

13. Insert R14, R15, R16, R21, D3, C7 & C8, C9. Insert R17 and R22 and bend over tabs to secure in place. Insert Q3 and I2 and note proper position.

14. Wire and Solder as shown.

15. Insert 12" wire leads to points indicated on board and connect to external controls; R18 and S1. Strain relieve and twist these leads via inserting through holes in perfboard.

16. Connect 12V and ground buss lines as shown.

17. Carefully check all wiring and soldering for shorts, etc. Note errors can be costly to the intergrated circuits.

18. Connect 12 volts as in step 5. Place S1 in "Auto" position and R18 at midrange. Observe test point 7 and note DC level starting from 11.4 and stepping down to about 8V. (INVERSE OF WAVE FORM at Test Point 6).

frequency as a function of the level DC voltage at pin 5 of I2. This voltage is the result of the staircase generator. You will note that the frequency excursions are controlled via R13 (Upper limit) and R22 (lower limit).

The VCO is the intergrated circuit I2 and contains an internal current source that charges external capacitor C8. When C8 reaches a certain voltage a Schmidt triggers and produces a square wave output at Pin 3.

An external resistor connected at Pin 6 along with the external capacitor C8 determines the center frequency of the device.

IV. PULSE INVERTER AND DRIVER (PID)

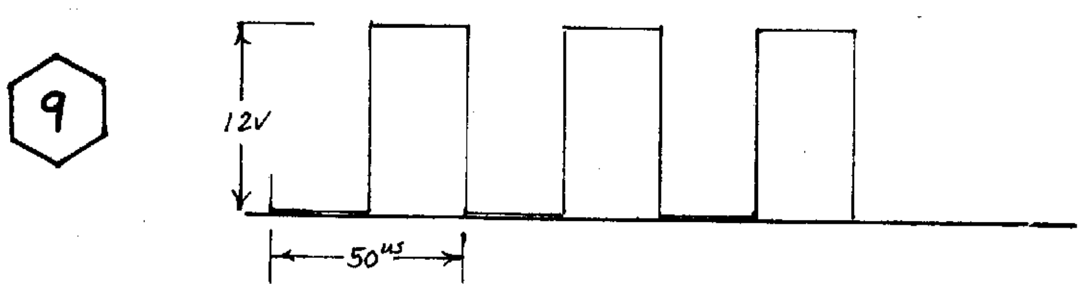
21 Drill extra holes for the bases of Q7 and Q8.

22. Insert R23, 24, 25, 26, 27, 28, 29, 30, 31, Q4, Q5, Q6, Q7, Q8 as shown. Note Q6 is a 2N2907 PNP. Note position and polarity of transistor.

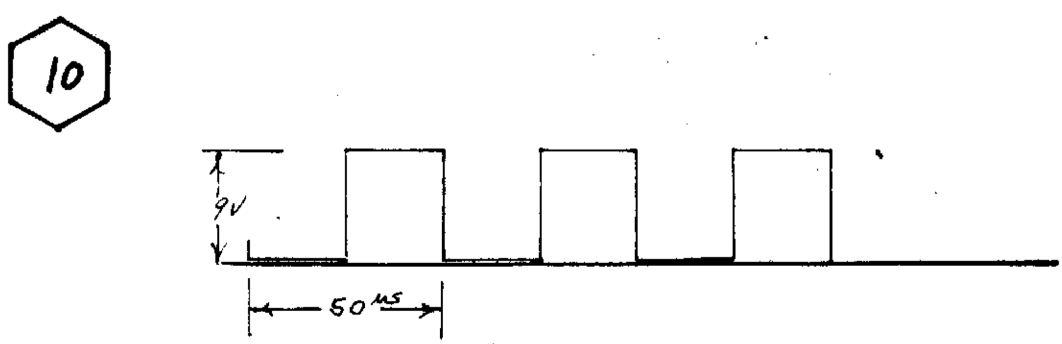
23. Wire and solder as shown connecting VCE, grounds and R20 as shown. Check for accuracy soldering and shorts.

24. Connect 12Vdc as in Step 5. Observe test point 8, set S1 to "Manual" and adjust R18 for 20Khz.

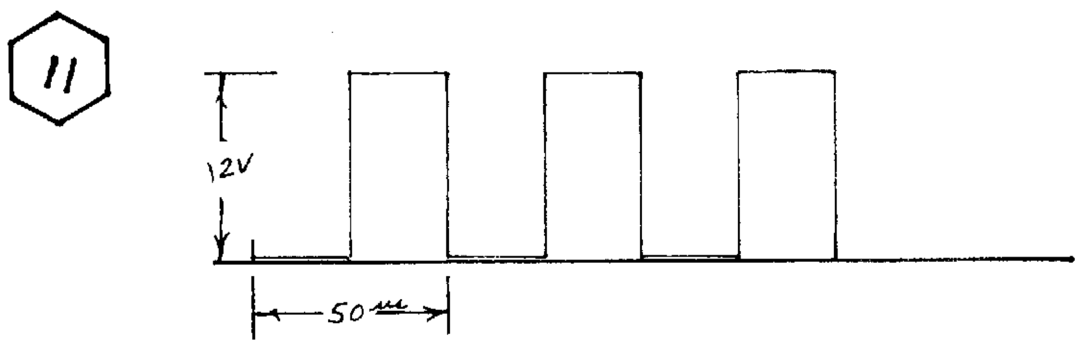
25. Note the following waveforms at test points 9, 10, 11, 12. Connect external trigger of scope to test point 8 to establish time reference. These waveforms are such without B1 and B2 being connected to the FINAL AMP. When connected the voltage should drop from 12 to less than .4 on waveform sketches 11 & 12.

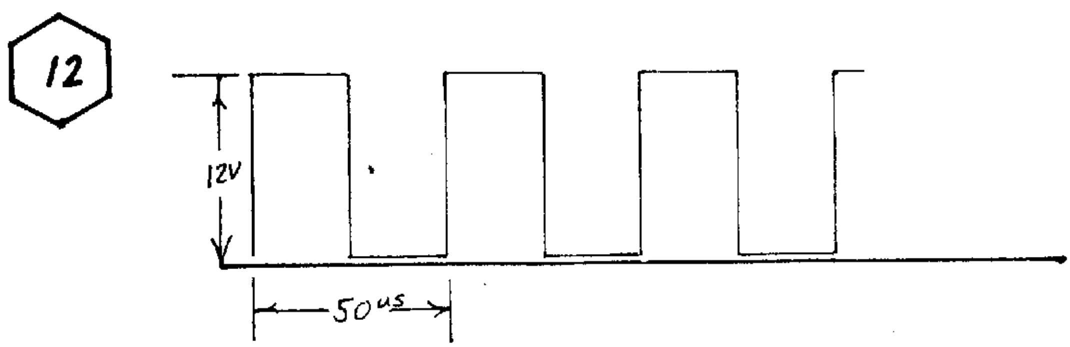


BUFFER STAGE OUTPUT - THIS SINGLE IS A SYMETRICAL SQUARE WAVE SATURATING Q6 AND APPEARING ACROSS R25.



INVERTER STAGE - THIS IS THE OUTPUT OF THE INVERTER STAGE Q5 AND INVERTS THE SQUARE WAVE DRIVING Q8.





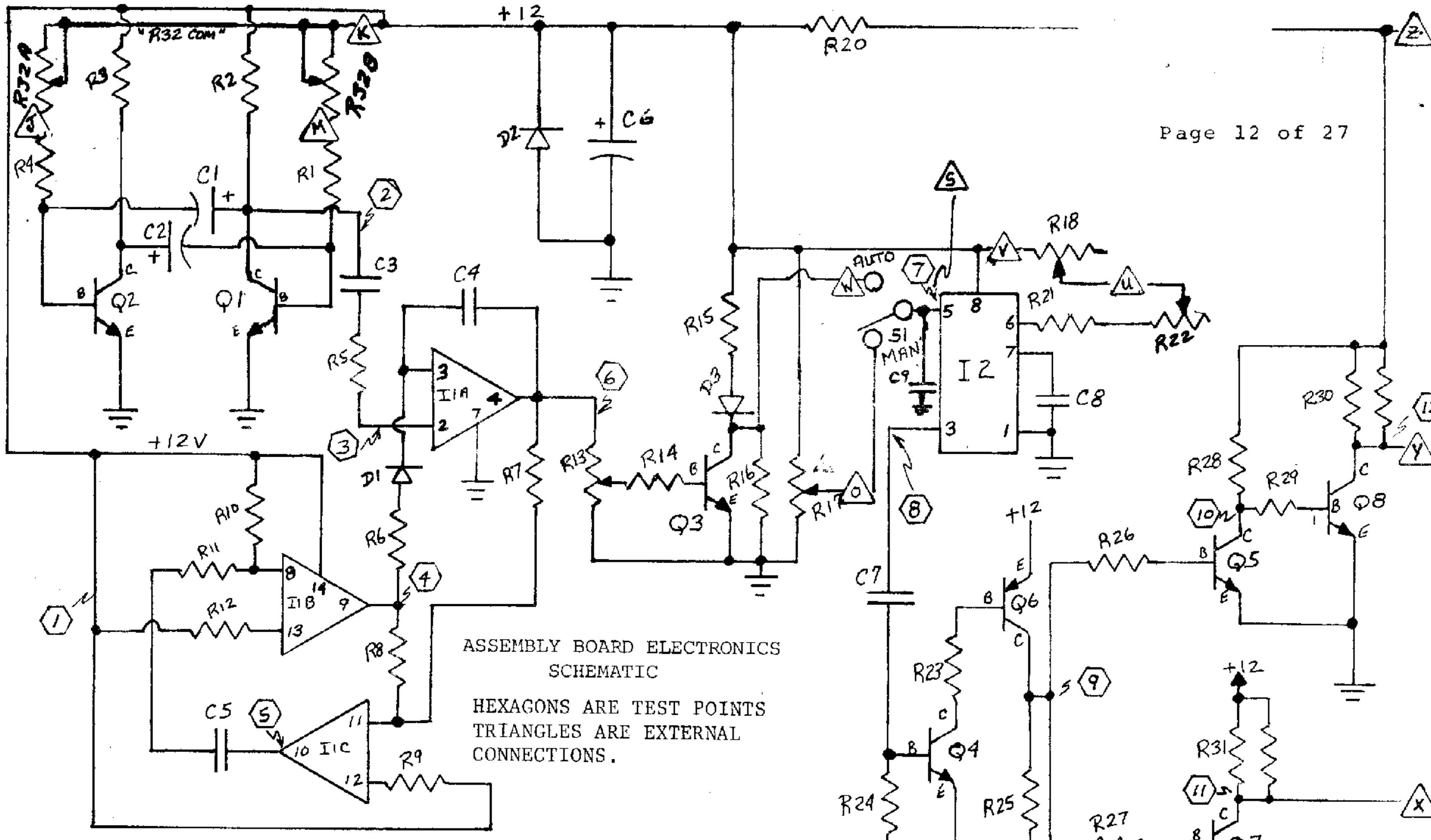
DRIVER OUTPUT TO BASE - THESE WAVE FORMS ARE 180 degrees OUT OF PHASE RESPECTIVE TO ONE ANOTHER (TEST POINTS AND (11 and 12) MUST SUPPLY SUFFICIENT CURRENT TO CAUSE COMPLETE SATURATION OF THE FINAL AMPLIFIER TRANSISTORS.

CIRCUIT DESCRIPTION OF THE PULSE INVERTER AND DRIVER (PID)

This state is a DC amplifier with an inverter stage supplying two positive going symetrical pulses of current 180 degrees out of phase for driving the final amplifier in a push-pull configuration.

Pulses occuring at "B" of Q4 switch Q4 and Q6 off and on (saturated). Voltage pulses across R25 ar separated and routed to driver transistor Q7 and inverter transistor stage Q5 and driver transistor Q8 providing square waves or voltages 180 degrees of out phase between B1 and B2.

The above described was the most difficult construction and completes the electronic assembly board of this system. This section must be properly operating before interfacing with the remainder of the circuit or damage to the final amp, transducers, etc., can result. The frequency limits described are only an example. Range can be as low as 5Khz to as high as 25Khz.



ASSEMBLY BOARD ELECTRONICS SCHEMATIC

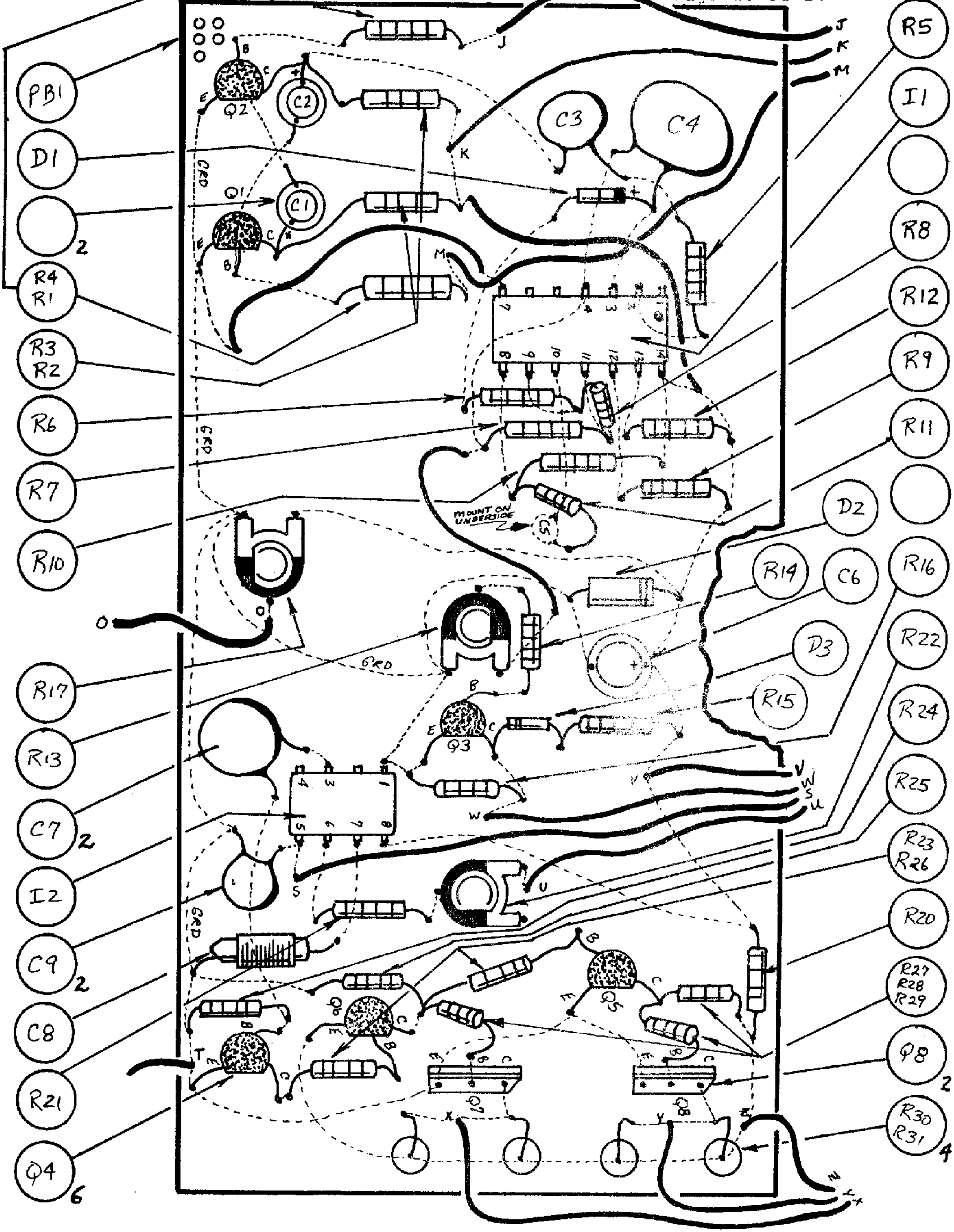
HEXAGONS ARE TEST POINTS
TRIANGLES ARE EXTERNAL CONNECTIONS.

YOUR UNIT IS PRESET AT THE FACTORY (OR RECOMMENDED PRESET) TO THE FOLLOWING FREQUENCY LIMITS:
Range is 5Khz to 20Khz adjustable via R18 "MAIN FREQ CONTROL".
In the "auto" mode R18 selects the lower starting frequency at the beginning of the sweep. Frequency now increases by approximately 5Khz at a rate determined by the R32 SWEEP RATE CONTROL. When in the "MA N" mode the frequency remains constant to that selected by R18. Examples of Frequency sweep are the following:

A. R18 at 5Khz sweeps to 10Khz - ANTI INTRUSION
B. R18 at 10Khz sweeps to 15Khz - CROWD CONTROL
C. R18 at 15Khz sweeps to 20Khz - RODENT, UNINHABITATED
D. R18 at 20Khz sweeps to 25Khz - RODENTS, INHABITATED

No internal adjustment should be made unless familiar with steps 20A to G in the plans. If you desire different ranges, please drop us a line.

SHEET B



PB1
D1
2
R4
R1
R3
R2
R6
R7
R10
R17
R13
C7
2
I2
C9
2
C8
R21
Q4
6
R5
I1
R8
R12
R9
R11
D2
R14
C6
R16
D3
R22
R15
R24
R25
R23
R26
R20
R27
R28
R29
Q8
2
R30
R31
4
C1
C2
C3
C4
C5
Q1
Q2
Q3
Q5
Q6
Q7
GRD
MOUNT ON UNDERSIDE
J
K
M
O
V
W
S
U
T
X
Y
Z

It is assumed that the assembly board is completed and set to the frequency limits desired. At this point the builder must decide how many transducers he is going to use, if he is going to mount them in an array, individual placements, etc.

The plans and sketches show an array of four mounted in the configuration shown on Sheets E & F, along with approximate dimensions for this approach. It should be noted that variations from this design will require mechanical enclosure changes while not requiring excessive circuit re-design other than that indicated.

1. Form CA1 from a piece of #22 guage galvanized or equivalent thickness in aluminum from a piece of sheet metal, as shown in Sheet A. Note stiffening and cover mounting flanges along bottom. Use this sketch for dimensions noting 1"= 2" scale. It may also be desirable to construct this housing from smaller pieces fastening them together with flanges, brackets, sheet metal screws, etc. Note also that the cover may slope saving space if desired (Note dotted Lines).

Use caution when cutting holes for transducers with a fly cutter. Drill holes for controls of rear of enclosure and for mounting of components, heat sinks, handle, brackets, etc.

2. Assemble transducers on front panel and control (R32, R18 and S1) from assembly board ,fuse and bushing on rear panel as shown on sheets C, D, & E. Do not attach assembly board to double tape at this point.

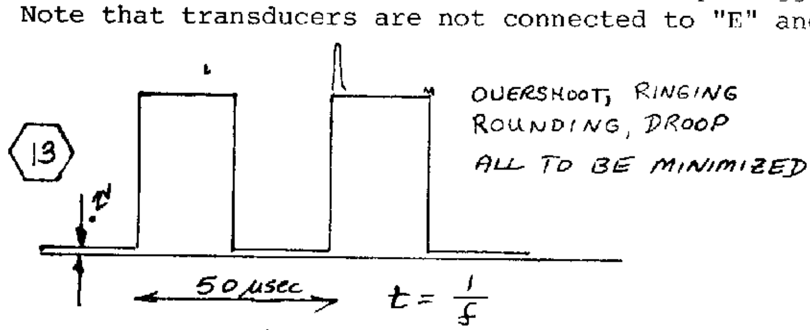
3. Assemble Transformer T1 as shown and mount as shown on Sheet D. Be careful not to break cores - use a thin piece of rubber.

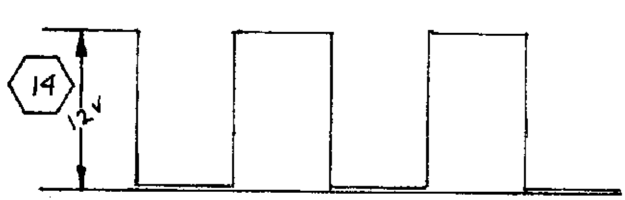
4. Assemble Power Transistor Q9 & Q10, to heat sink using TO3 insulated mounting kits.
(check with ohmeter before applying power).

5. Wire as shown in Final Amp Schematic and Sheets C, D, & E.

6. Install battery holders if using them. Test should be done using external power supply to monitor current, etc.

Apply external 12-V power and quickly check wave form at test points 13 and 14, the collectors "C" of Q9 and Q10 respectively. If waveforms shown are not correct, immediately remove power and check for errors. Externally trigger for time reference if desired. Note that transducers are not connected to "E" and "F" (T1 unloaded).





Vce must be no more than .2 volts with Vce being equal to 12V. Waveform must be symetrical respective to one another with a minimum of ringing and rounding of corners. The adverse conditions will increase as the load is increased.

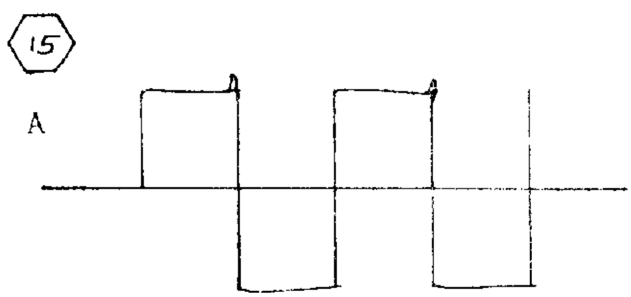
Note that this wave form must be that shown as transistors may immediately overheat. Also any excessive overshoot could cause breakdown.

PLEASE READ THE FOLLOWING DATA PERTAINING TO THE FINAL AMPLIFIER AND TRANSDUCERS.

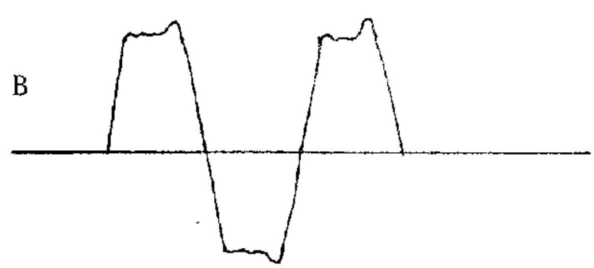
The final amplifier consists of 2 power transistors connected in a push, push configuration connected to T1 as shown in The FA schematic. Note R33 and R34 emitter resistors for current balance between the transistors.

PERFORM THE FOLLOWING:

A. With the 4 transducers disconnected observe waveform across E & F on T1 (TP15) as shown in sketch (Frequency set at 20Khz).



WAVESHAPE AT E & F WITHOUT TRANSDUCERS CONNECTED



WAVESHAPE AT E & F WITH TRANSDUCERS CONNECTED APPROXIMATELY 30 to 40 VOLTS PEAK TO PEAK.

B. Connect 4 transducers and note waveform changing from a square wave to a triangular shape. Note voltage value on scope and remove windings on T1 to produce 15 to 20 volts rms across the four transducers.

C. Place a 0-10 amp meter in series with the +12 volt and note current of about .5 to .8 amps.

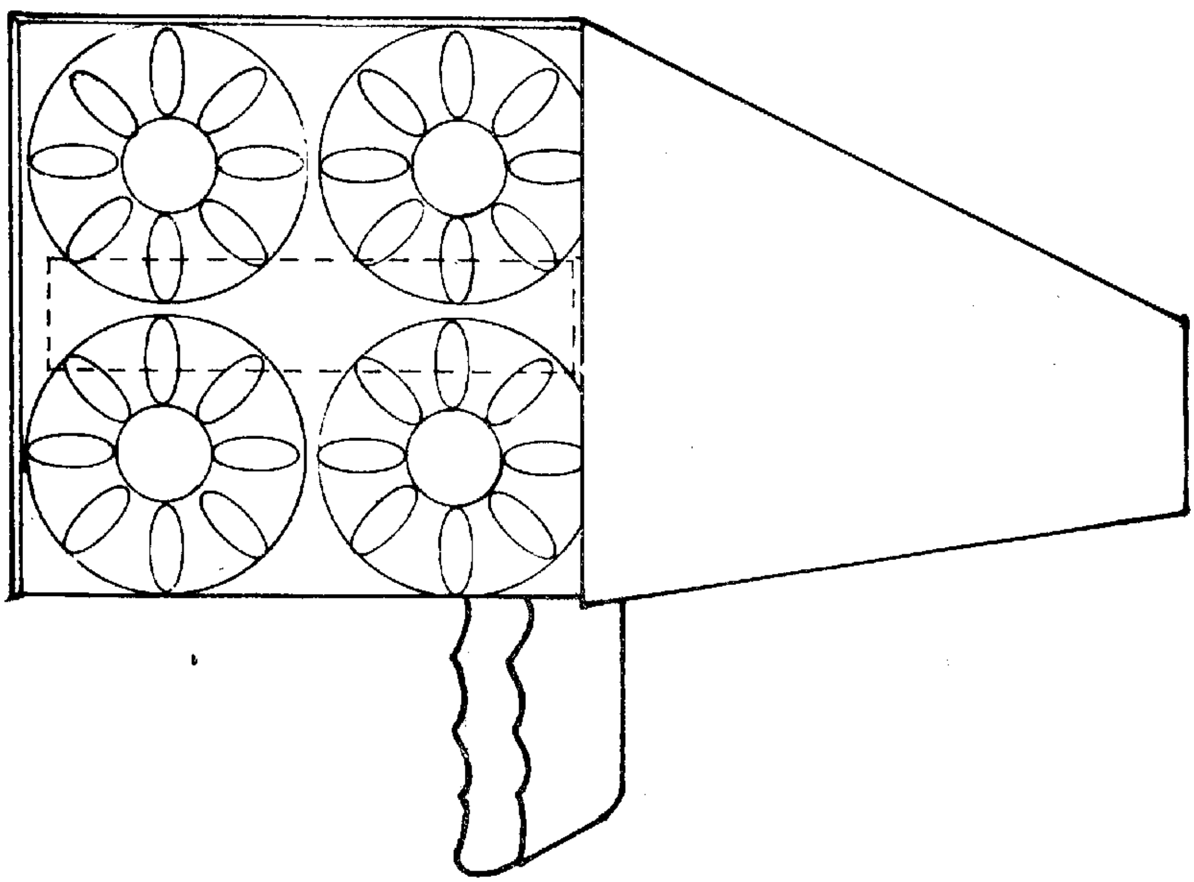
The power output of this system is about 120db measured at 18". It is possible to obtain more power by further selecting of the transducers.

It is important to OBSERVE SAFETY PRECAUTIONS IN PERFORMING THESE FOLLOWING STEPS. Remeber just because you do not hear this energy does not mean it's not affecting you.

OBTAINING FURTHER OUTPUT

At this point, a transducer connected as a receiver and fed to a sensitive volt meter or scope should be monitoring the accoustical output of this system. The trick here is to obtain maximum accoustical energy output fer FINAL AMP DC inout. This is indicated by observing the waveshape at TO13 and TP14, for squareness while adjusting for maximum accoustical output as indicated by the receiver. You must also be careful not to exceed the voltage limits of the transducer at that point where the frequency starts to cut in half. Enclosed chart on power, impedence, distortion and frequency response of transducers. Output voltage is increased approximately 1 volt per added turn on T1.

When all is satisfactory, connect to battery pack.

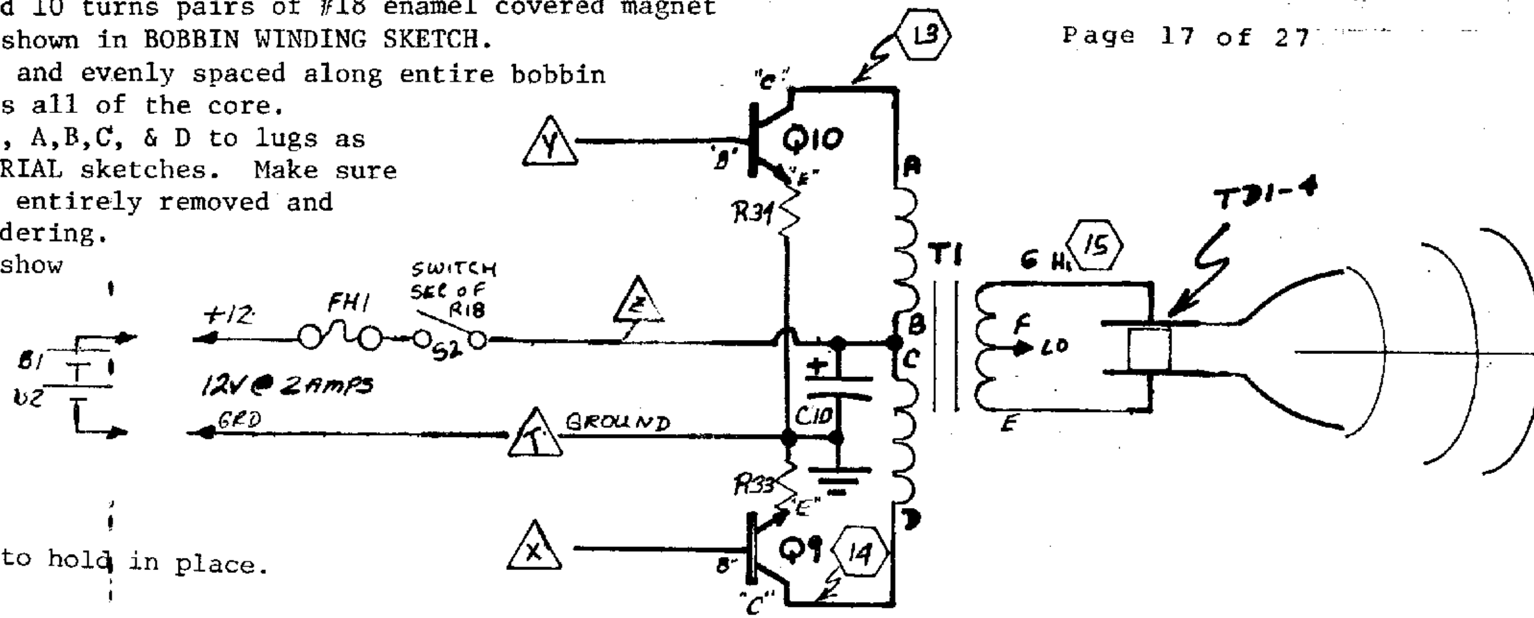


FINISHED SKETCH PICTORIAL

STEPS FOR WINDING T1 BOBBIN

1. Parallel of Bifilar wind 10 turns pairs of #18 enamel covered magnet (or vinyl) covered wire as shown in BOBBIN WINDING SKETCH. Identify wires as in sketch and evenly spaced along entire bobbin length. This fully utilizes all of the core.

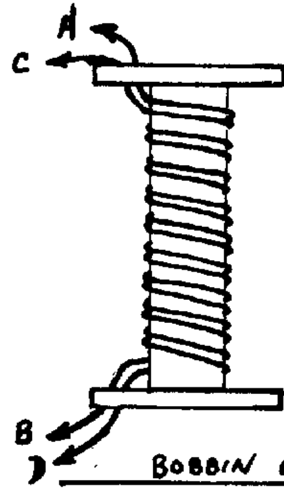
2. Secure and solder leads, A,B,C, & D to lugs as shown in SIDE AND TOP PICTORIAL sketches. Make sure that the enamel covering is entirely removed and leads are tinned before soldering. Note that sketches may not show all connection to Transformer T1.



FINAL AMP SCHEMATIC "FA"

3. Tape this winding to hold in place.

You may wish to bring out several taps on winding E & F to obtain optimum voltage levels for desired amount of transducers used. Rms voltage under load should be about 15 volts. Higher voltage and more output can be obtained for intermittent operation at the expense of possibly blowing transducers.

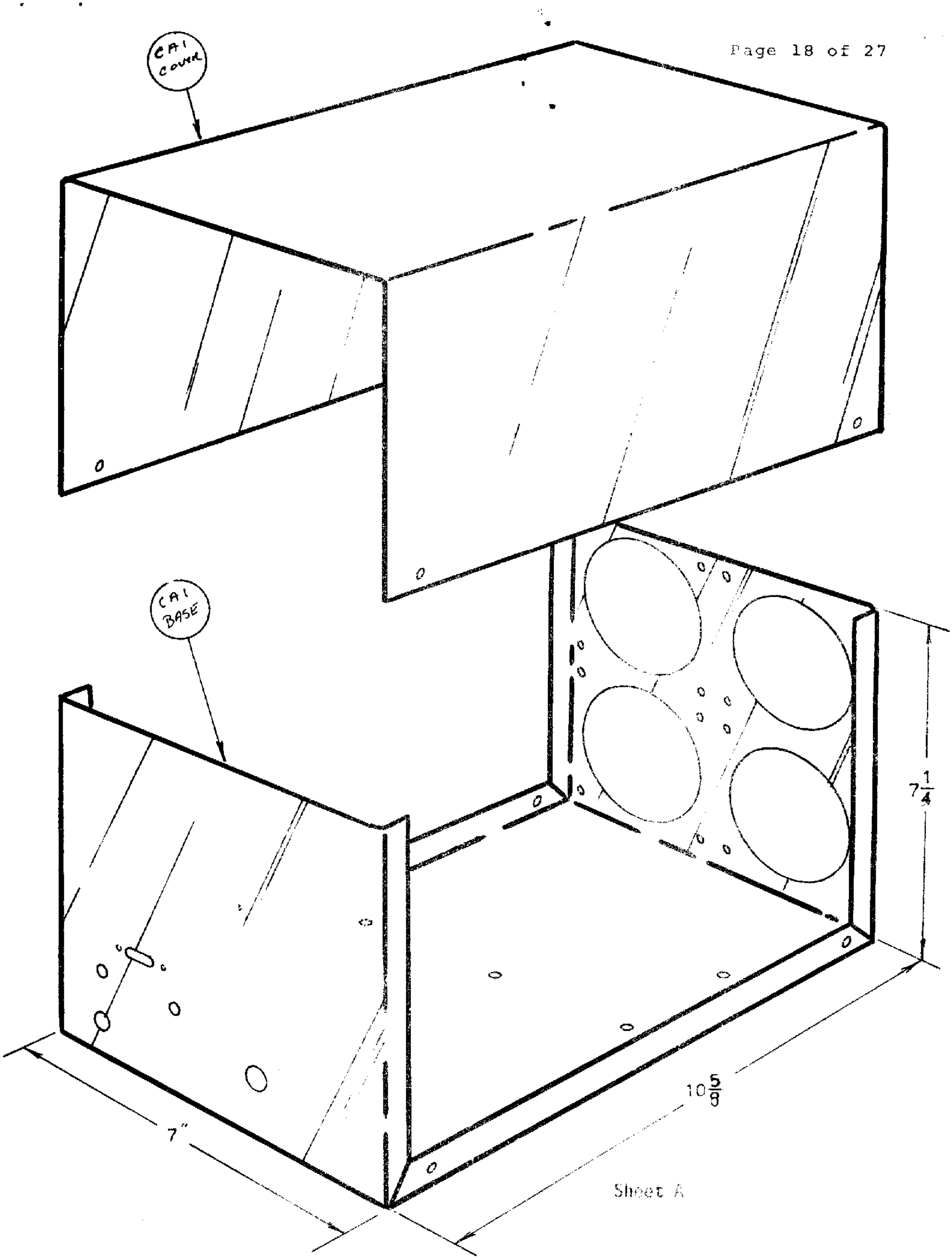


BOBBIN WINDING SKETCH

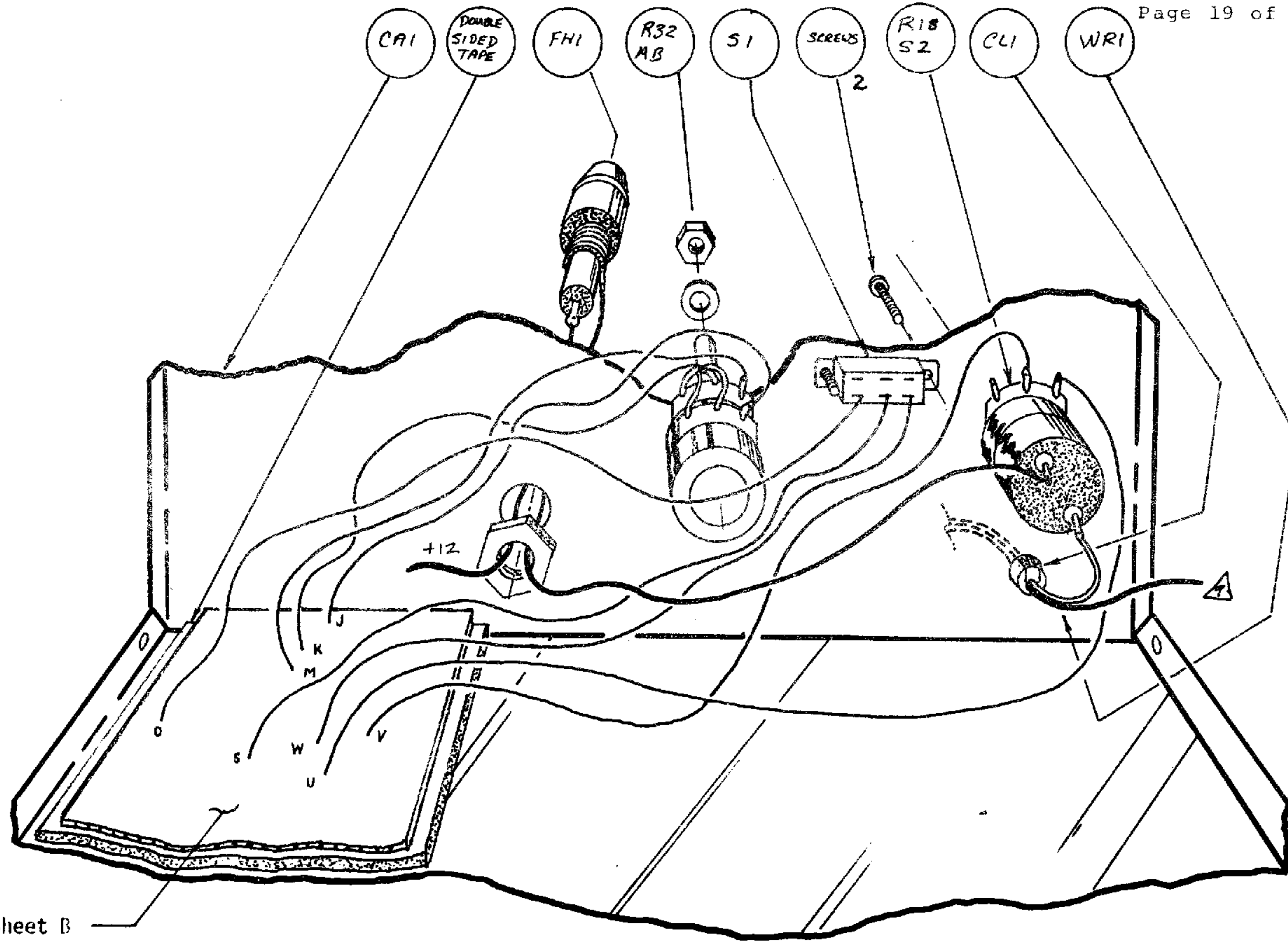
4. Wind 30 turns of #20 plastic covered wire neatly over above and connect leads to lugs (not shown). Note that enamel wire is not necessary and it may be necessary to remove turns to obtain the correct voltage levels for the transducer. It is easier to remove this plastic jacket rather than the enamel coating. Bring out taps if desired, at 15, 20 & 25 turns for selection of power output.

5. Carefully place "E" cores to bobbins and scotch tape together.

When the desired turns are determined, you may wish to place the single winding E & F first on the bobbin.

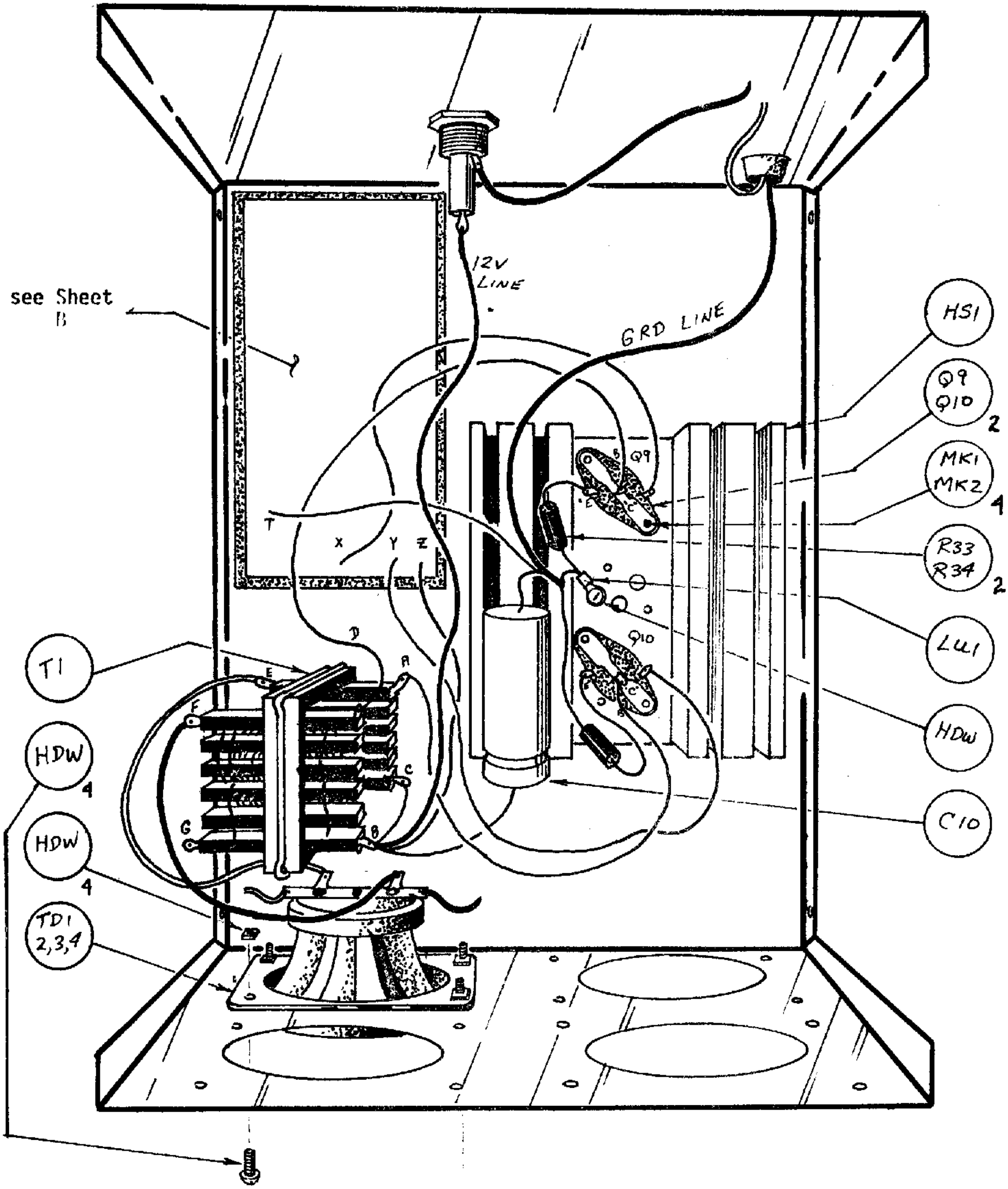


Sheet A

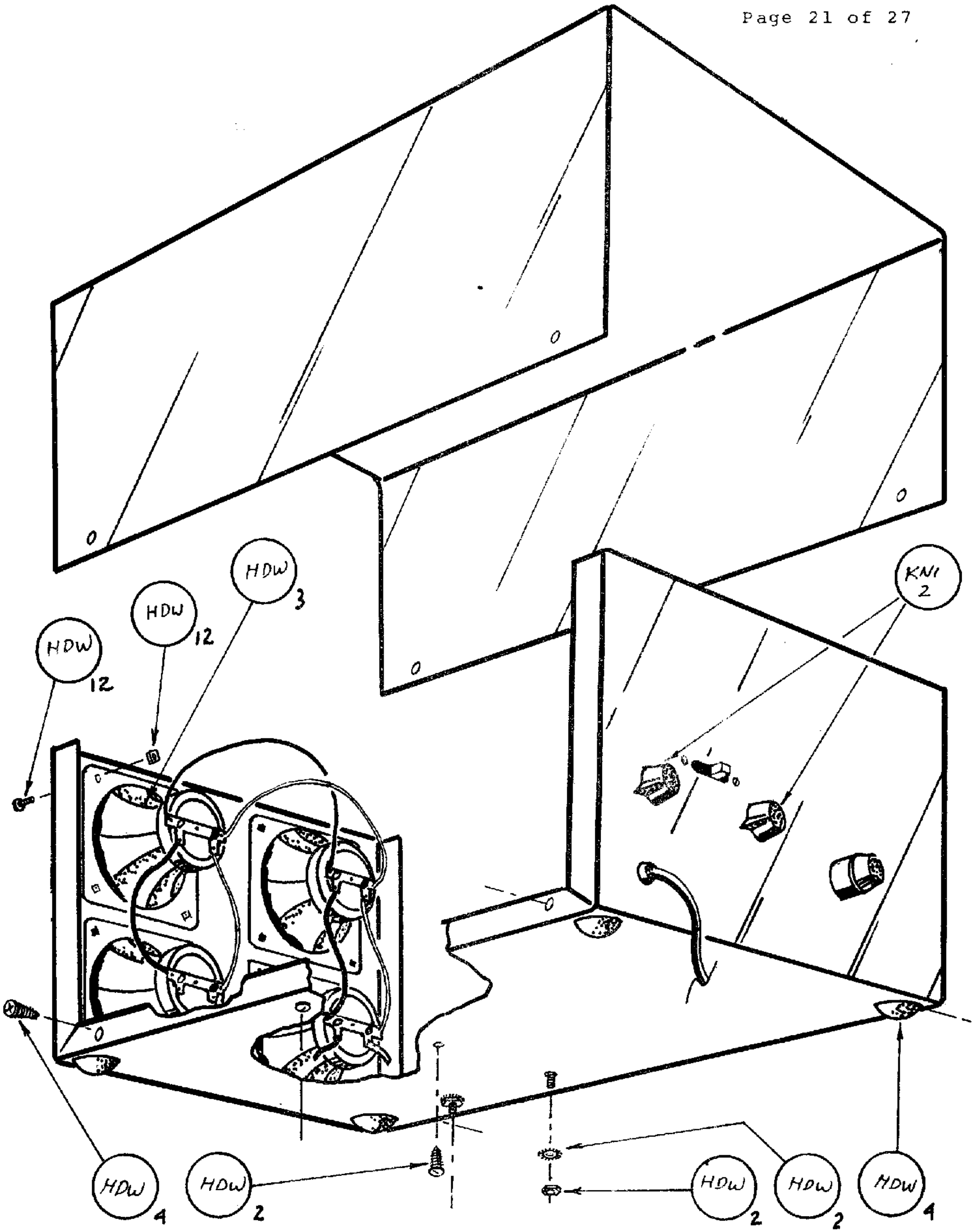


see Sheet B

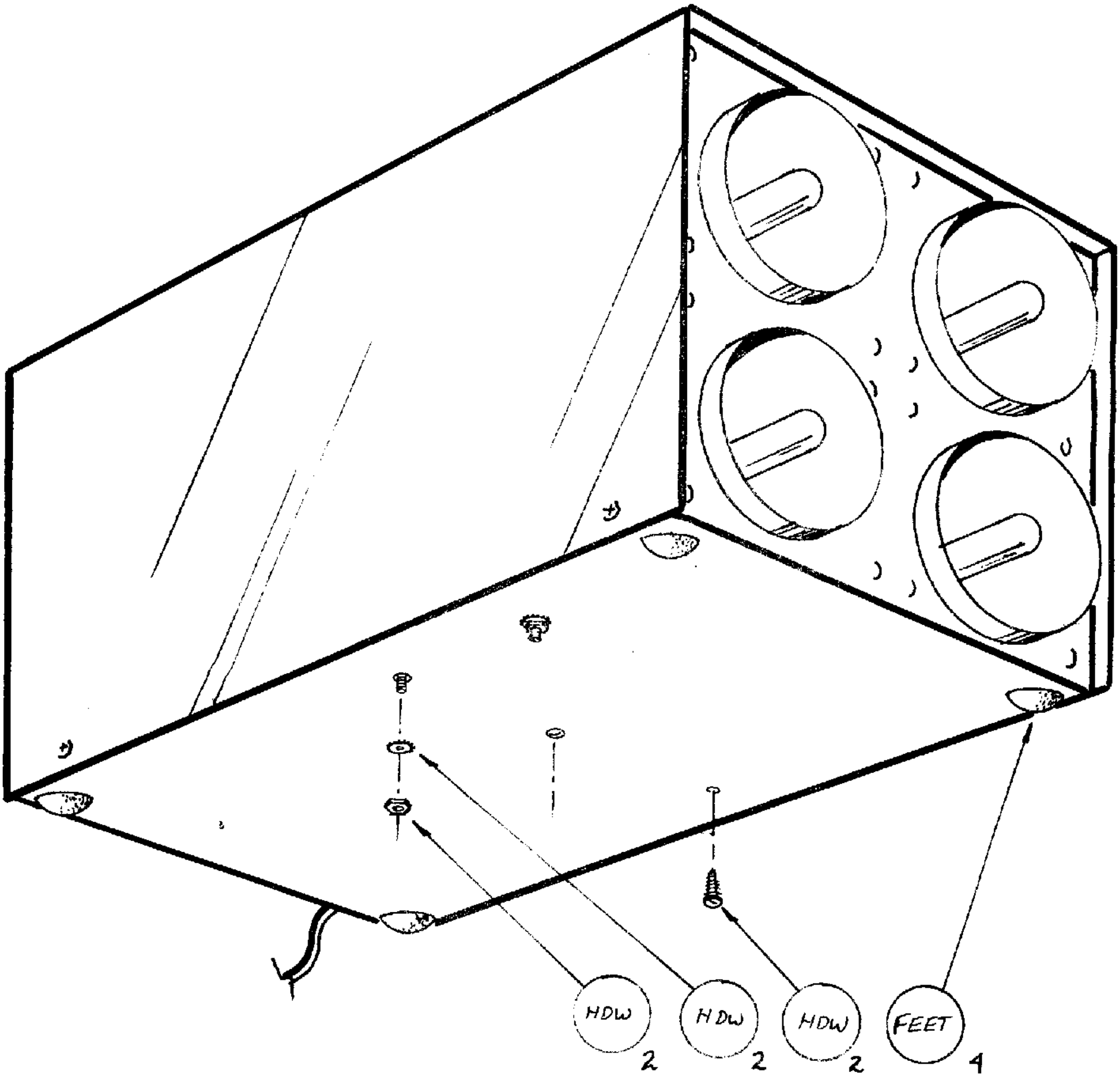
eet C (rear vie)



Sheet D (top view)



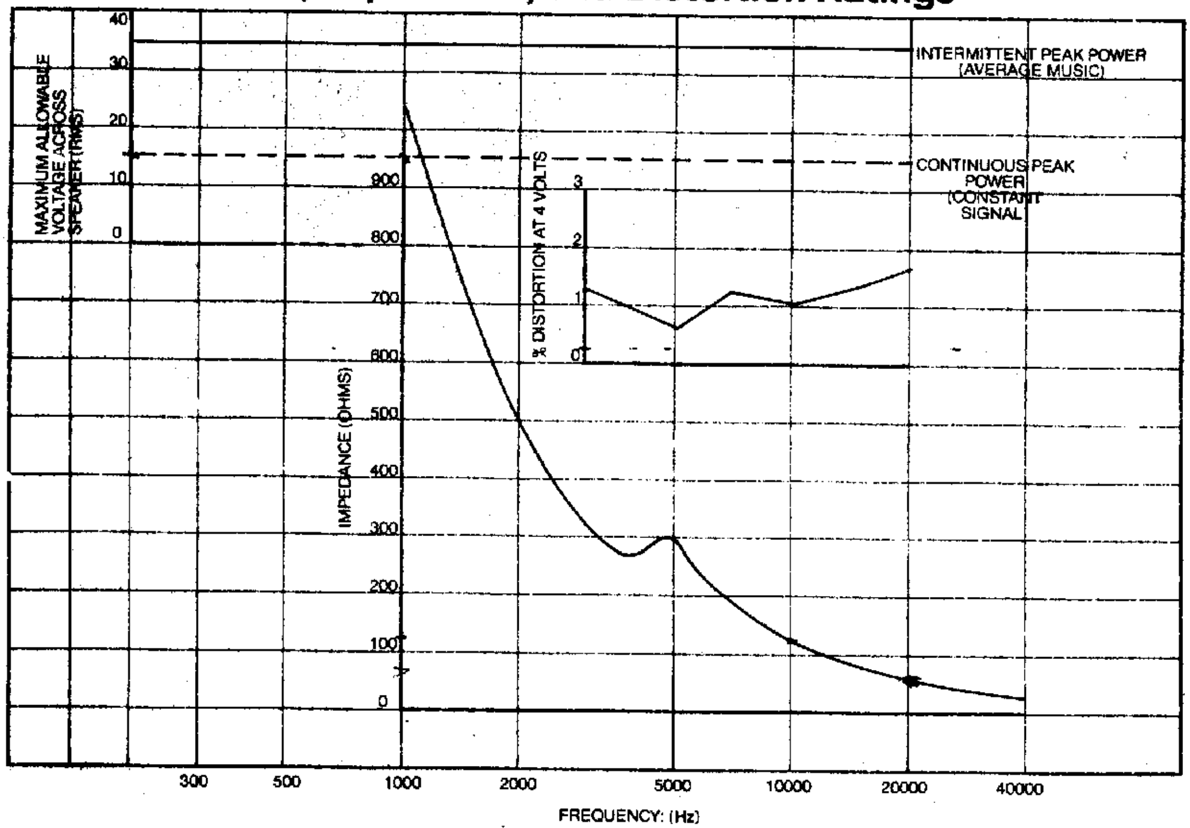
SHEET E



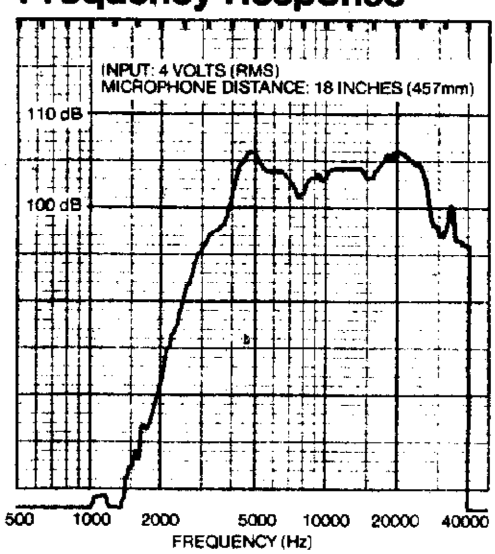
SHEET F (bottom view)

Piezoelectric Tweeters
MODELS KSN6001A, KSN6005A 3.5 Inch Super Horn

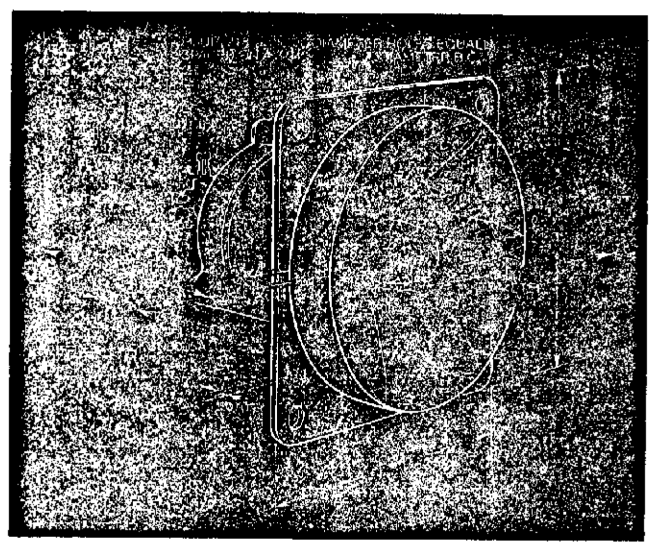
Nominal Power, Impedance, and Distortion Ratings



Frequency Response



Dimensions



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SUPPLEMENTAL SHEET ON FREQUENCY ADJUSTMENT OF YOUR ULTRASONIC UNIT

You will note three controls on the front panel of the console reference "FRONT VIEW CONSOLE" sketch. The slider switch selects either the "MANUAL" mode of operation or the "AUTOMATIC" mode. The manual mode does not vary in tone but remains constant depending where the "FREQUENCY ADJUST" knob is set. When the slider is placed in the "AUTOMATIC" mode you will note the tone is continually changing from a low to a high value with this rate of change being controlled by the "SWEEP RATE ADJUST" knob. The lower limit of this tone is again selected by the "FREQUENCY ADJUST" knob and will always vary about 5Khz higher than this preset low value. As an example; with the "FREQUENCY ADJUST" knob set at 10Khz low end, the high end will sweep to 15Khz, set at 15Khz, the high end will sweep to 20Khz, set at 20Khz high end will sweep to 25Khz, (25Khz is the high end limit and should not be exceeded). Obviously, any setting to an intermediate value will simply add 5Khz as this frequency is varied in the "AUTO" mode.

The recommended method of setting the controls is the following:
A. Determine the frequency limits per the application. There are two basic applications of these type of units. When used as an anti-intrusion device to discourage unauthorized entrance or access of protected premises, the adjustments are made for maximum human annoyance, usually with frequencies of from 10-15Khz. When used as a rodent device we have found that the lowest tolerable frequency to humans in the area usually has the most effect on common species of rats. This is not always true, but serves as a starting point in initial setting of the adjustments. Frequency setting of from 15 to 20Khz for non-humans habitated areas and 20-25Khz for areas where people are present usually suffices for good rat control. Note that at no time should the unit be set to go higher than 25Khz.

B. Adjust "FREQUENCY ADJUST" knob to value where output is detectable by human ear or just above the point of annoyance.

C. Set "SWEEP RATE" adjust to middle of range.

D. Set slider to "AUTO" and note frequency continually varying.
It must be noted at this point that there is no optimum frequency setting for conditions of operation, or species, infestation of rodents, etc. However, we have usually found that it is best to set the device to the lowest tone possible without causing annoyance to people or pets. The "SWEEP RATE" may be experimented with for the best results.
It is assumed that the internal adjustments are set by the factory or by the builder per the instruction alignment procedure outlined in the construction plans.

COMP ID	REF	AMT	CAT	DESCRIPTION/VALUE	VENDOR	VENDOR#
10/25	R20	1	RES	10ohm 1/4W Resistor	MOU	29SJ250
220/25	R25	1	"	220ohm " "	"	"
470/25	R2,3 15	3	"	470 " " "	"	"
1K/25	R1,4 27,28 29	5	"	1K " "	"	"
1.2K/25	R6	1	"	1.2K " "	"	"
4.7K/25	R23, 26	2	"	4.7K " "	"	"
5.6K/25	R24	1	"	5.6K " "	"	"
68K/25	R14	1	"	68K " "	"	"
470K/25	R7, 16	2	"	470K "	"	"
560K/25	R8	1	"	560K "	"	"
1M/25	R11	1	"	1M "	"	"
1.2M/25	R9	1	"	1.2M "	"	"
1.5M/25	R10	1	"	1.5M "	"	"
1.8M/25	R12	1	"	1.8M "	"	"
5.6M/25	R5	1	"	5.6M "	"	"
2.2K/25	R21	1	"	2.2K "	"	"
1/50	R33,34	6	"	3 wired in parallel 1ohm 1/2W "	"	"
220/1	R30 AB R31 "	4	"	220ohm 1W "	GEP	RCR32
10K/PS	R18	1	PRES	10K pot/switch "	MOU	31VM401
50K/PD	A&B R32	1	"	50K dual pot "	"	31VM405
25K/T	R13, 22	2	TRES	25K trim pot hor "	MOU	32RH403
100K/T	R17	1	"	100K trim pot hor "	"	32RH501
10M/25V	C1,2	2	ELCAP	10mfd @25V Elec CAP	MOU	20WK010
100M/25	C6	1	"	100mfd @25V Elec "	"	20WK100

PPF1 - PHASER PAIN FIELD

COMP ID	REF	AMT	CAT	DESCRIPTION/VALUE	VENDOR	VENDOR#
1000M/25	C10	1	ELCAP	1000mfd @25V Elec CAP	MOU	20WK901
.001/50P	C8	1	POCAP	.001mfd @50V poly "	"	23PS210
470P/50	C5	1	DICAP	470pfd/50V disc "	MOU	21CB470
.01M/50	C9	1	"	.01mfd/50V disc "	"	21EG010
.1M/25	C4,7	2	"	.1mfd/50V disc "	"	21KF100
1000P/50	C3	1	"	1000pfd/50V disc "	"	21ET001
LM566	I2	1	IC	semi-conductor vco dip 8 pin	LIO	LM566
LM3900	I1	1	IC	" quad amp dip	"	LM3900
PN2222	Q1,2,3,4,5	5	TRAN	npn plastic	LIO	PN2222
PN2907	Q6	1	"	npn plastic	"	PN2907
D40D5	Q7,8	2	"	npn power tab	HAM	D40D5
2N3055	Q9,10	2	"	npn power TO3	SO[illegible]	2N3055
IN4002	D2	1	DIO	50V lamp rect	LIO	IN4002
IN914	D1,3	2	"	sil signal	GER	IN914
MEDBOB	Bobbin	1	TRA	medium bobbin Transfor.	FER	52PTB
MEDCORE	"	1	"	medium core "E"	STK	EC52
HDWRUBOL	HDWRE	1	HDWRE	hdwre u bolt/brkt "	FER	52U
MEDLUGS	LUGS	1	"	solder lugs	FER	991-430
MEDULTRA	T1	1	"	ref spec PPF1 # "	INFO	MEDULTRA
KNOB	KN1,2	2	HDWRE	1/4" knob	MOU	5121400

COMP ID	REF	AMT	CAT	DESCRIPTION/VALUE	VENDOR	VENDOR#	
SLSW	S1	1	SW	small mini slid-switch er DP DT	MOU	10SM003	
HESINK	HS1	1	ENC	dual TO3 heatsink surplus vintage	INFO	HESINK	
MTGKIT	MK1,2	2	"	TO3 mounting kits	KY	4732	
MOTRAN	TD1	4	TRAND	motorola super horn	MIASCON	KSN6001	
FUHOL	FH1	1	FUS	3 ag fuse holder use 4 amp fuse	MOU	45FW03	
RUBFT		4		rubber feet stick-on			
BH4D	BH1,2	2	BAT	4D holder with leads	MOU	12BH143	
WR4	WR1	48"	WIRE	#24 wire red	MOU	2015-21	
WR3	WR1	48"	"	#24 wire black	"	2015-21	
		20		square nuts			
		18		6/32x1/4" screws			
K PBPPF1	PB1	1	PFBORD	2.5"x5" perfboard	INFO	FAB	
PPFSML	CA1	1	SML	metal case for 4 trans	INFO		
WR1		48"	WIRE	#18 wire red	MOU	2064-21	
WR2		48"	WIRE	#18 wire black	"	2064-21	
	OPTIONAL ITEMS & ACCESSORIES ARE AVAILABLE THROUGH INFORMATION UNLIMITED (NOT INCLUDED IN ABOVE KIT)						
MEDULTRA	T1	1	HDWRE	ref spec#PPF1	INFO	MEDULT	14.50
PCPPF1	PC1	1	PC	Assembled & tested electronic board with control			$74.50