40 M QRP TRANSMITTER

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Designed by K R Vasantha Kumar (Vu2 VWN)
Literature by Prathapan (Vu2 PCM)

Introduction .

When analyse the success story of the ham Vasanth Kumar. VU2 VWN, professionally a school teacher who rose to the height of superintent of the Junior Technical School with strong will power and commiument to this duties, then we should analyse how to was able to bone to an expert hambreiving ham?

Before becoming a ham be spend most of his time by reading books and periodicals. At this stage he came to know about ham radio and he was very much fascinated with it. He began studying literature regarding ham radio and electronic. He also started assembling various electronic projects and conducted various experiments in this field. When he wanted to study Morse Code there were no teachers who can teach wireless morse. He approached a telegraph operator working in the post and telegraph Department But he knews only line telegraph Morse Code. Even with this hardship he never given up his desire to become a ham. In order to study the Morse Code ,he spend may days near the radio receiver trying to decode it . At last he become an expert to send and receive the code.

When he was working at Kottayam he visited the Ham Radio Station (Shack) of Old Man (O.M) Gunhan Menon (Vu2 TG) for the first time. He was very much thrilled with the mere site and operation of it. O.M. Gunhan Menon advised him with the necessary guidelines in becoming a ham.

After many year of waiting he became the member of the Ernakulam Amateur Radio Society. The club arranged the venue for the A.S.O.C examination at the Chavara Cultural Centre. He passed the examination and got the A.S.O.C. grad I license. Now he is holding an advanced grade license.

When he got the license in 1983 the ham population in India was very low compared with U.S.A. and Japan. The availability of technical experts, literature on ham equipments and electronic components required for the assembly of ham station equipment was very poor. The purchasing capacity of imported equipment was also very low due to low income of an average Indian.The main source of technical matters available was from the American Radio Relay Leaque (A.R.R.L) publications. The sophisticated designs were beyond the reach of an average Indian ham due to the backward conditions. We had to depend on the older and cheaper versions of the designs. But the component availability was a challenge to face. Depending on the designs most of the hams at that time were used to assemble Vacuum tube based transmitters which required high voltage R.F materials obtained from the junk traders at Delhi. But it required long travel and consumed much time to sort the components for the remote dwellers. The

receivers were the repaired military junk obtained through auction. These equipments occupied a bulk of the space. Many hams used the crystal controlled oscillators which restricted the operations to certain fixed frequency. Few hams were able to work with variable frequency Oscillators with which one can work on desired frequency.

Sold State Design technique was only peeping to the scene. Some low power (Q.R.P) solid state design using crystal controlled oscillator and variable frequency oscillator C.W. transmitters were appeared in the publication 'Radio' , but it made no considerable effect.

It is cheap, cost effective, efficient easy to build and easy to operate on C.W. and A.M. mode . Low power Transmitters without the risk of shock was in demand among the notice at that period.

It was at this period O.M. Vasanth Kumar got his License and was planning to set up his Ham Radio Station. He started experimenting with readily available components in the Cochin market. The experiment yielded with a 5 transistor low power (Q.R.P) transmitter. It was built in two eliminator metal box with the small one for the variable frequency oscillor (V.F.O) with buffer amplifier and the big one for the Power Amplified (P.A) with driver RF preamplifier together with the power supply for the P.A.

Two F.E.T.'s (BFW 10) were used for the V.F.O. and buffer amplifier. 3 transistors, BC 148B, BC 157 and Sl 100 were used for the RF , preamplifier , driver and P.A. consientively . Pure

D.C. from 6 volt battery box was delivered to the V.F.O. and buffer. 12 Volt DC rectified and filtered from the 230 volt A.C. supply was delivered to the P.A.

The reports got from the band was very encouraging and the circuit was grand success. But it lacked power to overide the noise of the night band condition. So he started experimenting with the popular audio power transistors for the RF power amplifier .Finally the BD139 transistor with high terminating frequency (Ft) was chosen and made the job efficiently.

Since it lacked the modulator, it was very difficult to communicate with unskilled hams in plain language. A modulator developed with popular audio I.C. TBA 810 was added to the transmitter. So it became a full fledged transmitter.

When we analyse the modus operandi of his experiments we can see that the got no high tech laboratory facilities and never used the tough mathematical approach. It was all based on trial and error basis and simple design procedures. The sophisticated piece equipment was the multimeter and assembling tools were the soldering iron and screw driver. But his approach was very scientific. He studied the working principles of several equipment .He observed and analysed the advantages and drawbacks of it and moulded the idea for the further development according to his wish. When he conducted his experiments he thoroughly studied the principles and made the records / notes of the observations and inference. When the outcome was failure he looked into the cause and improved the design.

He never has the habit of copying conventional design as it is but be used to alter the design according to his wish. When he struck with an idea he quietly implemented it. He enjoyed the thrill of popularity of his design. He constantly communicated with those hams who copied the design and assisted them in making and setting up the station. He also cleared their douts and accepted their suggestion.

The advantages

1. It has fairly stable variable frequency oscillator so that one can operate on desired frequency .
2. It has adequate low power to establish a communication.
3. It has the C.W. as well as the A.M. mode.
4. It is cheap.
5. The design is efficient and cost effective.
6. The components used were easily available in the mar ket.
7. The tunable final tank circuit makes it more power effi cient.
8. The collection modulation reduces the circuit complication.
9. It is affordable for an average ham.
10. If we completely insulate the primary wiring of the mains transformers then the risk of getting an electric shock is minimum.

His ham style will inspire everybody to improve and their skill technique having. We are very much thankfull that Mr. Vasanth

have consend to published his experiments on the T.W 40 Meter Q.R.P. by giving all details, so that, even the lay man level beginner can easily understand the very complex electronic circuit application by the persistent insist of many well wishing hams.

ORP TRANSMITTER - THE CIRCUIT

It has three main blocks namely the variable frequency oscillator (V.F.O) R.F. power amplifier and the modulator.

Working Principle

The V.F.O and TW RF Power Amplifier together generates the Radio Frequency carrier wave to the required strength.To operate with C.W. Mode , the modulator amplifies the audio intelligence to the required strength and used to vary the amplitude of the carrier by audio super imposing on it . Thus the transmitter operates in the A.M. mode.

DESCRIPTION:

V.F.O.

The V.F.O. block consists of a variable frequency oscillator and a buffer amplifier. It is made with two F.E.T.S. (BEW10). The heart of the transmitter is a variable frequency colpits type oscillator. Then it generate a frequency in the range from 7 MHz to 7.1 MHz. L1,C2, C3, C4, C5, C6, C7 and CT2 one another forms the tank circuit. When power is applied to the transistor stage Q1, the

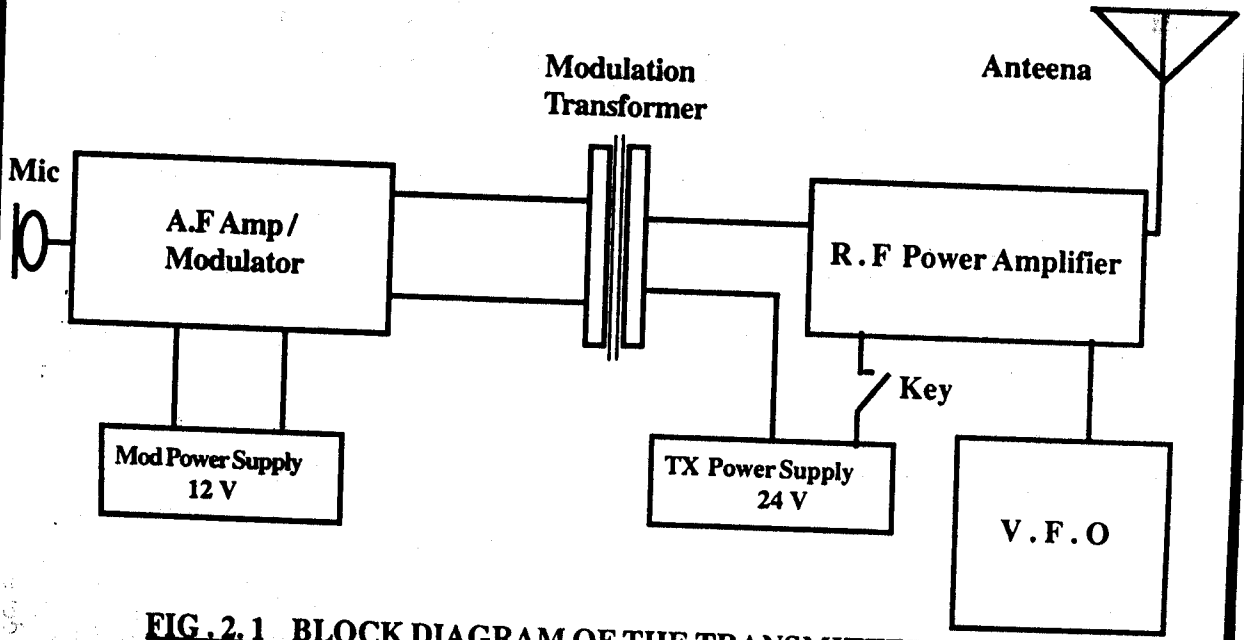


FIG . 2.1 BLOCK DIAGRAM OF THE TRANSMITTER

current flowing through the Q1, makes voltage across the RFC1 and the resistor R2 . This voltage excites tank circuit into oscillation to its resonant frequency. The damped oscillations is amplified using Q1, and fed back to maintain the oscillation at constant amplitude. The out is coupled to next buffer amplifier stage through the capacitor C8. The buffer amplifier is also of the F.E.T, Q2, in the source follower configuration which makes less loading to the oscillator. The output is developed across the resistor R4 and is coupled to the next R.F. preamplifier stage through C10.

The D.C. power supply to the V.F.O. stage is obtained from a 6 volt battery or from the battery eliminator which is optional.

Power amplifier .

The P.A. consists of three stages with the transistors Q3, Q4 and Q5 that is BEL 547 B, SK100 B and BD139 respectively Q3 is biased in class a mode and forms the R.F. preamplifier. This stage amplifies signal obtained from the V.F.O. through the capacitors C8 and C9. The output from this is coupled to the driver stage through C10 which is class-c operated with the P.N.P. transistor Q4 (SK100B). This transistor conducts during the negative peaks of the incoming signal and amplifies the signal further to driver the P.A., hence the name driver amplifier. The power amplifier stage is also operated in class c mode with an NPN transistor Q5 (BD139) whose collector load is a tank circuit made of C12, CT3 and L2 which is tuned to incoming V.F.O. frequency. The transistor Q5 conducts during the positive peacks of the signal developed across L3. A pulsating current flows through the

tank coil L2 and Q5. But due to the flyback action , a continuous wave is generated across the tank coil L2. The R.F. output is tapped from the coil L2 to match the impedance of the coaxial cable and is fed to the dipole antenna.

Power to the P.A. is obtained from stepdown transformer. The 24 volt stepdowned AC is rectified, filtered and the +ve line is connected to the P.A. through the modulation transformer secondary winding. The earth of the power supply is connected through the morse key to the P.A. earth. By tapping the key we can interrupt the power to P.A. and enable the code transmission in the C.W. Mode.

Modulator

The modulator consists of an A.F. preamplifier built using BEL 548 B and A.F. power amplifier us the I.C. TBA 810. The microphone picks up the audio wave and converts it into the corresponding electric wave of audio frequency. This audio frequency is amplified using the preamplifier and power amplifier to the required modulation strength. The output of the modulation level can be controlled by varying potentiometer tap (PT).

The A.F. from modulator is coupled to the P.A. using the modulation transformer. The B+ current flowing through the secondary winding of the P.A. get varied according to the A.F. current variation of the modulating signal. Hence the A.F. is super imposed on the R.F. carrier wave enabling the A.M. mode of operation.

CONSTRUCTION OF VFO

The construction of the VFO is straight forward and it does not requires any explanation . Circuit diagram is given in fig. 1.2 .You can make use of the PCB design given in fig.1.3 . PCB construction methods are explained in appendix . However you have to take note of the following points

Points to note :

1. Battery operation is preferred. For battery operation of VFO, remove the zener diode Z. If Zener diode is omitted, the total current drain from battery to the V.F.O. will be about 8 M.A.
2. Never use ordinary yellow dise capacitors. The V.F.O will not oscillate.
3. If silver mica capacitors are available, use that instead of styroflex capacitors.
4. V.F.O on/off switch is optional.
5. Always keep V.F.O. away from 5 Hz mains transformer to avoid hum pick-up. A distance of 2 feet will do.
6. Use home made P.C.B. or ready made vero board for assem bling the circuit.
7. V.F.O should be enclosed in an iron sheet box. Use a 6 volt eliminator box.
8. Use rigid copper wiring in the V.F.O. assembly to avoid frequency shift. Never let it loose.

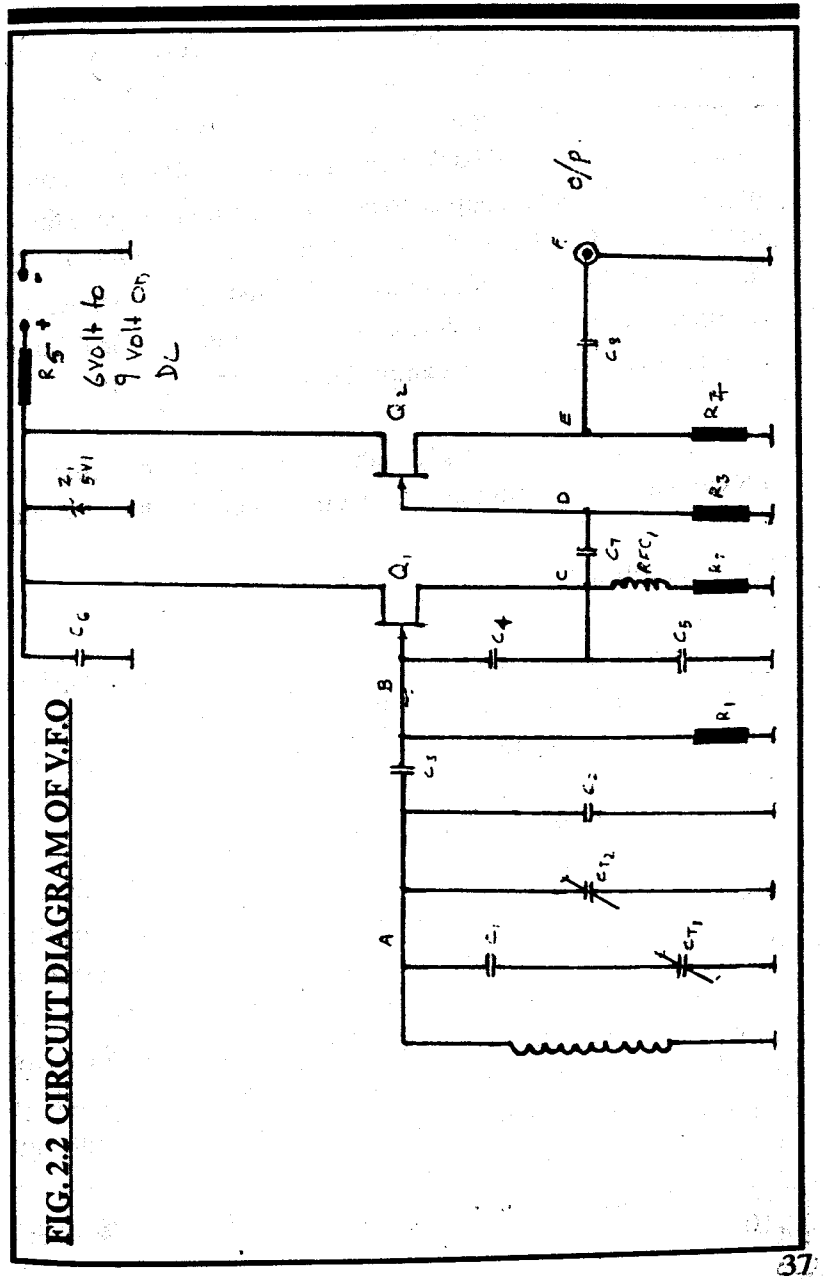
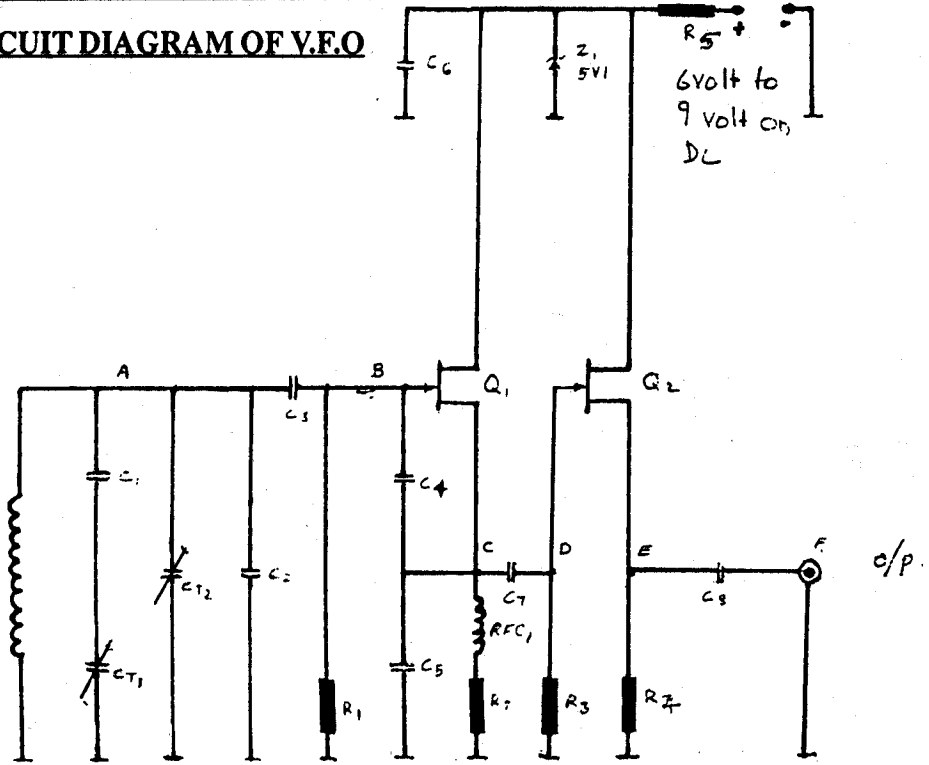


FIG. 2.2 CIRCUIT DIAGRAM OF V.F.O

FIG. 2.2 CIRCUIT DIAGRAM OF V.F.O



COMPONENT DETAILS OF V.F.O

Resistors

All resistor are 1/4 walt type, if not mentioned.

	Item No.	Description
1.	R1	100 ohms
2.	R2	220 ohms
3.	R3	100 ohms
4.	R4	1 k ohms
5.	R5	47 ohms
6.	R6	220 K /1 watt (for making RFC)

Capacitors:

When purchasing capacitors special care should be taken to get the specified capacitors as mentioned below.

	Item No.	Description
1.	C1	47 PF Styroflex only
2.	C2	180 PF " "
3.	C3	100 PF " "
4.	C4	100 PF " "
5.	C5	100 PF " "
6.	C6	01 MF Philips red or striped polyester
7.	C7	10 PF Philips gray disk or styroflex .
8.	C8	100 PF " "
9.	CT1	50 PF metal gang condensor is preferred If not available use oscillator section of 2 X PVC gang or one section of 2J PVC gang.
10.	CT2	22 PF Philips make green button trimmer

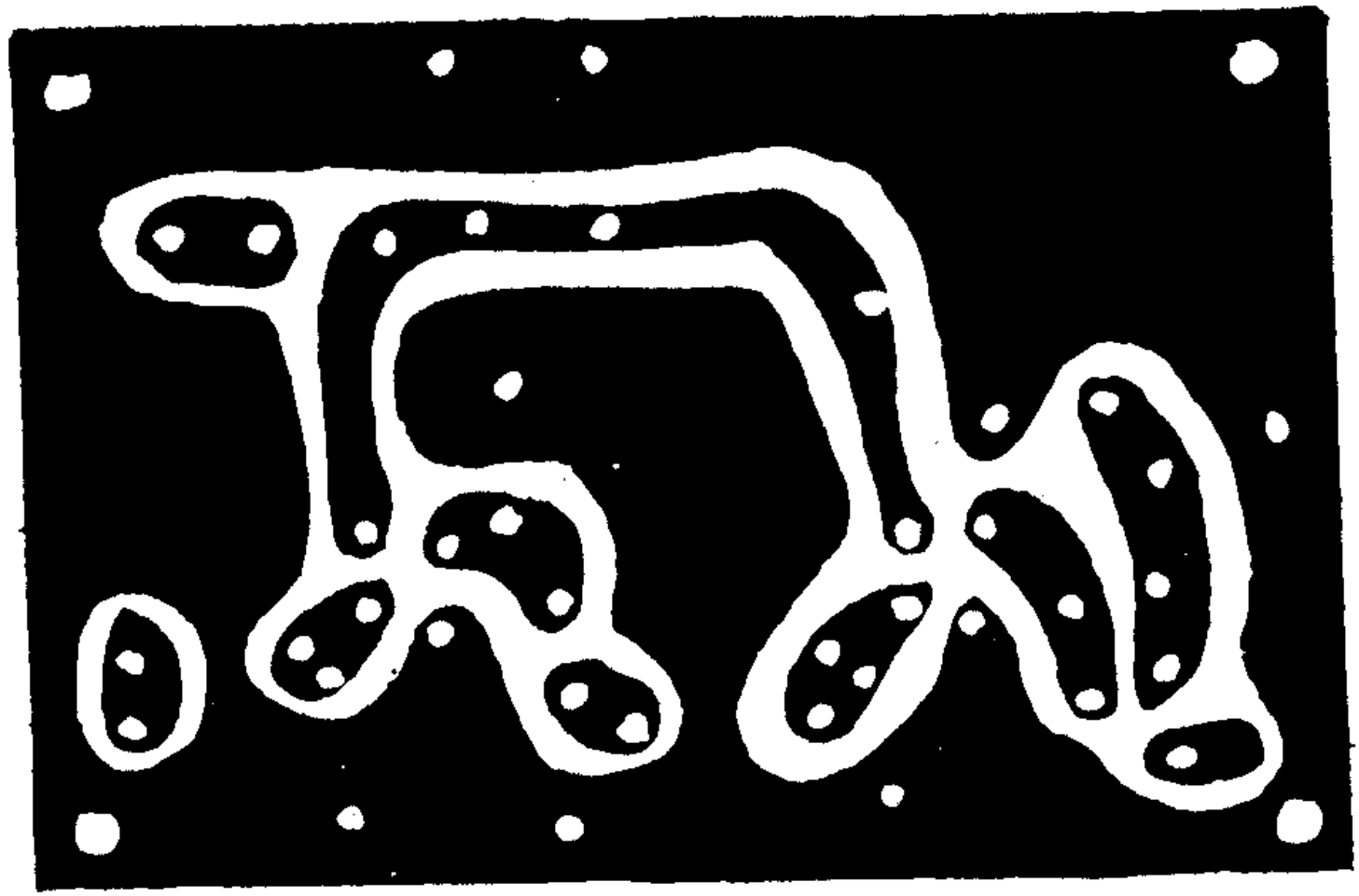
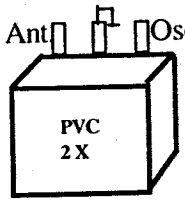
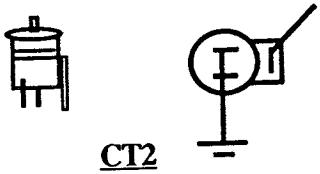


FIG. 2.3 PCB DESIGN FOR VFO



CT1

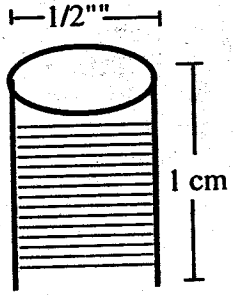


CT2

Inductors

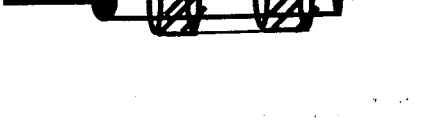
1. L1 - 2 micro henry (Tank Coil)

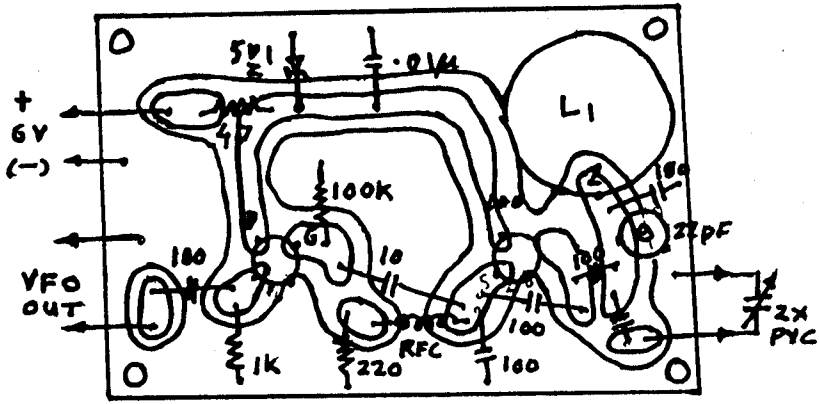
It can be made by winding 11 turns of 24 S.W.G. enameled copper wire on a piece of polythene pipe of 1/2 inch inner dia at a length of 1 c.m.



2. RFC

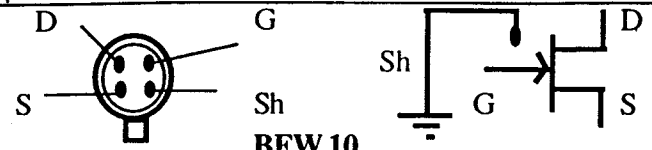
It can be made by winding 150 turns of 36 S.W.G. enameled copper wire on a 220K ohms/1 walt resistor in a random mode or in two sections as shown in the figure.





COMPONENT LAYOUT

Semiconductors		
F.E.T.S		
1.	Q1	BFW (BEL make preffered)
2.	Q2	BFW 10



BFW 10

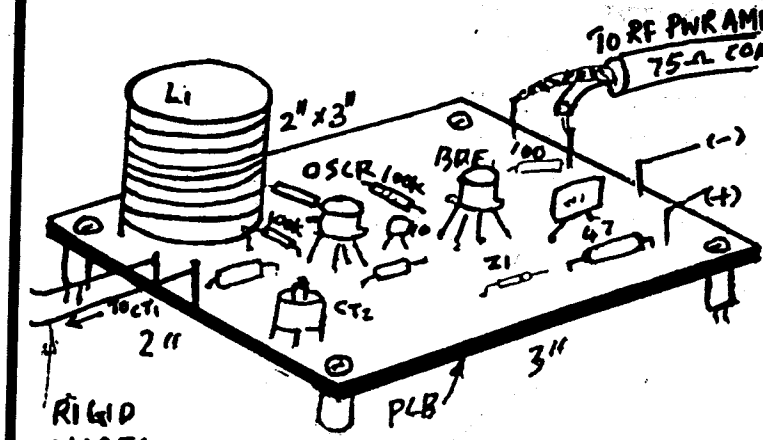
Diode (Zener)		
1.	Z1 - 5 V / 400 MW	

Miscellaneous components

1.	Switch - Miniature toggle
2.	Dial Drum - 2 inch plastic
3.	Printed Circuit Board (P.C.B) size 2"x3"
4.	Box (Iron metal) 6 volts Battery eliminator type or of that dimension
5.	Spaces - 4 nos.
6.	Nuts & Bolts for fixing the box.
7.	Hoock-up wire.

OPTIONAL POWER SUPPLY .

Even though the recomented source of power supply to the vfo is from the battery , it is not so practical due to the overhead expenses of the battery , charger etc . So a practical circuit that can be used to derive the power from AC mains is given in appendix . In order to avoid hum pick-up, Keep the V.F.O. power supply away from the V.F.O. box.



COMPONENT LAYOUT

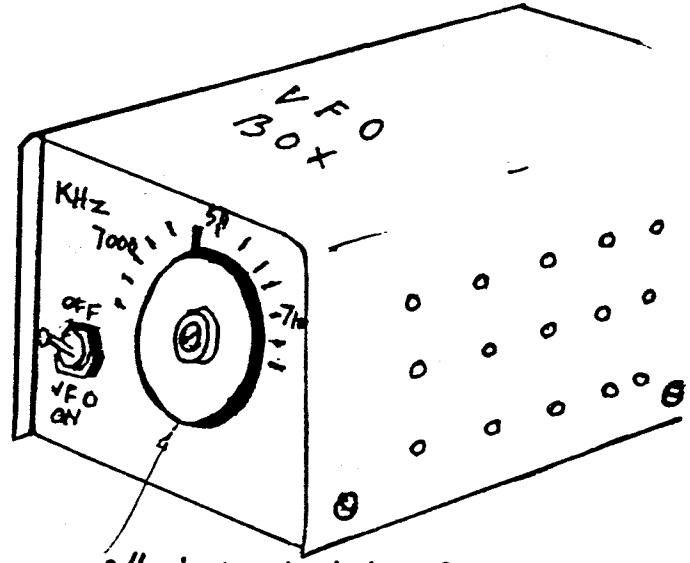


FIG.2.5 FRONT PANEL OF THE BOX

CONSTRUCTION OF RF POWER AMPLIFIER

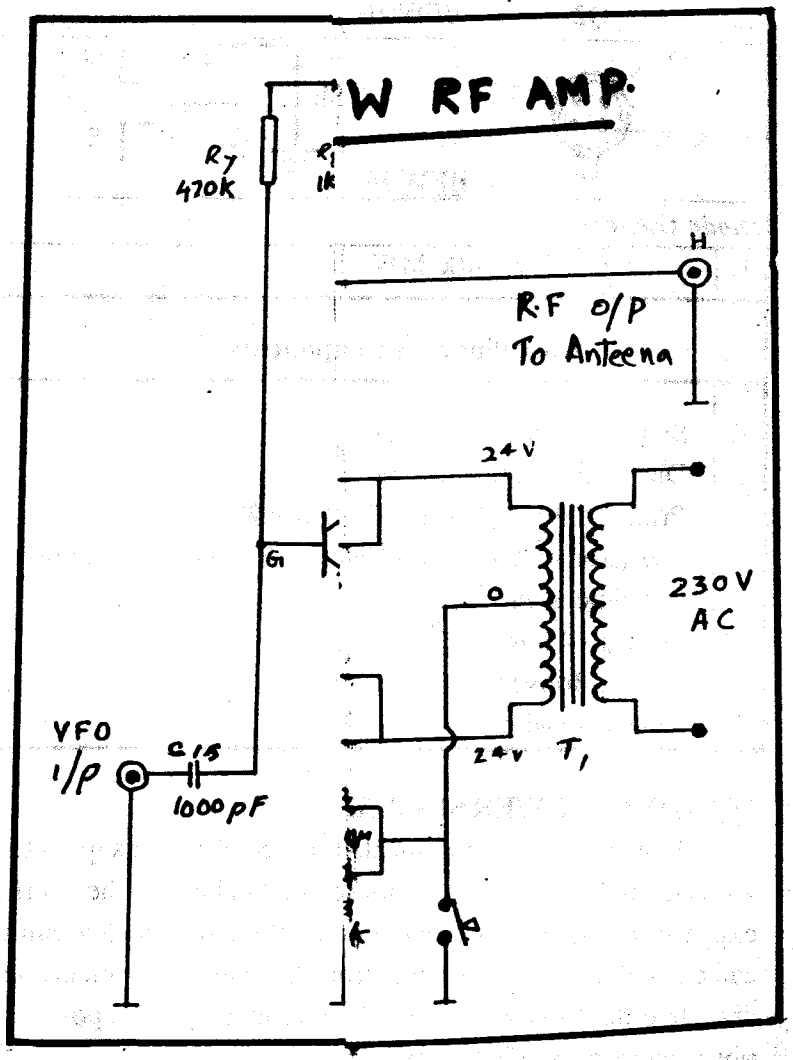
The construction of the Rf power amplifier is straight forward and it does not requires any explanation . You can make use of the PCB design given in fig . . PCB construction methods are explained in appendix. However you have to take note of the following points .

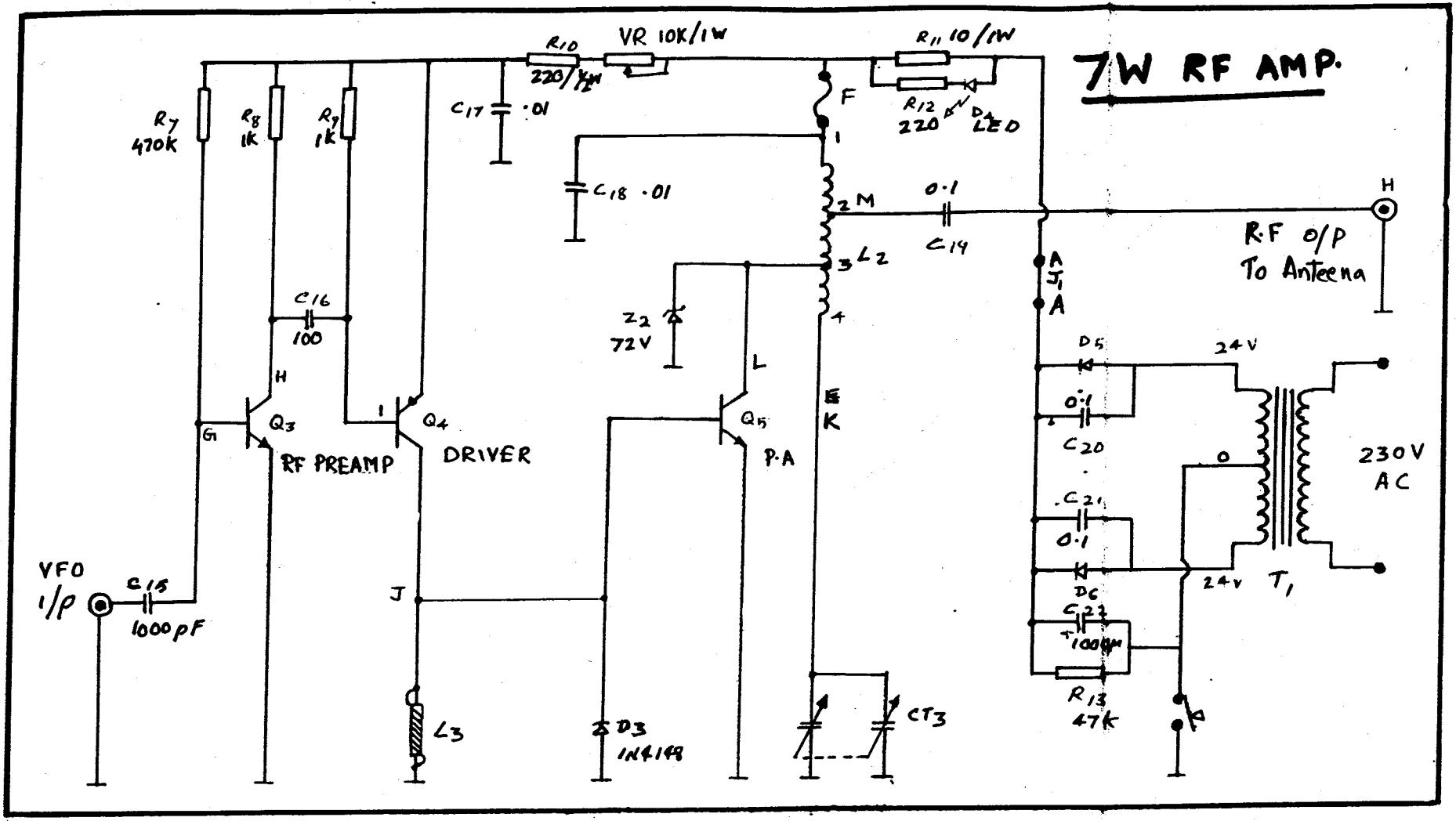
Specifications of RF amplifier :-

(1) DC input is about 7W measured at 35 volts when the current to the BD 139 final was about 200 m.A. to 250 m.A.
(2) RF output is 4 to 5 walts into 75 ohm load.

Precautions to be taken :-

(1) Use 75 ohm coaxial cable for connecting V.F.O to P.A., L2 to CT3, L2 to Antenna etc.
(2) If possible, avoid switches, connector etc., to save money as well as frequent repairs.
(3) L2 should be mounted vertically while L3 horizontally and away from L2 as far as possible. The space between L2 and L3 should be more than 1 1/2 inches.
(4) If any unwanted self oscillation is noticed, move collector tap upwards turn by turn, until the self oscillation stops.
(5) Enclose the Radio Frequency Power Amplifier in a large eliminator or amplifier box. V.F.O. can be placed in this box. But V.F.O. box placed outside is better.
(6) Special precaution should be taken while soldering the




7W RF AMP.
R10
VR 10K/1W
220/1W
R11 10/1W
R12
220
D4
LED
R7
470K
R8
1K
R9
1K
C17 .01
C18 .01
C16
100
C15
1000pF
VFO
I/P
Q3
RF PREAMP
Q4
DRIVER
Q5
P.A
Z2
72V
F
1
2 M
3 L2
4
E
K
L
H
I
G1
J
0.1
C19
H
R.F O/P
To Anteena
A
J1
A
D5
24V
0.1
C20
C21
0.1
D6
C22
100μF
R13
47K
0
24V
T1
230V
AC
L3
D3
IN4148
CT3

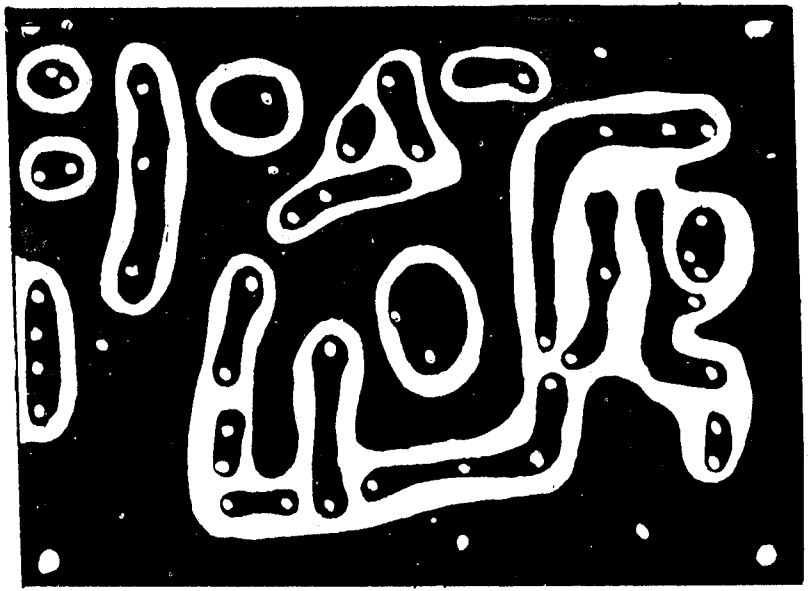


FIG. 2.7 PCB LAYOUT OF R.F AMPLIFIER

styroflex capacitors. Hold its legs using a nose plier to avoid over heating.

(7) Always use 0.1/100 volt capacitors across all rectifier di odes to eliminate hum in RF signal.

(8) 100 pF capacitor connected in the base of Q3 can be omitted.

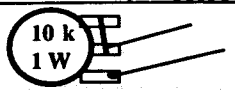
(9) Voltage at the collector of BEL 547 B (Q3) should be more tan 2.5V; If not, increase the value of bias resistor 470 K to 560 k etc.

(10) When A.M. operation is required remove the jumper be tween the points in the B+ line and connect the modulation transformer secondary there.

COMPONENT DETAILS OF R.F. POWER AMPLIFIER.

Resistors:-

No.	Item Id	Description
(1)	R7	470 K ohms 1/4 watt
(2)	R8	1 K ohms 1/4 watt
(3)	R9	1 K ohms 1/4 watt
(4)	R10	220 ohms 1/2 watt
(5)	R11	10 ohms 1 watt
(6)	R12	220 ohms 1/2 watt
(7)	R13	47 K ohms 1 watt
(8)	R14	1 K ohms 1 watt (For making L3)
(9)	VR	10 K ohms 1 W (wire wound potentiometer)Pankaj make pre ferred. It is used to control power.



Connection fig. of VR

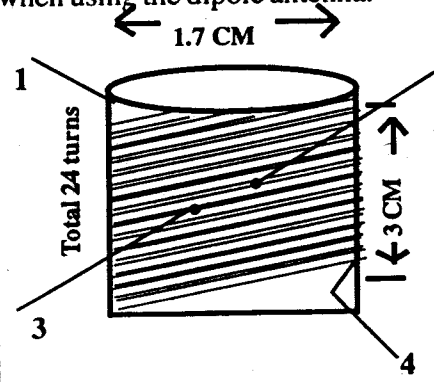
Capacitors:-

No.	Item ID.	Description
(1)	C15	1000 PF Styroflex only
(2)	C16	100 PF Philips gray disk or styroflex
(3)	C17	0.01 MF Philips red or striped poly. /box ty.
(4)	C18	0.01 MF " "
(5)	C19	0.1 MF " "
(6)	C20	0.1 MF " "
(7)	C21	0.1 MF " "
(8)	C22	1000 MF/47V - Electrolytic
(9)	CT3	330 PF - PVC 2 J gang condensor 'XYCON' make preferred

Inductors:-

(1) L2 - 4.4.micro henry

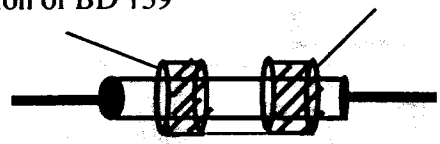
It can be made by winding 24 turns of 20 S.W.G. enameled copper wire on a piece of polythene pipe of inner dia 1.7 cm. and length 3 cm. Tap out the coil at 13th 15th and 16th turns. 13th tap can be used for connecting 50 ohms coax when using the inverted 'V' antenna . 15th tap can be used for matching 75 ohms coax when using the dipole antenna.



1-2 = 15 turns for 75 ohm diapole anteena
= 13 turns for 50 ohm inverted "V" anteena
1-3 = 16 turns
1-4 = 8 turns

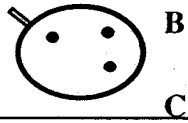
L3

It can made by winding 150 turns (75 + 74)(as in the figure) of 36 S.W.G. enameled copper wire on a 1 K ohm/1 watt resistor Horizontal mounting is essential. Open 1 K/1 watt resistor causes self oscillation of BD 139



Semiconductors:-

Transistors:

(1)	Q3	RF Preamp. - BEL 547B, SL100 B, BEL 100 N etc. 
(2)	Q4	RF Driver - SK 100 B (SMC or CDIL make) 
(3)	Q5	Final P.A. - BD 139 preferred (BU 407,UD 856, D 882, D 886, C 2562 etc. can be used) 

Diodes

(1)	Z2	72 volt/400 mw zener (If not available use three 24 V/0.4 watt in series)
(2)	D4	LED - (use clear LED instead of diffused type It is used as tuning indicator. Tune CT3 for minimum brightness)
(3)	D5	IN 4007
(4)	D6	IN 4007

(1)	T1	Step down mains transformer - 24 volt - 0 - 24 volt /1 Amp.

Miscellaneous:-

(1) F-Fuse holder with 500 mA fuse .For measuring collector current of BD139, remove fuse (F) and insert multimeter probes. After setting current insert F into holder.

(2) P.C.B. - Size 3" x 4" (vero board also can be used) Figure of component layout on P.C.B.is given in fig.2.7.

(3) Aluminium heat sink with mica washer - A sizes of 2" x 2" mm. is adequate. Place it on the transistor Q5 - BD 139.

(4) Head phame jack and pin to connect key to he transmitter.

(5) Dial Drum for the tuning condensor CT3.

(6) RF connector for antenna connection via coaxial cable (male & female).

(7) Use required length of hoockup wire.

(8) Key click filter using 0.01 and 100.ohms can be use as shown in fig. X .Not essentail .

(10) Metal box and fittings of suitable size.
See fig of System layout.

(G) Feeder - 75 ohms coax 14 metre long, with dipole antenna of length 66'6" 50 ohms coax 14 metre long, with inverted 'V' antenna of 66'6"

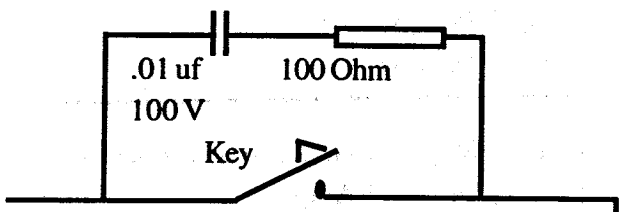


Fig. X Circuit of Key Click Filter

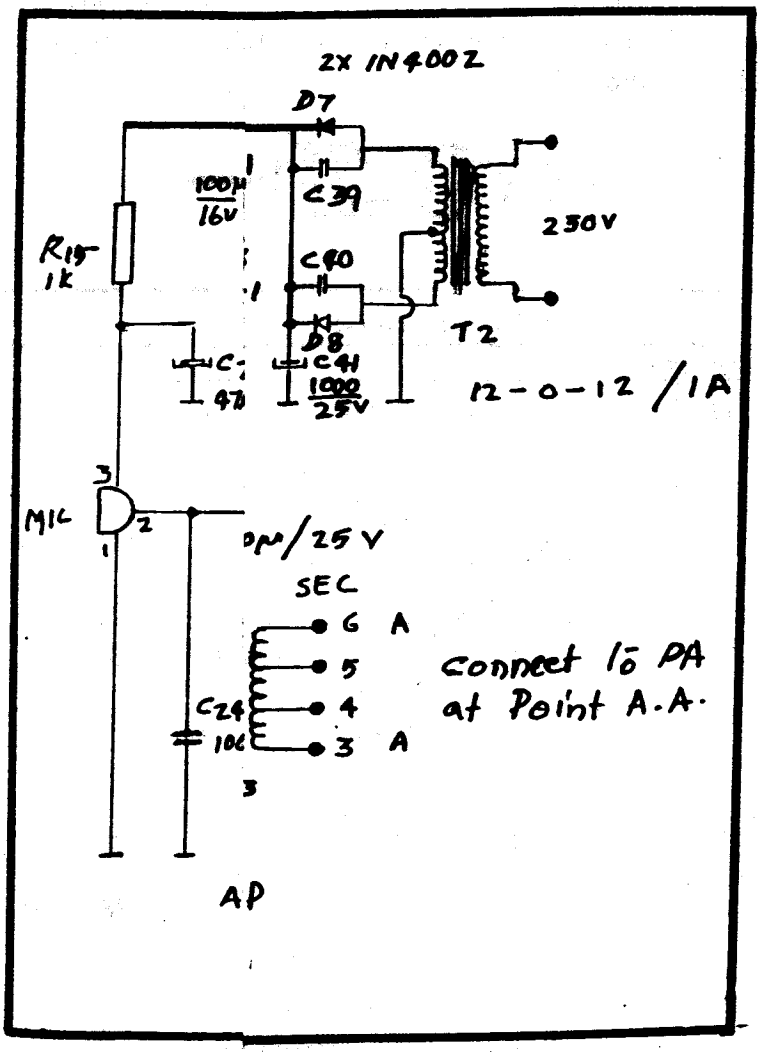
Modifications for 20 m operation

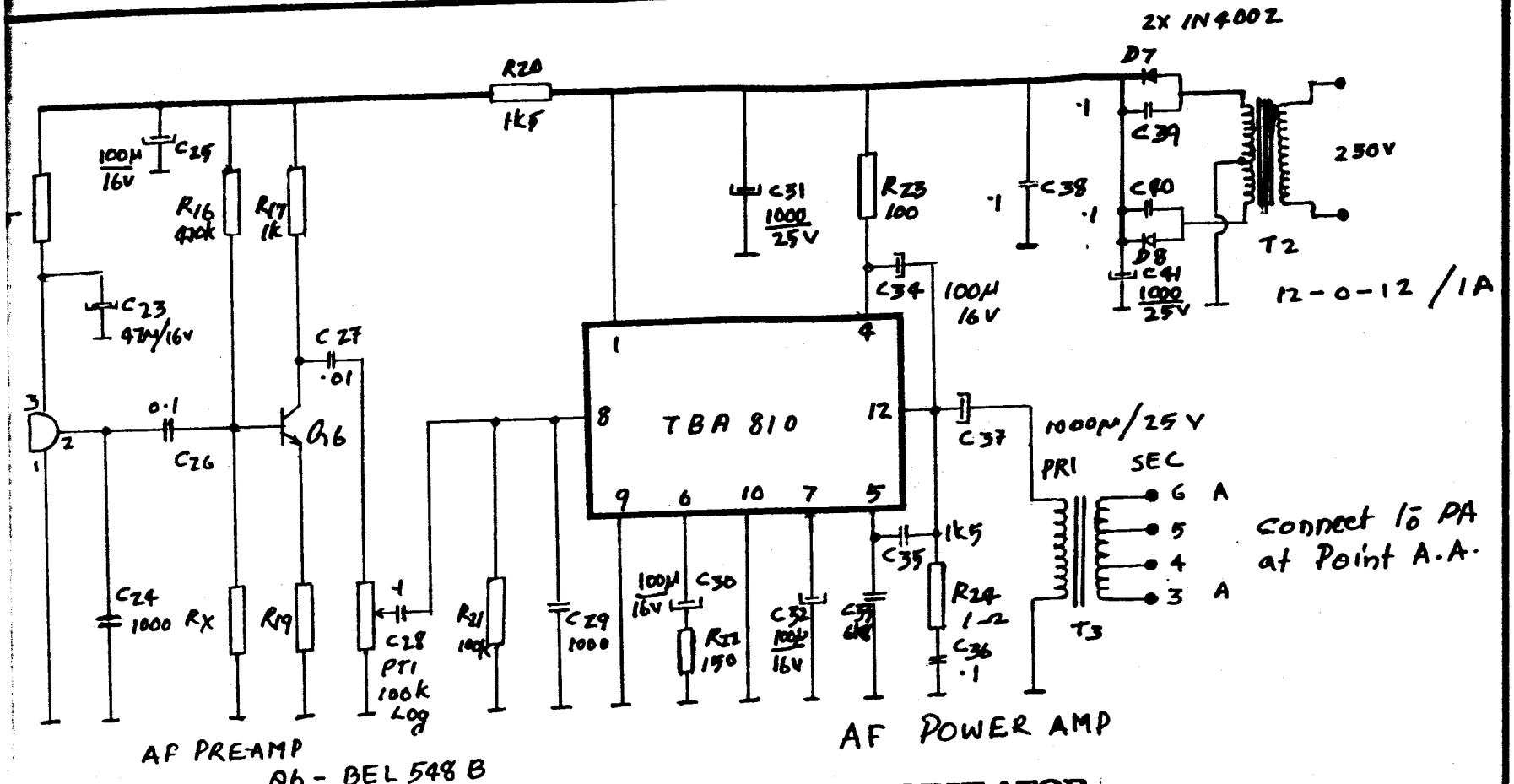
The same transmitter can be made to operate at 20 M by a simple modification . The methods are explained in appendix

CONSTRUCTION OF MODULATOR

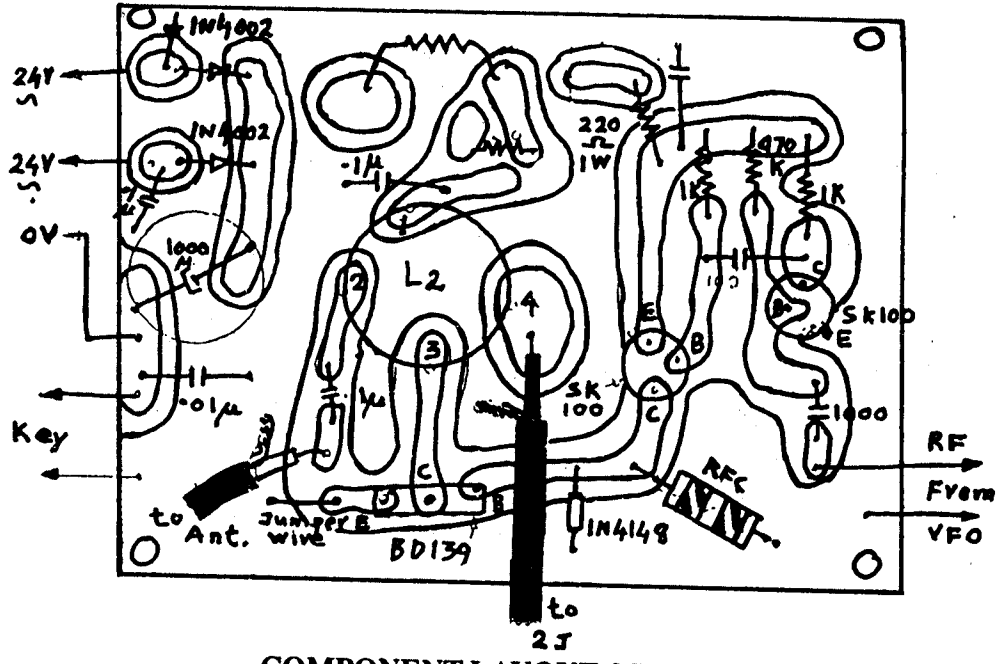
The construction of the modulator is straight forward and it does not requires any explanation . You can make use of the PCB design given in fig.9. PCB construction methods are explained in appendix ,pag.115. However you have to take note of the following points .

(1) Use coaxial mic cable (2 plus shield) or use ordinary





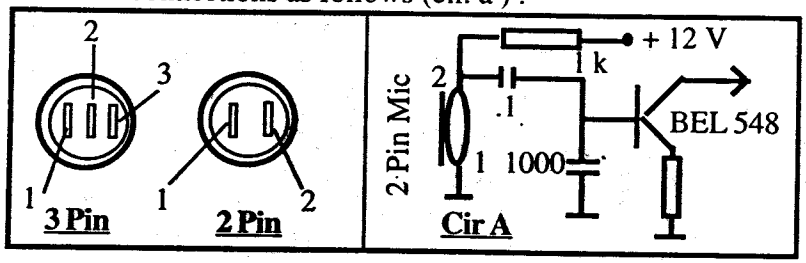
CIRCUIT DIAGRAM OF MODULATOR



COMPONENT LAYOUT OF RF AMP.

shielded wire for mic connection which is having 2 + shield.

(2) If 3 pin mic is not available, use 2 pin condensor mic. Modify the connections as follows (cir. a) :-



(3) Adjust R17/Rx to get 6v at the collector of Q6 - BEL 545 B or C. 548C has a gain more than 200. So it is preferred.

(4) For modulator, standard ready made TBA810 board can be used. Remove the bass/treble controls.

(5) For full modulation, the supply voltage to the TBA810 should be about 16V to 18V.

COMPONENT DETAILS FOR MODULATOR

Resistors		
No.	Item Id.	Description
(1)	R15	1 K. ohms 1/4 watt
(2)	F16	470 K. ohms 1/4 watt
(3)	R17	Rx - Choose values to get 6 volts at collector of Q6.
(4)	R18	1 K. ohms 1/4 watt
(5)	R19	47 ohms 1/4 watt
(6)	R20	1 KB ohms 1/4 watt
(7)	R21	100k ohms 1/4 watt
(8)	R22	150 ohms 1/4 watt
(9)	R23	100 ohms 1/2 watt
(10)	R24	1 ohms 1/2 watt
(11)	PT1	100 ohms/log (potentiometer)
Capacitors		
(1)	C23	47MF/16V - Electrolytic
(2)	C24	1000 PF - A
(3)	C25	100 MF/16V - Electrolytic
(4)	C26	0.1 MF -
(5)	C27	0.01 MF -
(6)	C28	0.1 MF -
(7)	C29	1000 PF -
(8)	C30	100 MF/16V - Electrolytic
(9)	C31	1000 MF/25V - Electrolytic
(10)	C32	100 MF/16V - Electrolytic
(11)	C33	6K 8 PF -
(12)	C34	100 MF/16V -
(13)	C35	1K 5 PF -
(14)	C36	0.1 MF -
(15)	C37	1000 MF/25V - Electrolytic
(16)	C38	0.1 MF -
(17)	C39	0.1 MF -
(18)	C40	0.1 MF -
(19)	C41	1000 MF/25V - Electrolytic
Semicondectors		
(1)	I.C	TBA 810
Transistor:-		
Q6 - BEL 548 B or C		

Diodes		
(1)	D7	1N 4002
(2)	D8	1N 4002

Transformers:-

(1) T2 — Step down mains transformer 12 V-O—12V/1Amp.

(2) T3 — Modulation transformer details

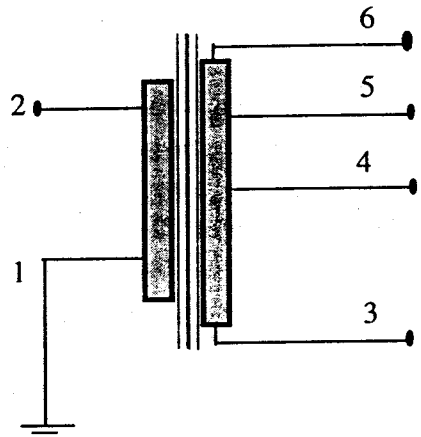
It can be made by winding on an iron core of size 3/4" x 3/4". That is approximately equal to the size of a 6V-0-6V/600 mA transformer.

For HT of 35 V use 200 T of secondary (3 to 6)

" 24V " 150 T " (3 to 5)

" 12 V " 100 T " (3 to 4)

Any slight adjustment can be made for optimum modulation.



1-2 :50 turns 24swg
3-4 :100 tur. 28 swg
3-5 :150 tur. 28 swg
3-6 : 200 tur. 28 swg

Winding Details

Fig. Modulation Transformer Details

Miscellaneous:-
(1) Use a suitable box with all fittings
(2) P.C.B. - with suitable dimension
(3) on/off switch
(4) Mains cord. and required length of wire

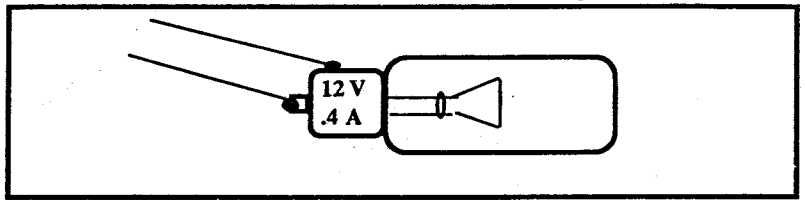
ALIGMENT AND TUNING UP .

As we have already seen the construction methods of the transmitter , now lets go for the final part i.e , the alignment and tuning up .

Accessories required for alignment and tuning up.

(1) Analog/Digital Multimeter

(2) Dummy Load - A 12 volt/0.4 A Miller cycle bulb will do. Solder wires to the bulb as shown in the fig. below .



(3) RF Probe for measuring, RF voltages:-

Construction method of a simple RF probe is explained in appendx .

The alignment procedures have to started from the VFO . Tuning of the VFO is nothing but the setting up of voltages at the test point to the wanted level . The following chart gives the voltages at various test points of the VFO . Reffer circuit diagrum of the VFO for locating the exact test point .

RF Voltage readings obtained at various test points of V.F.O.

Test points	Test D.M.M. in 20 volt rang (DC)	Analog meter in 10 volt range (DC)
A	4.9 V	Oscillation stops
B	4.6 V	2.7
C	3.0 V	1.9 V
D	1.0 V	0.8 V
E	0.9 V without load/ 0.7 V with load	0.6 V without load/ 0.5 V with load
F	0.63 V without load/ 0.3 V with load	0.4 V without load/ 0.2 with load

RF Voltage readings obtained at various test points of Tx P.A.

Test points	Test D.M.M. in suitable range (DC)	Analog meter in the suitable range (DC)
G	0.3 V	0.2 V
H	0.8 V	0.45 V
I	0.9 V	0.45 V
J	IV	0.8 V to 0.75 V
K	24 V (200 V range)	20 V
L	14.3 V (20 V range)	12.5 V
M	13.4 V "	12.5 V 50 V range
N	13.4 V "	12.5 V ""

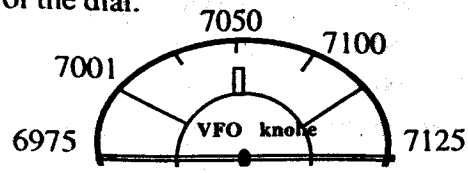
ALIGNMENT AND TUNING UP OF POWER AMPLIFIER

To align our transmitter, follow the steps explained below.

(1) Check thoroughly for any mistake in wiring.

(2) Connect the battery to the V.F.O. Measure RF output voltage at the V.F.O output terminal through the RF Probe. It should be around 0.4 volt.

(3) Bring the V.F.O. frequency to the 7 MHz ham band using the 22 PF (CT2) button trimmer. The frequency coverage using CT1 will be around 150 KHz. Bring the ham band in the centre of the dial.



V.F.O DIAL

(4) If the V.F.O. frequency is not within the ham band, the capacitor values are not correct. Try some other capacitors or different values so as to bring the frequency to the required band. It is better to change the capacitor C2 (180 pF) Now connect V.F.O. to the P.A. section.

(5) Set the power control potentiometer (VR) to its maximum value of 5 K ohms or 10 K ohms.

(6) Connect a dummy load to the antenna terminal A 12 V/0.4A Miller cycle bulb is ok. Use short leads.

(7) Switch on the P.A. power supply.

(8) Remove 0.5 Amp. fuse and connect the multimeter in 250 M.A. DC range across it.

(9) The TX should be in CW mode.

(10) Press key and adjust power control 50 as to get 100 m.A. reading in the multimeter.

(11) Tune CT3 so that this current decreases slightly and shows a dip at some setting of CT3. Now the tank is in tune.

(12) Gradually increase the power using the 10 K pot so that the bulb begins to light. Again tune the capacitor CT3 for maxi mum brightness of the bulb.

(13) Adjust the power control to get 200 - 250 m.A. of collector current.

(14) Now connect the antenna instead of the bulb and repeat the procedure.

(15) The LED will only light up at the collector current of about 150 m.A. When the tank is in tune the LED will become slightly dim. It shows that the tank is in tune.

(16) More than 250 m.A. of collector current is not recommended for safe operation.

(17) Coaxial cable as feeder is compulsory. Not other feeder can be used. If any mismatch/mistune occurs, the final BD 139 transistor (Q5) may burn off.

(18) Always start adjusting at low current. i.e. less than 150 m.A. and only after getting a dip, increase to the maximum power.

(19) Tune the final only in C.W. mode. Adjustment of collector current on A.M. mode will cause P.A. transistor burn off.

(20) For A.M. adjustment, gradually increase modulation to a level at which the collector current meter shows a flicker or a wavering. Stop the modulation gain from further increas ing.

(21) Always use minimum turns tap for the modulation transformer

secondary to attain 100% modulation. Over modulation will ruin the P.A. (BD 139-Q5)

(22) Normal range of this TX or C.W. mode is 500 kms. and on A.M. mode is 300 kms. But DX contacts can be made in better DX band condition. Possible distance is 7000 kms. on C.W. and 3000 kms. on A.M. To achieve this, you should be a patient and expert operator.

NOTICE

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