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amateur radio circuits book

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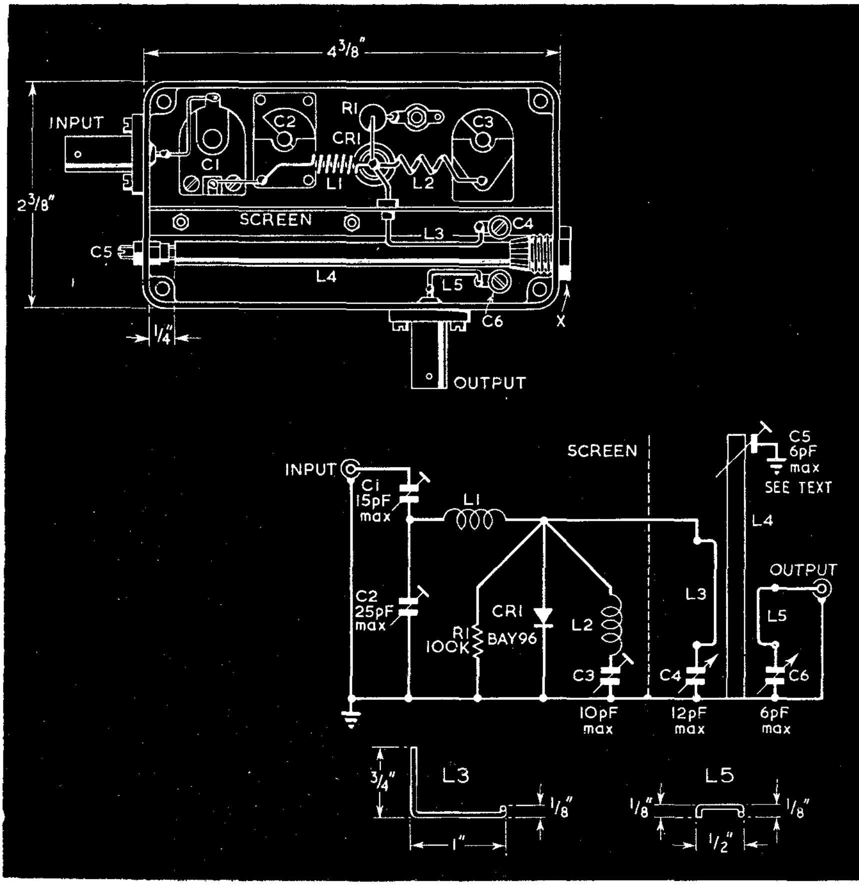
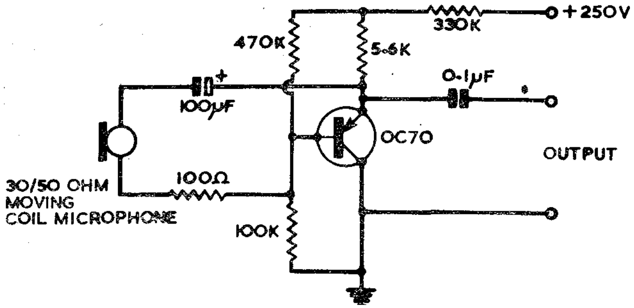
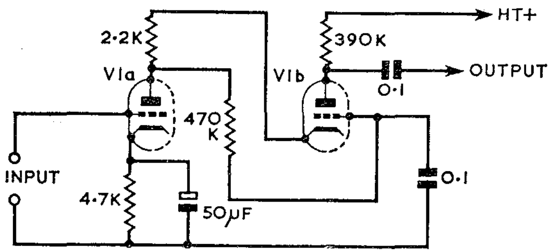
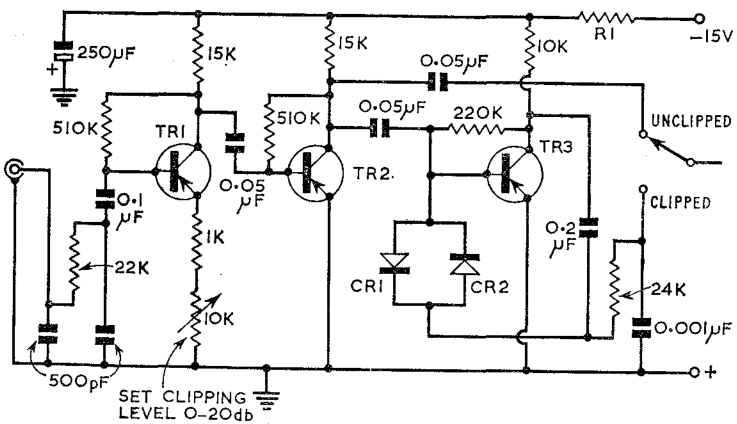




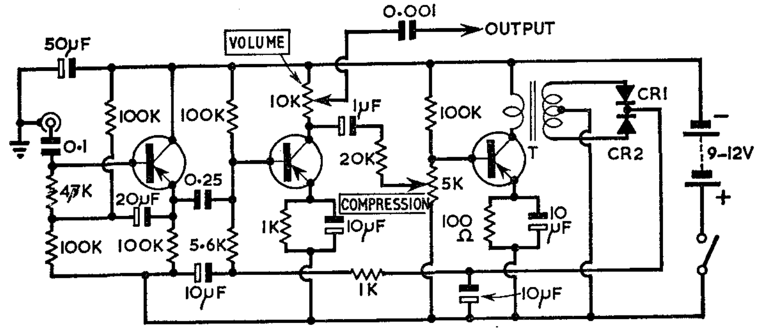
A high gain preamplifier particularly suitable for coupling a moving coil microphone to a valve amplifier. An input of 5·5 mV at 200 ohms impedance will give an output of 1·8 volts at 5000 ohms impedance. Note that both input leads are above earth and care must be taken to provide suitable insulation.



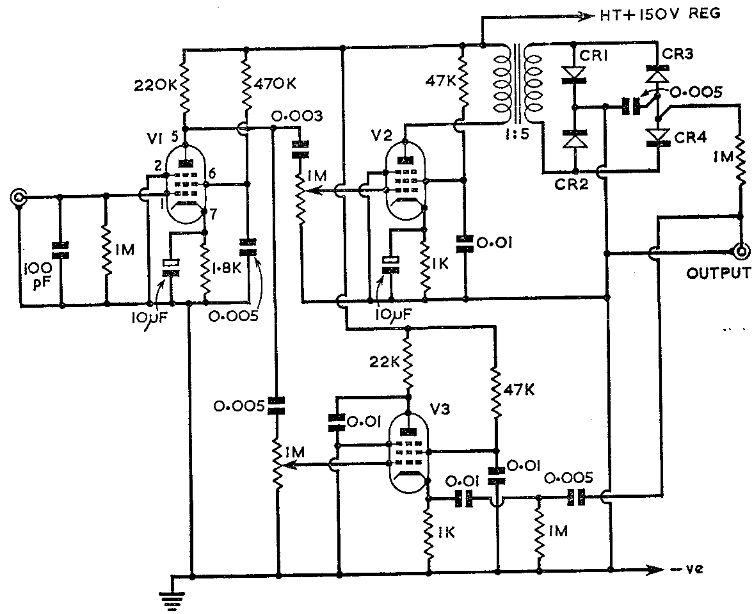
A cascode audio amplifier for low level inputs. To take advantage of the low noise capabilities of this arrangement, care must be taken to avoid introduction of hum by stray capacitance. A good quality socket should be used. V1, ECC83, 12AX7, or ECC807.



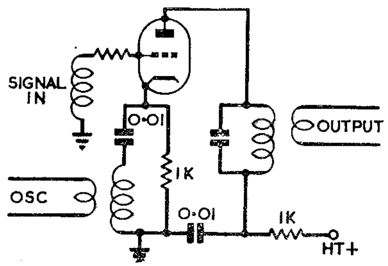
A transistor speech amplifier and clipper, with a frequency range of 500 to 3500 c/s. CR1, 2, any diodes of similar type. TR1, 2, 3, 2N324 or equivalent.

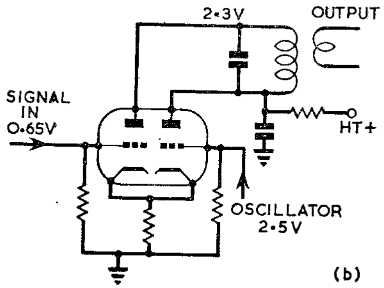


A transistor speech amplifier-compressor. Suitable transistors for all stages are 2N109, 2N217, or equivalent. CR1 and CR2 may be any general purpose diode such as the 1N34A, GEX34, etc. T, a small interstage transformer.

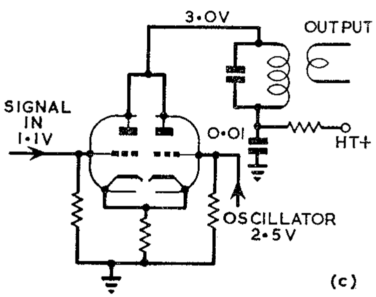


A speech amplifier-compressor suitable for s.s.b. or a.m. transmissions.
V1, 2, 3 EF94, 6AU6.
CR1, 2, 3, 4 1N34A or equivalent.





(b)

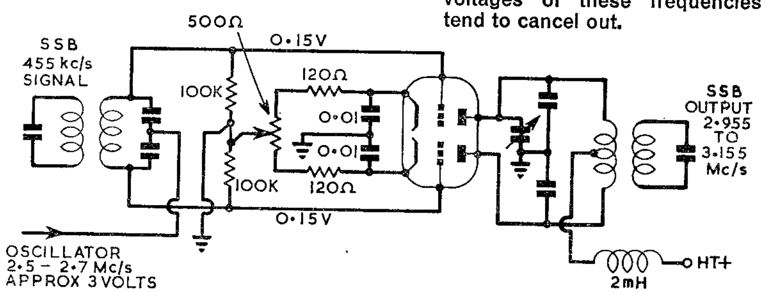


(c)

A single triode (a) will operate as a mixer and has a good dynamic range and low distortion. No balance action is possible, however, and all signal and oscillator attenuation has to be achieved by the tuned circuit. If several parallel tuned circuits are used, a satisfactory level can be achieved. Furthermore, cathode injection is not always acceptable owing to the difficulty of supplying the necessary oscillator power.

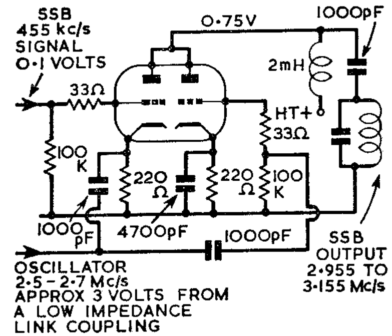
The use of a double triode, where the other triode is operated as a cathode follower as in circuits (b) and (c), provides a higher impedance feed and offers better isolation between signal and oscillator voltages.

Circuit (c) offers partial balanced operation, but due to damping of the tuned circuit by the second triode there is a loss of selectivity. When the cathodes are connected together the input from one triode is transferred to the other triode and the signal and oscillator voltages appear at the anodes out of phase. When the cathode resistor is high compared with $\frac{1}{g_m}$, each cathode "sees" a load nearly equal to its own source impedance and the signal and oscillator voltages at each cathode are about half that applied to the grid. Each grid-cathode voltage is thus approximately equal and opposite in phase and therefore the output voltages of these frequencies tend to cancel out.



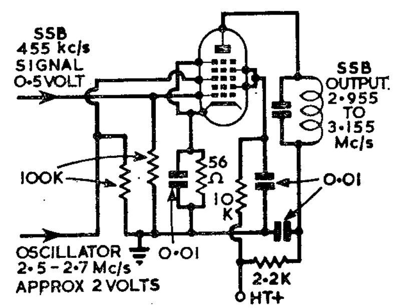
BALANCED DOUBLE TRIODE

In this circuit the oscillator voltage in the output can be reduced to 40db below the required signal by careful adjustment of the input and output balance controls. Suitable valves are the 12AT7 and A2900; the latter has closer characteristic matching.



DOUBLE TRIODE, SELF-BALANCING

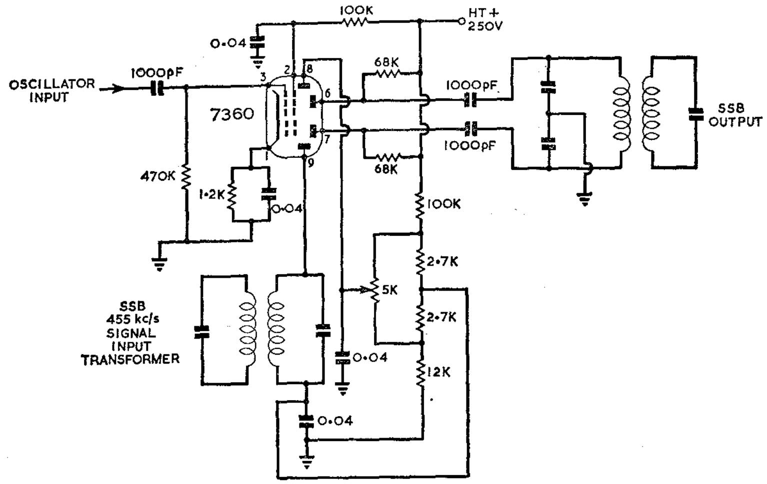
The oscillator voltage is applied to the cathode of the mixer triode and to the grid of the balancing triode. The loading of the tuned circuit by the balancing triode will reduce the conversion gain and selectivity, and the oscillator voltage in the output will be about 20db below the required output signal. Suitable valves are the 12AT7 and A2900.



HEPTODE

This circuit exhibits good isolation between signal and oscillator voltages. It may be possible to reduce distortion by interchanging the signal and oscillator inputs.

Suitable valves are the 6BA7, 6BE6 and ECH81. With the 6BE6 and ECH81, grid 5 is internally connected to the cathode, and in the case of the ECH81 the triode can either be neglected or used as the oscillator.

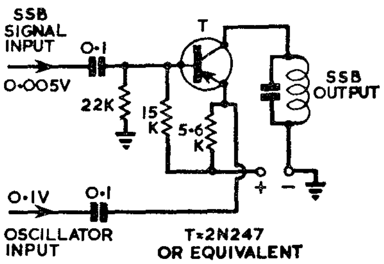


BEAM DEFLECTION VALVE

In this circuit, with careful adjustment of the deflection plate voltage, attenuation of the signal and oscillator voltages in the output may be 40db down.

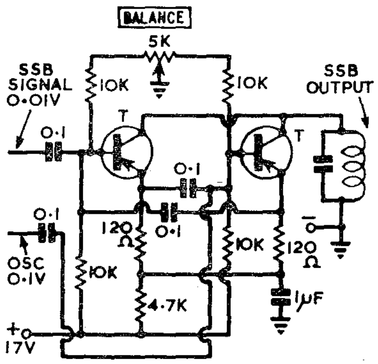
The advantages of the beam deflection valve are that the voltage output is greater than the double triode which, for reasons of linearity, has to be operated at low level, and also it is relatively easy to achieve a good attenuation of the signal and oscillator voltages in the output circuit. Care is necessary, however, to ensure that the oscillator input is not excessive and should be not more than about 3·5 volts.

A suitable valve is the 7360, and also, with minor circuit alterations, the 6AR8 or 6JH8 may be used. Beam deflection valves must not be subjected to excessive magnetic fields because hum may be induced.



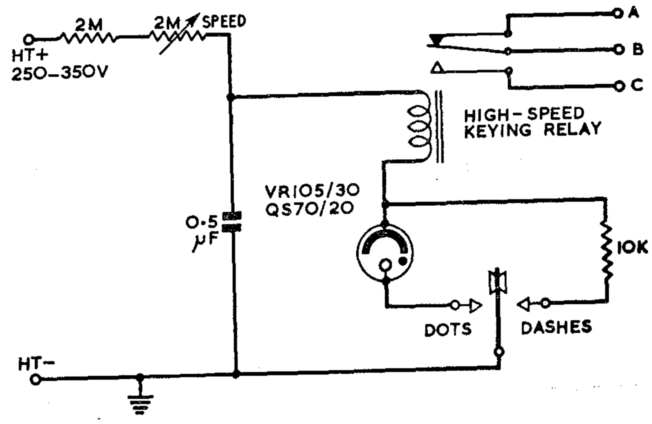
TRANSISTOR MIXERS

Transistors can be used in place of valves for mixer applications, with similar performance. The required signal and oscillator voltage levels are lower, but the mixer can provide adequate conversion gain. Operating conditions are normally similar to those which apply for amplification.

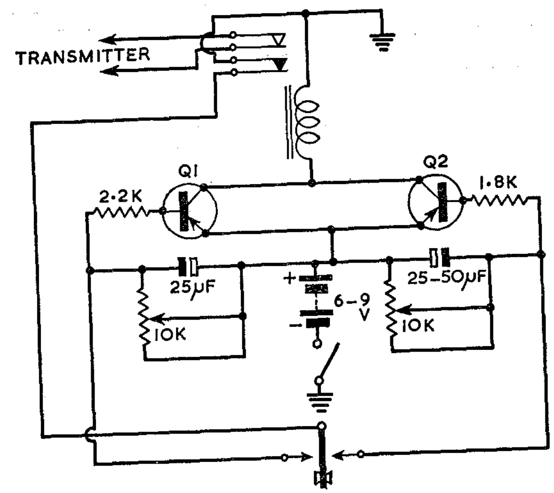


TRANSISTOR BALANCED PAIR

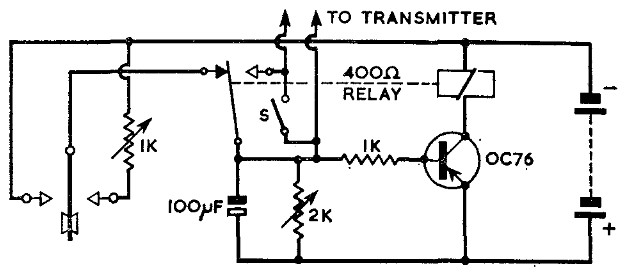
This mixer is approximately equivalent to the balanced double triode circuit shown on page 74.



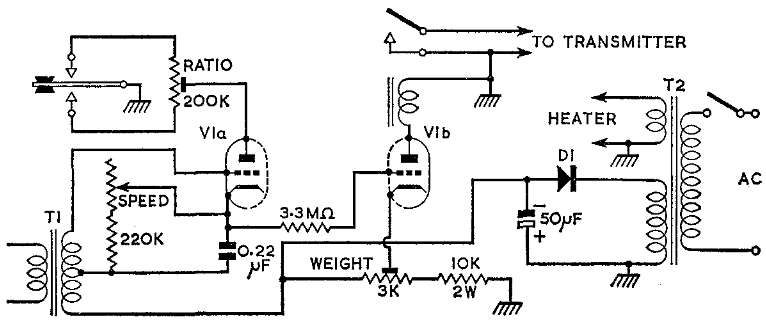
Semi-automatic electronic key.



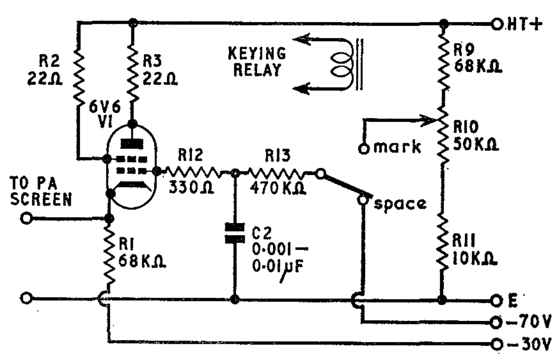
A transistorized electronic key. The adjustment range of the variable resistors should allow the generation of characters at speeds in the range 3 to 35 w.p.m. The relay is a low resistance type. The transistors, Q1, 2, can be virtually any type, such as an OC71, preferably suitable for audio applications.



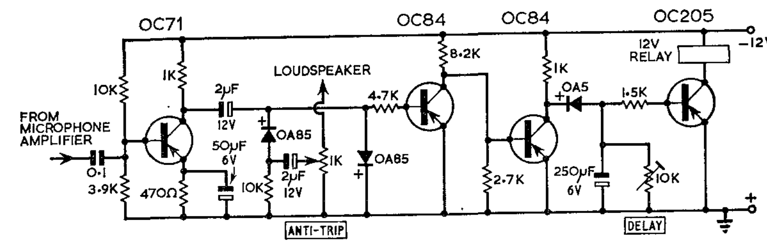
Transistorized el-bug. Switch S is used for transmitter tune-up. Supply voltage s 9 to 12 V.



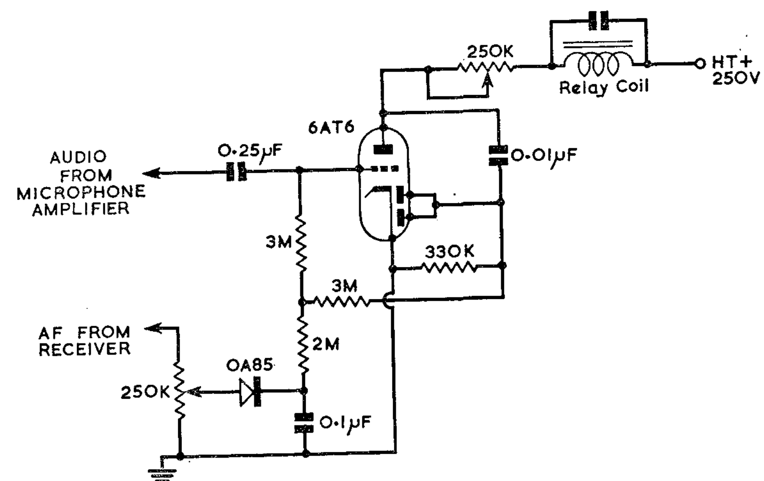
An electronic keyer. Note that the positive side of the power supply is connected to the chassis. T1, centre tapped push-pull output transformer. T2, 120 V at 20 mA, and 6·3 V at 0·3 A. Speed control potentiometer, 50 K ohms. The relay should be a high speed, low current type. D1, power diode rated at 150 V or greater; V1, small double triode such as 12AT7.



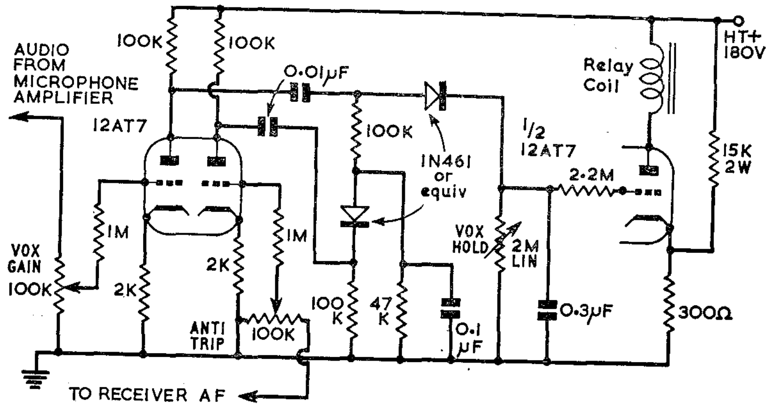
Cathode follower screen supply circuit incorporating provision for screen keying of the p.a. valve. The values shown are for example only.



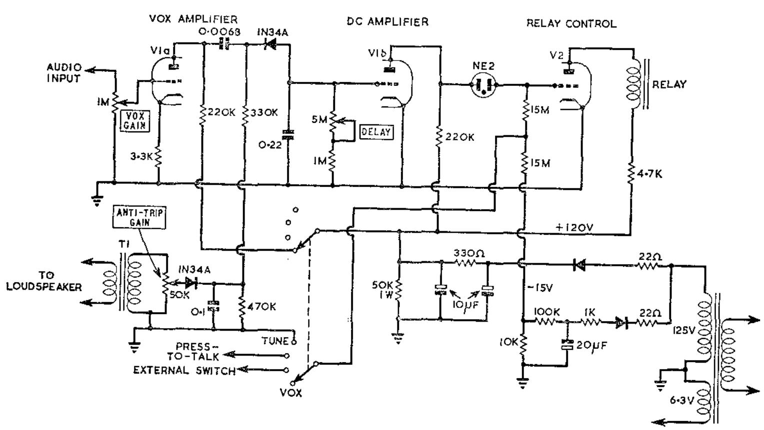
A transistorized VOX unit with anti-trip facilities. The input can be fed from the a.f. gain control in the transmitter. Any 12 V relay can be used provided the ratings of the OC205 (or substitute) are not exceeded.



A simple single valve VOX circuit. A.f. should be taken from a convenient point in the receiver after the volume control to prevent tripping of the VOX unit by signals from the receiver loudspeaker.



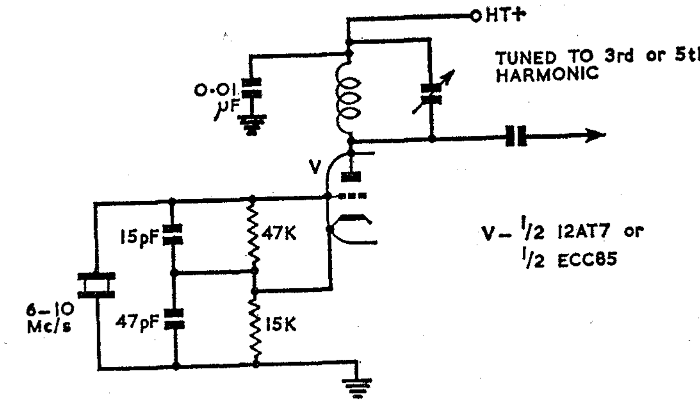
Simple VOX unit using triode valves and semiconductor diodes.



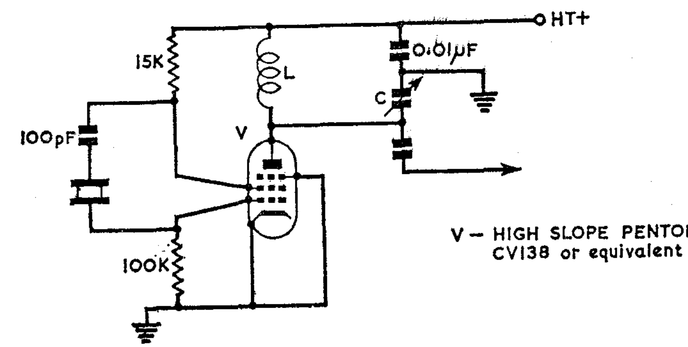
Complete control unit with four position switch to set operation: Tune, Press to Talk, External Switch and VOX. Audio input should be taken from a microphone amplifier before the gain control.

V1, 2 12AT7.

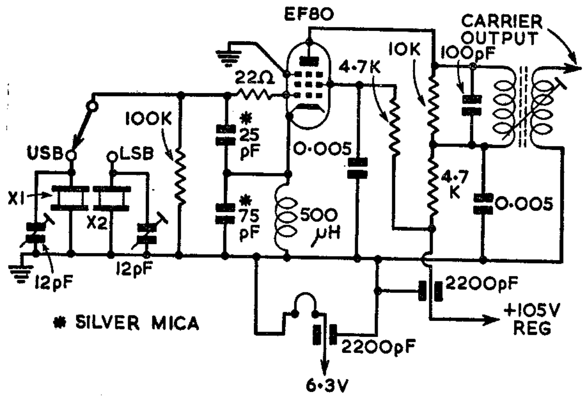
T1 small audio output transformer.



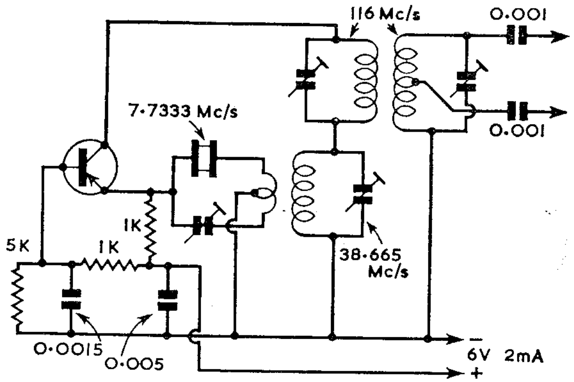
An oscillator suitable for third and fifth harmonic output ideal for use in a converter. A parallel resonant crystal is required. With low activity crystals it may be necessary to replace the 15 K ohm resistor with a 2·5 mH choke.



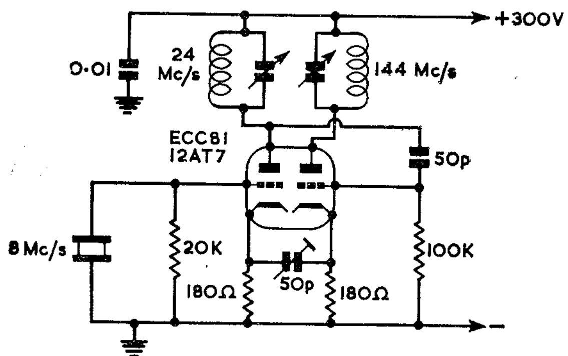
Modified Pierce oscillator, suitable for harmonic output; a useful signal up to the ninth harmonic can be obtained. L and C are tuned to the required output frequency.



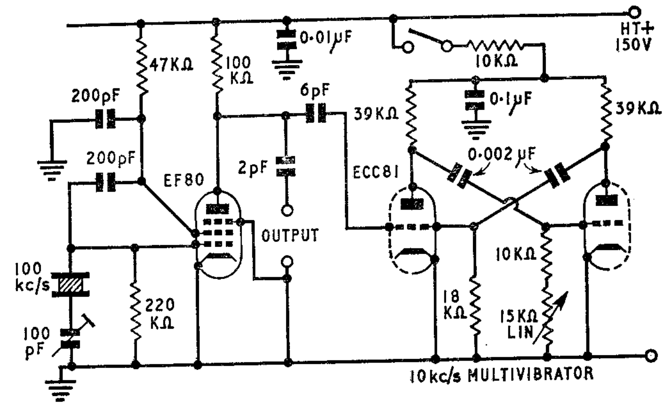
Crystal controlled Colpitts oscillator for use with a 9 Mc/s crystal filter, suitable for s.s.b. applications.



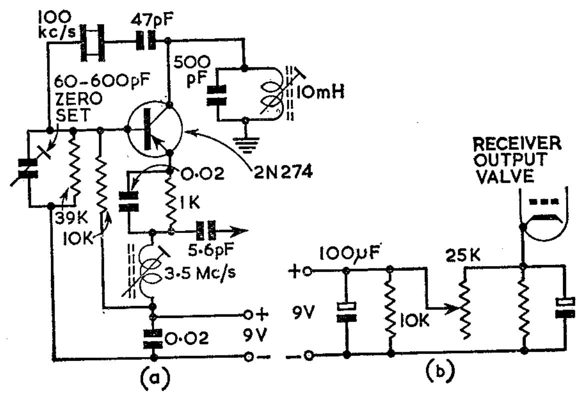
A series resonant crystal oscillator for local oscillator use in a converter for 144 Mc/s. The transistor can be an OC171.



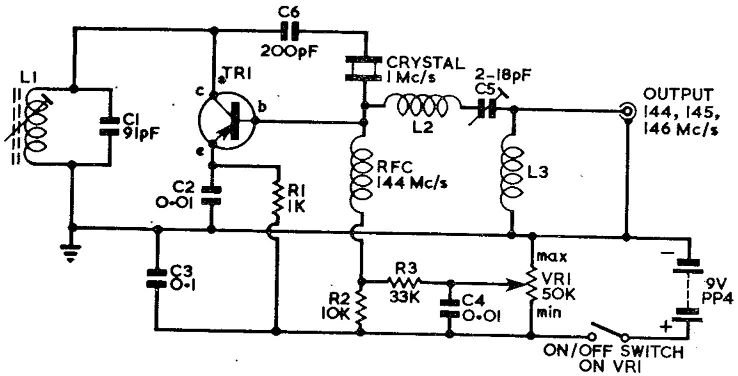
A single valve exciter for 144 Mc/s. The crystal should be parallel resonant and approximately 8 Mc/s, depending on channel.



Crystal calibrator giving frequency markers every 100 kc/s and 10 kc/s, provided the multivibrator is correctly adjusted to give the required subdivision of the 100 kc/s by setting with the 15 K ohms potentiometer. The supply must be stabilized.

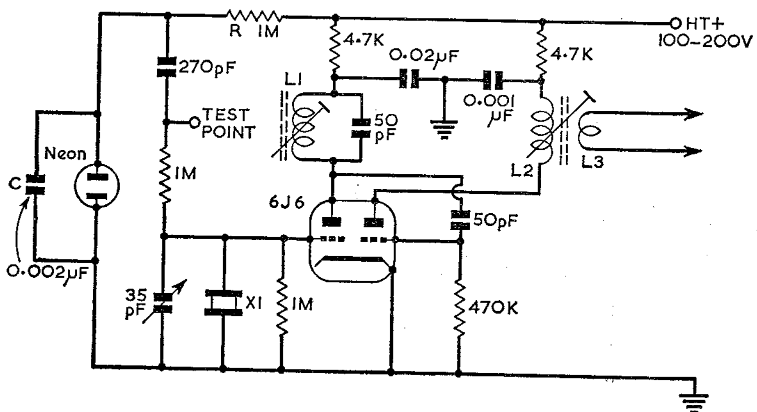


A 100 kc/s crystal calibrator for use with a receiver. The 3·5 Mc/s coil consists of 90 turns, 40 s.w.g. enam., scramble wound on a $\frac{3}{8}$ in. slug tuned former. The 10 mH coil is a winding from a Command 85 kc/s i.f. transformer with added core. (b) Method of deriving a 9 volt supply from the cathode of the output stage of the receiver.

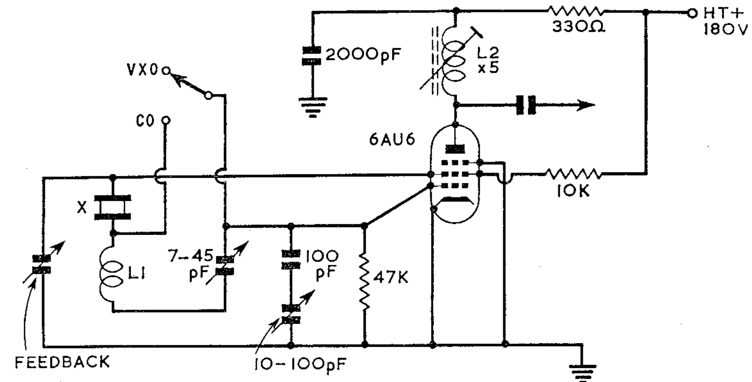


Circuit of a transistorized band edge and centre marker for 144 Mc/s. The transistor may be any type capable of oscillating at 1 Mc/s, such as the XA101, OC44 or OC45.

- L1 120 turns, 30 s.w.g., pile wound, $\frac{1}{4}$ in. diam. slug tuned former (1 Mc/s).
- L2 $5\frac{3}{4}$ turns, 18 s.w.g. tinned copper, $\frac{3}{8}$ diam., $\frac{5}{8}$ in. long, self-supporting.
- L3 20 s.w.g. brass strip, $3\frac{3}{4}$ in. long, $\frac{3}{8}$ in. wide, suitably bent if necessary to fit into container.
- RFC 1·9 in., 26 s.w.g. wire, wound $\frac{1}{8}$ in. diam., $1\frac{1}{4}$ in. long.



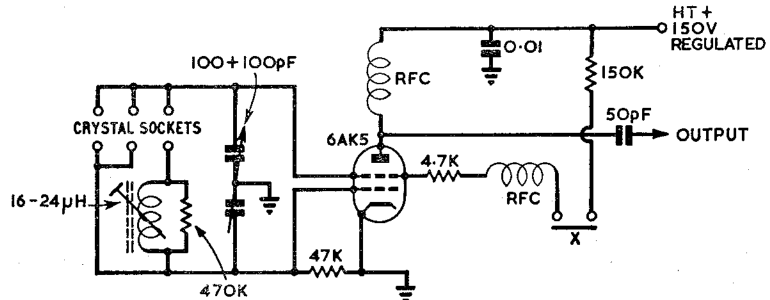
A modulated crystal marker oscillator for use at v.h.f. The values of C and R should be selected to provide a suitable audio modulation frequency. L1, 190 to 320 μH variable inductor to tune to 1 Mc/s; L2, 4 turns of 22 s.w.g., tuned to 145 Mc/s; L3, 2 turns, 26 s.w.g. The test point is provided to check that the modulation is operating correctly.



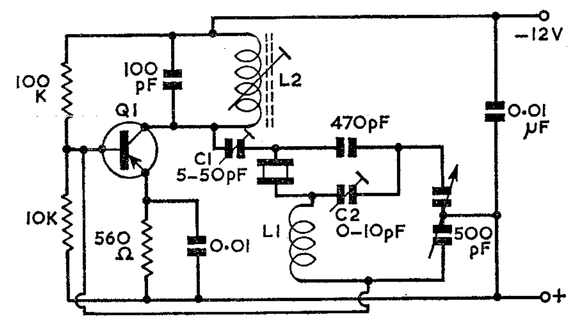
Variable crystal oscillator providing a tuning range of 200 kc/s at 144 Mc/s after frequency multiplication.

- L1 $2\frac{1}{2}$ turns, 18 s.w.g., spaced wire diam., $\frac{3}{8}$ in. diam.
- L2 35 turns, close wound, $\frac{1}{4}$ in. diam., with dust core.
- X 6 Mc/s series resonant crystal.

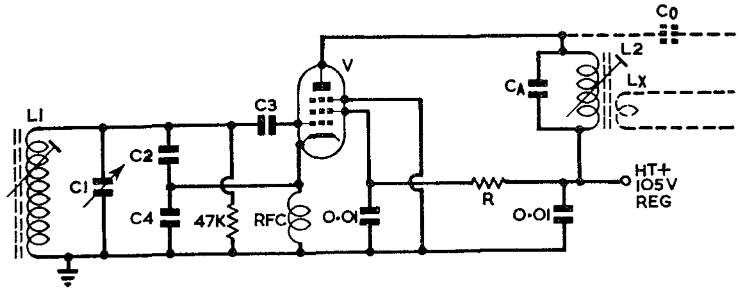
Feedback capacitor is a 0-50 pF trimmer.



With this circuit a frequency shift of up to about 300 kc/s is possible at 144 Mc/s using a 6 or 8 Mc/s crystal. Audio for n.b.f.m. may be applied at X.



This transistor oscillator is capable of a 5 per cent frequency range, though it should be restricted to 2 per cent for good frequency stability. L1, 80 turns, 34 s.w.g., close wound, $\frac{3}{8}$ in. diam. L2 should resonate at the crystal frequency. A 9 Mc/s series resonant crystal is required. Q1, OC171.



A simple reliable variable frequency oscillator. For maximum frequency stability the tuned circuit components must be rigidly mounted with an adequate surface area to keep the thermal effects of the valve to a minimum.

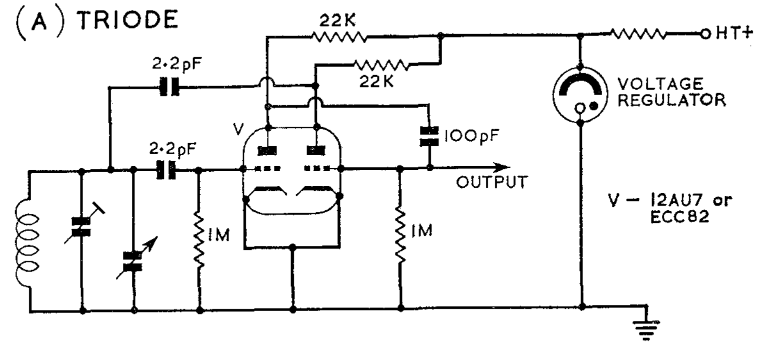
- C1 double bearing tuning capacitor.
- C2, 4 silver mica or other high stability capacitor.
- C3 100 pF for frequencies above 5 Mc/s. 200 pF for frequencies below 5 Mc/s.
- R dependent on the valve used and to some extent on the output level required.
- RFC 1 mH for frequencies above 5 Mc/s. 2·5 mH for frequencies below 5 Mc/s.
- V high slope pentode such as a 6AM6 or 6AH6.

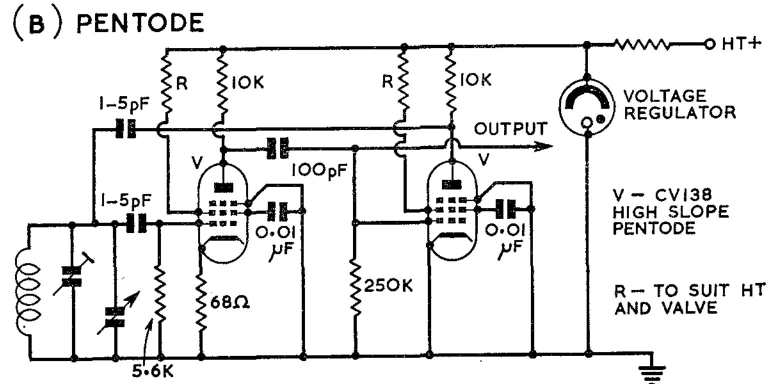
Anode circuit, L2 CA is tuned to twice the oscillator frequency. The output may be taken with capacitive coupling Co or by link coupling Lx.

With care, frequency stability can be quite high particularly if part of the capacitance formed by C2 C4 is of suitable temperature coefficient. The values of the frequency determining components L1, C1, C2 and C4 may be used in other forms of oscillator such as the Franklin or cathode coupled types, where higher frequency stability will be achieved. In these cases the value of the single capacitor to replace C2 + C4 where no tap is required will be half the value specified.

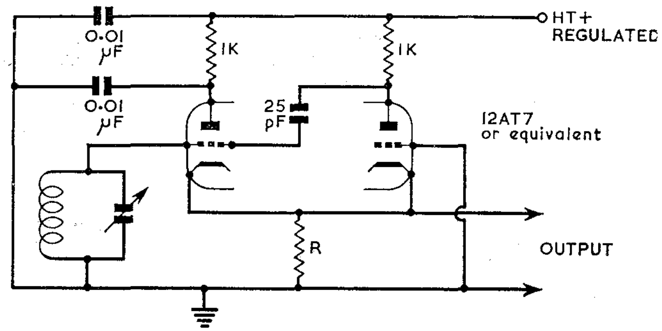
Tuning Range Mc/s	L1* μH	Turns	C1 pF	C2 and C4 pF
1·75–1·88	3·0	18	15–300	4000
3·5 –3·72	0·9	9	15–300	4000
3·5 –3·75	1·3	11	10–230	2500
3·5 –4·0	1·6	12	15–300	2000
5·0 –5·5	0·9	9	10–230	2000
6·0 –6·25	0·5	6	8–140	2500
6·0 –6·5	0·6	7	10–200	2000
7·0 –7·2	0·5	6	8–140	2000
8·0 –8·22	0·35	5	6–100	2000
8·33–8·66	0·35	5	6–100	2000

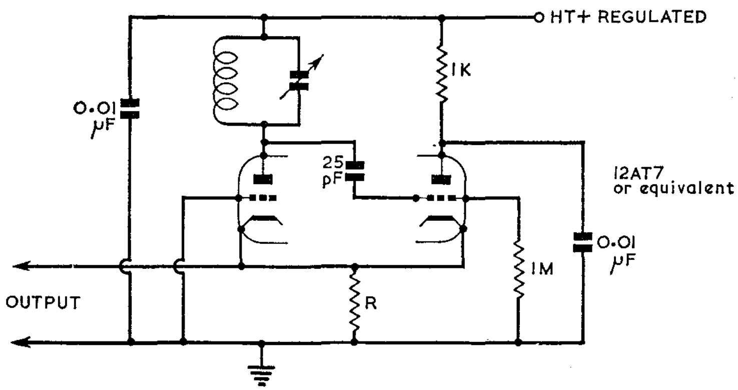
* L1 winding: 2 in. long winding of 18 s.w.g. enamelled copper wire on ½ in. diam. ceramic former with dust iron core.





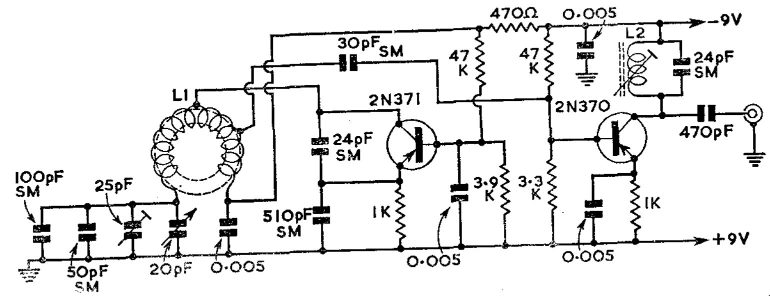
In these Franklin oscillators employing triode and pentode valves the coupling capacitors to the tuned circuit should be as small as possible consistent with free oscillation.





Cathode coupled oscillators. The lower circuit gives a greater output than that shown above, but both arrangements are suitable for use up to 45 Mc/s. In both circuits, the value of the resistor R should be adjusted to provide a suitable output. A good compromise value is 470 ohms.

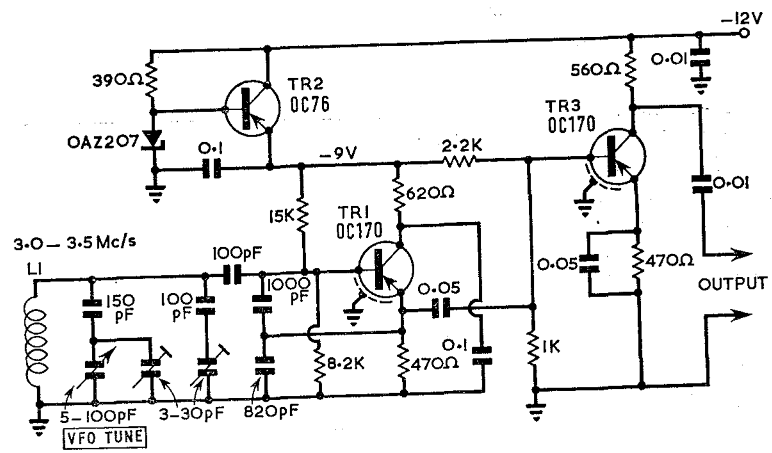
OSCILLATORS—LC, R.F.



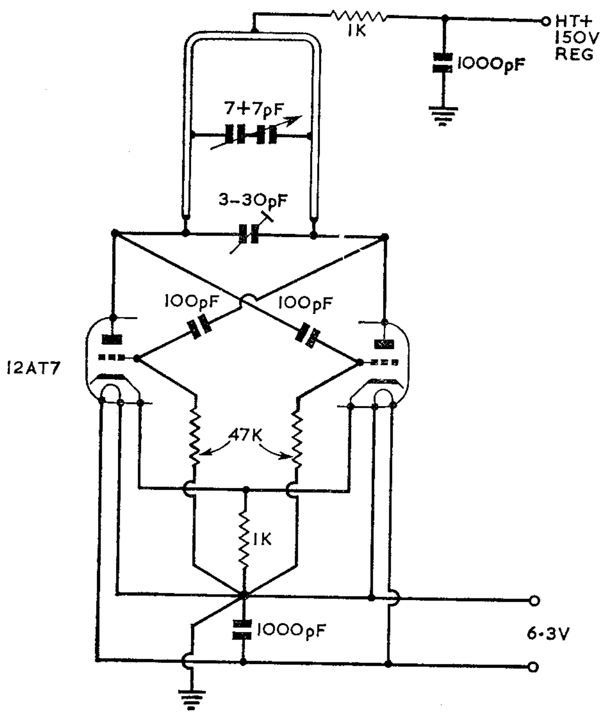
A highly stable transistor v.f.o. with an output covering any 300 kc/s segment between 4·5 and 5·5 Mc/s. The transistors are drift types, but the circuit could be adapted for OC170 or OC171 types if desired.

L1 41 turns, 25 s.w.g., close wound on 0·68 diam. toroidal core, with tap at 16 turns from the earthy end for the 2N371, and 10 turns from the earthy end for output to the 2N370.

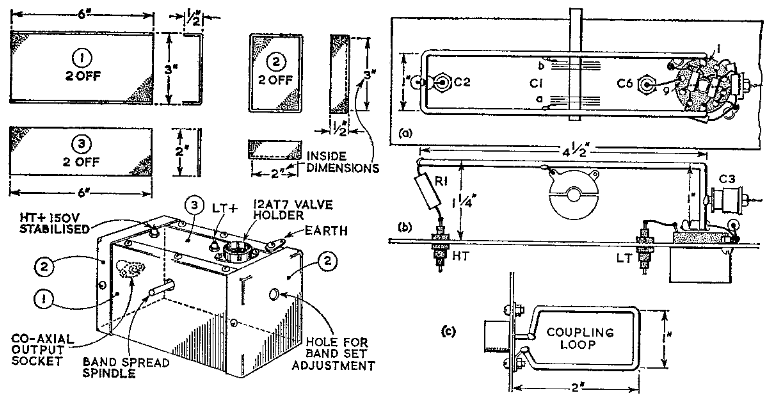
L2 36 turns, 40 s.w.g., scramble wound on a $\frac{5}{16}$ in. diam. slug-tuned former



A stable transistor variable oscillator, suitable for s.s.b. transmitter use, covering a tuning range of 3–3·5 Mc/s, and incorporating a stabilized supply and buffer isolation stage. Low frequency drift can be achieved if the various fixed capacitors across L1 are chosen for suitable temperature coefficients. L1, 17 μH.



A Kalitron variable frequency oscillator for 72 Mc/s.



Details of the construction of the copper or brass box. The thickness of the material may lie between 16 and 22 s.w.g. Diagram (a) shows a view of the underside of the top plate of the box, and (b) a side elevation. The coupling loop (c) is mounted approximately $\frac{1}{2}$ in. underneath the tuned circuits.

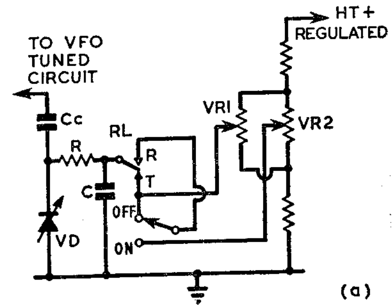


Fig. a illustrates the use of a variable capacitance diode for setting a v.f.o. to correct calibration frequency using VR1. With RL in the other position, VR2 can be used to offset the frequency for receive, thus allowing a small frequency difference between transmit and receive in an s.s.b. transceiver.

In Fig. a, the potentiometers VR1 and VR2 must be positioned in the supply so that they provide a voltage range covering the change of capacitance needed. Note that the rate of change of capacitance varies with different types of diode, and as they are non-linear, it is necessary to choose the most suitable bias voltage range to suit the particular application. The capacitor Cc in Fig. a should be chosen to suit the diode being used and the frequency change required. It must be of good stability such as silvered mica or other low temperature coefficient type.

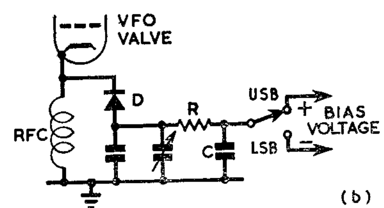
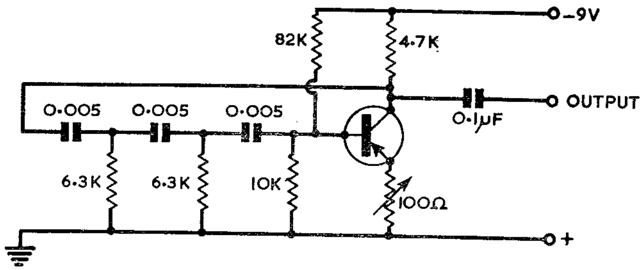
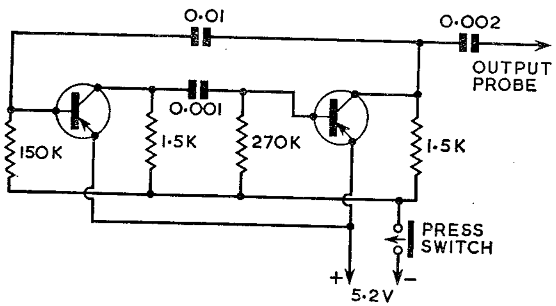


Fig. b shows a diode used as a switch so that when the bias potential is changed, the upper and lower sideband may be selected.

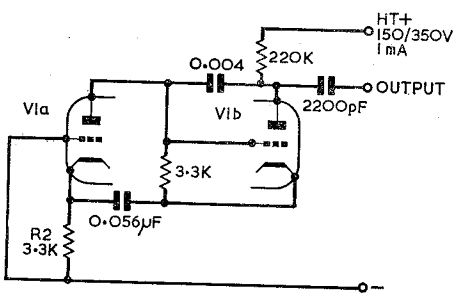
In both diagrams, R and C are decoupling components for isolating r.f. from the d.c. switching. R must be a high value to avoid shunting the capacitive elements.



Fixed frequency (2000 c/s) phase shift transistor oscillator. The transistor can be a 2N404 or equivalent. See also the two tone oscillator shown on page 93.

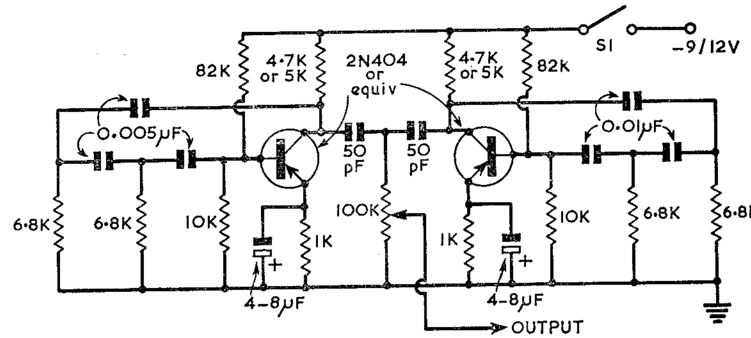


An audio square wave oscillator that can be made small enough to fit inside a pen-torch case. Almost any small-signal transistors are suitable; e.g., OC71, OC44.

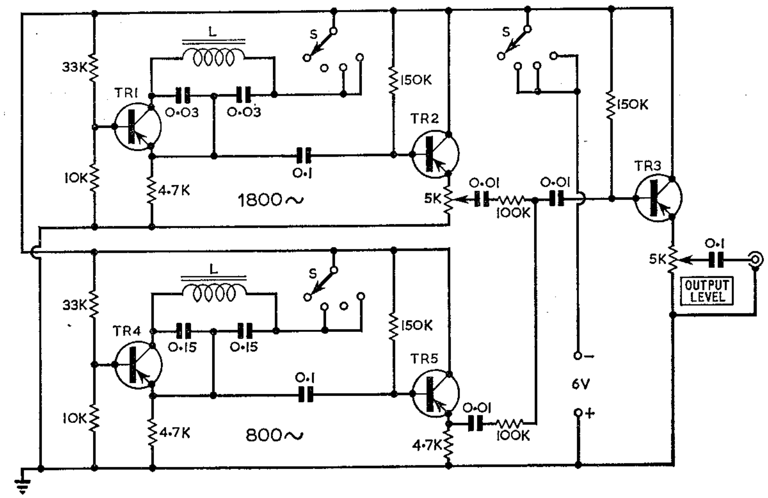


A simple 800 c/s RC oscillator using a double triode such as an ECC81 or ECC82.

Two tone audio oscillators for testing s.s.b. transmitters.

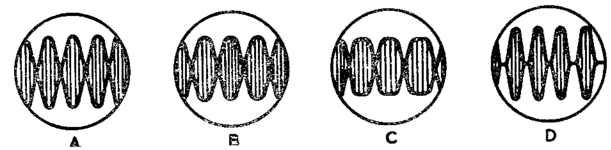


PHASE SHIFT TYPE



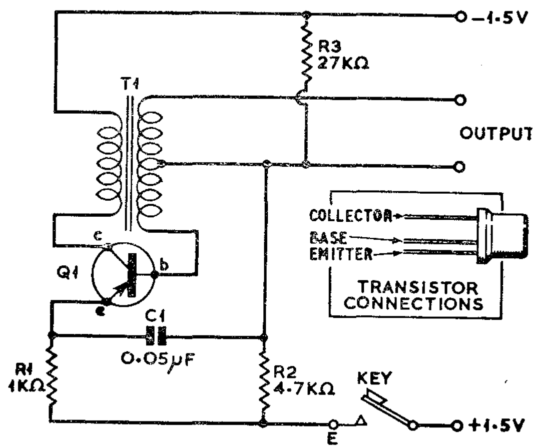
COLPITTS LC TYPE

L, 0·7 H. R, level control to enable the output of the 1800 c/s oscillator to be balanced with the 800 c/s oscillator. S, 3 pole, 4 position. TR1-5, 2N406 or equivalent. Switch positions: 1, OFF. 2, 800 c/s. 3, 1800 c/s. 4, 800 and 1800 c/s.

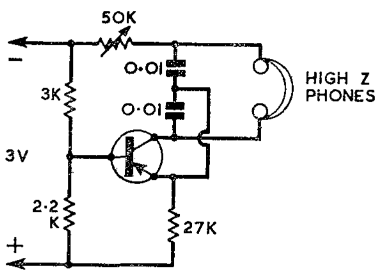


OSCILLOSCOPE PATTERNS

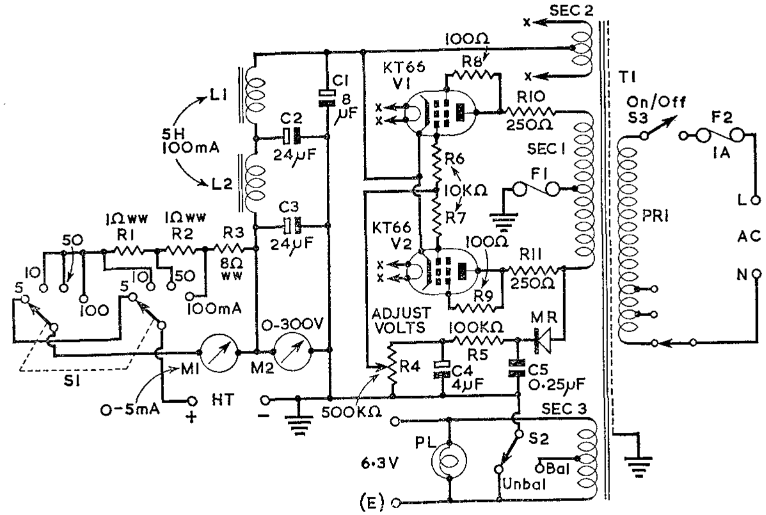
A, Correctly adjusted transmitter output waveform. B, Some clipping or rounding of peaks. C, Severe peak clipping caused by overdrive or under-loading of the amplifier. D, Incorrect bias causing rounding of the crossover points. Note that it is important for the outputs to be substantially pure sine waves.



A simple transistor Morse practice oscillator. An OC81 or NKT251 are suitable as Q1, although nearly any transistor will oscillate in this circuit. T1 is a small driver transformer.

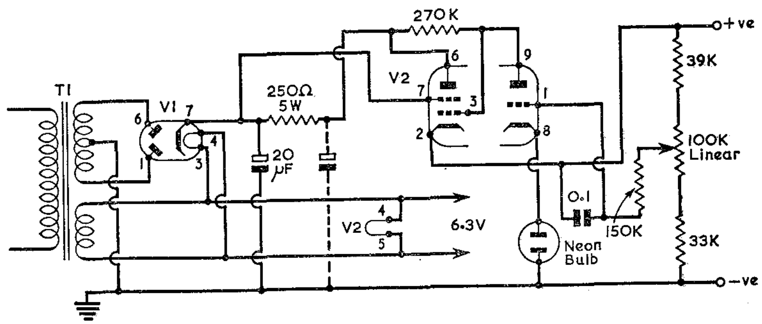


A transformerless oscillator suitable for Morse practice. Any general purpose transistor will be suitable.

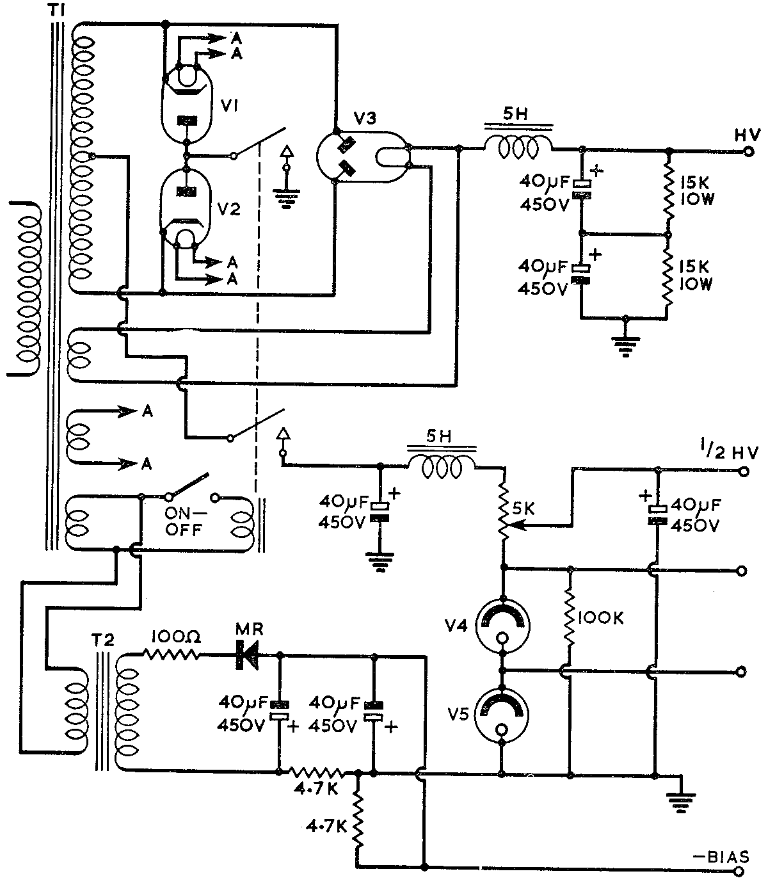


A power supply with a continuously variable output of 50 to 300 volts. A voltmeter, M2, is incorporated to measure the voltage delivered to the load, and M1 indicates the current passing.

C1	8 μF, 450 volts working.
C2, 3	24 μF, 450 volts working (8 + 16 μF).
C4	4 μF (2 × 8 μF, 450 volts working, in series).
C5	0·25 μF paper (2 × 0·5 μF, 350 volts working, in series).
MR	SenTerCel K3/25 metal rectifier.
R4	500 K ohms linear carbon potentiometer.
R5	100 K ohms, ½ watt.
R6, 7	10 K ohms, ½ watt.
R8, 9	100 ohms, ½ watt.
R10, 11	250 ohms, 5 watts.
F1	150 mA fuse.
T1	Mains transformer, secondary: 350–0–350 volts 100 mA, 6·3 volts 3 amps, 6·3 volts 3 amps.



Compact regulated power supply providing 110–250 volts at 0–40 mA. T1, 240–0–240 V, 60 mA secondary; neon, NE-2 or similar type; V1, 6X4 (EZ90, U78); V2, ECL82.

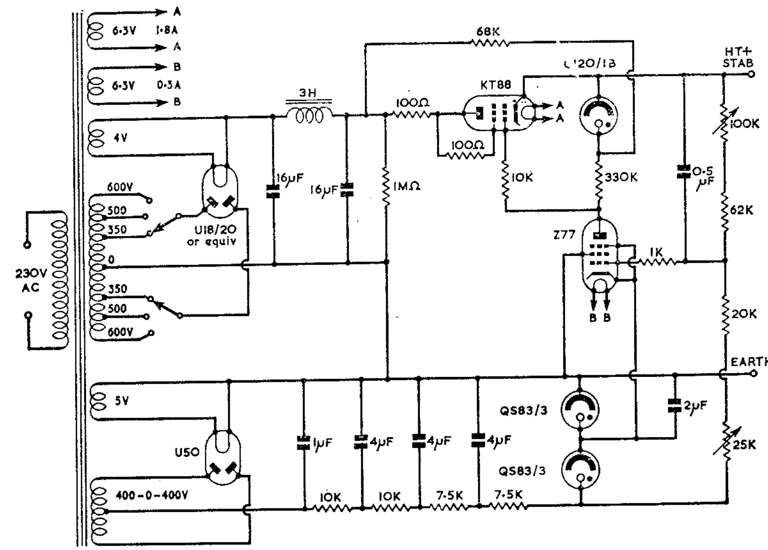


A comprehensive power unit suitable for supplying a transmitter.

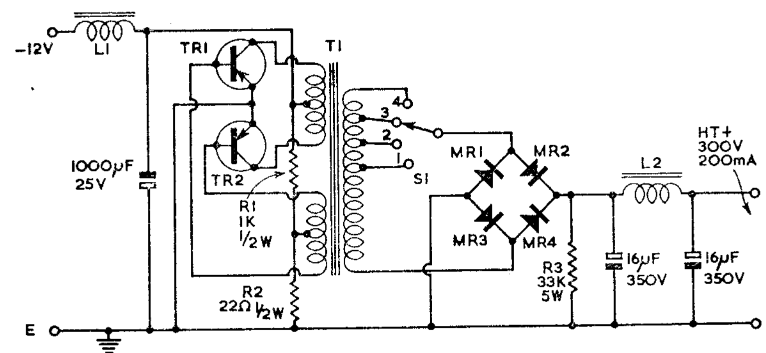
T1 h.t. transformer, 350–0–350 volts, with heater windings to suit rectifiers.
T2 heater transformer connected the reverse way round.
V1, 2 R12, etc.
V3 U18, 5R4, etc.
V4 OC3, etc.
V5 OA3, etc.
MR 250 V r.m.s. rectifier.

With the transformer specified the high voltage outputs will be about 650 volts and 350 volts.

If preferred, the rectifier valves may be replaced by semiconductors, although this will result in an increased output voltage. Care must be taken, however, to ensure that switching surges are limited to a suitable level by the introduction of resistors in series with transformer leads, or a resistor-capacitor suppressor across the transformer secondary. Voltage sharing resistors should be connected across individual diodes in series chains.



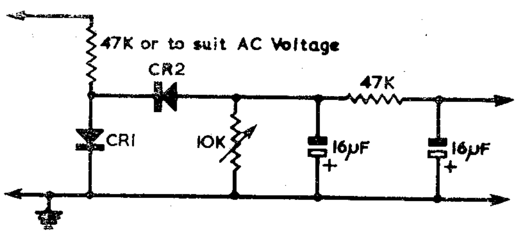
A stabilized power unit for output voltages between 0 and 400 V at 100 mA. The degree of stabilization at 100 mA is 0·65 V in 400 V. Regulation between 0 and 100 mA is 0·4 V in 400 V. The ranges at each switch setting are 0–100 V, 100–250 V, and 250–400 V.



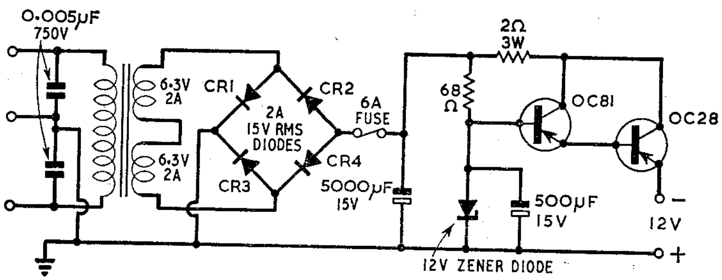
A 60 watt d.c.-to-d.c. converter providing an output of 300 volts at 200 mA from an input of 12 volts.

L1 12 turns, 16 s.w.g. enam. copper.
L2 single layer on former, 26 s.w.g. enam. copper.
T1 *(primary)* 32 turns, 16 s.w.g. copper, bifilar wound.
(secondary) 860 turns, 16 s.w.g., tapped at 680, 740, and 800 turns.
(feedback) 7 + 7 turns, bifilar wound over secondary.
L1, 2, T1 wound on Mullard Ferroxcube cores type FX1079.
MR1–4 OA214, OA211, or equivalents.
TR1, 2 2N1147A transistors.

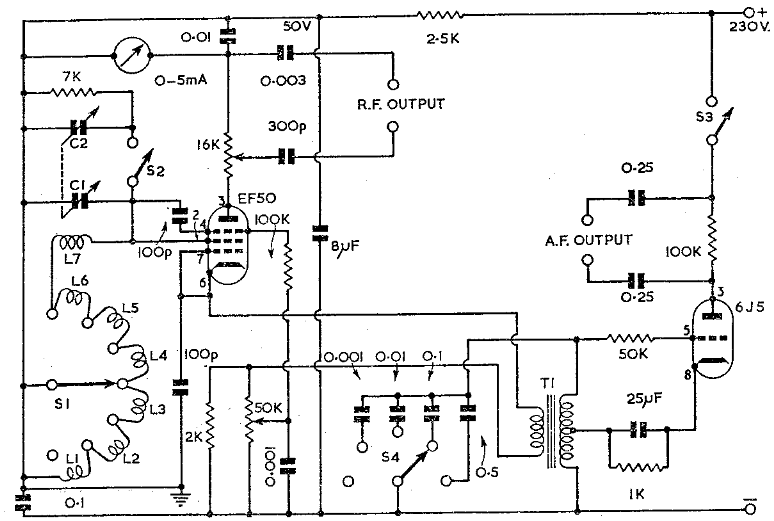
R2 should be adjusted to a minimum value consistent with reliable starting. R3 may be omitted if the converter is permanently connected to the load.



A low voltage variable bias supply. CR1 and CR2 should be chosen to suit the voltage and current requirements. For general purpose low voltage and current applications the GEX34 is suitable.



Electronically smoothed power unit for transistor equipment drawing a maximum current of 2 amps.



Circuit of a transitron signal generator covering 80 kc/s to 56 Mc/s.

C1, 100 pF max. }
C2, 500 pF max. } ganged capacitors.

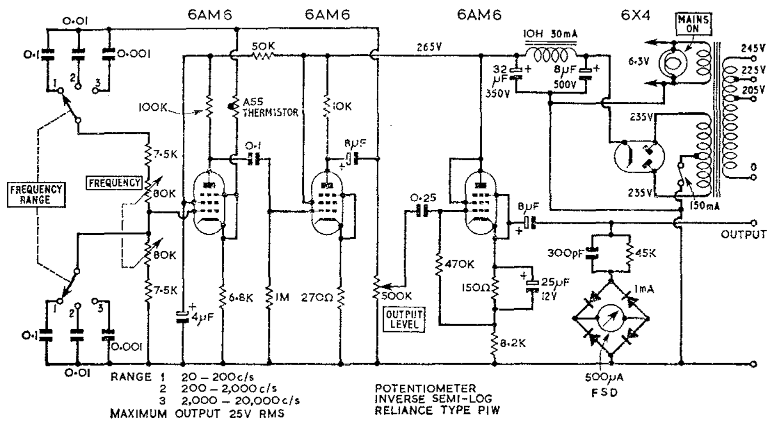
With these capacitors the frequency ranges will be

80–200 kc/s	2·6– 6·5 Mc/s	14–29 Mc/s
210–760 kc/s	5·6–15·8 Mc/s	24–56 Mc/s
660–2700 kc/s		

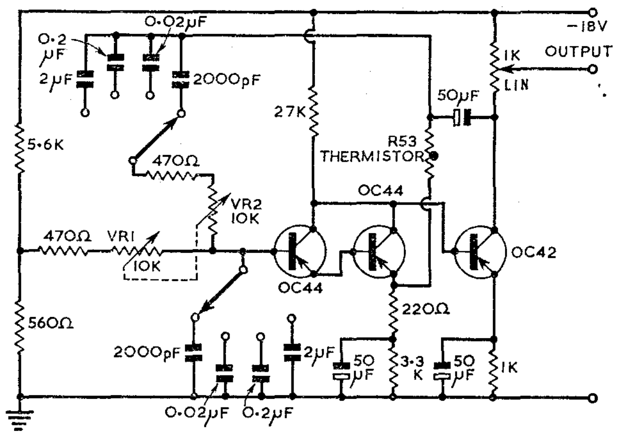
L1, two long wave broadcast coils in series.
L2, medium wave b.c. coil with quarter of total turns removed.
L3, 23 turns, 40 s.w.g. d.c.c., close wound on $1\frac{1}{4}$ in. diam. former.
L4, 17 turns, 24 s.w.g. enam., close wound on $1\frac{1}{4}$ in. diam. former.
L5, 8 turns, 20 s.w.g. enam., close wound on $1\frac{1}{4}$ in. diam. former.
L6, 7 turns, 20 s.w.g. enam., close wound, self-supporting, $\frac{3}{8}$ in. inside diam.
L7, 7 turns, 20 s.w.g. enam., close wound, self-supporting, $\frac{5}{16}$ in. inside diam.
T1, push-pull valve driver transformer.

A 6·8 K resistor may be substituted for the 7 K resistor in parallel with C2, if desired; a 10 K variable resistor may be used in place of the 16 K variable in the anode lead of the EF50. The output potentiometer should be a non-inductive carbon type.

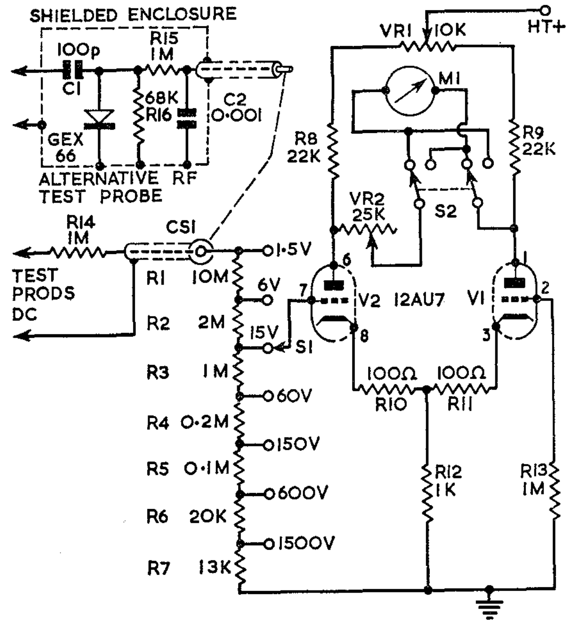
The whole unit including the power supply must be screened to avoid leakage of the r.f. signal.



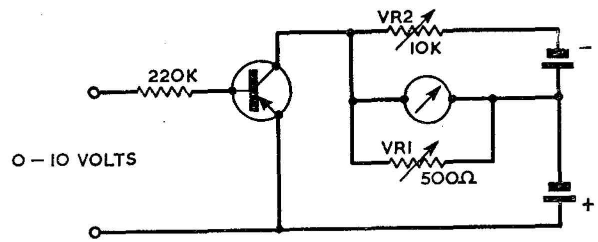
Resistance-capacitance audio generator. The valves may be any high slope type. The thermister A55 is an STC type. The output meter bridge rectifier is a 1mA instrument.



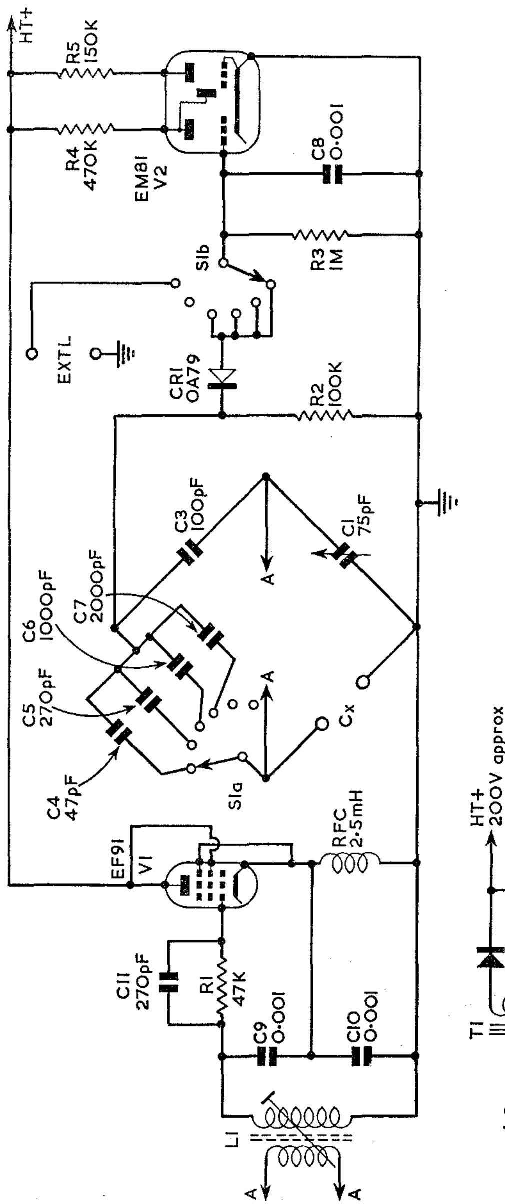
Transistor Wien-bridge oscillator covering 10 c/s to 100 kc/s. The frequency control twin-gang potentiometer VR1, VR2 should have a semi-logarithmic or logarithmic law. The R53 thermistor is manufactured by STC.

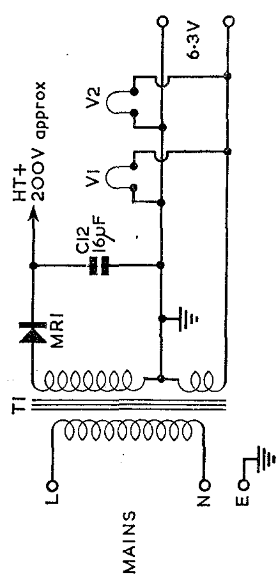


A simple valve voltmeter. The meter M1 should have a 0–500 µA movement, and be calibrated 0–1·5 and 0–6 volts. R1–7 should be of 1 per cent tolerance. S1 should have ceramic or similar low loss insulation. The h.t. supply should be suitably stabilized for reliable operation; a gasfilled stabilizer is adequate for this purpose.

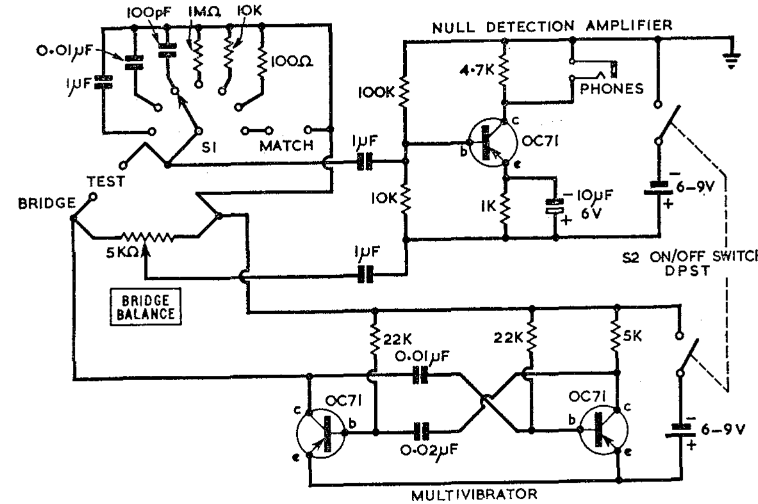


Transistor d.c. amplifier to increase the sensitivity of a 1 mA f.s.d. meter. Adjust VR2 for zero I_{co}, and set VR1 for the desired f.s.d. The transistor is an OC71 with a 6V supply.



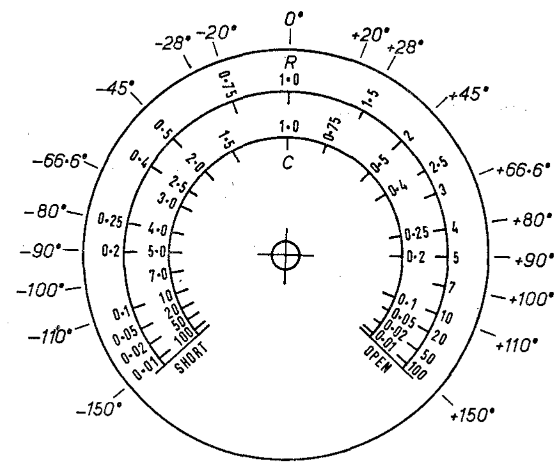


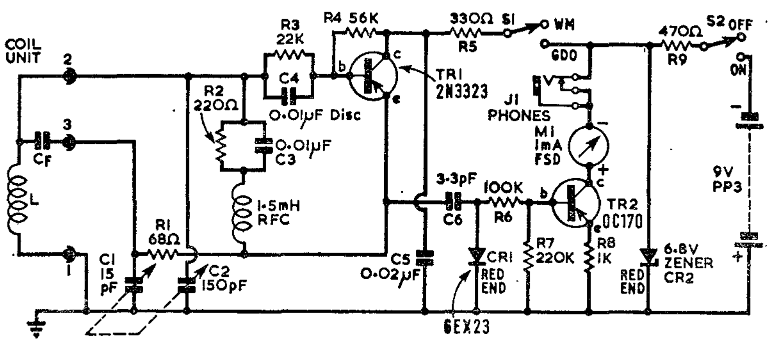
Circuit of a radio frequency capacitance bridge. The capacitors forming the standards in the bridge should be silvered mica, and of a tolerance suitable for the accuracy required. The operating frequency, which is governed by L1, should be between 500 kc/s and 3 Mc/s. MR1 can be a 250 volt, 15 mA contact cooled rectifier, or an appropriate silicon diode. T1 should be capable of supplying 15 mA at 250 volts. All resistors are ½ watt rating. Calibration should be carried out using a selection of capacitors of known value, such as 5, 10, 25, 100, 250, 500 and 1000 pF, preferably of ±1 per cent tolerance.



Transistor Wheatstone bridge.
The bridge balance potentiometer should be a wire wound type with a linear law, the larger diameter type being most suitable. All the standard components selected by S1 should be of close tolerance as the measurement accuracy is based on their value.
A typical scale calibration is shown below.
Actual calibration may be carried out by using a suitable selection of components of known value, or by measurement of the resistance of each side of the slider of the balance potentiometer and noting the ratios on the calibration dial. With a balance potentiometer of 3 in. diam., an accuracy of the order of 5 per cent can be expected.

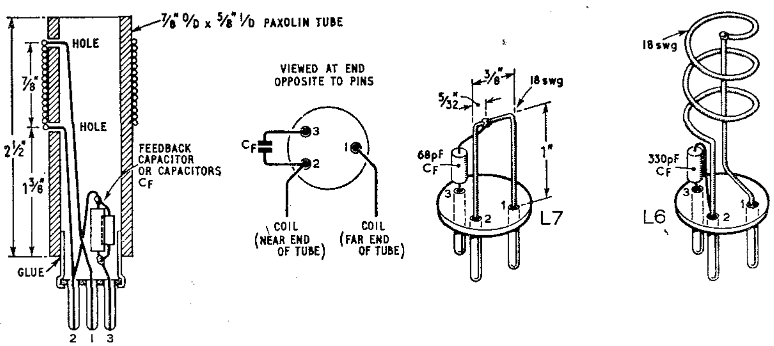
Normal components to be checked are connected to the test position. If it is desired to match pairs of components then the other component is connected to the terminals marked match (S1 in position 7). To obtain the actual value of a component, multiply the ratio indicated on the calibrated dial by the value of the standard which has been selected by S1.



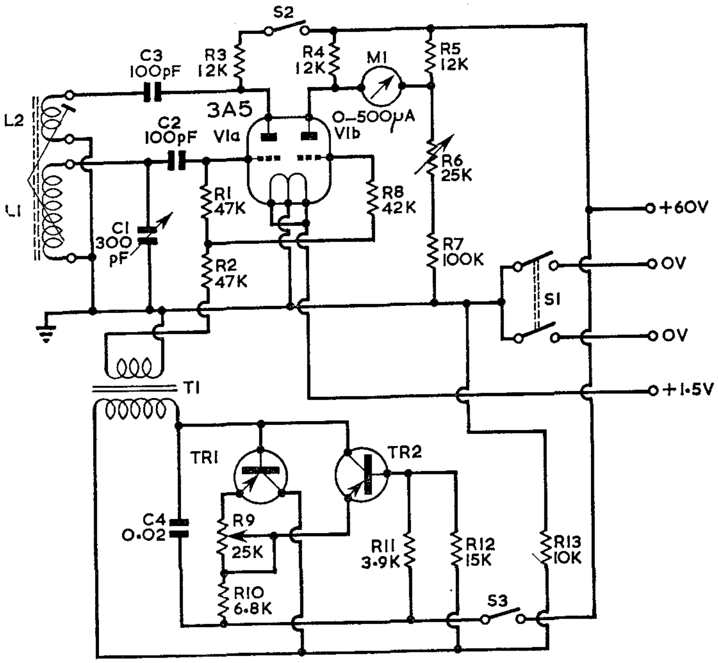


Dip oscillator covering 0·85–150 Mc/s. The r.f. transistor TR1 is a 2N3233 v.h.f. Motorola type. S1 is provided to enable the dip oscillator to be used as a sensitive absorption wavemeter.

Frequency Range Mc/s	No. of Turns	Wire S.w.g.	Former Diam.	Former Length	Winding Length	CF pF	Type
0·8– 2·0	180	28	⅞ in.	4⅛ in.	3 1/16 in.	3 × 1000	A
1·8– 4·0	54	28	⅞ in.	2½ in.	⅞ in.	2200 + 820	A
3·4– 8·0	27	22	⅞ in.	2½ in.	⅞ in.	2200 + 680	A
6·7– 16·0	13	22	⅞ in.	2½ in.	⅞ in.	3300	A
13·5– 34·0	6	22	⅞ in.	2½ in.	⅞ in.	2200	A
33·0– 85·0	3	18	⅜ in.	—	½ in.	330	B
50·0–150·0	1	18	—	—	—	68	C



A C B



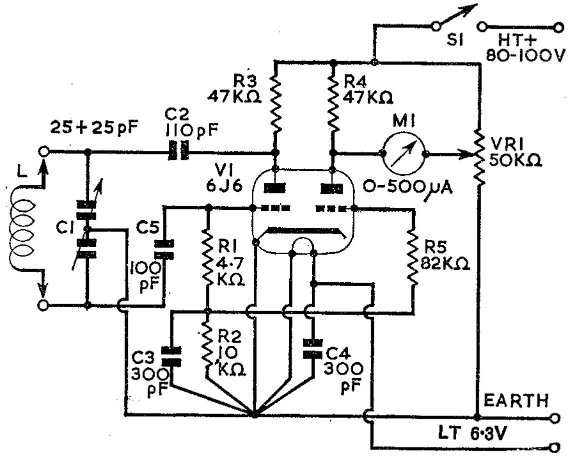
Circuit of a battery operated g.d.o. with self-contained audio oscillator/modulator and additional d.c. amplifying stage for increased sensitivity.

- C2, 3 — 100 pF silvered mica.
- M1 — 0–500 μA m.c. meter, 500 ohms int. resistance.
- S1 — 2 pole on/off toggle switch.
- S2, 3 — 1 pole on/off toggle switch.
- T1 — virtually any small audio transformer, the one used in the prototype having a primary inductance of 18 H.
- TR1, 2 — OC70 or OC71 transistors.

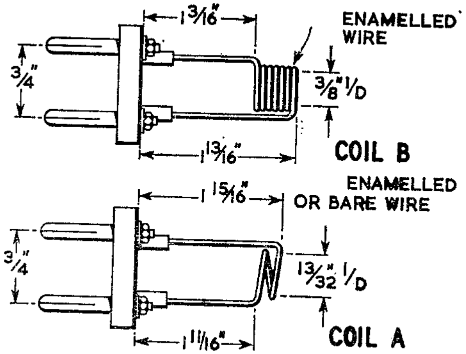
All resistors are ¼ watt rating. The l.t. supply is from a single U2 cell, and the h.t. from two series connected 30 volt B123 batteries.

Range	L1	L2
2·8–5 Mc/s	18 μH, commercial receiver oscillator coil.	
5–11 Mc/s	3·9 μH, 8 turns, 20 s.w.g. enam., close wound.	5 turns, 36 s.w.g. enam. close wound, spaced ⅛ in. from L1.
9–18 Mc/s	1·2 μH, 3 turns, 20 s.w.g. enam., spaced ⅛ in. between turns.	3 turns, 36 s.w.g. enam., interwound with L1.
18–28 Mc/s	0·8 μH, 2 turns, 20 s.w.g. enam., spaced ¼ in. between turns.	2 turns, 36 s.w.g. enam., interwound with L1.

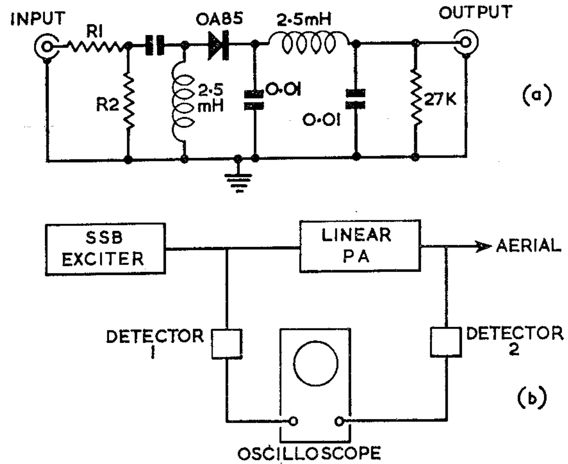
The coils are wound on medium size octal valve bases, except the 2·8–5 Mc/s coil, which is mounted inside an octal base.



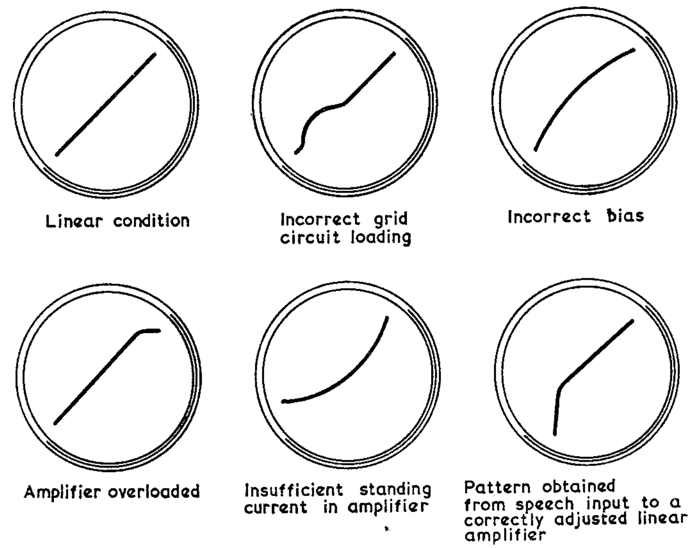
Circuit diagram of a g.d.o. for 70–160 Mc/s. Tuning ranges: Coil A, 107–163 Mc/s. Coil B, 67–103 Mc/s; A hair pin type coil will enable the upper frequency to be extended to about 230 Mc/s. The wire gauge can conveniently be 14 s.w.g.



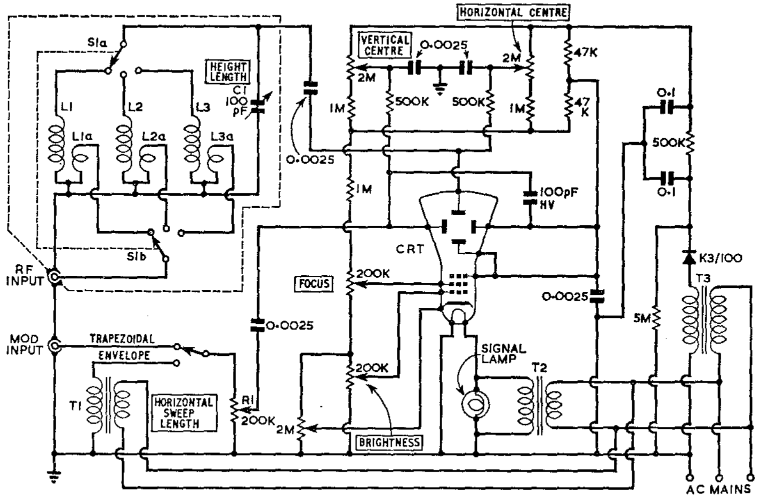
Winding details and construction of coils applicable to the above oscillator, Coil A is 1½ turns of enamelled wire, and coil B is 6½ turns, close wound.



Equipment for checking the linearity of a p.a. stage. (a) Detector. (b) Arrangement of equipment for checking s.s.b. transmissions by the 45° method. The value of R1 and R2 should be chosen so that the two detector units give outputs to suit the oscilloscope *X* and *Y* deflection sensitivity.

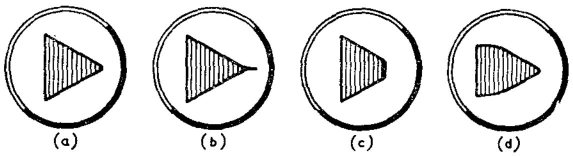


Interpretation of displays on the oscilloscope obtained with the above apparatus.

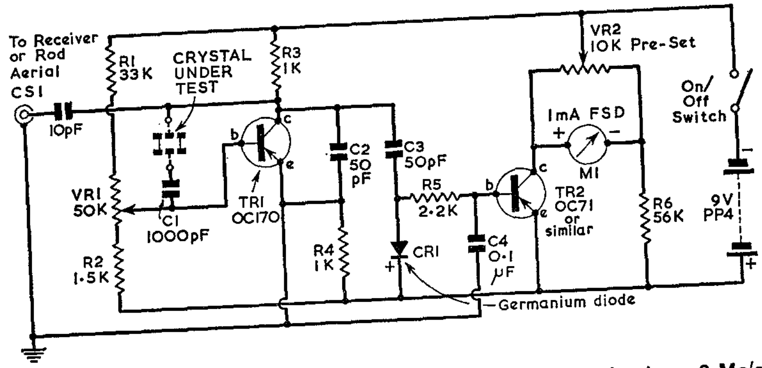


CR Tube Monitor

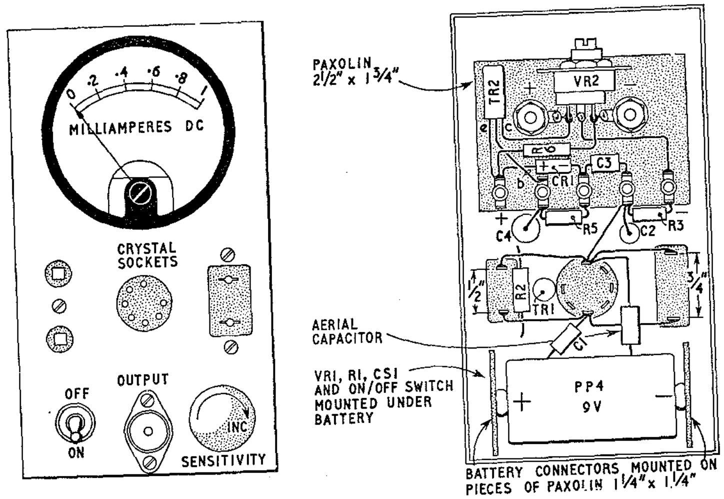
C1	height control.
CRT	3BP1 or similar 3 in. CR Tube.
L1	54 turns of 30 s.w.g. (enamelled) close wound.
L2	30 turns of 30 s.w.g. (enamelled) close wound.
L3	7 turns of 22 s.w.g. spaced $\frac{3}{4}$ in.
L1A, L2A, L3A	3 turns wound over earthy end of main winding. All on 1 in. diam. formers.
R1	horizontal sweep width control.
T1	secondary to give about 75 volts.
T2	6·3 volt filament transformer.
T3	h.t. transformer to give 1000 volts output at 5 mA max.



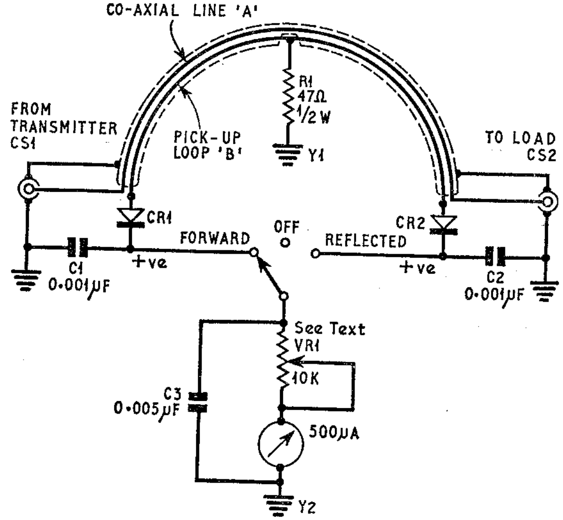
(a) Correct operation with 100 per cent modulation.
(b) Over modulation, more than 100 per cent·
(c) Under modulation, less than 100 per cent.
(d) 100 per cent modulation with insufficient grid drive.



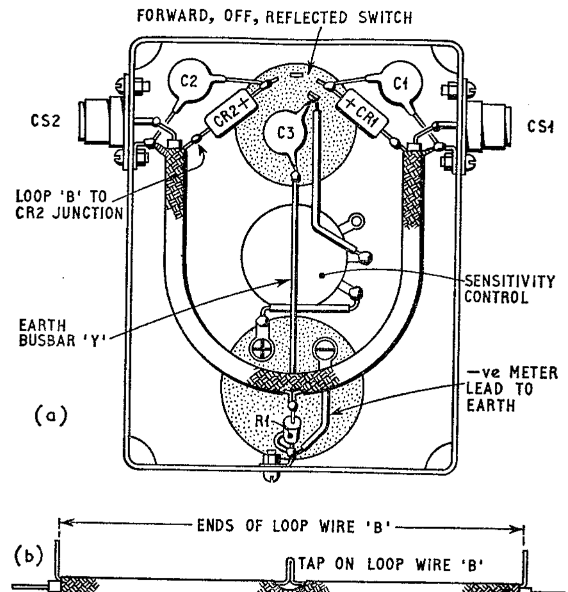
Transistorized crystal activity check meter, suitable for crystals above 3 Mc/s. In practice, although this unit gives only a relative indication of activity, it is very useful for comparative results. It is especially well suited for checking crystals being ground to a different frequency.



Front panel layout of the crystal test meter, and a suggested method of assembling the components on a paxolin sheet attached to the meter terminals.

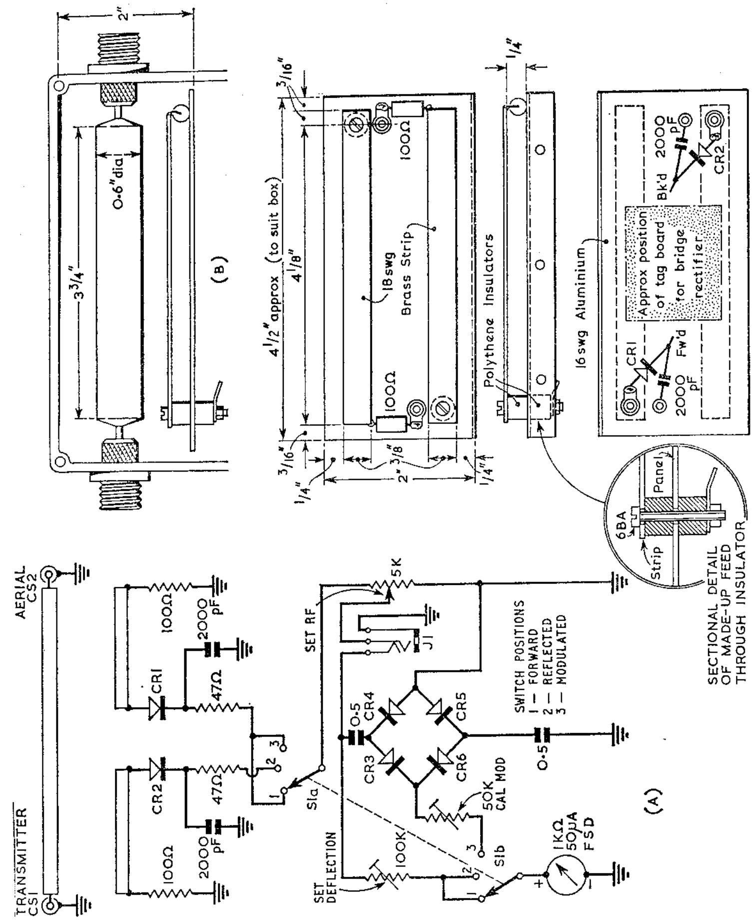


A reflectometer for frequencies below 150 Mc/s. For measurements up to 28 Mc/s, the coaxial line *A* should be 16 in. long, and line *B* an 18 in. length of 24 s.w.g. Tough enamelled wire inserted beneath the braiding of the co-axial cable, and centre tapped. For 50 to 150 Mc/s line *A* should be 7 in. long, and line *B* 9 in. long. Diodes CR1 and CR2 should be matched. OA79s.



Construction of Coaxial line A

The coupling loop wire is a thin insulated wire, threaded under the outer braid. Care should be taken to ensure that the wire is kept parallel to the inner conductor of the coaxial cable.



A reflectometer for the 144 and 432 Mc/s bands.

(A) The circuit diagram in which CR1, CR2, are GEX66 diodes. CR3, CR4, CR5, CR6, are GEX54 diodes, each of which should be bypassed with a 1000 pF capacitor. The unit can be built in to a small Eddystone diecast box.

(B) Construction of the coaxial line and pickup strips.

(C) Arrangement of the components on the screen separating the circuit from the coaxial line.

Note: the polarity of diodes CR4 and CR6 should be opposite to that shown.

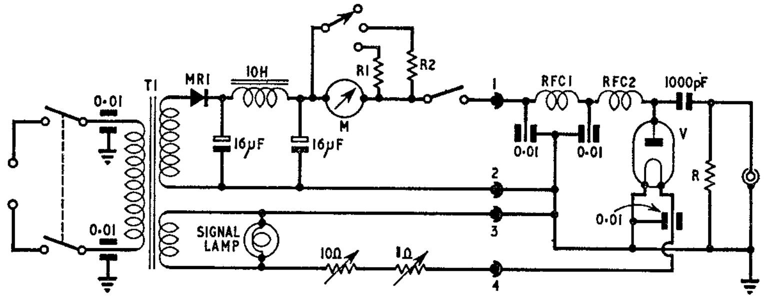
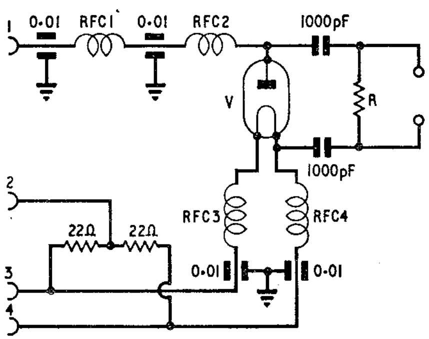


Fig. 1 is a simple noise diode generator (coaxial output). The diode should be fully screened and the leads of the output circuit as short as possible. With the noise diode shown, reliable measurements up to 150 Mc/s can be made without correction. For use at higher frequencies comparative checks with a discharge gas source should be made if accurate results are required, as the figure obtained will otherwise be optimistic.

RFC1, 2	50 turns, 30 s.w.g., close wound on $\frac{3}{8}$ in. former.
R1	25 mA meter shunt.
R2	5 mA meter shunt.
M	0–1 mA meter.
V	CV2171 or A2087 noise diode.
R	source resistor to suit equipment input impedance (generally 75 ohms).
T	mains transformer giving 125 V, 50 mA, and 4·5 V, 1A.
MR	silicon rectifier of suitable rating (300 V or above).



RFC3, RFC4, 36 turns, 18 s.w.g., $\frac{1}{2}$ in. diam.
C, RFC1, RFC2 and V are as for Fig. 1.
Resistor R in balanced output is generally 300 ohms.

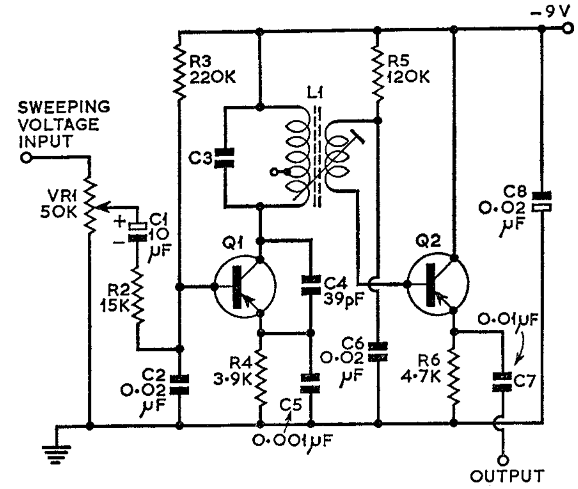
Fig. 2 shows a modified diode head suitable for balanced output.

The maximum noise factors that may be measured with the diode current ranges shown are:

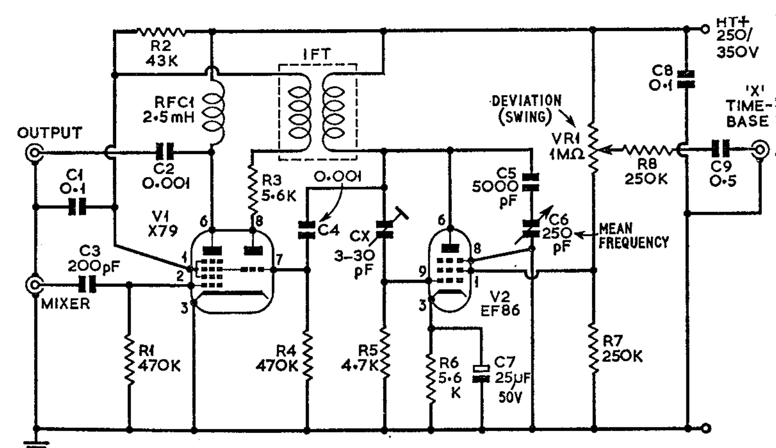
1 mA, 1·7db (75 ohms), 7·78db (300 ohms).
5 mA, 8·75db (75 ohms), 14·77db (300 ohms).
25 mA, 15·74db (75 ohms), 21·76db (300 ohms).

Caution

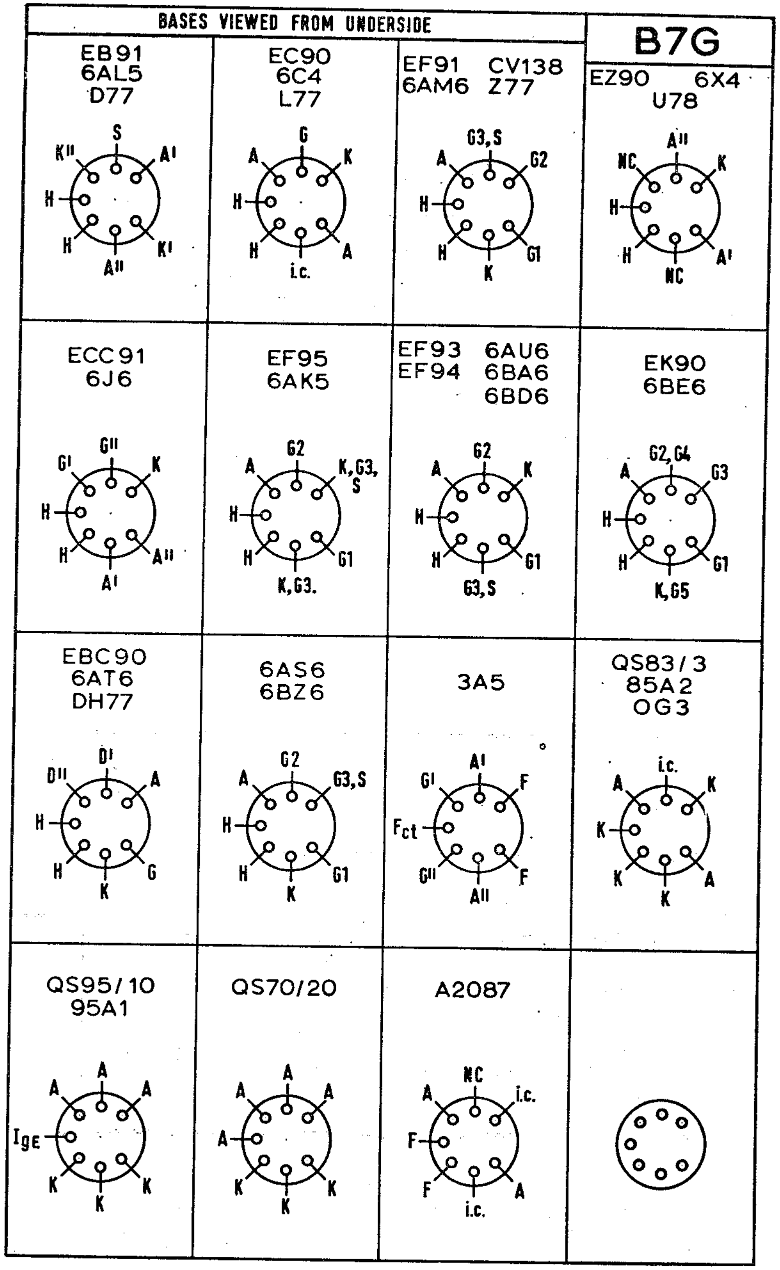
Noise diode filaments should be turned down or off when not actually being used for measurements to avoid filament burn-out.

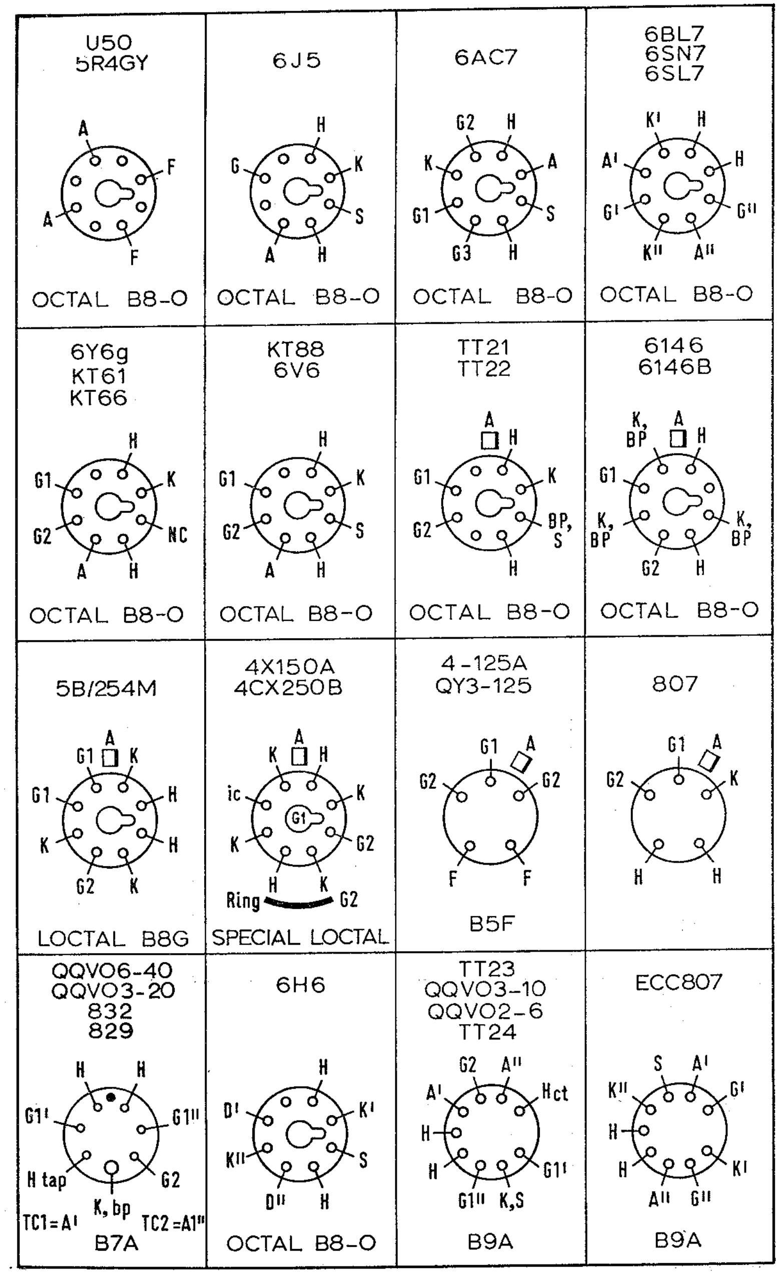


A transistor frequency modulated oscillator with a maximum deviation of 20kc/s for aligning 450–470 kc/s i.f. strips. L1 is a miniature i.f. transformer with the internal capacitor (C3) replaced by one of a suitable value to resonate at the required frequency. C4 should be adjusted to provide maximum deviation consistent with low distortion. Q1, Q2, OC45.



A wobbulator capable of covering a frequency range of 400 to 500 kc/s. The i.f.t. is a 460 kc/s transformer with the resonating capacitors removed. CX should be adjusted by injecting a timebase waveform of 50 c/s, setting VR1 near the h.t. end of its track, and then increasing the capacitance of CX to a point just before oscillation stops.

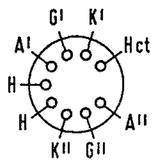

BASES VIEWED FROM UNDERSIDE
B7G
EB91 6AL5 D77
EC90 6C4 L77
EF91 CV138 6AM6 Z77
EZ90 6X4 U78
ECC91 6J6
EF95 6AK5
EF93 6AU6 EF94 6BA6 6BD6
EK90 6BE6
EBC90 6AT6 DH77
6AS6 6BZ6
3A5
QS83/3 85A2 OG3
QS95/10 95A1
QS70/20
A2087


U50 5R4GY
OCTAL B8-O
6J5
OCTAL B8-O
6AC7
OCTAL B8-O
6BL7 6SN7 6SL7
OCTAL B8-O
6Y6g KT61 KT66
OCTAL B8-O
KT88 6V6
OCTAL B8-O
TT21 TT22
OCTAL B8-O
6146 6146B
OCTAL B8-O
5B/254M
LOCTAL B8G
4X150A 4CX250B
SPECIAL LOCTAL
4-125A QY3-125
B5F
807
QQV06-40 QQV03-20 832 829
TC1=A' TC2=A1''
B7A
6H6
OCTAL B8-O
TT23 QQV03-10 QQV02-6 TT24
B9A
ECC807
B9A

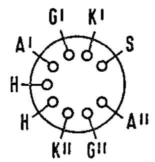
VALVE BASE CONNECTIONS

BASES VIEWED FROM UNDERSIDE — **B9A**

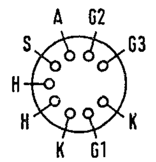
ECC81 12AT7, ECC82 12AU7, ECC83 12AX7, 12BH7



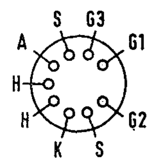
B719 6AQ8, ECC85 6BK7A, ECC88 6BZ7, 6DJ8



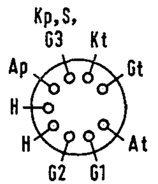
EF80 6BW7, EF85 6BX6, EF183 6BY7, W719, Z719



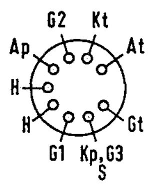
EF86, Z729, 6267



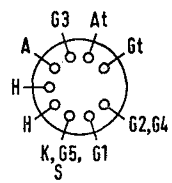
6U8, ECF82



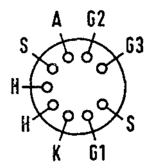
6BM6, ECL82



6AJ8, ECH81



6DA6, EF89



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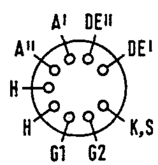
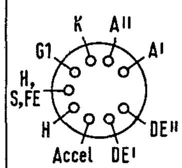
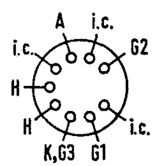


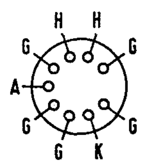
6AR8



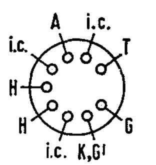
6BQ5, EL84, N709



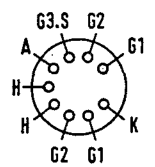
A2521



6DA5, EM81



6CL6



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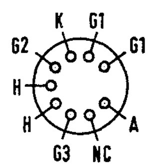
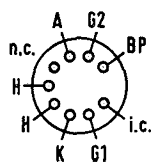


6CH6, 6BW6



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