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TUNER AMPLIFIER B13X.

This model has been designed as a stand-by receiver to replace any other receiving set (except for V.H/F) in emergency. In certain small craft it will be the only W/T receiver installed. The range of frequencies covered (15 to 20,000 kc/s) is necessarily large, and the simplest type of circuit consisting of a detector with variable reaction and two A/F stages has been adopted. The amplification and selectivity are not, therefore, of a high order. Furthermore, no steps have been taken to prevent radiation from the aerial when the detector is oscillating. These disadvantages have been accepted in view of the conditions under which these receivers will be used.

The frequency range of the receiver is divided at 1500 kc/s. For frequencies from 1500 to 20,000 kc/s four plug-in coils are provided, with a tuning condenser having a maximum capacity of 0.22-jar. The range of frequencies from 15 to 1500 kc/s is covered by six fixed coils connected to a 6-way switch. A second tuning condenser with a maximum capacity of 1.2-jars is provided for these ranges. The two tuning condensers are ganged together in tandem. They are of square low type and the maximum dial reading (100) corresponds to maximum kc/s (minimum capacity). A 3-pole 2-way switch changes over the coils and condensers for H/F or L/F reception (above or below 1500 kc/s).

The aerial is capacity coupled to the tuned grid circuit of the detector through a 5-way switch which connects one or more of four fixed condensers joined in series. In the first position of the switch the only aerial coupling in through the capacity of the switch and leads. The values of the fixed condensers are 0.3, 0.2, 0.05 and 0.01 jar respectively, giving the following effective coupling capacities for the five positions of the switch:-

Switch Position.	1	2	3	4	5
Capacity (jars)	very small	0.008	0.035	0.12	0.3

The frequencies nominally covered by the various ranges are as follows:-

L/F Ranges.

Position of Range Switch.	Kc/s Range.
1	15 - 32
2	32 - 70
3	70 - 150
4	150 - 320
5	320 - 700
6	700 - 1500

H/F Ranges.

H/F Ranges.

Range Coil.	Kc/s Range.
1	1500-3000
2	3000-6000
3	6000-11000
4	11000-20000

The actual frequency ranges covered by each coil vary somewhat from the above nominal values since they depend upon the value of the aerial coupling condenser as well as upon the size of aerial and capacity of trunk or cable. For this reason it is impossible to give even approximate calibrations for the receiver and it will be necessary to draw up a tuning chart for the receiver after installation and when the most suitable aerial couplings have been found.

The reaction in the detector circuit on both H/F and L/F is controlled by a square law variable condenser with 0.35 jar maximum capacity. With this condenser an increase in scale reading corresponds to an increase in capacity and in reaction. A resistance of 10,000 ohms in the anode circuit of the detector valve takes the place of the R/F choke usually employed with this type of circuit. A resistance is used in this model owing to the difficulty of designing a choke to give smooth reaction over the large range of frequencies required.

Resistance-capacity coupling is used between the detector and the first A/F valve with an anode coupling resistance of 50,000 ohms shunted by a 0.1 jar R/F bye-pass condenser. The coupling condenser to the next grid has a capacity of 10 jars and a 100,000 ohms R/F stopping resistance is connected in the grid lead to reduce R/F potentials passed on to this valve from the oscillating detector.

Transformer coupling, with a 1 to 4½ step up, is used between the first and second A/F valves. The primary winding of the transformer is shunted by a 2-jar condenser and a second 50,000 ohms R/F stopping resistance is connected between the secondary winding and the grid of the second A/F valve as a further precaution against R/F currents passing through to the output.

The output from the second A/F valve is connected to a telephone transformer the secondary winding of which is joined to two telephone jacks for operators' telephones and remote control line.

The two A/F valves are decoupled by 50,000 ohms resistances and 1 mfd. condensers, the actual potentials on the valves being approximately 50 volts with 100 volts H.T. supply. The detector valve anode supply is decoupled by a 50,000 ohm resistance and 1 mfd. condenser, but owing to the further drop in the 50,000 ohms anode resistance and 10,000 ohms R/F stopper the actual anode potential on this valve does not exceed 40 volts.

Suitable valves for the model are NR15A for the detector and NR15 or NR15A for the two A/F stages. 100 volt H.T. and 4 volt filament supplies are required. A filament rheostat is provided in the supply to the A/F valve for use as a volume control. The filament supply to all valves is switched off in the zero position of this rheostat.

The resistance values and purpose of the various plug-in resistances in the model are tabulated below:-

No.	Value	Purpose.	Position in Model.
R1	2 megohms	Detector grid leak	To left of and below detector valve.
R2	2 "	1st A/F " "	Centre of 3 leaks behind A/F valves.
R4	0.1 "	1st A/F stopper.	Left of 3 leaks behind A/F valves.
R5	0.1 "	2nd A/F "	Right of 3 leaks behind A/F valves.
R6	10,000 ohms	Detector anode stopper.	Under spare range coils.
R7	50,000 "	Detector anode resistance.	" " " "
R8	20,000 "	Detector decoupling.	On panel behind A/F valves.
R9	50,000 "	1st A/F decoupling	" " " " "
R10	50,000 "	2nd " "	" " " " "

The following notes on the operation of the model deal only with points which may differ from previous receivers. The tuning condenser dial has a slow motion knob which can be thrown in or out of gear. To engage slow motion, press the metal fitting carrying the index for the small knob upwards. To disengage slow motion, pull the small knob outwards.

The reaction condenser dial can be clamped by the thumb screw below the dial.

When used as a L/F receiver the aerial coupling switch may be used in position 5 for large values of the tuning condenser (towards the zero end of the condenser scale), but in order to cover the nominal ranges and to obtain an overlap between the ranges the switch must be brought back to position 3 when the tuning condenser approaches the minimum setting (100 on condenser scale). For H/F reception the aerial coupling switch should never be turned beyond the third stop. Position 2 gives the best coupling for normal use although the highest frequencies and for small settings of the tuning condenser on other ranges position 1 may be preferable. If, on any H/F or L/F range it is found to be impossible to make the circuit oscillate on any part of the scale the aerial coupling should be reduced.

In general it is best to use the smallest aerial coupling which gives reasonable signal strength as this setting ensures the best selectivity and least aerial radiation.

It should be noted that a large alteration in the position of the tuning condenser may be necessary when altering the aerial coupling.

For H/F reception and for C.W. reception on all other frequencies the reaction should be increased until oscillations just commence. This point must not be mistaken for the point where self-quenching commences which occurs at a much larger setting of the reaction condensor and is accompanied by a click in the telephones with or without a high pitched howl. It is particularly easy to confuse the self-quenching point with the true oscillating point when altering the setting of the aerial coupling switch, as each reduction in the aerial coupling requires a reduction in the setting of the reaction condenser which may be considerable when the frequency of oscillations is close to one of the tuning points of the aerial.

For reception of I.C.W. on I/F or M/F waves the reaction may be decreased just below the oscillating point in order to preserve the characteristic note frequency of the transmission. Slightly greater sensitivity will, however, be obtained with the detector just oscillating.

Any increase in reaction far beyond the oscillating point should be avoided as this reduces signal strength and increases radiation from the aerial.