INSTRUCTIONS
FOR USING THE 2A, 2B, AND 2C
ANTENNA COUPLING UNITS.

The purpose of these coupling units is to couple the antenna to the transmitter in such a way as to properly match the input impedance of the antenna to the output impedance of the transmitter. A secondary purpose is to reduce or eliminate entirely radiation on the harmonies of the transmitter frequency.

The 2A, 2B, and 2C units each consist of two coils L1 and L2 with taps for varying the inductance, and two variable condensers C1 and C2. The 2A is used with low power transmitters such as the Collins 4A, 32A, and 32B with power ratings of fifty watts or less. The 2B and 2C are used with transmitters of 250 watts rating or less such as the Collins 30FX, 30FXB, 300B and 150C.

The 2A is built on $3\frac{1}{2}$" x 19" panel, and the 2B and 2C on 7 x 19" panels for standard rack mounting. The units may be mounted on the transmitter rack or any convenient place between the transmitter and antenna lead-in or feeders.

The wiring diagram of the 2A and 2C units, which is identical except for power rating, is given in Fig. 1. Fig. 2 shows the connections of the 2B unit which differs from the 2C in having two RF ammeters instead of one.

In the diagrams C1 is the input condenser which is on the left-hand side and C2 is the output condenser which is on the right, viewed from the front of the panel. L1 is the coil nearest C1 and A1 is the meter nearest C1. CB are fixed mica blocking condensers which isolate the antenna from the high voltage direct current circuits of the transmitter.

CONNECTIONS FOR TWO-WIRE ANTENNA SYSTEMS

The units, as wired, are suitable for use with doublet or two-wire feed antenna system. One antenna or feeder wire is connected to the meter A2 of the 2A or 2C unit and the other wire to the rotor of C2. In the 2B unit, the two antenna wires are connected to the free terminals of the meters A1 and A2. The input leads, 1 and 2, may be connected to taps equally spaced from the ends of a split-stator or push-pull amplifier tank coil or of any tank coil in which the point of ground potential is located at the center of the coil. If the tank of the transmitter happens to have a neutralizing or plate voltage tap which is at ground potential or by-passed to ground and is not at the center of the coil, the input leads 1 and 2 should be connected to taps on the coil which are spaced an equal number of turns from this ground tap.

CONNECTIONS FOR SINGLE-WIRE ANTENNA SYSTEMS

For single-wire fed antennas, or for Marconi antennas, which are operated against ground, meter A2 should be connected to the antenna or feeder wire and the rotors of both C1 and C2 should be grounded as in Fig. 3. In the case of the 2B unit, meter A1 need not be included in the circuit. Fig. 3 shows coils L2 and L1 connected in series. This is generally necessary only for operation on the 1715-2000 Kc. band where the inductance of both coils is required. On the higher frequencies L1 may be left out of the circuit entirely or simply short circuited. For single-wire fed or Marconi antennas, input lead 1 is connected to the filament center tap or ground connection of the transmitter. Input lead 2 is connected to the plate end of the final amplifier tank coil.

TUNING

1. Disconnect the input terminals of the unit from the transmitter and tune the latter in the normal way so that the power-amplifier tank condenser is adjusted to exact resonance, that is, to the point of minimum power-amplifier plate current. After this adjustment is made, the power-amplifier tank condenser should not be touched again.

2. Switch off the power-amplifier and reconnect the input leads of the unit to the transmitter.

3. Set C2 (the condenser connected on the antenna side of the unit) at approximately mid position; also set the tap on the inductance to a point where resonance is likely to be obtained on the frequency on which the transmitter is operated; that is, use maximum inductance for 80 or 160 meters, about one-half inductance for 40 meters, or one-fourth for 20 meters.

4. Switch on the power amplifier and rapidly rotate C1 (the condenser on the transmitter side of the unit) until resonance is restored in the power-amplifier. The minimum plate current at resonance may be too high or too low for proper operation of the final amplifier. If the plate current is not correct, rotate C2 slightly and then readjust C1 for resonance. This procedure can be repeated using C2 to adjust the degree of coupling and C1 to restore the circuit to resonance until the correct plate current is drawn in the power-amplifier.

5. The inductance of the coils does not need to be adjusted critically, but approximately the maximum inductance should be used at which it is possible to make the amplifier draw its full plate current at resonance by adjusting C1 and C2. When the network is used with a two-wire feeder or antenna system, as in Fig. 1 and Fig. 2, it is important that an equal number of turns be used in L1 and L2.

The antenna ammeter or ammeters will indicate maximum antenna current when C1 is adjusted to resonance. If the network with two meters as in Fig. 2 is used with a doublet antenna or two-wire feeders, meters A1 and A2 should indicate approximately equal currents. If this is not the case, and L1 and L2 have an equal number of turns and the input leads 1 and 2 are connected equally distant from the ground potential part of the coil, this indicates the antenna system is not balanced. This is particularly likely to happen with Zeppelin feeders not an odd number of quarter waves long. The result is that the neutralization of the final amplifier may be disturbed. With balanced antenna systems such as the doublet or "Y" type, this difficulty is not experienced.

On the 1715-2000 Kc. band, it is sometimes impossible to match certain antennas with the network in its original form without using extremely large variable condensers. If the connections of Fig. 3 do not produce the deisred result, it is necessary to resort to the connections of Fig. 4 or Fig. 5. Here an "L" network is used. Both the coils are connected in series and both condensers in parallel, although neither the full inductance of both coils nor the full capacity of both condensers may be required.

In general the connections to be used with antennas over one-quarter wave long are shown in Fig. 4, and those for antennas one-quarter wave long or less, are shown in Fig. 5. In each case, input lead 1 is connected to the ground or filament center tap of the transmitter, and lead 2 is connected to the plate end of the power-amplifier tank inductance.

The tuning procedure for the networks of Fig. 4 and 5 is as follows:

1. Tune the power-amplifier tank circuit to resonance, as indicated by a minimum of power-amplifier plate current, with the input leads from the unit disconnected.

2. Switch off the power-amplifier and reconnect the input leads of the unit to the transmitter.

3. Include approximately the full inductance of one coil in the circuit. Switch on the power-amplifier and rapidly vary the condensers C1 and C2 until resonance is restored in the amplifier. If the minimum plate current obtained is not correct, change the number of turns included in the inductance and try again. The condensers C1 and C2 which are in parallel will be used to restore the circuit to resonance, and the setting of the taps on the coils will adjust the degree of coupling or the plate current drawn by the power amplifier at resonance.

ANTENNA RECOMMENDED

The particular antenna to be used with the coupling units, of course, depends upon local conditions. Any single-wire fed antenna, Marconi antenna, or end-fed Hertz antenna, constructed accordingly to the usual principles of good antenna design is, of course, satisfactory. For 1715-2000 Kc. operation, a quarter wave antenna operated against ground is usually the most desirable.

When a Hertz antenna is to be used with a two-wire feeder system, the most satisfactory arrangement is the "Y" type, in which a feeder is connected to a tap on each side of the center of the antenna. This system is very satisfactory on the frequency band for which it is designed.

If a more flexible system is desired, to operate on several harmonically related frequency bands, the doublet antenna, consisting of two parallel feeders connected to the two halves of a Hertz antenna which are separated by an insulator, is desirable. The antenna is made one-half wave long at the lowest operating frequency and the feeders tuned by the tuning unit.

The unit may also be used with Zeppelin feeders. In this case, however, unless the feeders are exactly an odd number of quarter waves long and the antenna exactly an even number of quarter waves long, unbalanced reactances to ground will disturb the neutralization of the final amplifier stage. It is strongly recommended that when a Zeppelin antenna is to be used with the networks of Fig. 1 and 2, the feeders be made exactly one-quarter wave long, even though this necessitates bending the feeders or deviating considerably from the most direct line between transmitter and antenna.

In cases where an unbalance loud or reactance might be applied to a transmitter circuit, as when Zeppelin feeders are to be used on a frequency other than that for which they were designed or when a Marconi or single-wire fed antenna is to be used with a push-pull transmitter, the best system is to use an inductive "pick-up" coil with the unit. This is done by using a coil concentric with the tank coil, such that if a 600 ohm resistor were connected across its terminals, the amplifier stage would draw the proper plate current at resonance.

The pick-up coil may be placed inside or outside the tank coil, but should be spaced from it no further than is necessary to provide insulation between the two coils, and it should be placed near the center turn or low potential part of the tank coil.

The proper number of turns for the pick-up coil may be determined by experiment, but it is not critical. Usually one-third as many turns are used in the pick-up coil as in the tank coil. If a 600 ohm termination is assumed for the pick-up coil, the impedance presented to the plates of the RF amplifier tubes is about right for the usual triode amplifier stage. If the amplifier stage uses screen grid tubes, somewhat fewer turns may be used.

The two ends of the pick-up coil are then simply connected to the input leads 1 and 2 of the tuning unit in every case. No further connection to the transmitter is required and the tuning of the unit is exactly the same as though the unit were connected to the transmitter directly.

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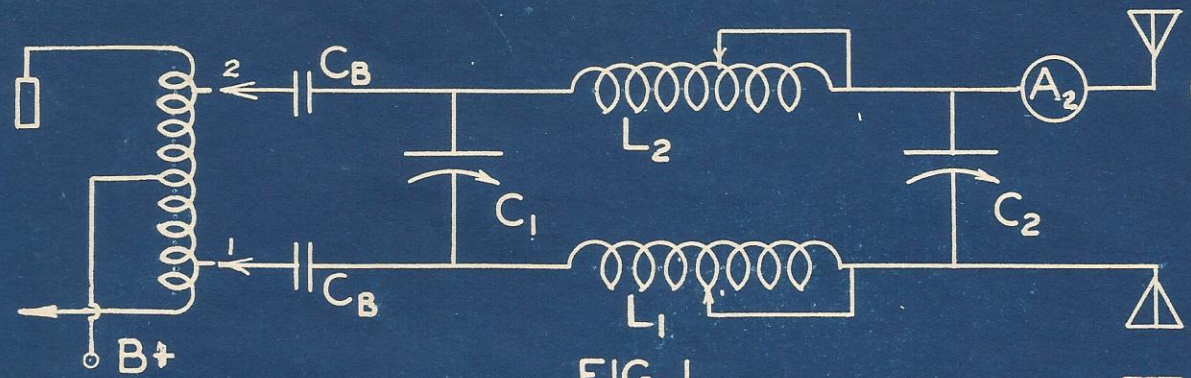
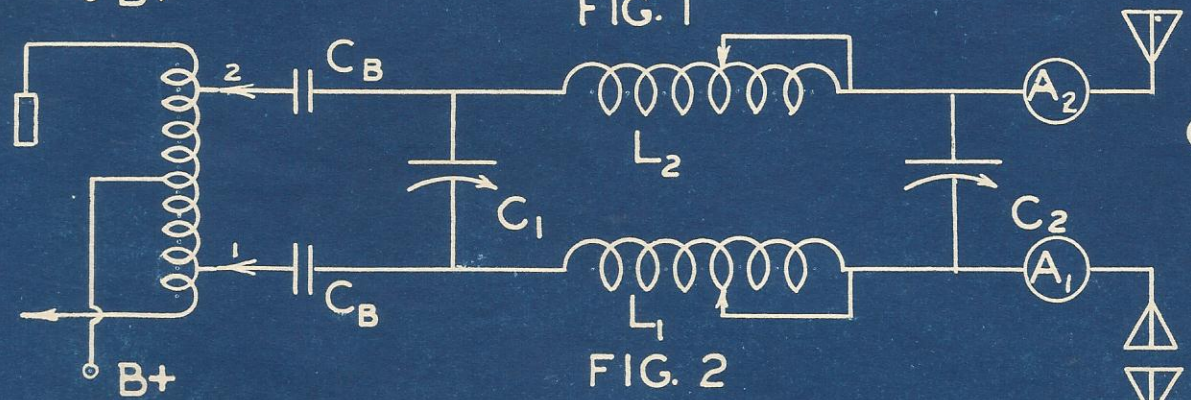


COLLINS 2A & 2C UNITS

FIG. 1



COLLINS 2B UNIT

FIG. 2

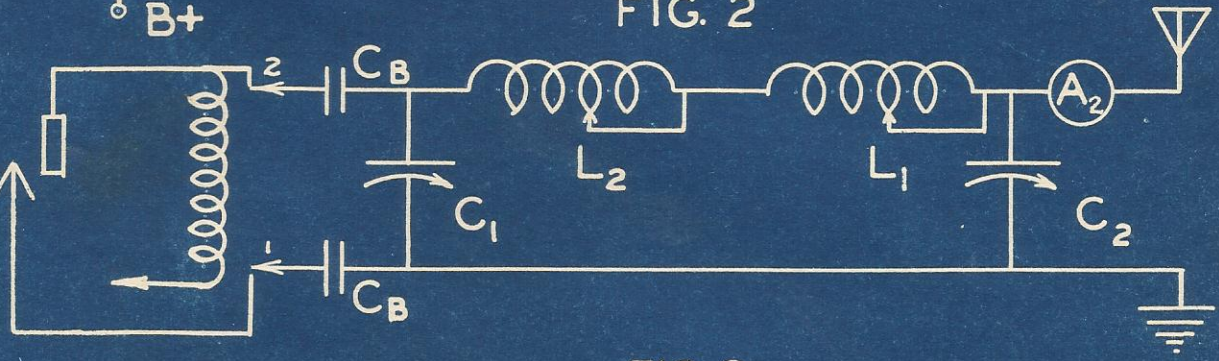


FIG. 3

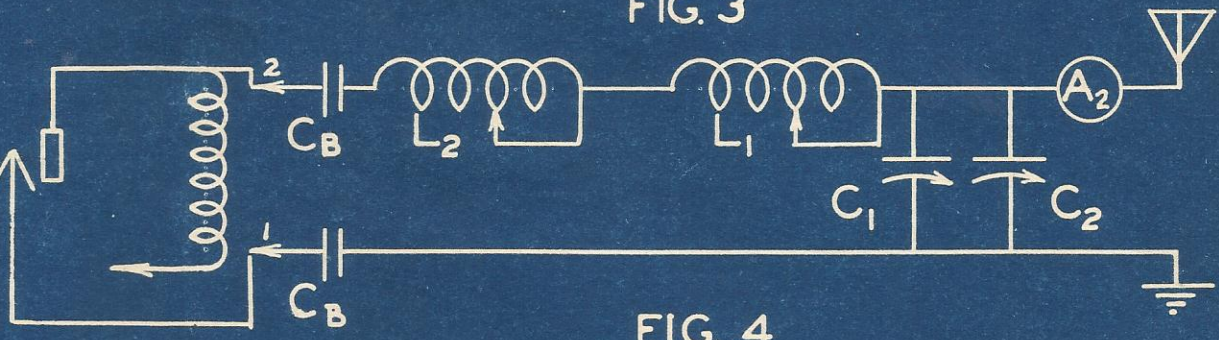


FIG. 4

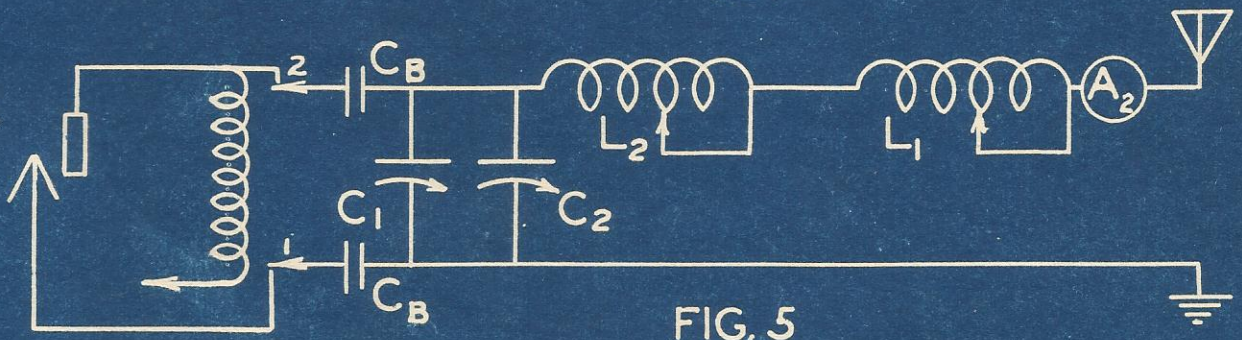


FIG. 5

DRWG NO. 1235

ANTENNA TUNING UNITS 2A-2B-2C

COLLINS RADIO COMPANY

CEDAR RAPIDS IOWA

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