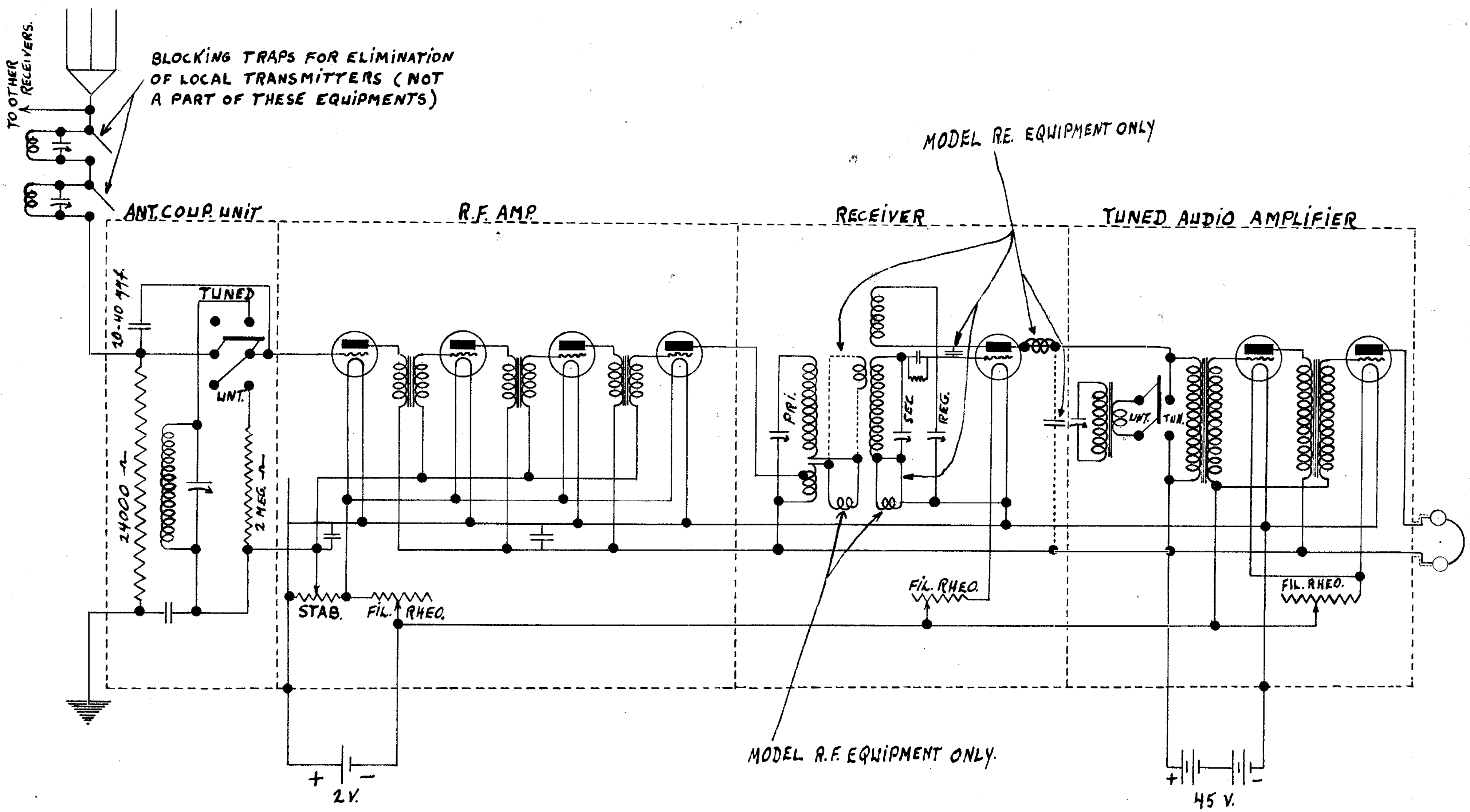
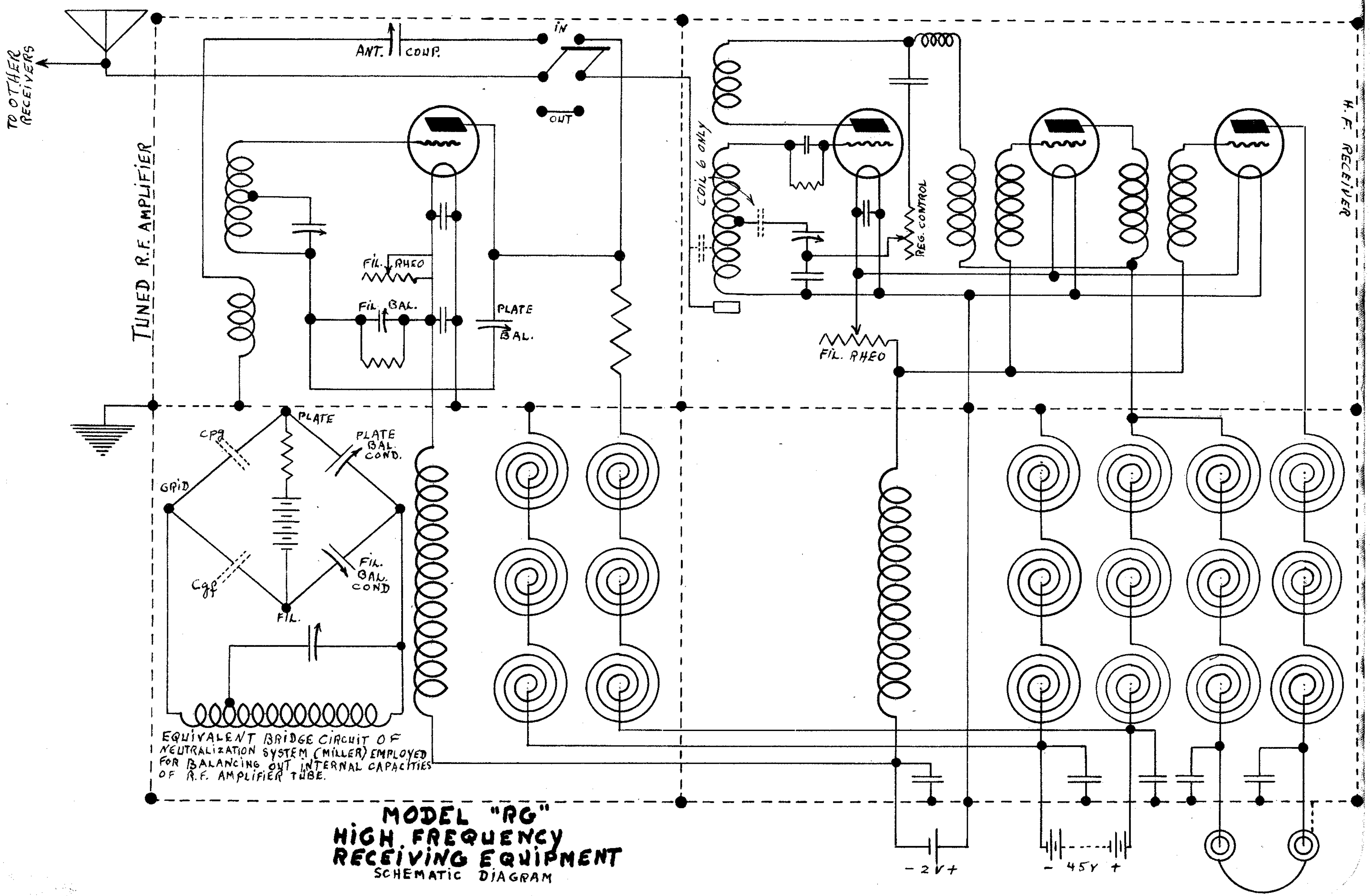


MODELS "RE – RF" RECEIVERS



MODEL "RG"
HIGH FREQUENCY RECEIVING EQUIPMENT
SCHEMATIC DIAGRAM

FIFTEENTH WEEK. G.B.Todd, RM1c.
RECEIVERS.

QUESTION #1. What methods of detection are there in present use?

ANSWER #1. Crystal and vacuum tube.

QUESTION #2. Explain the action of a crystal detector.

ANSWER #2. Very little is actually known regarding the ACTION of a crystal detector BUT, from experiment and experience, it has been found that when a galena, or other type, crystal is touched lightly, with a catwhisker, rectification will result.

QUESTION #3. What different methods of tuning are used in single circuit reception?

ANSWER #3.
1. Inductance variable by steps.
2. Use of variometer.
3. Variable capacitance (in series with ground or antenna)
4. Variable inductance with condenser across inductance.

QUESTION #4. What kind of signals may be detected with a circuit using a crystal detector?

ANSWER #4. Damped, ICW, and modulated CW.

QUESTION #5. What is meant by regeneration? Explain.

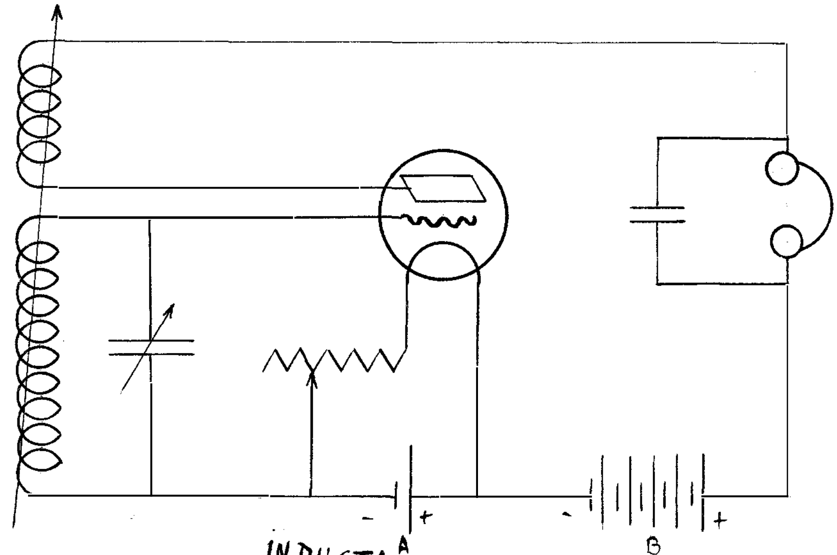
ANSWER #5. By regeneration is meant the act of rectifying the incoming signal and feeding part of the rectified signal back into the grid circuit thereby greatly increasing the strength of said signal. In a regenerative circuit, when t the current changes in the plate circuit a corresponding variation takes place in the tickler coil which is inductively coupled to the grid and oscillatory circuit of the receiver. When the grid is negatively charged , due to an oscillation from the LC circuit, current flow, from the plate to the filament, is stopped. A corresponding change takes place in the tickler and no current is induced in the LC circuit. When the grid swings positive, current again flows in the plate circuit and likewise in the tickler circuit from where it is induced into the LC circuit thereby building that circuit up with an oscillating energy The LC circuit is free to oscillate at its natural period until the grid is again charged positive when more energy is supplied. This action is repeated over and over again until the energy expended, generating oscillations, is the product of the current and the impedance of the circuit which is the capacity of the tube.

QUESTION #6. How is regeneration accomplished? Draw sketches showing three different methods of regeneration control.

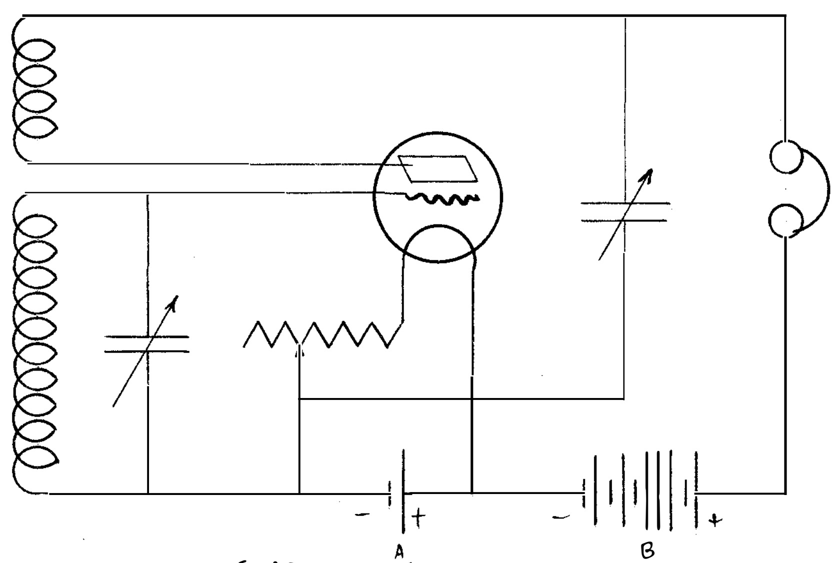
ANSWER #6. Regeneration may be accomplished by variations of L and C.

(See next sheet for sketches)

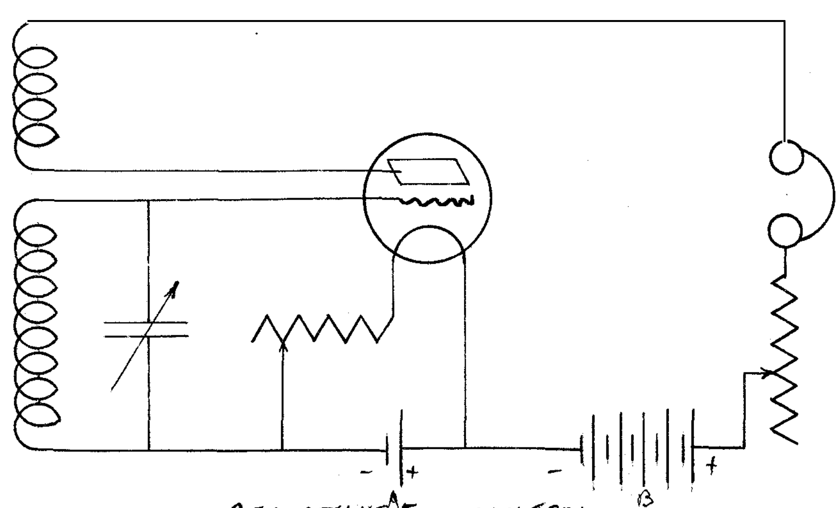
ANSWER #6. Continued.



INDUCTANCE CONTROL



CAPACITY CONTROL



RESISTANCE CONTROL

QUESTION #7. What is meant by "beat reception?"

ANSWER #7. Incoming continuous waves occur at a radio-frequency and are therefore inaudible even after detection because the average plate current is changed only at the beginning and end of dots and dashes. If, however, local RF oscillations differing from the frequency of those being received by a small amount are impressed on the detector circuit, the two sets of RF oscillations will, on account of their difference in frequency, swing periodically in and out of phase. The resulting AF can be adjusted at will, the normal beat frequency employed being in the neighborhood of 1000 cycles.

QUESTION #8. Explain Autodyne reception.

ANSWER #8. Autodyne reception utilizes the principle of an oscillating receiver tuned to a frequency far enough from the incoming oscillation frequency as to produce a beat note in the telephones. The beat frequency can be varied at will. The in-phase components of the two oscillations add and the out-of-phase components subtract from each other.

QUESTION #9. Explain Heterodyne reception.

ANSWER #9. The heterodyne principle is to induce oscillations in the receiver circuit by means of an external oscillator inductively coupled to the LC circuit of the receiver. Beat note is accomplished by slightly detuning the heterodyne to the incoming oscillation. The difference between the incoming oscillation frequency and that generated by the heterodyne is the beat note received in the telephone circuit.

QUESTION #10. Which is the better method of beat reception - Autodyne or Heterodyne. Why?

ANSWER #10. The autodyne is the best method because of its simplicity of operation and economy of equipment.

QUESTION #11. Explain resistance coupled amplification of audio-frequency signals.

ANSWER #11. In the resistance coupled type of amplifier the coupling units consist of high resistances of about 50,000 ohms and a 1 to 4 megohm grid leak. The filament and plate batteries are common to all vacuum tubes in the amplifier The input voltage which is applied between the filament and grid of the first tube causes an AC to flow in the plate circuit of that tube and through the high resistance. The voltage drop across the resistance is applied to the input of the next vacuum tube through a coupling condenser to the grid and thru an A and B battery to the filament. The coupling condenser is employed to prevent a steady positive voltage on the plate of the first vacuum tube from being applied to the grid of the second tube. The grid leak resistance, connected from grid to positive A, serves to place a positive potential on the grid and prevent the tube from becoming blocked. The phone current is taken from across another high resistance connected from positive B to the plate of the last tube in the amplifier.

QUESTION #12. Can resistance coupling be used in radio frequency amplification? Give reason for you answer.

ANSWER #12. Yes, but it is not practical below 1000 Kcs. At RF the resistance type of amplifier will give a uniform amplification over the whole range of frequencies except the lower band, where the capacity of the tube acts as a low reactance shunt to the coupling resistance and thereby lowers the amplification. Satisfactory amplification is not secured for wave lengths under 300 meters (1000 KCs) with this type of amplifier and the type of tubes generally used. Because of the uniformity of amplification the resistance type of amplification gives less distortion than other types.

QUESTION #13. Explain reactance type of amplification.

ANSWER #13. In place of the high resistances used in the resistance coupled amplifiers, the reactance type of amplifier makes use of coils, or combinations of coils and condensers in parallel, for coupling the unites between the stages. A higher amplification is secured with the reactance type than the resistance coupled amplifier because the reactance can be very high and still have a low DC resistance In this case the full plate battery voltage will be applied to the vacuum tube with a resultant low value for plate resistance. When reactance is inserted in the plate circuit of a vacuum the total impedance of the circuit is less than the total impedance of the circuit when an equal number of ohms is inserted. The AC component of the plate current has a greater value with reactance coupling than with resistance coupling. It is this greater current multiplied by the reactance or resistance in ohms, which gives the voltage applied to the grid and filament of the next tube.

QUESTION #14. Make a comparison of the resistance and reactance types of amplification.

ANSWER #14. The reactance type amplifier has a greater amplification than the resistance type. The resistance coupled amplifier produces less distortion for radio telephony signals but required a much higher plate voltage due to the higher resistance required for coupling the stages. The reactance type will operate at higher frequencies than the resistance coupled but does not permit the variation of frequency input over such a range as does the resistance amplifier.

QUESTION #15. Explain transformer coupled amplification.

ANSWER #15. The primary of a transformer is connected to the plate battery and inductively coupled to the secondary which is connected to the grid and filament of the next tube in the amplifier. Hence the grid of the following tube receives the full value of the secondary voltage of the transformer. The amplification is obtained by the amplification constant of the tubes and the ratio of step-up of the windings of the transformers. The amplification is greater in the transformer coupled amplifier than in the reactance, or resistance coupled types.

QUESTION #16. Explain multiple stage amplification.

ANSWER #16. The various types of multiple stage amplifiers are named in accordance with the way they are coupled. For instance resistance coupled, reactance coupled, and transformer coupled amplifiers. Multiple stage amplifiers consist of one or more coupling units and their respective vacuum tubes. By means of multiple stage amplifiers the output of one vacuum tube can be placed on the grid of a succeed ing tube thereby greatly increasing the strength of the incoming signal oscillations.

QUESTION #17. Explain untuned radio frequency amplification.

ANSWER #17. Untuned radio frequency amplifiers consist of stages of one or more coupling units. No means is employed to tune this type to a given frequency but, due to the reactance of the coupling unit, the amplifier operates best over a certain band of frequencies.

QUESTION #18. Explain tuned radio frequency amplification.

ANSWER #18. In the tuned radio frequency amplifiers condenser are placed in the primary and secondary circuits to neutralize the Xl of the coupling units and to cause their operation on certain frequencies. The condesnsers placed in this type are usually fixed and can be varied only by means of a switch. The band of frequencies covered by the amplifier is limited when tuned.

QUESTION #19. What is the advantage of using radio frequency amplification?

ANSWER #19. The advantage of using radio frequency amplification is that the signal oscillation can be increased in volume before being rectified thereby giving a greater amplification without distortion than would be possible with an equivalent audio frequency amplifier. The receiving circuit can also be made more selective covering a very limited band of frequencies with tuned RF amplification.

QUESTION #20. Give a general description of the RE and RF receivers, telling of the different units of which they consist.

ANSWER #20. The RE and RF receivers are essentially the same with the exception of their frequency band range (RF 75 to 1000 KCs RE 10 to 1000 KCS) Both types consist of four units which are: Antenna coupling unit, RF amplifier, receiver unit, and AF amplifier unit. Each unit is shielded, the shields being grounded to give better selectivity and prevent local magnetic induction effects. The RF is kept separate from the other units to increase the selectivity and reduce the coupling between the RF amplifier and detector circuits. The detector is inductively coupled to the radio frequency amplifier and the RF amplifier capacitively coupled to the antenna when the antenna coupling unit is untuned. When the antenna coupling unit TUNED a parallel circuit of inductance and capacitance is inserted in the circuit. All inter-connecting leads are shielded. All receiver boxes are made of hard rolled aluminum. All outside surfaces are finished with a leather lacquer.

QUESTION #21. Give the method of calibrating these receivers including the balancing of the RE type of receiver.

ANSWER #21. The SE 2307 Master Heterodyne Frequency Meter should be set to each of the frequencies desired, and the resonant adjustments of the three selective radio frequency circuits of the equipment successively determined, proceeding as follows for each frequency:

(A) Carefully adjust the three filament rheostats to where the associated voltmeters indicate the filament terminal voltage corresponding to the proper rating of the color of the tubes used in each unit, and set the stabilizer on the RF amplifier in the "Off" position.

(B) Throw the "Tuned-Untuned" switches on the antenna coupling unit and tuned audio amplifier to the "Untuned" side.

(C) Place the selector switch on the audio amplifier in "2 audio" position.

(D) Determine from the tabulated ranges in the detailed description of the antenna coupling unit involved which band on the step adj. switch includes the frequency to be calibrated, and set the primary and secondary step adjustment switches of the receiver unit in this position The same should be done with the kilocycle selector switch on the RF amplifier.

(E) Set the primary and secondary coarse adj. knobs approximately, basing the assumption on the relation that the desired frequency bears to either limit of the tabulated frequency range for the step involved. In this connection it should be borne in mind that the higher frequencies occur at the lower scale settings of all step, coarse, and fine adjustment controls.

(F) Set the regeneration control just above the point where oscillations start, as can be determined by the presence of clicks in the phones when the oscillation test button is depressed and released. If these clicks are obtained when the regeneration control is set at minimum, however, it is an indication of oscillations in the RF amplifier; in this case the setting of its stabilizer should be increased until the clicks disappear before attempting to increase the regeneration in the receiver.

(G) Tune for the master frequency meter wave with the secondary fine adj. control, following approximately with that of the primary circuit, until an approximate 500-cycle beat is heard in the telephones; then key the output of the frequency meter to determine that the signal heard is from that source.

(H) Tune with the primary fine adj. until this beat is loudest. Resonance clicks, coupled with a dragging of the beat tone, will be noted, in addition to the increase in amplitude as the primary circuit is tuned through resonance, if the frequency of the wave falls within the higher frequency half of the step 1 band of either equipment. Such reaction will not normall be present, however, at settings for lower frequencies than these. However, if tuning the primary circuit through resonance with the secondary causes squeals, or continuously varying beat notes that build up in pitch on either side of zero, it is an indication of internal oscillations in the RF amplifier, and the stabilizer should be rotated clockwise to the position where the condition no longer obtains.

(I) Throw the lever switch on the antenna coupling unit to the tuned position, set the step and coarse adj. controls to correspond with those of the receiver and tune with its fine adj. for the loudest signal. The resonant setting will approximately correspond with those of the primary and secondary circuits and will result in considerable increase in intensity over that obtained in the untuned condition. No change in the tone of the beat note will result, as this circuit is tuned through resonance, unless the amplifier tends to oscillate, in which case the stabilizer setting should again be increased to where the reaction ceases.

(J) At this juncture, but not as a necessary step in the calibration, the operation of the AF amplification switch and audio-tuning feature may be tested, noting the change in intensity for the three positions of the former, and the selective tuning of the latter when its control switch is placed in the tuned position. This switch should always be in the untuned position when hunting with the RF circuits, otherwise signals may be passed over on account of their low intensity, except when the beat note is resonant A slight change in beat tone will be noted when the amplification switch is changed from the 1 audio to the det. position, this being a natural result of the insertion of the detector and its resultant effect on the radio-frequency circuit. For this reason all calibration should be done with either one or two stages of AF amplification, since at least one stage will always be used for distant reception.

(K) Returning to the calibration, and having finally adjusted both the primary and antenna coupling unit circuits to resonance, retune the secondary fine adj. to absolute resonance, which is the zero beat position on either side of whish the tone frequency builds up from a low to a high pitched note.

(L) Record the step, coarse, and fine adjustment settings of each of the three circuits, after which the same procedure should be followed for the rest of the frequencies to be calibrated.

(M) Having completed calibration, the chart frames should be removed from the ant.coup. unit and receiver panels and the respective settings listed on the charts.

QUESTION #22. How would you hunt for a signal of known frequency but whose settings were unknown?

ANSWER #22. Throw the antenna switch to the untuned position, set the RF switch covering the band in which the frequency lies, then tune with the secondary of the receiver following closely with the primary until the entire band had been covered.

QUESTION #23. What might be the cause of failure to receive signals?

ANSWER #23. The probable causes of failure to receive signals are:

(a) Burnt-out tubes are the most common cause. The unit in which the tube is located can be readily noted by an increase in its filament voltmeter reading. If a unit employing more than one tube is so involved no time should be lost in turning off its filament rheostat. Otherwise its remaining tubes will be impaired.

(b) Burnt-out transformer winding. The defective stage can be located, if in an AF amplifier, by comparing the relative intensity on each position of the amplification switch with normal conditions. If the trouble is in the RF amplifier the equipment as a whole should function normally on a different frequency band employing another set of transformers. Such being the case, the stage including the defective winding may be located with a ringing-out device, after removal of the panel from its box. If such a defect is found and the defective transformer replaced or repaired, the vacuum tubes connected thereto should be inspected for plate-grid or plate-filament short circuits before retesting the repaired unit.

QUESTION #24. Give a remedy for each cause of the above question.

ANSWER #24. The remedies for above causes were incorporated in the answer to above question.

QUESTION #25. What are the usual causes of weak signals?

ANSWER #25. (a) Assuming that both plate and filament batteries are normal, worn-out tubes will probably constitute the cause

(b) Open circuit near plate or filament end of primary or secondary windings of either RF or AF transformers allowing weak transfer of energy through capacity.

(c) Dirty vacuum-tube contacts or contacts of the selector switch in the AF amplifier.

(d) Stabilizer resistance open on negative filament battery side.

QUESTION #26. What are the remedies of the above causes?

ANSWER #26. (a) Substitute tubes known to be good in the various receptacles and note the relative intensity of a given signal.

(b) Method of search given in paragraph (b) of #23.

ANSWER #26. Continued.

(c) Clean all contacts with fine sandpaper.

(d) Remake circuit from stabilizer resistance to negative filament battery.

QUESTION #27. If the receiver secondary fails to oscillate how would you determine it and what might be the cause?

ANSWER #27. If the receiver secondary fails to oscillate it can be determined by pressing the oscillation button. If it does not click the secondary is not oscillating. Turn the condenser up still higher and if it still fails to oscillate it will be due to one of the following causes:

(a) Poor detector tube. Try substitution.

(b) Discharged plate battery.

(c) Poor contact between battery spring connectors and receiver panel.

(d) High resistance contact between brush and rotary plates of either secondary or regeneration condenser.

(e) Broken strands in litz cable at soldered connections of grid or plate inductances in secondary system, causing high resistance.

(f) Open or short circuit somewhere in secondary system.

QUESTION #28. What would you do to make it oscillate?

ANSWER #28. To make it oscillate, repair defects listed under previous question, most of which are obvious:

(a) Try several different detector tubes.

(c) Clean contacts with fine sandpaper.

(d) Inspect and eliminate high resistance contact.

(e) Replace with new litz strands.

(f) Test with ringing-out device and repair.

(b) Replace with new plate battery.

QUESTION #29. If oscillations were present in the radio frequency amplifier and you were unable to stop them what might the trouble be?

ANSWER #29. The probable causes are:

(a) Discharged plate battery causing resistance coupling between stages.

(b) Poor tube or tubes.

(c) Stabilizer resistance open on positive filament battery side.

ANSWER #29. Continued.

(d) Shield circuit not continuous from AF amplifier box, to metal cases of head phones.

(e) Excess plate voltage.

The conditions peculiar to some installations, such for instance, as coupling of the antenna through the shielding system to various parts of the circuits, may be the cause of oscillations of such persistance as to be beyond the limit of control by the stabilizer. Such may be assumed if none of the foregoing causes show up in test, in which case excessive plate battery voltage will aggravate the condition.

QUESTION #30. How would you remedy these troubles?

ANSWER #30. (a) A 45 volt battery should not be allowed to fall below 40 volts, while a type CU 1707 will show a tendency to reverse polarity if the discharge is carried below the point where the individual cells read 1.2 volts, so replace B battery.

(b) Replace with good tubes.

(c) Close the circuit.

(d) If the plate battery used is of a type which gives a reading higher than 45 volts, a sufficient number of cells should be removed from the circuit by moving back the positive lead until this value is reached. It may be said in passing, that the maximum negative grid biasing potentials available in these equipments are such that no increase in signal strength will be obtained by operating at a higher plate potential.

QUESTION #31. Give a description of the RG receiver telling of the units of which it consists.

ANSWER #31. Due to the inherent characteristics of the frequency band over which it functions, the Model RG high frequency receiving equipment is designed along different lines from previous Naval receivers. By reference to the schematic diagram it will be seen that the circuits comprise a single neutralized stage of tuned RF amplification, capacitively coupled to a tuned autodyne detector circuit and two stages of AF amplification. The tuned circuit comprises the input to the RF amplifier tube is coupled inductively to a few turns of wire which are included in a series circuit from the antenna through a small adjustable condenser to ground. The antenna circuit is therefore UNTUNED and a plurality of equipments may be operated from a single collector. The radio frequency stage was incorporated in the design on account of the increased selectivity and protection against nearby powerful interference which it provides, the prevention of radiation of the oscillating energy in the autodyne detector circuit and the elimination of the absorption and reaction of the antenna system on the detector oscillations other than because of design limitations inherent to the wide frequency range covered by the equipment. The maximum amplification obtained by the use of this radio stage does not exceed 2 to 1 at the lower frequencies while at the high frequencies the value of (L/R) in the circuits is necessarily so small that an actual signal loss results. For this reason an "In - Out" switch has been provided which allows the removal of the RF stage from the circuit when signals of frequencies above 12,000 KCs are so weak as to be otherwise unreadable. Excepting under these extreme conditions, however, all operation should be through the RF stage since considerable interference may be caused to other receivers from radiation of the oscillating energy in the autodyne detector circuit when the latter is not so isolated from the antenna system. Each of these equipments consist of four major units which are briefly described below:

SE 2514 CABINET AND FILTER SYSTEM: This is a leather finished two compartment box of aluminum for housing and individually shielding the RF amplifier and high frequency receiver panels.

SE 2512 TUNED RF AMPLIFIER: This panel, which slides into the left hand compartment of the cabinet, supports a .00023 mf variable air condenser, a 6 ohms rheostat, a 0-2-60 filament plate voltmeter, a highly damped, shockproof receptacle for the type CW 1344 vacuum tube, a receptacle for the plug-in type of RF amplifier coils, and adjustable condensers for the antenna coupling circuit and plate side of the Miller Balancing circuit.

SE 2511 HIGH FREQUENCY RECEIVER: This panel unit consists of an autodyne detector circuit and two stages of AF amplification with a three position switch for connecting the phones in the output circuit of any one of the three tubes. A 2500 ohms variable resistance unit, in series with the RF path from tickler to filament and operated through a commercial type of friction vernier drive, provides the feed-back control means of adjusting the circuit to regenerative or oscillating condition as desired and a series connected push-button (osc test) supplies an actual indication thereof.

SE 2513 INDUCTANCE SYSTEM: This is a combination wood, and bakelite, base member, equipped with a leather finished aluminum cover and carrying six sets of plug-in coils with the equipment and overall frequency range of 1000 to 20,000 KCs. The six RF amplifier coils carry the antenna coupling and tuned grid circuit windings and have their coil numbers filling in in white. The six receiver coils contain the tuned grid circuit and tickler windings and a capacitive electrode for input coupling, the engrave nomenclature being filled in in red. In addition, both sets of coils are equipped with guide struts which engage in slots in their respective receptacles, these being so arranged as to prevent the insertion of the RF coils in the receiver unit and vice versa.

QUESTION #32. Give method of calibrating the RG receiver.

ANSWER #32. The calibration may be accomplished as follows: Set the master heterodyne frequency meter to the frequency it is desired to calibrate.

Insert the coils, whose range includes this frequency, in the receptacles of the receiver.

Adjust the filament rheostats to the proper voltage for the color of tube tips.

Set the regeneration control for oscillating condition and tune the HF receiver to the desired beat note from the heterodyne.

After the beat note has been picked up with the receiver in the UNTUNED position the RF amplifier should be TUNED in the same manner as the autodyne receiver unit.

Make a record of all settings on the calibration chart.

Use the same procedure for each frequency desired.

QUESTION #33. How would you balance the radio frequency amplifier of the RG receiver?

ANSWER #33. After installation is completed the equipment must be tested for capacity neutralization, or rebalanced to suit the conditions peculiar to the particular installation and the radio-frequency amplifier tube used, before it is placed in actual operation. This may be accomplished in the following manner.

(1) Select the set of coils whose frequency range includes the band in which the equipment is to be mostly used a and insert them in their respective receptacles through the doors in the top of the cabinet. If the equipment is to be generally used throughout its entire range, it is recommended that the No. 4 set of coils be used for these tests.

(2) Slowly turn on the two filament rheostats until their associated voltmeters register at the lower limit of the colored spaces corresponding to that of tips of the vacuum tubes which they control. Any subsequent operation of the tubes at filament voltages higher than these ratings will result in lowered operating efficiency coupled with a considerable reduction in their life.

(3) Place the switch on the radio-frequency amplifier pnale on the "in" position and set both variable condensers at approximately 500, then adjust the regeneration control to the point just above where oscillation start. The presence of oscillations is indicated by clicks in the phones when the "osc.test" button is both depressed and released. The amplification switch should preferably be on either the 1-audio or 2-audio position.

(4) Adjust the receiver variable condenser to about a

ANSWER #33. Continued.

200-cycle beat note with any steady unmodulated CW signal that can be found near the center of the scale. Follow approximately with the radio-frequency amplifier condenser when hunting. When found make sure that the regeneration control is still set just above the point where oscillations start, as this adjustment varies more or less with the variable condenser setting, according to the coil in use.

(5) Rapidly vary the radio-frequency amplifier fine-adjusment control back and forth through the resonant point and note the effect of this operation on the beat note. If the nots varies in intensity only, the equipment is still neutralized and does not require readjustment. If the note varies in frequency as well as intensity, the radio-frequency stage must be rebalanced. This can be accomplished by removing the calibration chart and resetting the plate balance condenser through the right-hand hole thereunder. Use a screw driver shaped blade of hardwood or bakelite about 2 inches long and turn the adjusting screw until the setting is found where the pitch of the note remains constant as the radio-frequency amplifier circuit is tuned through resonance. This operation should be repeated after each change of radio-frequency amplifier tube or at any other time that an unbalanced condition is indicated by the variation in tone of a beat note with a received signal as a direct reaction from the operation of tuning the radio-frequency amplifier circuit.

(6) If the equipment is assigned to a definite frequency channel or a narrow band of frequencies, such as that covered by only one set of the coils, it may now be made more sensitive to that band by adjusting the antenna coupling condenser through the hole to the left of the balance condenser until the desired signals are maximum and rechecking the balance thereafter. Otherwise the setting of this condenser should not be changed, as it is adjusted to 30 microfarads, including the residual capacity of the circuits, before shipment to the service-a value which has been found to give the best average results where the equipment is to be used at all frequencies within its range.

QUESTION #34. What might be the cause of failure to receive signals?

ANSWER #34. (a) Burnt out tubes are the most common causes.

(b) Burnt out radio-frequency transformer winding.

(c) No plate potential.

(d) Vacuum tube elements short circuited.

(e) Antenna coupling condenser in radio-frequency amplifier unit burnt out, due to over arc, from heavy transmitter currents.

ANSWER #34. Continued.

(f) Open circuit in telephone cords, or telephones burnt out.

(g) Open or short circuit in wiring of units.

QUESTION #35. What are the remedies of the above causes?

ANSWER #35. (a) Replace with good tubes.

(b) Damaged transformer replaced or repaired. Vacuum tube should be inspected for plate-grid and plate-filament short circuits before retesting repaired unit.

(c) If no deflection noted on pressing push buttons for panel voltmeters, look for burnt out choke coils in filter compartments and replace, if any.

(d) Substitute known good tubes.

(e) Disassemble parts and clean thoroughly. If soft-rubber pad is burned, reassemble in reverse position. If tin-foil plate is badly damaged, tin-foil wrapper of cigarette package will provide material for a new one.

(f) Test by plugging into another equipment known to be operative.

(g) Test all circuits with a low-voltage ringing-out device such as a telephone receiver and battery cell.

QUESTION #36. If signals are weak what might be the cause?

ANSWER #36. (a) Worn-out tubes.

(b) Open circuit in audio transformer windings.

(c) Dirty vacuum tube contacts.

QUESTION #37. How would you remedy the above causes?

ANSWER #37. (a) Substitute tubes known to be good.

(b) Search as in paragraph (b) of #23 and replace.

(c) Clean with fine sandpaper.

QUESTION #38. What might cause inability to obtain oscillations in the HF receiver circuit?

ANSWER #38. (a) Poor detector tube. Try substitution.

(b) Discharged plate battery.

(c) Poor contact between spring connectors and high-frequency receiver panel - This will be indicated if the filament voltmeter shows a variable deflection when pressure is applied to various points on the surface of the panel. Clean with fine sandpaper.

ANSWER #38. Continued.

(d) High resistance contact between brush and rotary plates of variable condenser or in the oscillating test push button. Clean as in preceding paragraph.

(e) Poor contact between receiver coil plugs and receptacle jacks. Press lightly on the points of the plugs to expand their diameter.

(f) Open circuited resistor choke mounted on the underside of coil-receptacle base.

QUESTION #39. If the operation of any of these receivers is noisy how would you eliminate the noise?

ANSWER #39. If the operation is noisy it is probably due to the following causes and the remedies are given:

(a) Dirty spring-connector contacts. Clean with sandpaper.

(b) Dirty contact between brush and rotary plates of either variable condenser. Clean.

(c) Dirty contact where brushes rub on rear of worm wheels of either fine adjusting mechanism. Clean.

(d) Dirty contact at oscillating test push button. Clean.

(e) Dirty contacts on amplification switch. Clean.

(f) Dirty or weak contact between coil plugs and receptacle jacks - Clean these with a rag only, as sandpaper will cut through their silver plating.

(g) Dirty contact between filament rheostat brushes and their windings - These may be cleaned by simply rubbing the windings with the bare finger.