BUFFALO RADIO SUPPLY, 219-221 GENESEE ST., BUFFALO 3, N. Y.

THE SENSATIONAL RT-1248

Complete with 15 tubes-$29.95. 10% less in quantities of 2 or more.

Without doubt this is the most versatile radio surplus item ever offered to amateurs, experimenters, automobile drivers, etc. You will instantly recognize, as we did, the unusually large variety of applications of this equipment, which contains 15 tubes, 8 relays, dozens of condensers and resistors, supersonic filters, a supersonic oscillator, a powerful transmission line oscillator, pulse forming, and pulse analysing circuits. Two of the relays are of the supersensitive type that operate on as little as 1 ma. Altogether the purchaser has available several hundred dollars worth of the latest, most versatile electronic equipment that can be adapted to any of the uses in the following list, which is by no means complete:

1. Two Way Radio-Telephone for the 460-470 mc. Citizen's Communication Band, where no technical knowledge, code test or license (See Page 58, Dec. 1946 Radio News) are required, for either mobile or fixed stations.
2. As a 20 Watt Automobile or Truck Public Address System. The tubes included; 2-6F6s, 7F7s, and 7H7s, can allow the simultaneous use of several mike and phono pickup inputs, and can comprise a powerful amplifier, especially when powered by the dynamotor originally designed as a companion power supply, which will operate from either 12 or 24 V., and which is also available, brand new, for $15.00, a small fraction of its original cost and real value.
3. As a Standard 80-110 mc. FM Receiver for regular broadcast FM. The receiver uses 4 stages of 40 mc. IF amplification and contains most of the other components necessary to convert it to a high quality FM set for 110 V. service, except the power transformer, choke and filter condensers.
4. As a Facsimile Transmitter. The 316A oscillator in the RT-1248 can be easily A. F. tone modulated at any output frequency up to 500 mc. for facsimile transmission by conventional methods.
5. As a Television Receiver. The 40 mc. IF is wide-band, and thus suitable for high-definition images. Another interesting application of the Rt-1248 is using the components for a television transmitter. The 316A in the unit can be video modulated for this application. The 1248 can also be converted to the very latest thing in television; the new Young system, where both video and sound are superimposed on one channel.
6. The Supersonic Filter-Receiver combination can be used for selective remote control work such as controlling drone (pilotless) airplanes or driverless automobiles from a 1248 used as a transmitter at a remote location, thru servo motors operated by the relays in the 1248 used to receive the signals.
7. The RT-1248 can be converted into a capacity operated switch which will be actuated by the proximity of other equipment or objects; such as mercury in a thermometer, thru which it can thermostatically control temperature within a fraction of a degree by placing a metal clip on a thermometer at the proper point for the desired temperature and allowing the relay circuits in the 1248 to control the temperature source; it can similarly be used to control liquid level in a storage tank; it can advantageously be used to electronically indicate acceptance or rejection for production dimensional tolerances by the method recently developed by a physicist at the Bosch Laboratory in Germany, in which an object such as a piston, for instance, is dipped in castor oil before placement in the cylinder it is to fit (or a suitable standard cylinder),

and the capacity between cylinder and piston indicates the proper fit; or it can be used in such simple capacity relay applications as turning on display-window lights when a passerby pauses; opening a garage door when a car drives up; notifying a service station attendant when a car has driven up to the gas pump, etc.

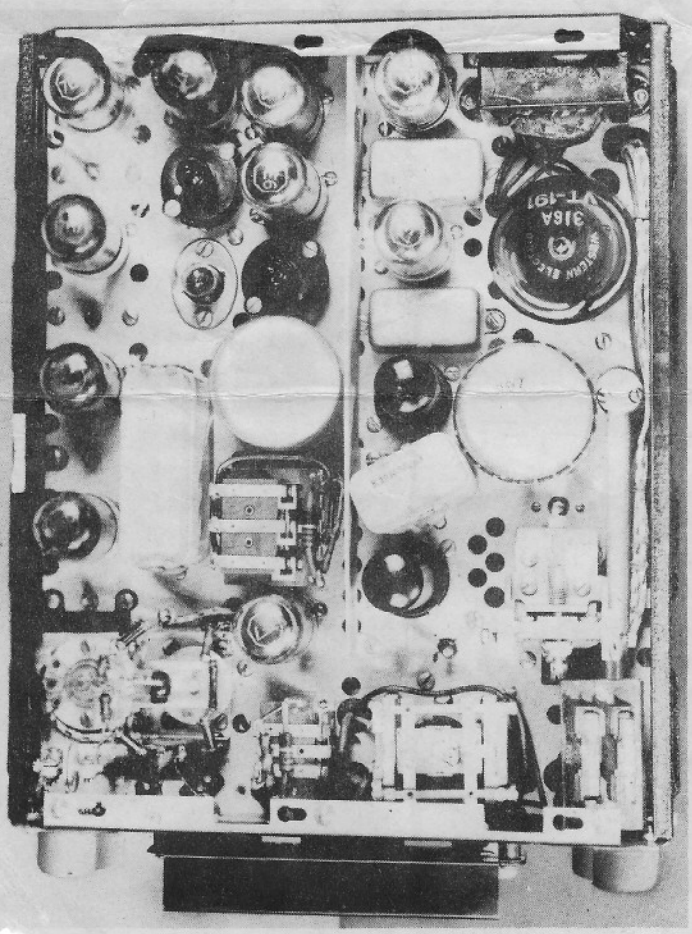
8. Use of the RT-1248 with a Geiger-Muller tube, where especially good use can be made of the various relays included in the unit, as follows:

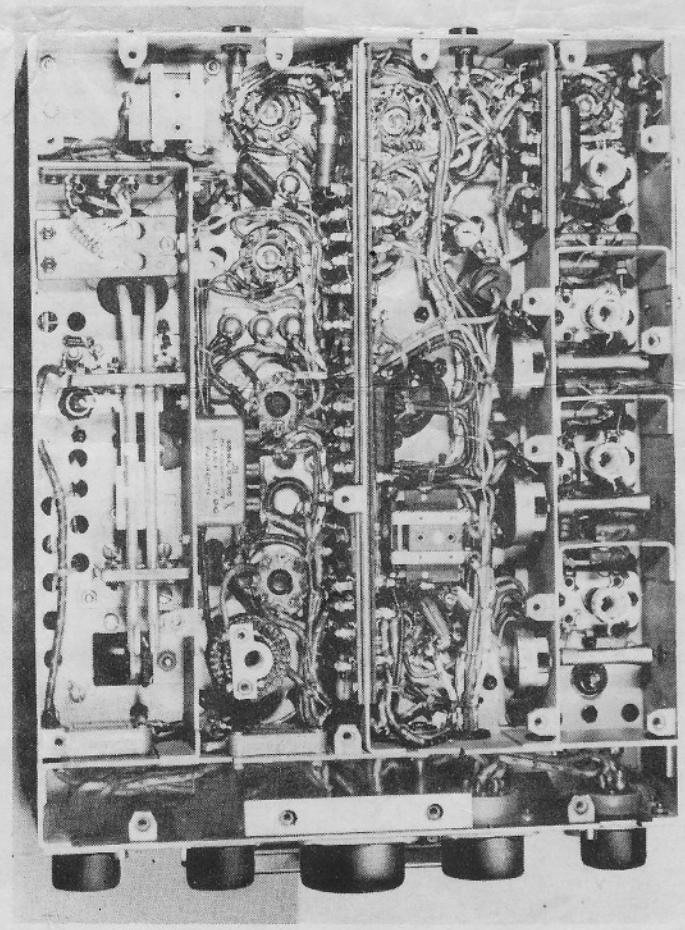
A. Use in geophysical prospecting to locate deposits of radioactive minerals such as radium, pitchblende, and uranium.

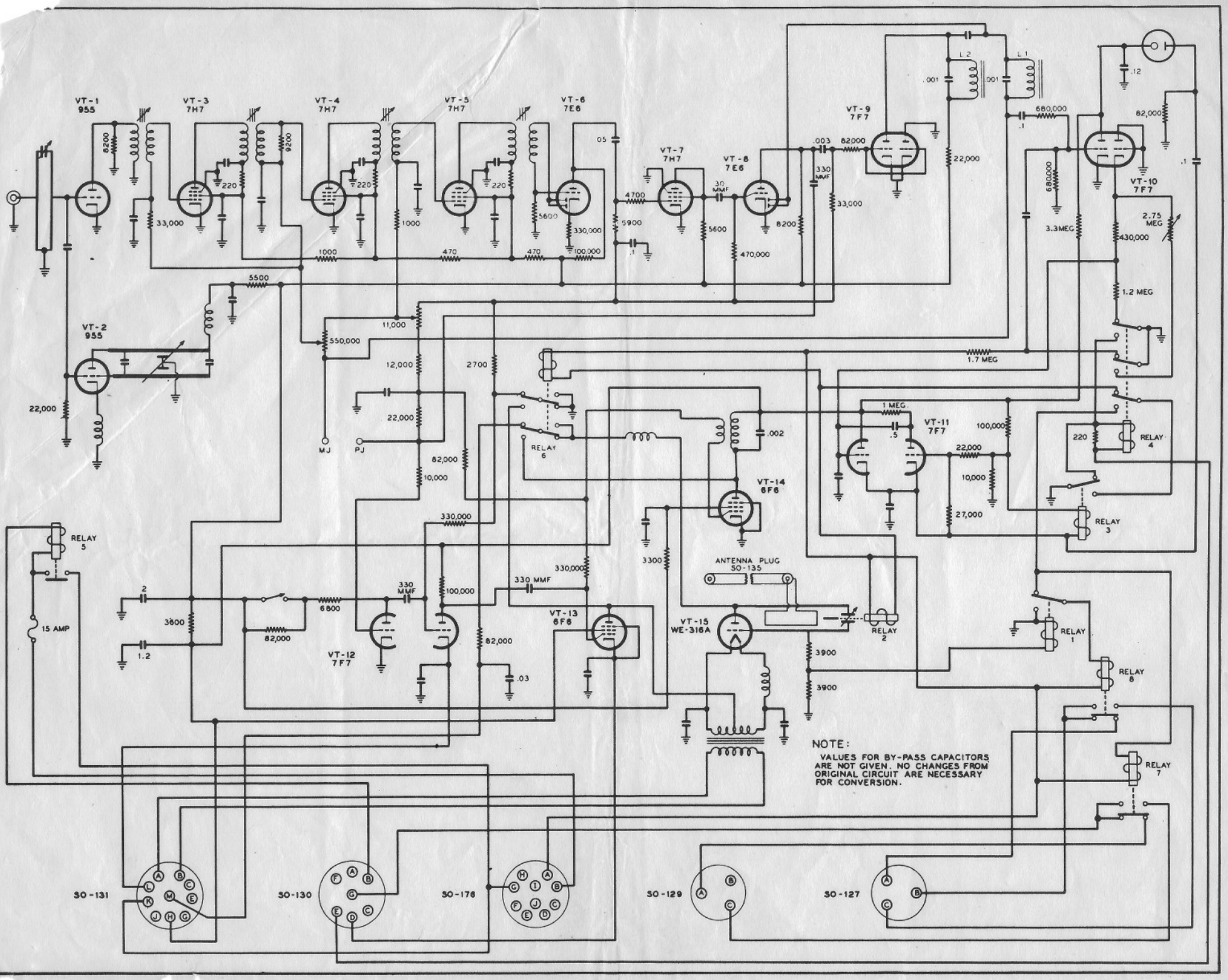
B. Determining the exact intensity of X-Ray radiation for measurement of therapeutic dosage,or determination of exposure time for a radiograph with perfect accuracy for any of the X-Ray film speeds available.

C. Qualitative and quantitative analysis of organic and inorganic compounds by the new X-Ray spectrographic method. Thousands of different materials have already been listed by the American Society for Testing Materials by this method, which catalogs them by the three strongest lines in their X-Ray spectrums. By this method of analysis detailed information may be obtained in 20 minutes about complex compounds that would take days of painstaking effort by older methods, if indeed, it could be obtained at all.

D. Measurement of the intensity of ultra-violet radiation using the special Geiger-Muller tube for that purpose. This application will be useful in quantitatively gauging the actinic output of various sunlamps, checking the bacteria killing qualities of the new germicidal lamps, or for just measuring the ultra-violet in ordinary sunlight under differing atmospheric conditions. The tube circuits in the RT-1248 lend themselves to easy conversion to flip-flop circuits, several stages of which are generally necessary to proportionally scale down the pulses for recording purposes when the ionizing events occur in rapid succession.






VT-1 955
VT-3 7H7
VT-4 7H7
VT-5 7H7
VT-6 7E6
VT-7 7H7
VT-8 7E6
VT-9 7F7
VT-10 7F7
VT-11 7F7
VT-12 7F7
VT-13 6F6
VT-14 6F6
VT-15 WE-316A
VT-2 955
RELAY 1
RELAY 2
RELAY 3
RELAY 4
RELAY 5
RELAY 6
RELAY 7
RELAY 8
ANTENNA PLUG SO-135
15 AMP
MJ
PJ
SO-131
SO-130
SO-176
SO-129
SO-127
NOTE:
VALUES FOR BY-PASS CAPACITORS ARE NOT GIVEN. NO CHANGES FROM ORIGINAL CIRCUIT ARE NECESSARY FOR CONVERSION.

RT-1248 CONVERSION MANUAL

CHAPTER 1

PHYSICAL AND ELECTRICAL DESCRIPTION

The RT-1248 may be used to radiate signals from 435 to 500 mc. Quarter-wave oscillation is used. The impedance frequency characteristics of a transmission line changes very quickly when the line is a quarter-wave long. This has a marked effect on the amount of voltage fed to the grid when the line is connected from plate to grid. This is why the circuit oscillates near quarter-wave frequency. In the RT-1248 an open half-wave is used, which acts in the same manner as a shorted quarter-wave. Frequency is varied by changing the capacity across the line. Grid bias is supplied thru a 3900 ohm grid leak. Grid current also flows thru the coil of Relay 1. Refer to the RT-1248 circuit diagram, figure 1. This coil actuates single pole double throw contacts when grid current flows during oscillation of the 316A. Relay 1 has a resistance of 2000 ohms and is of the supersensitive type operating on as little as 1 ma. One side of the filament is at ground potential while the other side is kept above ground by means of a radio frequency choke. The output of the transmitter terminates in antenna plug SO-135 and is obtained by coupling a single turn loop to the transmission line. The transmitter section of the RT-1248 includes a Western-Electric doorknob tube, type 316A. This tube is designed with very short leads and may be used to give several watts output up to 500 mc.

The RT-1248 is designed for relay control of frequency and any two frequencies may be preselected in the 435-500 mc. band. Relay 2 moves a piece of dielectric between the transmission line to change the frequency. This changes the amount of capacity across the line. Since the dielectric piece is connected to the armature the frequency is set by adjusting the closed and open position of the armature by means of the two set screws.

Two types of modulation are used depending on the position of Relay 6. In the position shown on the diagram, the 316A is modulated by the voltage inserted on the grid of the 6F6 (VT-13). This voltage may be pulsed, square wave or audio. This voltage is obtained from the 7F7 (VT-7), which is used in a two stage resistance coupled amplifier circuit. Referring to figure 1, we see that for this relay position plate voltage is applied from terminal M on SO-131 to the 6F6 (VT-15) in series. Varying the grid voltage on the 6F6 changes the voltage between its plate and cathode, thus modulating at super-sonic frequency. Referring to the circuit diagram the other 6F6 (VT-14) is used as a combination oscillator and modulator. In this position of the relay the filament of the 316A is at D.C. ground potential and the plate is connected across the supersonic oscillator tank coil. The modulation frequency is approximately 30,000 cycles.

The receiver circuit consists of a 955 oscillator and a 955 first detector. Four stages of intermediate frequency amplification are used at 40 mc. The IF signal is detected by the diode section of the 7E6 (VT-6). The receiver also tunes from 435 to 500 mc. Signal from the antenna is fed over a low impedance transmission line which connects to plug SO 126. A shortened quarter-wave line is used to match the low impedance transmission line to the grid of the 955 mixer. Set screw adjustment is provided for tuning the antenna circuit for maximum response. To change the resonant frequency of the antenna circuit quarter-wave line, loosen the screws which lock the two round disks at the end of the line. By doing this, the capacity at the end of the line is varied and this has the effect of lengthening or shortening the line. The oscillator also is a quarter-wave type similiar to the transmitter oscillator. Changing the frequency may be accomplished by bringing the disk just under the oscillator line closer or farther from the line by turning the setscrew. This varies the capacity between the line and thus changes the frequency. Oscillator voltage is coupled to the 1st detector grid by means of a small capacitor. It will be noticed that there is a certain amount of interaction. Vary both circuits simultaneously until the right combination is found for maximum gain. Mixing is accomplished by adding the oscillator and antenna circuit voltage and applying them to a non-linear element formed by the grid and cathode acting as a diode rectifier. The difference frequency, which is 40 mc., is coupled to the primary of the first intermediate frequency transformer thru the grid plate capacity of the 955 mixer. No plate voltage is used. Intermediate frequency band width is approximately 2½ megacycles. Four intermediate frequency transformers are used and there is only one adjustment on each transformer to tune it to 40 megacycles. No trimmers are used as stray coil capacity is used to tune the primary and secondary. The resonant frequency is varied by coupling a single turn shorted cylinder to the transformer by means of the screw adjustment on top. Bias is varied by adjusting the 11,000 ohm and 550,000 ohm potentiometers. Since the IF tubes are variable mu, the gain of the IF section is varied when bias is varied. The output of the 7E6 second detector is fed thru a 7F7 (VT-7), 7E7 (VT-8) and 7F7 (VT-9) to L2 and L1 which form a double section band pass filter. The filter is tuned to 30,000 cycles. The output of the filter is fed to (VT-10). A neon voltage limiter is used.

The dynamotor supplies the following voltages:

400 volts at 135 milliamperes
800 volts at 20 milliamperes (actually can supply 135 mills. since same size wire is used as in other 400 winding)

9 volts at 1.12 amps, 80 cycle AC

To operate the dynamotor 13 volts at 12.6 amps. or 26 volts at 6.3 amps. DC must be supplied. Since the rated RPM of the 2 pole dynamotor is 4800, the AC output frequency is 80 cycles. There are two 13 volt windings on the machine which are placed in series or in parallel depending on whether 26 or 13 volts operation is desired. The 800 volts is taken across one of the windings. A centrifugal type blower is attached to the armature shaft to cool the dynamotor.

CHAPTER 2

CONNECTING THE RT-1248 POWER SUPPLY

To get the RT-1248 into operation a number of voltages are applied. Filament voltage is supplied to the 316A by applying 9 volts AC to the primary of its filament transformer. This voltage comes in on terminals A and B on plug SO-131. When the transmitter is in the series modulation position the 316A and the 6F6 (VT-13) are placed in series. This requires 800 volts, 400 volts each for the 316A and 6F6. This voltage comes in on terminal M on plugs SO-131. The rest of the equipment operates on 400 volts at 135 milliamperes, which comes in on terminal H on SO-131. Filament voltage for some of the other tubes is supplied at terminal D and C on plug SO-176. Since the filaments are connected series-parallel 12 volts AC or DC is required. The rest of the tubes may be lighted by supplying 12 volts between terminal D on SO-176 and ground. Sockets SO-129 and SO-127 are used as terminals for contacts on some of the relays in the RT-1248.

CHAPTER 3

CONVERSION TO AM TRANSMITTER-RECEIVER COMBINATION

The transmitter portion of the RT-1248 was designed to operate between 435 and 500 megacycles. If it is desired to transmit anywhere in the band no alterations of the transmitter tunning lines will be necessary. In addition a relay is used to select any two channels in this band. This is done by varying the capacity at the end of the line by inserting a piece of dielectric between the flat plates at the end of the line. First of all select any two frequencies in the 435 to 500 megacycle band. The lower frequency is set when relay #2 which controls the position of the dielectric is energized. Insert a screw-driver in the hole marked LF on the front panel and adjust the set screw until the transmitter radiates on the desired frequency. To set the higher frequency, denergize the relay and insert a screw-driver in the hole located about 1½" above the LF hole and turn the set screw until the desired high-frequency is reached. To cover the 420-450 mc. amateur band additional capacity must be placed across the line. A neutralizing condenser soldered across the end of the line is satisfactory. The frequency change relay may be used as above provided the condenser is soldered in such a way so as not to interfere with the movement of the dielectric. A suitable voltage source for the relay will be described later.

The circuitdiagram shown in Fig. 2 is used for Voice modulation. Dismantle both 6F6 circuits and the 7F7 nearest to the 6F6 sockets. The three .1 mfd. condensers are conveniently located and may be used for cathode and screen by-pass purposes. The modulation choke may be a filter choke or a windings of an audio transformer so long as it will withstand the combined 6F6 and 316A plate currect. All that needs to be done to the 316 oscillator is to ground the center tap of the filament transformer and disconnect the wire leading from the grid leak resistors to Relay #1. The antenna plug connects to a low impedance transmission line.

The receiver needs to be revised somewhat as it originally tunes from 450 mc. to 500 mc. To cover the 420 to 450 mc. amateur band the oscillator tuning rods are removed and longer ones (approx. 1 7/8") soldered in their place. The receiver may be wired according to Figure 3.

All tubes beyond the second detector are dismantled. A conventional AM detector is built in (Refer to Fig. 1 and 3). Be careful to use short leads and include the 50 uuf by-pass condensers inside the 2nd-detector compartment to prevent IF oscillation. The output of the second detector is applied to one triode section of a 7F7 and then to a 6F6 output. The 6F6 will match any load between 5000 and 7000 ohms although this impedance range is not at all critical if maximum audio output is not necessary. The 6F6 output can be connected to a jack for external speaker attachment. Most components such as by-pass and coupling condensers, resistors, etc. in the transmitter and receiver are not critical and can be obtained from the parts removed when the RT-1248 is dismantled.

For AM the 316A may be easily tone modulated (Refer to Fig.4). No audio amplification is necessary. An ordinary audio transformer is used but the plate winding must withstand the combined 6F6 and 316A plate currents. The 6F6 grid winding is resonant somewhere in the upper audio frequencies. This frequency may be lowered by means of a condenser placed across the grid winding. Relay #1 is used as a keying relay and only the tone modulation is keyed. This helps to reduce the noise between the keyed characters.

An AC power supply can be used to operate the transmitter receiver and may be constructed in one unit. It is possible to construct the power supply on the RT-1248 chassis provided small size components are used. A suggested circuit diagram is shown in figure 5. Voltage for the filaments is supplied by connecting two 6.3 filament windings in series, while 9 volts for the 316A transformer is obtained by connecting one half of a 6.3 filament winding in series with the other 6.3 winding. D.C. voltage for operating the relays is obtained by rectifying the A.C. If a transformer with two 6.3 windings cannot be obtained, a separate filament transformer may be used. The Buffalo Radio Supply can furnish all the necessary components for the power supply including the small selenium rectifier for the 12 volt D.C. supply. The Buffalo Radio Supply can furnish a power transformer with a single 6.3 winding as well as a filament transformer which will furnish the other 6.3 volt winding.

The dynamotor may be used to supply power to the transmitter-receiver with very little alteration. Connect the dynamotor terminals as shown in Figure 6 for 12 or 24 volt battery operation. Voltage for the relays may be obtained from the same terminals which provide filament voltage.

CHAPTER 4

CONVERSION TO A MOBILE PUBLIC ADDRESS SYSTEM

To convert the RT-1248 remove all the components not shown in figure 7. Most of the components for the P.A. system will be found in the RT-1248. A circuit diagram using the two 6F6's is shown in fig.7. Maximum power output is 20 watts. For additional input channels use other 7H7 stages connected exactly as the diagrammed one, coupled similarly to the 7H7 input thru .05 condensers. All condensers are 600 volt except the two 8 mfd. condensers which are 450 working voltage. The output transformer should have a plate impedance of 10,000 ohms and be capable of handling 20 watts. The SO 131 terminals on the dynamotor should be connected as in figure 8. All other terminals are left disconnected.

CHAPTER 5

80-110 MC. FM RECEIVER

The RT-1248 can easily be converted to an 80-110 MC. FM receiver. Except for the output transformer and loud speaker, the receiver may be completely constructed using components found in the RT-1248 together with the kit of power supply parts available. To obtain the high-fidelty reproduction characteristics of better FM receivers, highest quality loud speaker and output transformer are recommended. An excellent quality 12" PM speaker can be ordered from Buffalo Radio Supply for $7.95 and a matched ouput transformer for $1.69.

The RT-1248 as it comes to you is a 15 tube transmitter-receiver which transmits on 2 pre-adjusted frequencies from 435 to 500mc. The receiver uses 10 tubes including 2-955's one as a first detector and the other as oscillator, 3-7H7's as IF's, with 4 slug-tuned 40 mc. IF transformers, plus a 7H7, 2-7E6's and 2-7F7's. Transmitter tubes are 2-7F7's, 2-6F6's and a WE316A as in the original circuit. The converted FM receiver will use the two 955's for detector and oscillator, and the same IF system, a 7F7 FM detector, a 7F7 phase inverter and 2-6F6's are used for output. The power supply components are available from Buffalo Radio Supply in kit form.

Study the layout of the RT-1248 together with the converted layout. Also look over the original circuit as well as the converted circuit keeping in mind the changes necessary for conversion. Dismantling must be done very carefully. Dismantle the entire transmitter circuit leaving only sockets for the two 6F6's in place as well as the adjacent socket which held VT-189 (7F7). Also leave the triple .1 mfd. condensers between the 6F6 and 7F7 as these sections are used by-pass condensers in the audio amplifier. The following instructions must be observed:

1. Be careful to leave the filament leads to the 955 and the IF tubes in place as they will be useful in converting the filaments for 6 volt operation.
2. Do not remove the condenser which by-passes to ground the red-white lead coming out of the last IF transformer compartment.
3. Do not remove the resistors protruding thru the sides of the 2nd and 3rd IF transformer compartments.

All other transmitter components may be safely removed. Most of the receiver components are left intact. The filament wiring on the 955's is left unchanged. Remove the antenna tuning circuit. Short the R. F. choke in the osc. plate circuit and remove the condenser at the end of the oscillator grid and plate rods. Leave the oscillator plate and tuning rods in place.

To make the receiver pick up signals from 80 to 110 mc. the oscillator frequency must vary from 120 to 150 mc. The oscillator is wired according to figure 9. Mount C_1 and C_2 close to the two 955's using short leads. Each tuning condenser must be tuned separately to bring in an F.M. signal at which time the interaction will be noticed. High voltage is supplied to the oscillator plate at the shorted R.F. choke. Unsolder the condenser between the 955 grid and plate terminals and use it to couple oscillator voltage from the oscillator grid to detector grid.

Dismantle the 7E6 second detector circuit and remove the last IF transformer. Plug a 7F7 in the socket formely occupied by the 7E6 second detector. The discriniator transformer is easily made. The primary and secondary are wound on the same form used for the last IF transformer. Remove the tuning slug. The primary consists of 7 turns of no. 26 enamel wire close wound at the base end of the form. The secondary is wound at the other end and is identical to the primary except that it is center-tapped. Both primary and secondary are tuned by trimmer condensers 25 uuf each, mounted close to the coils. The value of the resistor connected to the center-tap of the secondary of the discriminator is only nominal and various values should be tried for clearest reception.

Having removed the transmitter components there is plenty of room available to construct an audio amplifier and power supply. Mount the components as shown on the layout plan,(fig. 10). For a volume control use the 550M pot. removed from the chassis. The audio amplifier components can be purchased in kit form and no special difficulty will be encountered. The power supply furnishes 250 volts B supply and 6.3 volts for the filament.

The filament wiring must be changed from 12 volts to 6.3 volts. The 955's are lighted by grounding the white-red lead connected to 1 side of the oscillator filament and connecting 6.3 volts from the power transmformer to the ungrounded side of the first detector filament. The 1st and 2nd I.F. tubes may be lighted by grounding the red-white lead connected to the 2nd IF filament and connecting 6.3 volts from the transfromer to the ungrounded side of the filament of the 1st IF tube. The last IF tube and second detector may be lighted by grounding the white-blue lead connected to one side of the filament of the 2nd detector tybe and connecting 6.3 volts from the power transformer to the other side of the filament.

Ground the 33,000 ohm resistor coming out of the 2nd IF transformer compartment. Also ground the 1000 resistor coming out of the 3rd IF transformer compartment. High voltage can be supplied to the IF tubes by connecting 250 volts to the red-white lead coming out of the last IF transformer compartment. The power supply uses a 5Y3 rectifier in a conventional circuit.

Having wired up the receiver, alignment is very simple . Place a DC vacuum tube voltmeter at the point where the two cathode by-pass condensers of the FM discriminator join together and ground. Connect an unmodulated 40MC signal to the antenna terminal and tune all the slugs in the IF transformers as well as the discriminator trimmers for a maximum reading on the VTVM. The set is now ready for FM reception. If the entire 80-110 mc. FM band is not covered spread or squeeze together the turns of the oscillator coil or change the oscillator condenser until the range is covered.

Without de-emphasis the higher audio frequencies may be predominant toagreater degree than desired by the user in which case a condenser placed across the volume control will bring about normal reproduction. Various values of capacity should be tried to suit individual preference.

CHAPTER 6

CONVERSION TO FACSIMILE TRANSMISSION

For facsimile transmission and reception an ordinary amplitude modulation is used. Any number methods of scanning may be adop-

ted. One method is to mount the picture to be sent on a revolving drum which moves axially a small fraction of an inch every revolution. A point of light from a lens system is projected on the picture. The reflected light, which is picked up by a photo-electric cell varies with the density of the spots scanned. In another method the material to be scanned is rolled up in a cylinder and scanned in a to&fro motion as the material is unrolled and moves at a constant speed. At the receiver a stylus, actuated by an electromagnet, scans a sheet of carbon backed sheet of white paper. The movements are synchronized and the varying pressure of the stylus makes an impression on the white paper depending on the voltage supplied by the photo-electric cell at the transmitter.

Briefly then, scan voltages are transmitted by modulating a source of 60 cycle A.C. by the photoelectric cell voltage. This in turn is used to modulate the 316-A UHF oscillator. A syncronous motor is powered from the same 60 cycle power supply to actuate the mechanism.

The photo-cell circuit diagram, shown in figure 11 is used to feed an AM transmitter similar to that described in Chapter 3. Resistance R will depend on the photocell used and should be varied for 1 volt grid bias on the 7H7. The AC screen voltage should be varied for best 60 cycle modulation. The AM transmitter and modulator used is the same as described in Chapter 3.

The receiver circuits are shown in figure 12. The operation of the facsimile receiver is very simple. It is assumed that identical mechanical arrangements are used at the transmitter and receiver so that the stylus is in the same position as the photo cell at all times. The modulated 60 cycles is amplified by means of the 7F7. The 60 cycles is reduced to constant amplitude by clipping the top and bottom portion of the sine wave. The top is clipped by inserting a high resistance in the grid lead of the last 7F7 which keeps the grid voltage from going higher than zero volts, while the cutoff bias determines the lower clipping point. Thus a square wave results.

This voltage is fed to a push-pull power amplifier whose output is enough to run the motor. If a 60 cycle 110 volt motor is used a small receiver power transformer connected backwards can be used as an output transformer. No values are given for the power amplifier but a push-pull 6L6 circuit giving from 25 to 50 watts is suggested.

The modulated 60 cycle voltage is fed into a 6F6 and then rectified to supply power for the stylus. The choice of output transformer and rectifier depends on the impedance of the stylus used.

CHAPTER 7

CONVERSION TO AMATEUR TELEVISION TRANSMISSION

The Federal Communication Commission permits television transmission in the 420-450 mc. amateur band. The transmitter and receiver section of the RT-1248 are suitable for this band. The other components in the RT-1248 can be readily adapted to make a complete television system.

Briefly, 60 cycles and 30,000 cycles sine wave are used for vertical and horizontal sweep for simplicity. The transmitter is video modulated by the output of an iconoscope, which must be used for pickup at the transmitter, and 30,000 cycles is superimposed on the video modulation. At the receiver the 30,000 cycles is removed from the video by means of a band elimination filter and used for sweep purposes.

To make a complete system, that is, a transmitter and receiver, two RT-1248's will be necessary. A suitable iconoscope must be obtained. Electrostatic iconoscopes can be obtained at the Buffalo Radio Supply for as low as $15. The output of the iconoscope is amplified by means of a video amplifier and then applied to a video modulator. The 316-A oscillator is used for the transmitter. Figure 13 shows a complete transmitter. Standardized details such as power supply are not included in the diagram. It is assumed that the iconoscope is set up with a lens system which gives a suitable optical image on the mosaic. The horizontal sweep voltage for the iconoscope is supplied at 30 kc. The coil for the oscillator is taken from the RT-1248. Wind several hundred turns of wire on the same form as the coil, and tune the coil by means of a condenser to 30 kc. Wind the coil so that the coupling can be varied so that the voltage applied to the iconoscope can be raised or lowered. It is advisable to have the voltage about twice the amount necessary to completely scan the mosaic. This will place the mosaic in the most linear portion of the sine wave.

The vertical sweep is obtained from the 60 cycle power line. The voltage required depends on the iconoscope in use but it should be twice the voltage required to scan the mosaic. The coil condenser circuit connected across the 60 cycle source is designed to filter out any 60 cycle harmonics which might exist in the line. The voltage and coupling resistor R for the iconoscope should be used as recommended by the manufacturerer of the iconoscope. This resistor and the entire input system to the video amplifier should be experimented with to reduce random noise effects.

The video amplifier should present no trouble. Additional stages may be used if the output of the iconoscope is very low. The output of the oscillator is superimposed on the video by means of a 100 mmf variable coupling condenser, and both 30 kc. and video are transmitted on the same carrier.

The receiver circuit diagram is shown in figure 14. All unmarked parts are parts of the RT-1248. A cathode ray tube made especially for television should be used but an ordinary tube from a cathode ray oscilloscope should give fair results. In fact an ordinary cathode ray oscilloscope with its built in power supply may be used. Connection need only be made to the vertical and horizontal plates and control grid. The complete receiver is not shown becuase it is identical to the previous receiver circuits shown in the early chapters.

Rewire the second detector of the RT-1248. The output consists of video superimposed on 30,000 cycles. This combined signal is amplified by means of two stages of video amplification using two of the 7H7's from the RT-1248. The 30 kc. is seperated from the video by means of a band pass filter and then amplified and fed to the horizontal plates of the cathode ray oscilloscope. The video signal is derived by passing the combined signal thru a band elimination filter which rejects the 30 kc. Both filters are obtained from the powdered iron core units found in the RT-1248. The video is also amplified and fed to the control grid of the cathode ray tube.

Vertical sweep for the cathode ray oscilloscope is obtained from the 60 cycle power line and both transmitter and receiver must operate from the same power system. If the transmitter and receiver are a considerable distance apart the 60 cycle supplied to both will possibly be out of phase. A phase correcting network is used and should be adjusted so that the picture is centered on the screen.

CHAPTER 8

RELAY SIGNAL HOOKUPS

To operate a relay when a signal is received, the super-sensitive relays #1 and #3 are used. A circuit diagram for this is shown in figure 15. Both relays are single-pole double throw type and may be used either to open or close a contact when a signal is received. The values for the resistances are approximate and should be experimented with, until the relay functions on the signal available. Since Relay 1 and 3 are for light duty, a heavy current should be handled by any of the other relays in the RT-1248. Relay 2 and 3 may be used to operate any of these relays. Operating voltages or currents necessary for the 8 relays are as follows, Relay 1,1ma., Relay 2,12 volts, Relay 3, 1ma., Relay 4, 12volts, Relay 5, 12 volts, Relay 6, 6 volts, Relay 7, 12 volts, Relay 8,12 volts. All relays are D.C. and are ideal for all kinds of remote control work such as starting motors, opening garage doors by a transmitter signal from a car, photo-electric cell applications ets. Figure 16 is a circuit which may be used to close a relay on the photo electric cell is exposed to light. The value of R depends on the photo electric cell used and should be varied for best results. Be certain that the peak photo electric cell current does not exceed the recommended maximum.

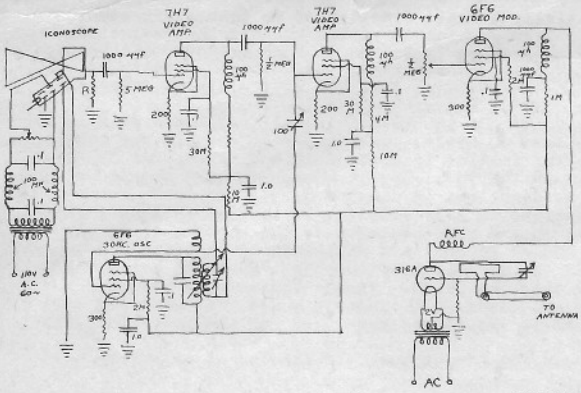
CHAPTER 9

CONVERSION TO FM TRANSMISSION

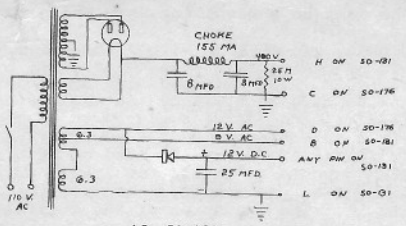
The RT-1248 is easily adaptable to "Transmission Line Frequency Modulation". The Federal Communication Commission allows FM in the following bands: 29 to29.7 mc., 52.5 to 54mc., 144 to 148mc., 235 to 240mc., 420 to 450mc., The list is not all inclusive and FM may be used in the still higher frequency amateur bands. This system of FM consists of inserting a variable reactance in a Hartley oscillator. This reactance is obtained from a trasmission line with a variable resistance load. Figure 17 gives the circuit diagram. For transmission in any of the FM bands an oscillator using the WE-316 is constructed. Tuned circuit L_1C_1 is selected to resonate at the desired frequency. If the length of line is carefully selected a variation ofload resistance at one end will cause only the reactive component to vary at the other end while the resistive component will remain constant. This varying reactance is inserted in series with L1 and no AM will result, since the total resistance in series will remain constant. Select the length of line so that the cotangent of the length of line in degrees is equal to the plate resistance of the triode modulator divided by the characteristics impedance ofthe transmission line, both of which are expresses in ohms. Expressed mathematically $\cot\theta = \frac{R_p}{Z_o}$ where θ is the length of line in degrees, R_p is the plate resistance of the modulator and Z_o is the characteristics impedance ofthe line. The varying load resistance is obtained from the varying plate resistance as the bias is changed at an audio rate. The resistance of the transmission line is inserted in series with L1 and the result of the combination should not be less than 12 or unstable oscillation will result. This resistance may be lowered by changing the length of transmission line and using a tube with a different plate resistance. Also the plate resistance of a given triode can be suit the line by means of a closely coupled RF transformer.

CHAPTER 10 RADIOACTIVITY DETECTOR

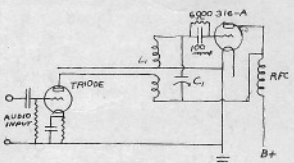
The RT-1248 has an 800v. power supply and enough components for numerous experiments with radioactivity detection. In general, radiation emitted by radium and uranium, as well as cosmic and X-rays, is identical to radio waves, the only difference being in frequency. The frequencies used in modern radio are much lower and consequently the wavelengths associated with these radiations are measured in very small fractions of a mm. One method of detecting these radiations is by means of a Geiger Mueller tube. A typical counter consists of a gas filled tube containing a long thin wire. This wire is surrounded by a metal cylinder. The tube is filled with one of several gases at low pressure.. A positive voltage of several hundred volts is applied to the thin wire, whenever any of the above radiations enters the space inside the tube the gas ionizes, causing a large current to flow momentarily. By placing a high resistance in series with the tube, a pulse of voltage is developed across it. A Geiger-Mueller counter circuit using one stage of subdivision is shown in figure 18. Additional stages should be added if it is desired to count at slower rate. The 800v from the RT-1248 dynamotor is used to operate the tube. A self quenching Geiger-Mueller tube should be used as no provision has been made for quenching the discharge once it has started. Resistance depends on the tube used. The last 7H7 picks off the positive pulse from the multivibrator and its output may be used to trigge other subdivider stage.



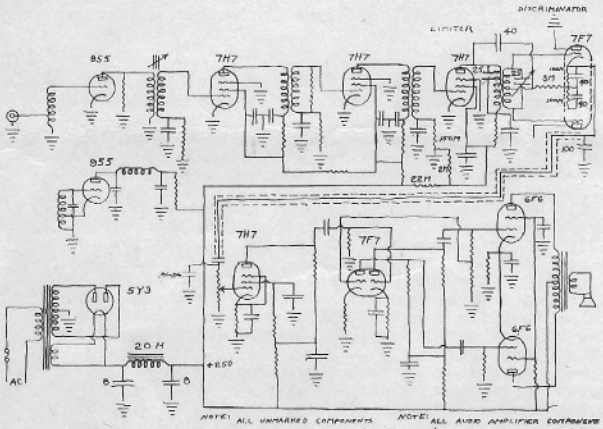
TELEVISION TRANSMITTER FIGURE 13



AC POWER SUPPLY FIGURE 5



FM TRANSMITTER FIGURE 17

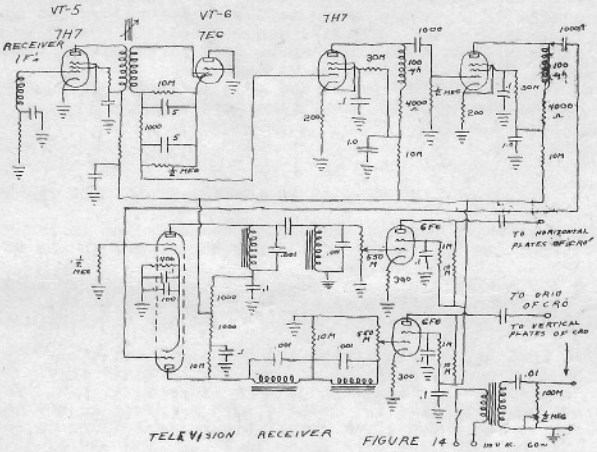


FM RECEIVER

NOTE: ALL UNMARKED COMPONENTS ARE THE SAME AS IN THE ORIGINAL RT 1648

NOTE: ALL AUDIO AMPLIFIER COMPONENTS ARE THE SAME AS IN THE

FIGURE 9 MOBILE PA AMP. APPLICATION



TELEVISION RECEIVER FIGURE 14

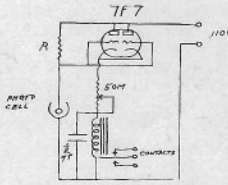
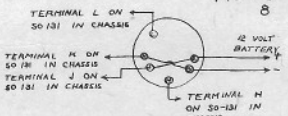


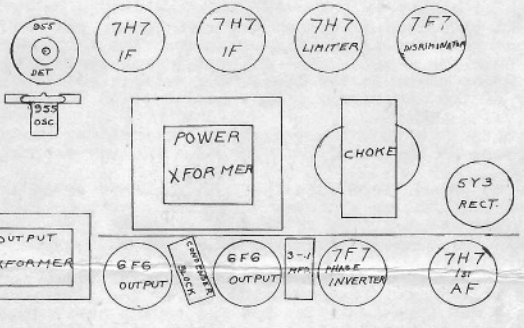
PHOTO ELECTRIC CELL RELAY

FIGURE 16

FIGURE 8



50-131 WIRING FOR MOBILE PUBLIC ADDRESS SYSTEM



TOP VIEW

LAYOUT FOR FM RECEIVER FIGURE 10

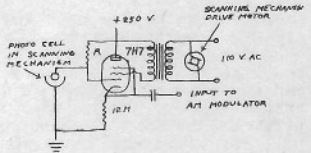
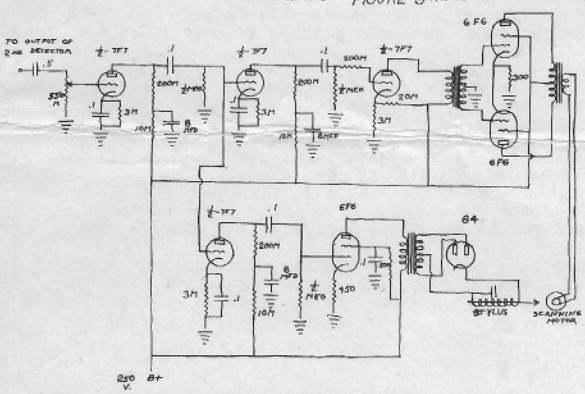
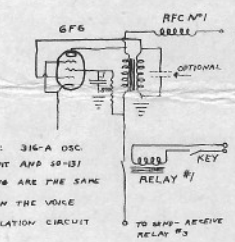


PHOTO CELL SCANNING CIRCUIT FIGURE 11

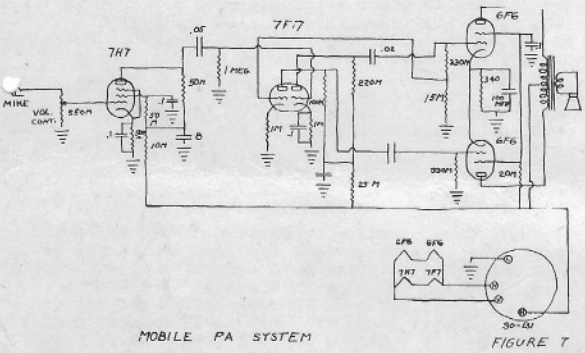


FACSIMILE RECEIVER CIRCUIT FIGURE 12

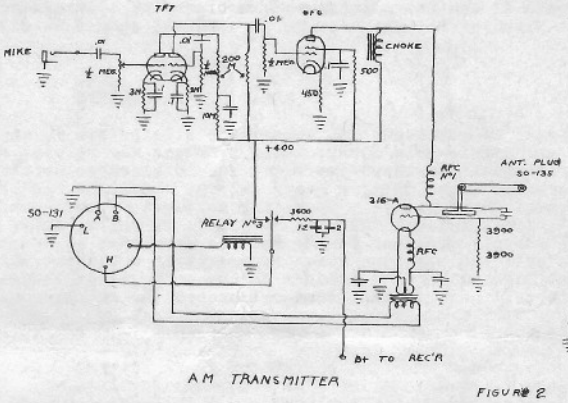


Note: 316-A OSC. CIRCUIT AND 50-131 WIRING ARE THE SAME AS IN THE VOICE MODULATION CIRCUIT

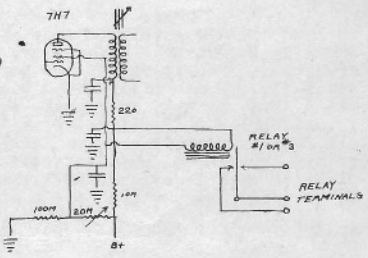
TONE MODULATOR FIGURE 4



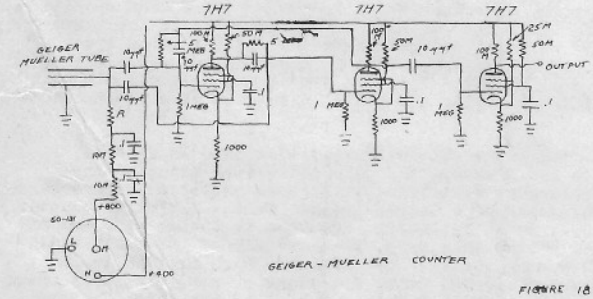
MOBILE PA SYSTEM FIGURE 7



AM TRANSMITTER FIGURE 2

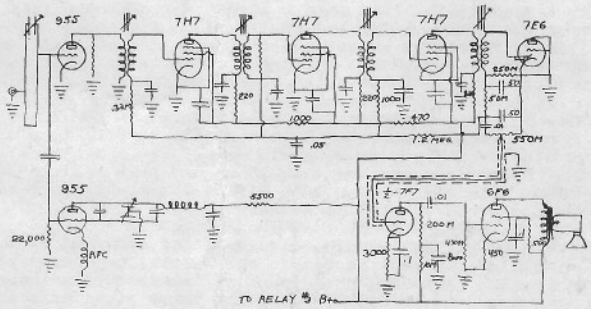


SIGNAL RELAY CIRCUIT FIGURE 15

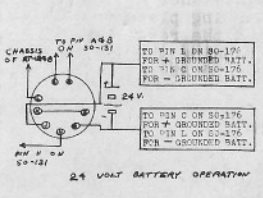


GEIGER-MUELLER COUNTER

FIGURE 18



CONVERTED AM RECEIVER FIGURE 3



12 VOLT BATTERY OPERATION

24 VOLT BATTERY OPERATION

PLUG 50-131 WIRING FIGURE 6