INSTRUCTION MANUAL

STANCOR
RADIO TRANSMITTER KIT
ST-202-A

INSTRUCTION MANUAL
35 CENTS PER COPY

A PRODUCT OF
THE ELECTRONIC EQUIPMENT DIVISION

STANDARD TRANSFORMER CORPORATION
ELSTON, KEDZIE & ADDISON CHICAGO 18, ILL.

Warning . . . The operation of a radio transmitter other than by the Federal Government without authorization from the Federal Communications Commission is in violation of the Communications Act of 1934, as amended, the penal provisions of which provide a fine not to exceed $10,000 or imprisonment for two years, or both.

For licensing information write to the Secretary, Federal Communications Commission, Washington 25, D. C., indicating type of equipment and proposed use.

The fact that this transmitter is operable on certain frequencies does not constitute authorization for use of those frequencies. It is the personal responsibility of every operator to keep himself informed on current regulations governing frequency allocations, and the types of communication services permitted therein, granted for use under his class of license.

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RADIO TRANSMITTER
ST-202-A
SPECIFICATIONS

Type of Emission	Radiotelegraphy
Amplifier Plate Power Input	100–125 Watts
Frequency Range	Six Bands between 3.5 and 30 Megacycles
Internal Frequency Control	Six Quartz Crystals
Output Circuit	Link Coil with Adjustable Coupling
Source of Power	117 Volts, Single Phase, 60 Cycles
Total Power Consumption	335 Watts
Oscillator Tube (VT1)	Metal 6V6
Intermediate Tube (VT2)	Metal 6L6
Power Amplifier Tube (VT3)	Triode (Per Choice. See text)
Low Voltage Rectifier (VT4)	5Y3-GT
High Voltage Rectifier (VT5)	5R4-GY
Cabinet Dimensions	14 1/16″ W. x 9″ H. x 13 3/16″ D.
Shipping Weight	55 Lbs.

GENERAL

Stancor Model ST-202-A fulfills the demand for a compact, desk type, high frequency, radio transmitter having substantial power output. Internal circuits for radiotelephony were purposely omitted to satisfy the "strictly CW" operator as well as to offer the "phone man" a choice of either amplitude or frequency modulation. Hence, either type of modulation may be ultimately applied.

Such important features as six band coverage (10, 11, 15, 20, 40, and 80 meters), inter- and intra-band flexibility, and extreme simplicity of adjustment and control were included without resorting to complexities. Ease of construction was given paramount consideration in the design of this unit.

The ST-202-A incorporates a novel and highly simplified band-switching exciter circuit involving only two receiving type tubes, a single deck coil turret, and one tuning capacitor. The radio frequency power amplifier employs a triode transmitting tube in a balanced, neutralized circuit for stable, trouble-free operation. For this position, several tubes are recommended (see ACCESSORIES) and a choice may be made according to the dictates of the individual operator. To meet all of the requirements of the various triodes listed, the ST-202-A provides a range of amplifier filament voltages of 5.0, 6.3, and 7.5, and a wide range, neutralizing capacitor. The amplifier tank circuit uses 150 watt plug-in inductors of standard availability, one being required for each major frequency range. A link coil, with variable coupling adjustment, facilitates proper loading of the amplifier by the antenna system. Quick channel shifting is accomplished by panel-switch selection of six different frequencies.

Separate power supplies develop 350 volts DC for the exciter stages and 1,000 volts DC for the amplifier stage. The exciter power supply is electrically inverted so that it may also provide a grid bias potential for the amplifier tube. Further, this system allows simultaneous screen keying of both exciter tubes, giving clean-cut, telegraphic signals along with the highly desirable "break-in" feature of operation.

Both grid and plate current readings of the final amplifier tube are taken with a single milliammeter employed in a switching system.

Suitable terminals at the rear of the cabinet provide connections to an antenna system, a telegraph key, a remote standby switch, an antenna changeover relay, and an amplitude modulator. An extractor type fuse receptacle and the 117 volt AC line cord are also located at the rear.

The output of a frequency modulator or a variable frequency oscillator may be introduced into one of the six crystal sockets.

ACCESSORIES

Accessories needed, but not furnished with the ST-202-A Kit for operation as a telegraph transmitter are:

TUBES—One metal 6V6 (oscillator stage).
One metal 6L6 (intermediate stage).
One 35T, 35TG, HK54, 811, or 5514 (amplifier stage).
One 5Y3-GT (350 volt supply rectifier).
One 5R4-GY (1,000 volt supply rectifier).

METER—One standard, 2⅜″ square, 0–150 or 0-200 DC milliammeter.

AMPLIFIER PLATE TANK COILS—Standard 150 watt plug-in inductors with center space for swinging link coil. See TABLE OF OPERATION for recommendation for each band.

TELEGRAPH KEY—Any standard manually operated or semi-automatic type as preferred by the operator.

ANTENNA SYSTEM—The choice of antenna(s) will depend upon frequencies to be used, particular kind of coverage required, and physical limitations of the location. While a comprehensive study treating the multitude of antenna systems in existence is not within the scope of this instruction manual, the general categories of radiating and feed systems that may be applied to the output terminals of the ST-202-A are covered in the ANTENNA APPLICATION section.

ANTENNA RELAY (Optional)—Any DPDT unit having an electromagnetic coil for 117 volt, 60 cycle operation and contacts of high current carrying capability. Relays of this type are manufactured specifically for antenna switching purposes and are characterized by low-loss insulation and low capacitance between contact members.

CRYSTALS—Quartz crystal plates in plug-in type housings. The ST-202-A crystal sockets accommodate the popular type crystal holders having 0.095″ diameter pins spaced 0.487″ apart. Selection of actual frequencies may be determined by consulting the TABLE OF OPERATION.

CIRCUIT EXPLANATION

The radio frequency channel of the ST-202-A consists of an exciter section (crystal oscillator and intermediate stage) and the power amplifier or output stage.

EXCITER SECTION—A 6V6 beam tetrode, VT1, is employed in the crystal oscillator circuit. To minimize the number of stages and crystals required for multi-band operation, controlled regeneration is utilized to provide oscillator output on either the fundamental or second harmonic of a crystal frequency. An optimum degree of regeneration is developed in the cathode circuit by inductor L1 and throttling capacitor C3 which together form a cathode impedance common to both plate and grid circuits of the tube. With this circuit, oscillations at the crystal frequency are generated even when an aperiodic impedance, such as L2, is used in the plate circuit.

Because of its high power gain and ability to generate harmonics, a 6L6 beam tetrode, VT2, is employed in the intermediate stage. Associated with the plate circuit of this stage is a band-switching assembly consisting of a four position selector switch and four inductors which, in conjunction with variable capacitor C9, will tune the ten and eleven meter bands in the first switch position, the fifteen and twenty meter bands in the second switch position, the forty meter band in the third switch position, and the eighty meter band in the fourth switch position.

More specifically, the exciter functions as follows:

BAND SELECTOR AT 80—Inductor L80 is switched into the plate circuit of VT2. With an 80 meter crystal in the grid circuit of VT1, the oscillator delivers excitation at the crystal frequency to the grid of VT2. VT2, in turn, when its plate tank circuit is resonated by adjustment of C9, provides amplified 80 meter excitation to the grid of VT3.

BAND SELECTOR AT 40—Inductor L40 is switched into the plate-circuit of VT2. With a 40 meter crystal in the grid circuit of VT1, the oscillator delivers excitation at the crystal frequency to the grid of VT2. VT2, in turn, when its plate tank circuit is resonated by adjustment of C9, provides amplified 40 meter excitation to the grid of VT3.

BAND SELECTOR AT 15-20 Inductor L20 is switched into the plate circuit of VT2. With a 40 meter crystal in the grid circuit of VT1, the oscillator delivers excitation at the crystal frequency to the grid of VT2. However, with the band switch in this position, inductor L80 is switched back into the plate circuit of the oscillator. The inductance of L80, combined with the circuit capacitances of the oscillator, causes it to become broadly self-resonant on 40 meters, thus increasing the amplitude of the exciting voltage to the grid of VT2. VT2, in turn, efficiently doubles or triples the exciting frequency, as determined by the adjustment of C9, and provides amplified 20 or 15 meter excitation to the grid of VT3.

BAND SELECTOR AT 10-11—Inductor L10 is switched into the plate circuit of VT2. With a 40 meter crystal in the grid circuit of VT1, the oscillator delivers excitation at twice the crystal frequency to the grid of VT2 since, with the band switch in this position, inductor L40 is switched back into the plate circuit of VT1. The inductance of L40, combined with the circuit capacitances of the oscillator, causes it to become broadly self-resonant on 20 meters. VT2, in turn, efficiently doubles the exciting frequency, as determined by the adjustment of C9, and provides amplified 10 or 11 meter excitation to the grid of VT3.

It is obvious that double-duty usage of the band-switching coils economically eliminates the need for an extra band [illegible]

The 350 volt system is arranged so that the positive terminal is grounded and the negative terminal is "hot". Full-wave rectification is obtained with a 5Y3-GT tube. The output of this supply energizes the exciter section which is designed to operate from an inverted supply voltage. Resistors R10 and R11 form a "bleeder" for this supply and also act as a voltage divider from which a negative bias potential is obtained for the grid of the amplifier tube.

The 1,000 volt system is more conventional in that its positive terminal is "hot". Full-wave rectification is obtained with a 5R4-GY tube. The output of this supply energizes the plate circuit of the amplifier stage. Resistor R12 serves as a "bleeder".

All tube filaments are heated by transformer T3 which has four output windings. Two of these windings each provide 5.0 volts at 2 amperes for rectifier tube filaments. A third winding provides 6.3 volts at 2 amperes for the filaments of the 6V6, 6L6, and pilot light. The remaining winding is tapped and can deliver either 5.0 volts at 5 amperes, 6.3 volts at 4.5 amperes, or 7.5 volts at 3 amperes to satisfy the filament requirements of the particular amplifier tube employed.

Control switches SF1, SL1, and SH1 are interconnected with the primaries of transformers T1, T2, and T3 so that plate voltage cannot be applied to the exciter section by closing SL1 unless filament switch SF1 has been previously closed. Plate voltage cannot be applied to the amplifier stage by closing SH1 until both SF1 and SL1 have been previously closed.

METERING—A standard 0–150 or 0–200 DC milliammeter is used for taking amplifier plate and grid current readings. By means of a DPDT toggle switch, the meter either connects across resistor R8 to provide grid current readings or across resistor R13 to provide plate current readings. The 68 ohm values of these resistors are very low compared to the resistance of the circuits in which they are placed and therefore their effect on these circuits is insignificant. Conversely, their resistances are high compared to the terminal resistance of the meter and their shunting effect upon the meter is negligible. This arrangement makes for a simple meter switching system without disturbing the operation of the plate and grid circuits of the amplifier or upsetting the accuracy of the meter.

KEYING—An advantage of using the inverted plate potential system for the exciter section is the ability to key simultaneously the screens of VT1 and VT2, through suitable voltage dropping resistors, R4 and R7, to ground. To ensure complete plate current cut-off of VT1 when the key contacts are open, a small amount of supply current is bled, by means of R3, through cathode bias resistor R2. Thus, "break-in" operation is possible. Capacitor C6 and resistor R14 form a key click filter, reducing arcing at the key contacts to a minimum.

Amplifier tuning capacitor, C15, requires certain preparation before mounting. If this component is held with the stator plates resting in the palm of the hand and the long shaft end facing you, it may be noted whether the rotor wiping contactor, found at the center of the capacitor, fans out to the frame tie rod to the left or to the right. In the ST-202-A, it is desired to have this contact at the left, and, where necessary, it may be easily changed to the correct position.

Another preparatory operation on this capacitor is the addition of a solder lug to the front stator terminal and a solder lug to the rear stator terminal, both on the left side, as determined by holding the capacitor as described in the preceding paragraph. The lugs supplied are bent and should be affixed to the end screws of the capacitor so that their free ends face toward each other.

In the envelope accompanying capacitor C15 will be found mounting brackets and screws. Fasten these brackets to the capacitor end frames by means of the screws and tapped holes on the end frames. Should the brackets have more than two holes on their upright sides, select the pairs of holes that will position C15 closer to the chassis. Mounting feet of the brackets should face outward from the capacitor.

It should be noted that the two contact terminal board, TS1, which provides connections for an external amplitude modulator, should be mounted to recede 1/4" behind the appropriate rectangular opening at the rear of the cabinet. This is done as a factor of safety since the terminals carry the full amplifier plate potential. The lugs should face the bottom of the cabinet.

Mount the five contact, terminal board, TS2, flush against the outside of the other rectangular opening at the rear of the cabinet. The lugs should face the bottom of the cabinet.

Mount each antenna terminal by taking a metal terminal stud and placing over the threaded end a metal washer, the male ceramic bushing, and a fiber washer. Feed through the cabinet hole from the inside and add another fiber washer, the female ceramic bushing, another metal washer, a soldering lug, and 5/16" diameter hexagon nut to the threaded end of the stud on the outside of the cabinet.

Place C17 and C18, the 2 mfd. 1,500 volt filter capacitors, in their alloted holes, add the large lockwashers over the insulated, threaded, terminal bushings beneath the chassis, and tighten the large hexagonal nuts thereto. These assemblies should be oriented so that their terminals align in a row parallel to the side wall of the cabinet.

Affix dual electrolytic filter capacitor, C16a and C16b, in the 3/4" diameter hole with the supplied locknut.

Fifty watt bleeder resistor, R12, mounts beneath the chassis by means of the clip type brackets supplied for it. Fasten the rear bracket on the screw holding the filter choke, CH2, by adding a lockwasher and nut. For the front bracket, fasten a 6–32 x 3/8" long screw, lockwasher, and nut in the chassis hole behind the last crystal socket. In addition, add the bracket, a soldering lug, and a 6–32 nut. This serves to elevate the front bracket to approximate the level of the other bracket.

The band-switching assembly, BSA, mounts on the provided bracket with the two higher frequency coils near the chassis. A panel bushing is used where the BSA shaft protrudes through the panel. With the hardware removed from the threaded shank of the band-switch, advance the assembly into place by feeding the shaft a short distance through the 3/8" diameter hole in the bracket, slip the switch's lockwasher and nut onto the shaft between the bracket and the front panel, add the nut from the panel bushing onto the shaft while it is in the same position, push the BSA completely against the bracket so that the shaft now protrudes through the front panel hole, and slip the panel bushing over the shaft from the front into the panel hole. Then tighten the BSA lockwasher and nut to fix the BSA to the bracket, and take up the other nut on the panel bushing to fasten it to the front panel.

Mount exciter tuning capacitor C9 directly on the front panel using its threaded shank and hexagonal nuts. The first nut on the shank should be positioned so that when a lockwasher is added, a portion of the threaded shank protrudes sufficiently through the panel to fully engage the other nut to be used on the front. Before C9 is firmly affixed, the body of the capacitor should be held in place so that the stator plates are close to the BSA as depicted in the bottom view photograph.

Use the hardware accompanying the fuse receptacle to mount it on the rear wall of the cabinet in the 1/2" diameter hole. Place the rubber washer on the assembly first so that it rests between the head of the fuse receptacle and the cabinet. Add the lockwasher and nut on the other side.

In the large hole centered between the toggle switch holes on the front of the panel, mount the pilot light assembly with the flat portion of its bracket against the chassis.

Affix tuning knobs to the shafts of the variable capacitors so that, when the capacitors are set at maximum capacitance, the white pointer lines align with figure 10 of the dial calibrations. Fasten a knob on the shaft of the BAND SELECTOR switch so that the white line aligns with the 10–11 marker when the rotor is at its extreme, left position. The white line on the knob should align with the number 1 marker of the CHANNEL SELECTOR when the crystal switch is mounted and its rotor is at the extreme, left position.

It will be found convenient to mount the crystal switch, toggle switches, and meter during the wiring procedure as will be specified later.

CIRCUIT WIRING

In general, wiring of the ST-202-A may be broadly classified into three phases: that accomplished by the prefabricated cables, that done by the various flexible leads not contained in the cables, and that associated with the RF circuit components and bus bars.

An extra schematic diagram is supplied for use in the wiring process. Note that the heavier lines on the diagram denote the leads contained in the cables. Therefore, the diagram automatically records the extent of wiring accomplished by installation of the cables. It is advantageous to expand this tally of the wiring by drawing, with a pen or colored pencil, over the thinner diagramatic lines as the respective connections which they represent are progressively added to the chassis. This procedure eliminates any possibility of confusion.

It may be mentioned here that good electrical and mechanical junctions not only provide dependable, electrical contacts but also result in neat, orderly appearance. Wires should be well wrapped and snugly shaped around contacts by means of long-nose pliers. Rosin core solder should be adequately, but not excessively, applied along with sufficient heat from the soldering iron to result in a smooth flow into the joint. Wiping off superfluous rosin with a small piece of rag immediately after the melted solder has "set" around a joint produces a clean looking connection.

Tabulated below are prepared leads which should be installed first. Connections marked with an asterisk are not yet to be soldered, as other leads are to be added at these specified points. Those not marked should be soldered as they are placed into position.

INSTALLATION OF PREPARED LEADS

LEAD		CONNECTION	
COLOR	LENGTH (inches)	FROM	TO
Red	6	Lug #4 on T1	Contact #6 of VT4 socket
Red	5¼	Lug #8 on T1	Contact #4 of VT4 socket
Red	4¼	Lug #2 on T2	Contact #6 of VT5 socket
Red	6	Lug #10 on T2	Contact #4 of VT5 socket
Blue	8	Lug #8 on T3†	Contact #4 of VT3 socket*
twist			
Blue	8	Lug #2, 4, or 6 on T3†	Contact #1 of VT3 socket*
Red	5	Front lug of rear capacitor, C17*	Rear lug of R12*
Yellow	8	Lug #3 on T3*	Rear lug of front capacitor C18*
Brown-Yellow	3¼	Lug B of R10 mounting strip*	Lug A of R11 mounting strip*
Slate	7	Lug A of mounting strip near VT2*	Contact #6 of VT1 socket*
Green	6	Contact #2 of VT2 socket*	Contact #7 of VT1 socket*
twist			
Green	6	Contact #7 of VT2 socket*	Contact #2 of VT1 socket*
Green	10½	Contact #2 of VT1 socket, via grommet	Shell lug of pilot light socket
Green	10	Contact #7 of VT1 socket, via grommet	Center lug of pilot light socket
Black	4	C.T. lug of R9	Lug #7 on T3*

†At this time, connect the end leads of resistor R9 across the lugs on T3 to which the blue filament leads are to be affixed

In this section of the manual, reference is made to four, two-lug mounting strips. Differentiation of the two lugs on each strip is made by viewing the strip on the chassis with the mounting foot facing you and calling the lug to the left, A and the lug to the right, B.

The next operation involves the small, laced cable having four wires. Lay this cable against the chassis parallel to the mounting strips for R10 and R11 along the side adjacent to T3. The longer, free lead ends should fan out toward the sockets for VT4 and VT5. At the T3 end of the cable, connect the short, yellow lead to lug #1, the long, yellow lead to lug #3, the short, blue-yellow lead to lug #5, and the long, blue-yellow lead to lug #7. Leave the last mentioned terminal unsoldered since two more leads are yet to be joined at this point. At the other end of this cable, connect the short, yellow lead to socket contact #2 of VT5 and the long, yellow lead to contact #8 of the same socket. Connect the short, blue-yellow lead to socket contact #2 of VT4 and the long, blue-yellow lead to contact #8 of the same socket.

The large, cabled harness may now be fitted to the chassis. Begin by feeding the loose ends of the group made up of the black-brown, black-yellow, black-green and black-red leads through the grommet hole in the right front corner on the chassis. Feed the black, red-yellow, brown, and brown-yellow leads at the same corner of the cable through the adjacent grommet hole. The main body of the cable should be fitted snugly along the seams formed where the chassis joins the cabinet side and back. A long appendage comes out of the cable at the back of the cabinet near TS1 and should be positioned against the chassis between CH2 and T1 and continued around the forward edge of T3.

Lead ends of the cable may be treated in groups as they emerge from the cable. Each of the next several paragraphs is titled with the name of the component to which associated groups or cable leads connect.

TRANSFORMER T2—Black-red lead to lug #3. Black-white lead to lug #7 along with one of the 117 volt line cord leads. (The line cord is first fed through the grommet at the rear of the cabinet. A knot is tied on it leaving about five inches of cable inside the cabinet with the leads separated down to the knot.) Red-yellow lead to lug #6.

FUSE HOLDER—Black-brown lead to side lug. Remaining lead of line cord to end lug.

SOCKET FOR VT4—One slate lead to contact #3. Other slate lead to contact #7. (Add resistor R14 across contacts #3 and #7.)

TERMINAL BOARD TS2—Two black leads to lug #1. Slate lead to lug #2. Black-yellow lead to lug #3. Black-green lead to lug #4. Two black-white leads to lug #5.

TRANSFORMER T1—Two black-green leads to lug #3. Two black-white leads to lug #7. (Not included in the cable are a lead from CH1, choke above chassis, and a negative lead from C16 which both connect to lug #6.)

TERMINAL BOARD TS1—One red lead to one lug on TS1. Other red lead to other lug on TS1.

FILTER CAPACITOR C17—Two red-yellow leads to rear terminal. (One lead from CH2, choke below chassis, connects to other terminal of C17, where a red lead has already been attached. Solder.)

FILTER CAPACITOR C18—Two red-yellow leads to front terminal. (Other lead from CH2, choke below chassis, connects to rear terminal of C18, where a yellow lead has already been attached. Solder.)

BLEEDER RESISTOR R12—Red lead to rear lug. Two red-yellow leads to front lug. (This junction is not to be soldered as yet since R13 and C19 are to be attached later.)

R11 MOUNTING STRIP—Brown-yellow lead to lug A. Two black leads to lug B. (Add two positive leads from C16a and C16b to lug B and mount resistor R11 across lugs A and B.

R10 MOUNTING STRIP—Brown-yellow lead to lug B. Red-blue lead to lug A. (Add remaining lead from CH1, choke above chassis, and remaining negative lead from C16 to lug A. Mount resistor R10 across lugs A and B.)

TRANSFORMER T3—Two black leads to lug #7. Two black-yellow leads to lug #9. Black-white lead to lug #11. One green lead to lug #12. Other green lead to lug #10.

TWO LUG TERMINAL STRIP (Behind VT2)—Slate lead to lug A. Red-blue lead to lug B. (These connections left unsoldered until other leads and parts are added later.)

SOCKET FOR VT2—One green lead to contact #2. Other green lead to contact #7.

BAND SWITCH ASSEMBLY—Black lead to rear plate lug near VT2. (Not to be soldered until later.)

TWO LUG TERMINAL STRIP (Behind VT3)—Brown lead to lug A. Brown-yellow lead to lug B. (Add resistor R8 across lugs A and B and RFC L3 between lug A and contact #3 of VT3, but do not solder latter contact as yet.)

RFC L4—Red lead through small grommet to lower lug of L4.

It will be found easier to connect the cable leads above the chassis to the toggle switches before the switches are actually mounted. The longer leads which reach to the farther switches should be routed under the shanks of the switches they pass by. The three SPST toggle switches, when wired, should be held with their terminals facing to the right.

Beginning with the filament switch, SF1, which is to be mounted at the extreme left of the switch row, connect the black-brown lead to the upper terminal and the separate, 3½″ black-yellow lead to the lower terminal. Next in line is the low voltage, supply switch, SL1. Connect the short, black-yellow lead from SF1 and the black-yellow, cable lead together to its upper terminal and the separate, 6½″ black-green lead to its lower terminal. At the extreme right is to be mounted the high voltage, supply switch, SH1. Connect the separate, black-green lead from SL1 and the black-green, cable lead together to its upper terminal and the black-red lead to its lower terminal.

Before wiring to meter switch SM1, which is the DPDT unit, the separate 7″ black and red leads should be prepared by affixing a meter lug to the end of each lead. Then connect the black lead to the lower, center terminal of SM1 and the red lead to the upper center terminal. Now add the red-yellow lead to the lower, right terminal, the black lead to the upper, right terminal, the brown lead to the lower, left terminal, and the brown-yellow lead to the upper, left terminal.

These toggle switches may now be mounted. Adjust the hexagonal nut on the threaded shank of each switch so that just sufficient thread length will protrude through the front panel to fully engage the knurled nut placed on the front. Tighten the hexagonal nuts with an open end-wrench while holding the switches in position.

The meter may now be mounted. Twist together the leads coming from SM1 and attach the red wire to the positive terminal of the meter and the black wire to the negative terminal of the meter by means of the affixed meter lugs.

The final phase of the wiring procedure is begun by connecting together, in a row, one lug of each crystal socket, on the side nearest VT1 and VT2, with a length of the #16 bus bar wire. This grounding bus should protrude through the rear, crystal socket lug sufficiently to contact the soldering lug on the forward mounting bracket for R12. Run another piece of #16 wire from the grounded terminal of the fourth crystal socket to the #1 socket contact of VT1, but do not as yet solder at the latter point.

Crystal switch SX1 should be prepared by affixing #16 bus leads to its six stator contacts before it is mounted. With the switch held so that the ceramic wafer is facing upward and the stator lugs outward, put a 3½″ lead on the left stator contact, a 2¾″ lead on the next contact, a 2″ lead on the next contact, a 1¾″ lead on the next contact, a 2¼″ lead on the next contact and a 2¾″ lead on the last and the farthest right, stator contact. Then mount the switch with the group of stator contacts toward the chassis and rotate it to an angle discernable on the under chassis photograph by noting the position of the detent action spring. Use the large lockwasher on the threaded bushing behind the panel and tighten the provided nut from the front of the panel. Now connect the 2¾″ lead from the farthest right stator contact to the free terminal of the front crystal socket, connect the 2¼″ lead from the next switch contact to the free terminal of the second crystal socket, and progressively repeat this procedure until all six stator contacts of the switch are wired to all six terminals of the crystal sockets.

Using the #14 solid wire, form a set of bus wires in accordance with the drawings of Figure 5. They will be referred to by the letters identifying them on the drawings. Notice the information on Figure 5 describing the points to which the ends of the buses connect.

Anchor one end of Bus A on SX1 by placing it into the blank hole, on the ceramic wafer, directly opposite the switch contact which connects to crystal socket #4. Mount the other end of Bus A on lug B of the terminal strip behind the VT2 socket and solder. It should be mentioned here that the bus wire just installed does not ground directly to the chassis but is later by-passed to ground. On the schematic diagram, this bus is shown as a double line and is associated with components that return to it in the inverted exciter circuit. The DC potential of this line is 350 volts negative with respect to actual ground.

Install Bus B between the #1 socket contact of VT1 and the lug on the rear plate of the band-switching assembly, near VT2, on which a black cable wire has already been attached, and solder. Solder a short piece of the #14 solid wire from the #1 socket contact of VT2 directly to this bus wire.

Run Bus C from the #3 socket contact of VT2 to the stator terminal, near the chassis, of C9. Connect a very short length of #16 solid wire from the band-switch rotor contact, close to L10, the coil with the fewest turns, to the nearest point on Bus C.

Insert Bus D between the #3 socket contact of VT1 to the other rotor contact of the band-switch near inductor L40.

Place Bus E between the rotor lug of C9 and the lug remaining on the rear plate of the band-switching assembly. Run a piece of #16 solid wire from the single lug on the front of the band-switch wafer to the nearest point on Bus E.

The table that follows lists, in convenient mounting order, various component parts and their positions in the circuits. Asterisks denote that soldering should be deferred at the points so marked until other parts are added.

COMPONENT	ORIENTATION	CONNECTS BETWEEN
R4	horizontal	#6 contact of VT1 and #4 contact of VT1*
C1	vertical	#5 contact of VT1* and rotor contact of SX1
R1	vertical	#5 contact of VT1 and Bus A
L1	horizontal	#8 contact of VT1* and #6 contact of VT2*
C2	across VT1	#4 contact of VT1 and #8 contact of VT1*
C3	vertical	#8 contact of VT1 and Bus A
C4	horizontal	#3 contact of VT1 and #5 contact of VT2*
L2	vertical	#1 contact of VT1 and Bus D (near BS1 contact)
R2	vertical	#6 contact of VT2* and Bus A
R3	vertical	#6 contact of VT2 and Bus B
R5	vertical	#5 contact of VT2 and Bus A
R6	vertical	#8 contact of VT2*and Bus A
C5	vertical	#8 contact of VT2 and Bus A
C7	vertical	#4 contact of VT2* and Bus B
R7	horizontal	#4 contact of VT2 and lug A on mounting strip behind VT2*
C6	vertical	lug A on mounting strip behind VT2 and Bus B
C8	horizontal	Bus A and Bus B
R13	horizontal	front lug of R12* and Bus B
C19	horizontal	front lug of R12 and ground lug on mounting bracket of R12

Figure 1. ST-202-A Front View

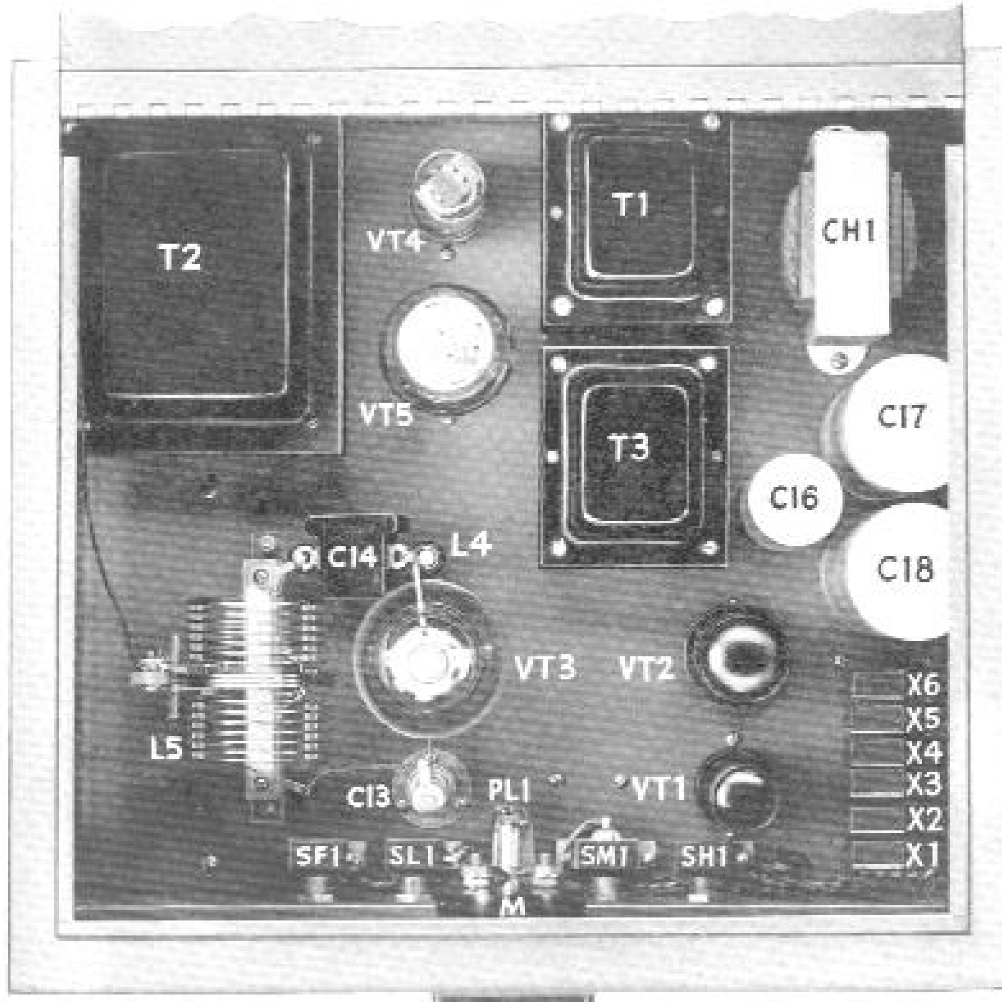


Figure 2. ST-202-A Above Chassis View

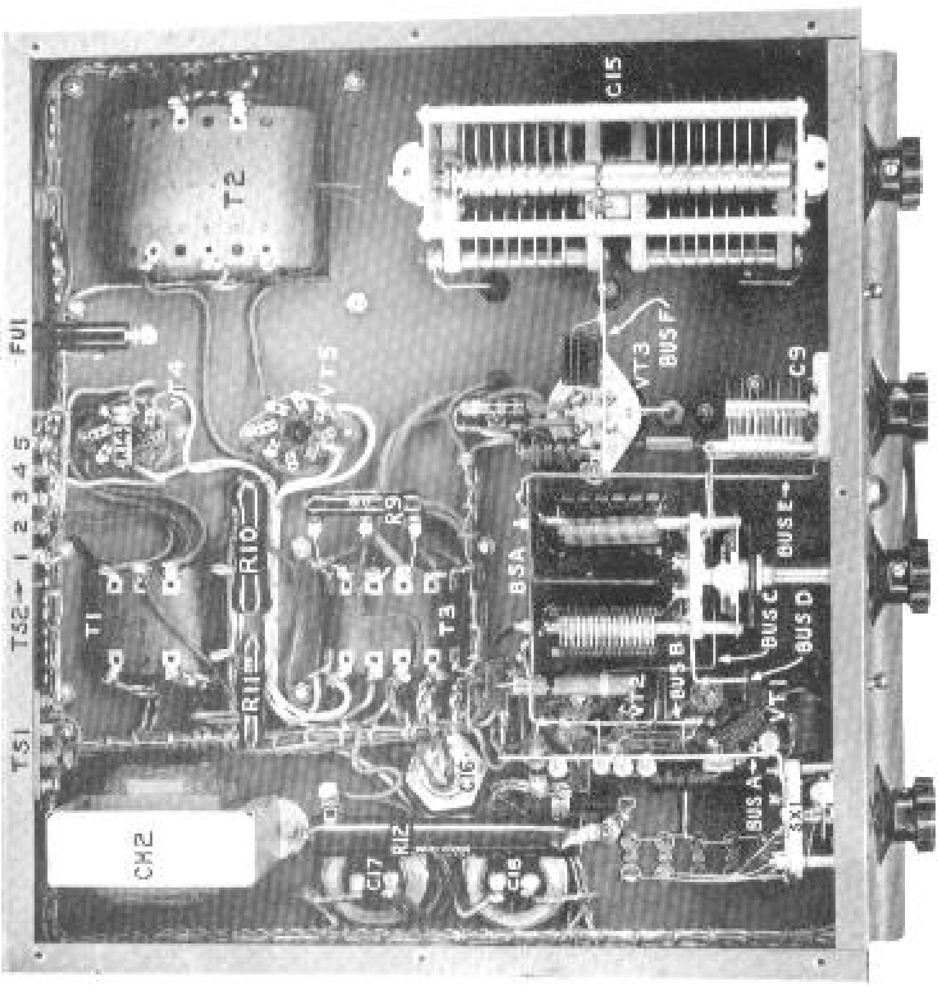


Figure 3. ST-202-A Under Chassis View

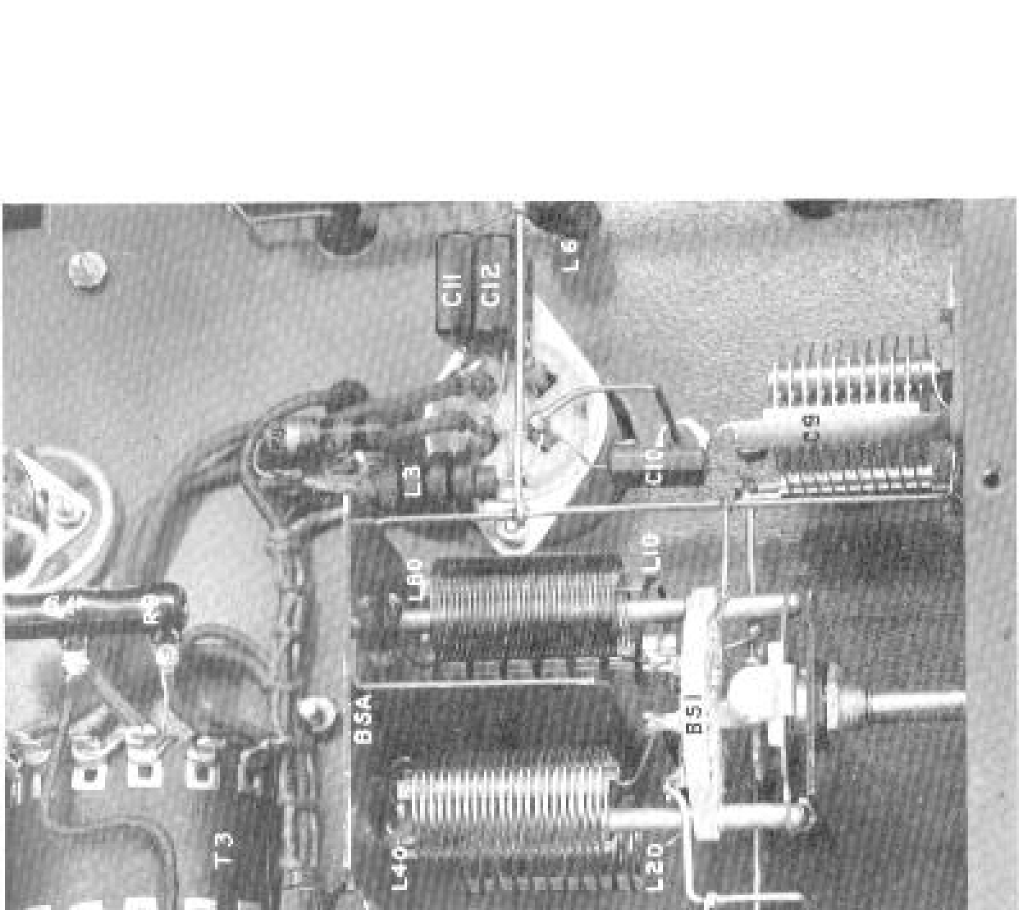


Figure 1. ST-202-A Under Chassis Close-Up

From the lower terminal of neutralizing capacitor C13 and through the opening in the polystyrene bushing, run a piece of #14 solid wire to the #3 socket contact of VT3 and, at the same time, connect C10 between the #3 socket contact and the stator terminal of C9. If the 35TG or HK54 tubes have been chosen for VT3 (these tubes have their grid connections protruding from the sides of their glass envelopes), a flexible lead should be added to the lower terminal of C13 with a suitable clip on the free end so that the grid terminal of the tube may be contacted. Grid terminals of the 35T, 811, and 5514 come out at base pin #3 which automatically contacts socket terminal #3.

Returning below the chassis, capacitors C11 and C12 should be added between the filament contacts of the VT3 socket (#1 and #4) to the grounding bus wire crossing the socket. If this socket is mounted flush with the chassis, C11 and C12 may be mounted vertically between the socket contacts and bus wire, however, if this socket is submounted, it will be necessary for the capacitors to assume a horizontal position.

Capacitor C14 should be held in place so that one of its terminals rests on the top lug of L4 and its other terminal rests on the rear end lug of the jack-bar for L5. Run the 6″ length of bare stranded wire through the lug of C14 and the top lug of L4, bend it around them, and solder. To the other end of the flexible lead, affix a plate clamp suitable for the amplifier tube to be used.

Now, a piece of #14 bare wire should be soldered to the rear stator lug of C15 with a right angle bend having been made in the wire so that it will pass through the center of the ½″ diameter chassis hole and continue up above the chassis through the rear jack-bar lug and C14 lug where it should be securely bent around both lugs and soldered.

Feed a longer piece of #14 bare wire from below the chassis through the center of the front ½″ diameter hole, up through the front jack-bar lug, and over to the top terminal of C13. Wrap it around this terminal and solder. Where it passes through the jack-bar lug, it should be crimped against the lug and soldered. Below the chassis, make a right angle bend and solder the end of the wire to the front stator lug of C15.

Use a short piece of #14 bare wire as a jumper between the two inner lugs of the jack-bar assembly. Between Bus F below the chassis and the ¼″ grommeted hole near C15, mount L6 with one of its leads protruding above the chassis. Connect this lead to the jack-bar jumper.

And finally, use the 150 ohm, twin lead-line to complete the circuit from the swinging link coil lugs to the soldering studs of the antenna terminals.

Before any attempt is made to operate the ST-202-A, the constructor should check thoroughly the accuracy of his work while reviewing all of the facilities contained in this manual.

ADJUSTMENT AND OPERATION

WARNING DANGEROUS HIGH VOLTAGES ARE DEVELOPED IN THE ST-202-A TRANSMITTER. ***Any person who operates or handles this transmitter should be fully aware of and alert to the presence of lethal electrical potentials. No attempt to change amplifier coils, tubes, crystals, etc. should be made without first turning off all switches. It would be wise to form a habit of turning OFF all switches before the cabinet lid is opened. Extreme care should be taken to avoid bodily contact with any circuit components when the bottom plate of the transmitter is removed for any purpose whatsoever. The operator should also be aware of the presence of various voltages on the terminals at the rear of the cabinet.***

CONTROLS

Referring to Figure 1, the identity and function of the ST-202-A panel controls are as follows:

FILAMENT SWITCH—The function of the toggle switch marked FIL is to turn ON or OFF the filaments of all tubes. To allow the filaments to reach a satisfactory operating temperature, the FIL switch should be turned ON to provide a pre-heating period of approximately one minute before applying plate and screen voltages.

LOW VOLTAGE SWITCH—The primary function of the toggle switch marked LV is to turn ON or OFF the 350 volt DC supply to the exciter stages and bias to the amplifier stage. With this switch ON and the HV switch OFF, tuning of the exciter section may be accomplished safely without having the 1,000 volt DC supply on before the amplifier is to be tuned. Another purpose of the LV switch is to act as the transmitter standby control during communications since it is interconnected with the high voltage switch in such a manner that the latter is ineffectual until the LV switch is turned ON. Where remote control of transmit-standby periods is desired, a SPST toggle switch may be mounted in a convenient operating position and wired to terminals #3 and #4 of terminal board TS2 located at the rear of the cabinet. The remote switch is then in parallel with the LV panel switch and assumes control if the LV switch is left in the OFF position.

HIGH VOLTAGE SWITCH—The function of the toggle switch marked HV is to turn ON or OFF the 1,000 volt DC supply to the amplifier stage. This switch should be turned ON when it is desired to tune the amplifier only after the exciter section has been already adjusted properly. During transmit-standby operating periods, the HV switch must be left in the ON position so that the amplifier's plate supply will be controlled along with the exciter's plate supply.

METER SWITCH—The function of the toggle switch marked MA is to switch the milliammeter to the I_g position when it is desired to read amplifier grid current or to the I_p position when it is desired to read amplifier plate current.

BAND SELECTOR—The function of this four position, rotary switch is to condition the exciter stages so that RF grid excitation will be provided for the final amplifier tube on any of the frequency bands marked around the dial. The panel is labeled with the traditional wavelength (in meters) nomenclature.

CHANNEL SELECTOR—The function of this six position, rotary switch is to provide convenient selection of any of six quartz crystals which can be installed to determine the operating frequency channels of the transmitter.

EXCITER TUNING—Rotation of this dial varies the capacitance of C9. Resonance of the tank circuit which it tunes is attained when a setting is found that produces a peak I_g reading on the meter. The TABLE OF OPERATION lists approximate dial settings for the various bands.

AMPLIFIER TUNING—Rotation of this dial varies the capacitance of C15. Resonance of the tank circuit which it tunes is attained when a setting is found that produces a minimum I_p reading on the meter. The extent or depth of plate current dip varies with the degree of antenna loading.

PILOT LIGHT—This red light indicates that the AC line is completed to the filament transformer as soon as the FIL switch is turned ON. It is not affected by LV and HV switching and, therefore, is not indicative of the absence or presence of high voltages inside the ST-202-A cabinet.

TUNING PROCEDURE

Assuming that the ST-202-A has been readied for operation, e.g., bottom plate has been affixed, tubes, crystals, and fuse inserted in proper receptacles, and a wire jumper connected across the terminals of TS1, the tuning procedure may now be described. For this purpose, operation of the transmitter may be arbitrarily chosen on the 20 meter amateur band as typical for adjustment on any other band. An exact channel frequency of 14,100 kilocycles may be named. Consultation with the TABLE OF OPERATION reveals that a crystal frequency of one-half the channel frequency, 7050 kcs., is required. Further, the 20 meter amplifier tank coil should be inserted in the jack-bar for L5 and the BAND SELECTOR switch rotated to 15–20. The keying circuit must be completed before tuning can begin.

EXCITER TUNING- Turn the FIL switch ON and permit tube filaments to heat. With the meter switch in the I_g position, turn the LV switch ON and rotate the EXCITER TUNING dial to establish maximum I_g current. (When the band switch is in its present position, output from the exciter may be obtained on either 15 or 20 meters as determined by the setting of C9. Therefore, two I_g peaks will be noticed when tuning the exciter variable capacitor through its entire range, one near minimum capacitance and another near maximum capacitance. The peak which occurs at the higher dial setting is the correct one for 20 meter operation.) Approximate amplifier grid current figures per band for each of the various amplifier tubes recommended may be found on the TABLE OF OPERATION. Some deviation from the figures specified may obtain because of such factors entering into the results as degree of crystal activity and electronic emission of tubes.

NEUTRALIZATION—*CAUTION*—To avoid bodily contact with 1,000 volts DC, the HV switch must be in the OFF position throughout the neutralizing procedure. Of secondary importance, it should be realized that plate voltage on the amplifier tube is not functionally desirable while neutralizing. Neutralization of the RF amplifier, when once accomplished, should remain substantially in adjustment on all bands.

Connect a 6.3 volt, 150 milliampere, pilot light across the antenna terminal and advance the antenna, pick-up coil for maximum coupling to L5. With the LV switch ON, the HV switch OFF, and the EXCITER TUNING dial adjusted for maximum I_g, rotate the AMPLIFIER TUNING dial until a resonant setting is found that produces maximum brilliance of the pilot light at the antenna terminals. Using an insulated screwdriver, preferably a "low capacity" neutralizing tool, engage the slotted adjusting screw of neutralizing capacitor C13 and slowly rotate it through its range until a setting is found that causes the pilot light's filament to go nearly or completely out. Carefully readjust C15 to find if the light can be made to brighten. If it does, slightly readjust C13 for minimum incandescence. A barely, discernable glow may still prevail at the point of neutralization of a tube of high, interelectrode capacitance, while the light can be expected to go out completely with an amplifier tube of low, interelectrode capacitance. Once the absolute minimum is found, the locknut on the threaded adjustment of C13 should be tightened against the metal bushing, while holding the screw adjustor in place with the neutralizing tool, to preserve the neutralization setting.

It should be mentioned that as C15 is swung back and forth through resonance, a well defined deflection of the I_g meter reading will be noticed when the circuit is grossly out of neutralization, but as the point of neutralization is approached, the intensity of the I_g deflection will become less and less pronounced. After complete neutralization, the I_g reading should remain at a substantially constant value as C15 is rotated through its resonant point.

Removal of the neutralizing tool from the screw adjustor of C13 often will cause a slight displacement in the electrical adjustment, since the presence of the tool at C13 adds capacitance to the circuit. Therefore, as neutralization is being closely approached, the tool should be removed between minute adjustments while checking for thoroughness of neutralization.

It is also noteworthy that neutralization should be a well defined point within the range of capacitance of C13 and it should be possible to adjust C13 to either side of that point. Of course, the exact point of neutralization is the proper setting. Where, within the range of C13, neutralization will occur is dependant upon the interelectrode capacitance of the amplifier tube used. With the higher capacity tubes, neutralization will take place at a higher capacity setting of C13, while with the lower capacity tubes, neutralization will take place at a lower capacity setting of C13.

Before proceeding to AMPLIFIER TUNING, remove the pilot light from the antenna terminals of the transmitter as turning ON the HV switch will cause prompt burn-out of this bulb.

AMPLIFIER TUNING—Having neutralized the amplifier, the EXCITER TUNING dial should be rechecked to ascertain that maximum I_g prevails. With the LV switch off, no loading circuit as yet connected to the antenna terminals of the transmitter, and the antenna, pick-up coil swung out for minimum coupling to L5, place the meter switch in the I_p position. Turn the LV and HV switches to the ON positions and quickly adjust the AMPLIFIER TUNING dial to produce a downward dip of plate current to a minimum value, which denotes resonance of the amplifier tank circuit. With the amplifier tank capacitor detuned, plate current will be quite high, in the vicinity of 150 milliamperes or more, but should drop to 20–35 milliamperes at resonance without antenna loading.

It is important that the amplifier tube is not abused by exceeding its heat dissipating capability by allowing the detuned, high current condition to prevail for an appreciable length of time. Therefore, the amplifier tank circuit, resonating adjustment should be accomplished immediately after the HV switch applies high voltage to the amplifier tube.

With all high voltages turned OFF, a suitable antenna may be applied to the output terminals in accordance with information provided in the ANTENNA APPLICATION section of this manual. Preliminarily, the antenna, pick-up coil should be advanced half-way toward L5.

High voltages may be again turned ON. If an antenna system requiring a tuner is employed, adjust the antenna tuning circuit to cause a rise in I_p reading. Now slightly readjust for minimum amplifier plate current which will be higher than without antenna loading. If the resultant minimum dip, plate current is below 100 milliamperes, move the pick-up coil progressively closer to L5, in small steps, until this plate current figure is reached. Remember to turn off high voltages while adjusting the position of the link coil. If plate current above 100–125 milliamperes results, decrease the coupling until the antenna loads the amplifier correctly. Because of loading characteristics peculiar to different antenna systems, changes in degree of antenna coupling and antenna tuning reflect changes in amplifier tank circuit constants. For this reason, each readjustment of the antenna should be followed by careful retuning of the amplifier tank circuit to reestablish the exact point of resonance.

If an antenna system employing a transmission line having a constant impedance characteristic is to be used with the ST-202-A, the amplifier tuning and loading procedure, as already related, fully applies except that those remarks dealing with adjustment of an antenna tuner may be ignored.

Plate power input to the amplifier tube is easily computed by multiplying its plate voltage, 1,000 volts DC, by its plate current in amperes. For example, when the I_p is 100 milliamperes (0.1 ampere), the plate power input to VT3 is exactly 100 watts. At 125 milliamperes (0.125 ampere), the plate power input is 125 watts.

It should be realized that a change in the crystal frequency should be followed by readjustment of the EXCITER TUNING dial, AMPLIFIER TUNING dial and the antenna tuner (if one is used).

While operating radiotelegraphy, I_g and I_p will drop to zero when the key contacts are open. The carrier is completely suppressed and "break-in" operation may be used. Upon closing the key contacts the carrier is released to the extent of the full power output available under the conditions to which the transmitter has been adjusted.

It is important to realize that the full DC potential of the exciter power supply exists across the open contacts of a telegraph key connected to the ST-202-A. In the interest of safety, the more exposed portions of the key (base and armature) should be kept "cold" by connecting them to the #1 terminal of TS2. The "hot" contact of the key should connect to terminal #2 of TS2. When the key contacts are closed, all portions of it are at ground potential. Keying relays are commonly used to isolate the operator from high potentials.

ANTENNA APPLICATION

Although the host of radiating systems that have been developed to satisfy various communication needs are classified in groups depending upon electrical and physical characteristics, in this manual antennas are divided into two general categories as determined by their application to the output terminals of the ST-202-A. The first group consists of radiators that employ transmission lines (feeders) having constant impedance characteristics. The second group contains those systems which employ transmission lines having standing waves and therefore require antenna tuning circuits.

An antenna in the first category is energized at a point where its characteristic impedance is matched by the impedance of the transmission line chosen to feed it. Examples are: the half-wave doublet which is fed at its center with 72 ohm cable, the folded dipole which may be arranged to be fed by a 300 ohm two-wire line, the "J" antenna which may be fed at appropriate points on its matching stub by a two-wire spaced line, and various types of parasitic, colinear and long-wire beams which are generally fed with closely spaced, two-wire, transmission lies. The feeder wires of antenna systems in this group may be connected directly to the output terminals of the ST-202-A, and, assuming that the antenna itself has been properly erected and initially adjusted, no further tuning facilities are required for it in the radio station. The only adjustment consideration is the degree of loading that the antenna imposes upon the output amplifier of the transmitter. This is satisfied by the ability to vary the coupling setting of the pick-up coil in the amplifier's output circuit.

An antenna in the second category is associated with a transmission line whereon, by tuning, standing waves are built up to agree with the high or low impedance point at which the antenna is to be fed. Typical of this group are radiators that are end-fed or center-fed with "Zepp" feeders. This type of antenna is useful for multi-band operation providing that the different bands are harmonically related and the radiating wire is a half wave length long, or multiple thereof, for the lowest frequency band to be used, and that a suitable tuning circuit permitting series or parallel resonance, as the need may be on different bands, is available at the station end of the feed system. This requires a low impendance two-wire line from the output terminals of the ST-202-A to be link coupled to the antenna tuner which, in turn, connects to the antenna feed system. With this system the antenna tuner must be resonated in addition to the usual adjustment of coupling to the output amplifier.

For specific details of importance in the selection of an antenna system, the reader is referred to publications that are devoted to this subject.

RADIOTELEPHONY — AMPLITUDE MODULATION

An audio frequency, amplifier-modulator of conventional design having sufficient overall gain to amplify from the low voltage level of the type of microphone to be used to a power level of approximately 50 watts will be satisfactory to amplitude modulate the ST-202-A.

The amplifier's output modulation transformer should have a secondary impedance of 8,000 to 10,000 ohms and should handle a DC current of 150 milliamperes. The load impedance presented by the ST-202-A Class C amplifier may be computed by dividing the plate voltage of VT3 (1,000 volts) by the plate current (in amperes) to be used.For example, at an I_p of 100 milliamperes (0.1 ampere) the load impedance is 10,000 ohms.

The output of the modulator is, of course, connected to the terminals of TS1 which interposes the secondary of the modulation transformer into the plate supply circuit of the RF amplifier. When reverting back to CW operation, provisions should be included in the modulator to remove the secondary winding of the modulation transformer from the plate supply circuit of the RF amplifier and, at the same time, bridge the terminals of TS1 to complete the plate supply circuit. This may be accomplished by a suitable switching arrangement using components capable of handling the high voltages (both DC and audio voltages) which will prevail at this point of the circuit.

RADIOTELEPHONY—FREQUENCY MODULATION

Narrow band frequency or phase modulation may be applied to the ST-202-A. In the selection of such a modulator, it should be borne in mind that for amateur FM it is generally agreed, at the time of this writing, that a peak modulation index of 1 seems most desirable. The modulation index expresses the ratio between the maximum, modulation frequency and the peak, frequency deviation of the carrier. Thus, as a typical example, a maximum, modulation frequency of 3 kilocycles and a peak, frequency deviation of 3 kilocycles result in a modulation index of 1.

Actual installation of the modulator will depend upon the characteristics of the particular modulator to be used, however as far as introduction of it to the ST-202-A is concerned, it should be considered as replacing a crystal. For instance, for NBFM on the 10 meter band, the output frequency of the modulator should be one-fourth of the channel frequency to be used, just as is required for direct crystal control per the TABLE OF OPERATION. Radio frequency output of the FM modulator may be connected into one of the six crystal receptacles so that its use is made available by means of the CHANNEL SELECTOR switch.

VARIABLE FREQUENCY OPERATION

Where the extreme, intra-band frequency flexibility offered by a good variable frequency oscillator is wanted, such a unit may be connected to the ST-202-A in the same manner as related in the second paragraph of the preceding section dealing with the application of FM. A nominal VFO output power of 2 or 3 watts will suffice to adequately excite VT1.

PARTS MOUNTING TABLE

See Parts Mounting text for complementary mounting detail.

Component	Hardware Used for Each Component
SOCKET, crystal (Six used)	(2) 4–40 X 7/16″ long, round head screw (2) 4–40 X 3/16″ across flats, hexagon nut
SOCKET, octal, brown, for VT1 and VT2. Key slot faces rear.	(2) 6–32 X 3/8″ long, binder head screw (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
SOCKET, octal, black, for VT4 and VT5. Key slot faces front.	(2) 6–32 X 3/8″ long, binder head screw (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
SOCKET, 4 contact, ceramic, for VT3. Lugs 1 & 4 face rear. (Sub-mounting)	(2) 6–32 X 1 1/4″ long, binder head screw (2) 1″ long metal spacer (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
SOCKET, 4 contact, ceramic, for VT3. Lugs 1 & 4 face rear. (Flush mounting)	(2) 6–32 X 3/8″ long, binder head screw (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
JACK-BAR, coil L5. Link coil faces left side of cabinet.	(2) 6–32 X 3/8″ long, binder head screw (2) 3/4″ long metal spacer (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
CAPACITOR, variable, C15. (Amplifier tuning)	(2) metal brackets (4) 6–32 X 1/4″ long, round head screw (2) 6–32 X 3/8″ long, round head screw (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
CAPACITOR, neutralizing, C13. Lugs face rear.	(3) 6–32 X 3/8″ long, round head screw (3) 6–32 X 1/4″ across flats, hexagon nut (3) #6 split lockwasher
BRACKET, for mounting band switch assembly mounting foot faces rear.	(2) 6–32 X 3/8″ long, round head screw (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
RFC, Coil L4. Above chassis. Lugs left. Two lug mounting strip. Beneath chassis. Strip parallel to cabinet sides.	(1) 6–32 X 3/8″ long, round head screw (1) #6 split lockwasher
TERMINAL BOARD, two contact TS1. (Receded mounting)	(2) 6–32 X 1/2″ long, round head screw (2) 1/4″ long, metal sleeve (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
TERMINAL BOARD, five contact TS2.	(2) 6–32 X 3/8″ long, round screw (2) 6–32 X 1/4″ across flats, hexagon nut (2) #6 split lockwasher
TERMINAL, antenna (two used)	(1) 1 1/4″ long stud, 6–32 thread, one end (2) metal washer (2) fiber washer (1) solder lug (1) 6–32 X 5/16″ across flats, hexagon nut
RESISTOR, R12	(2) metal spring brackets (1) 6–32 X 3/8″ long, round head screw (2) 6–32 X 1/4″ across flats, hexagon nut (1) 8–32 X 5/16″ across flats, hexagon nut (1) #6 split lockwasher (1) #8 split lockwasher (1) solder lug

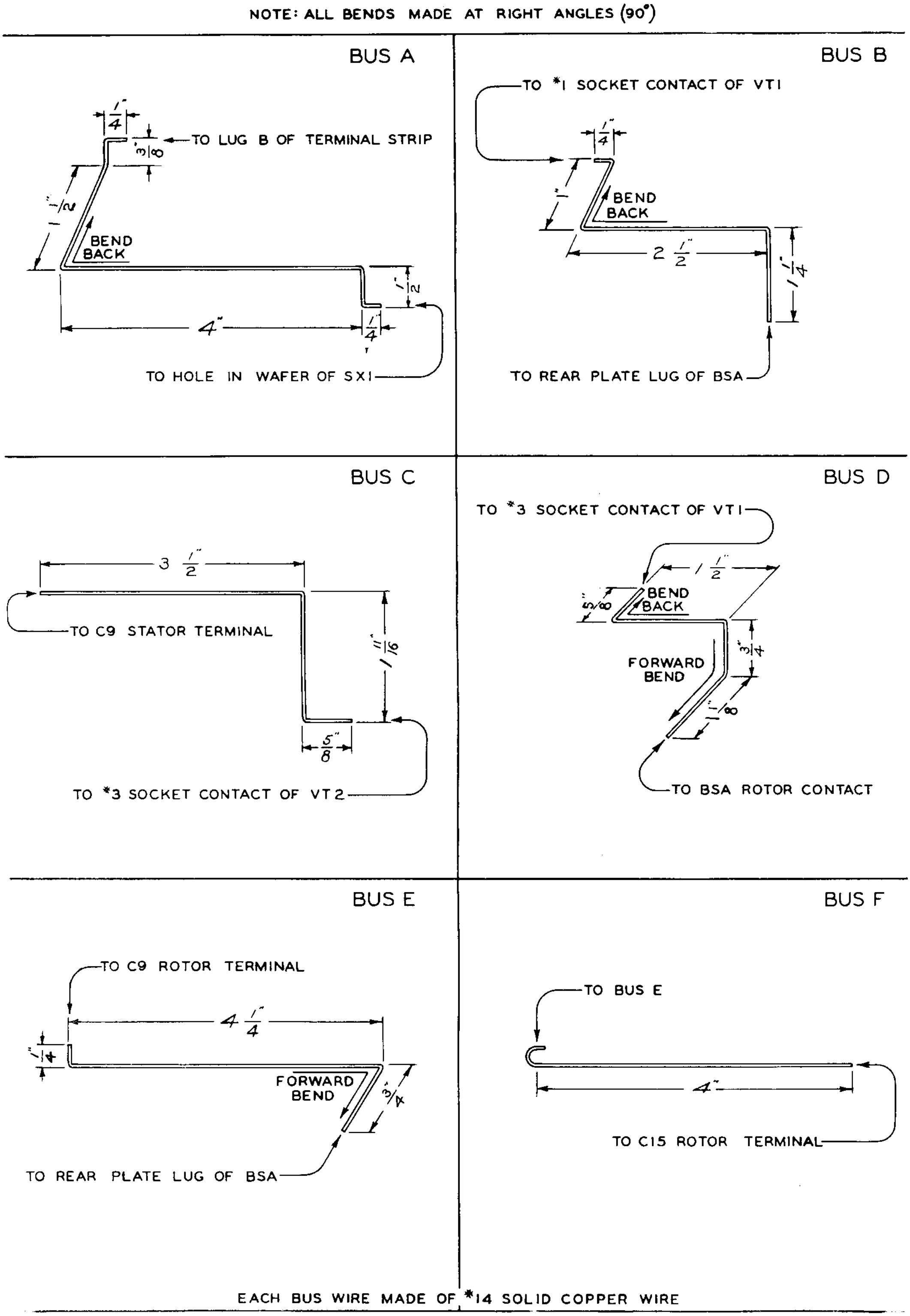


Figure 5. Formation of Bus Wires Used Below Chassis

TABLE OF OPERATION

BAND (meters)	CRYSTAL FREQUENCY	BAND SELECTOR SETTING	AMPLIFIER COIL (L5)	EXCITER TUNING (scale region)	AMPLIFIER GRID CURRENT (I_g)†			
					35T (G)	HK54	811	5514
80	3.5 mc. region. Calibrated to output frequency.	80	80BVL (Barker & Williamson)	Upper half of scale.	45 ma.	43 ma.	50 ma.	50 ma.
40	7.0 mc. region. Calibrated to output frequency.	40	40BVL (Barker & Williamson)	Upper half of scale.	42 ma.	39 ma.	44 ma.	46 ma.
20	7.0 mc. region. Calibrated to ½ output frequency.	15–20	20BVL (Barker & Williamson)	Upper half of scale.	42 ma.	39 ma.	45 ma.	47 ma.
15	7.0 mc. region. Calibrated to ⅓ output frequency.	15–20	15BVL (Barker & Williamson)	Lower half of scale.	36 ma.	33 ma.	36 ma.	40 ma.
10–11	7.0 mc. region. Calibrated to ¼ output frequency.	10–11	10BVL (Barker & Williamson)	Lower half of scale.	42 ma.	38 ma.	42 ma.	45 ma.

†These I_g figures were recorded without the amplifier operating (HV switch OFF). After the amplifier stage has been turned on and fully loaded, an approximate diminution of 25% in these figures will normally prevail.

Filament voltage ratings of amplifier tubes recommended: 35T(G)—5.0 volts, HK54—5.0 volts, 811—6.3 volts, 5514—7.5 volts.

LEGEND TO ST-202-A SCHEMATIC DIAGRAM

DIAGRAM REFERENCE	DESCRIPTION OF COMPONENT	FUNCTION IN CIRCUIT
BSA	Band-switching assembly	Exciter band switch
C1	100 mmfd. 500 w.v. mica capacitor	Oscillator grid isolation
C2	2,000 mmfd. 500 w.v. mica capacitor	Oscillator screen by-pass
C3	100 mmfd. 500 w.v. mica capacitor	Oscillator regeneration throttler
C4	100 mmfd. 500 w.v. mica capacitor	Oscillator output coupler
C5	2,000 mmfd. 500 w.v. mica capacitor	Buffer cathode by-pass
C6	2,000 mmfd. 500 w.v. mica capacitor	Keying circuit filter
C7	2,000 mmfd. 500 w.v. mica capacitor	Buffer screen by-pass
C8	2,000 mmfd. 500 w.v. mica capacitor	Exciter negative bus to ground by-pass
C9	100 mmfd. variable capacitor	Buffer plate tank tuner
C10	100 mmfd. 500 w.v. mica capacitor	Buffer output coupler
C11	2,000 mmfd. 500 w.v. mica capacitor	Amplifier filament by-pass
C12	2,000 mmfd. 500 w.v. mica capacitor	Amplifier filament by-pass
C13	1.8–8.5 mmfd. adjustable capacitor	Amplifier neutralization
C14	500 mmfd. 2,500 w.v. mica capacitor	Amplifier plate coupler
C15	100–100 mmfd. variable capacitor	Amplifier plate tank tuner
C16a, b	8–8 mfd. 450 w.v. electrolytic capacitor	350 volt supply filter
C17	2 mfd. 1,500 w.v. oil capacitor	1,000 volt supply filter
C18	2 mfd. 1,500 w.v. oil capacitor	1,000 volt supply filter
C19	2,000 mmfd. 500 w.v. mica capacitor	Plate metering shunt by-pass
CH1	7 hy. 150 ma. reactor	350 volt supply filter
CH2	7 hy. 150 ma. reactor	1,000 volt supply filter

FU1	5 Ampere 250 volt 3 AG fuse	117 volt AC line fuse
L1	2.5 mh. 50 ma. RFC coil	Oscillator regeneration cathode inductance
L2	2.5 mh. 50 ma. RFC coil	Oscillator plate impedance
L3	2.5 mh. 50 ma. RFC coil	Amplifier grid impedance
L4	2.5 mh. 125 ma. RFC coil	Amplifier plate impedance
L5	150 watt plug-in inductors	Amplifier plate tank coil
L6	2.5 mh. 50 ma. RFC coil	Amplifier tank ground return impedance
L10	10–11 meter inductor	Buffer plate tank coil
L20	15–20 meter inductor	Buffer plate tank coil
L40	40 meter inductor	Buffer/oscillator plate tank coil
L80	80 meter inductor	Buffer/oscillator plate tank coil
M	0–150 or 200 DC milliammeter	Amplifier grid/plate current meter
PL1	6.3 volt 150 ma. bayonet base bulb	AC line voltage indicator
R1	47,000 ohm 1 watt carbon resistor	Oscillator automatic grid bias
R2	1,000 ohm 1 watt carbon resistor	Oscillator cathode bias
R3	270,000 ohm 1 watt carbon resistor	Oscillator cathode cut-off bias
R4	27,000 ohm 1 watt carbon resistor	Oscillator screen voltage reduction
R5	47,000 ohm 1 watt carbon resistor	Buffer automatic grid bias
R6	220 ohm 1 watt carbon resistor	Buffer cathode bias
R7	10,000 ohm 2 watt carbon resistor	Buffer screen voltage reduction
R8	68 ohm 1 watt carbon resistor	Amplifier grid metering shunt
R9	60 ohm C.T. 10 watt wirewound resistor	Amplifier filament center tap return
R10	15,000 ohm 20 watt wirewound resistor	350 volt supply bleeder
R11	1,500 ohm 10 watt wirewound resistor	Amplifier bias voltage divider
R12	50,000 ohm 50 watt wirewound resistor	1,000 volt supply bleeder
R13	68 ohm 1 watt carbon resistor	Amplifier plate metering shunt

LEGEND TO ST-202-A SCHEMATIC DIAGRAM

DIAGRAM REFERENCE	DESCRIPTION OF COMPONENT	FUNCTION IN CIRCUIT
R14	1,000 ohm 1 watt carbon resistor	Keying circuit filter
SB1	3 circuit 4 position rotary switch	Coil selector
SF1	SPST toggle switch	Filament switch
SH1	SPST toggle switch	1,000 volt supply switch
SL1	SPST toggle switch	350 volt supply switch
SM1	DPDT toggle switch	I_g–I_p meter switch
SX1	Single circuit 6 position rotary switch	Crystal selector
T1	748 volts CT @ 125 ma. plate transformer	350 volt supply transformer
T2	1860 volts CT @ 150 ma. plate transformer	1,000 volt supply transformer
T3	Multiple filament transformer	Filament supply
TS1	Two contact terminal board	Terminals for external modulator
TS2	Five contact terminal board	External operating terminals
VT1	Type 6V6 metal tube	Crystal controlled oscillator tube
VT2	Type 6L6 metal tube	Intermediate amplifier-multiplier tube
VT3	Type 35T, 35TG, HK54, 811, or 5514	Final amplifier tube
VT4	Type 5Y3-GT tube	350 volt supply rectifier tube
VT5	Type 5R4-GY tube	1,000 volt supply rectifier tube
X1	1st crystal position	Frequency control
X2	2nd crystal position	Frequency control
X3	3rd crystal position	Frequency control
X4	4th crystal position	Frequency control
X5	5th crystal position	Frequency control
X6	6th crystal position	Frequency control

RMA RESISTOR-CAPACITOR COLOR CODE

The values of small components such as fixed, composition resistors and capacitors, if not directly labeled, are identifiable by a standard color coding system adopted by manufacturers. Listed below, are the code colors and the significant figures which they represent.

Black —0	**Green—5**
Brown —1	**Blue —6**
Red —2	**Violet—7**
Orange—3	**Grey —8**
Yellow —4	**White—9**

RESISTORS—Observe that an insulated carbon resistor has three colored rings in succession across its body. These colors designate the resistance value in ohms and should be translated starting with the end color. The first ring color represents the first digit of the resistance value, the second color represents the second figure, and the third ring color represents the number of zeros following. A fourth ring is sometimes added to indicate the percentage of tolerance, silver for 10% or gold for 5%.

Example: given a carbon a resistor having a red end ring followed by a violet ring and an orange ring. The table gives red as "2", violet as "7", and orange as "3" (indicating three zeros) or a composite figure of 27,000 ohms.

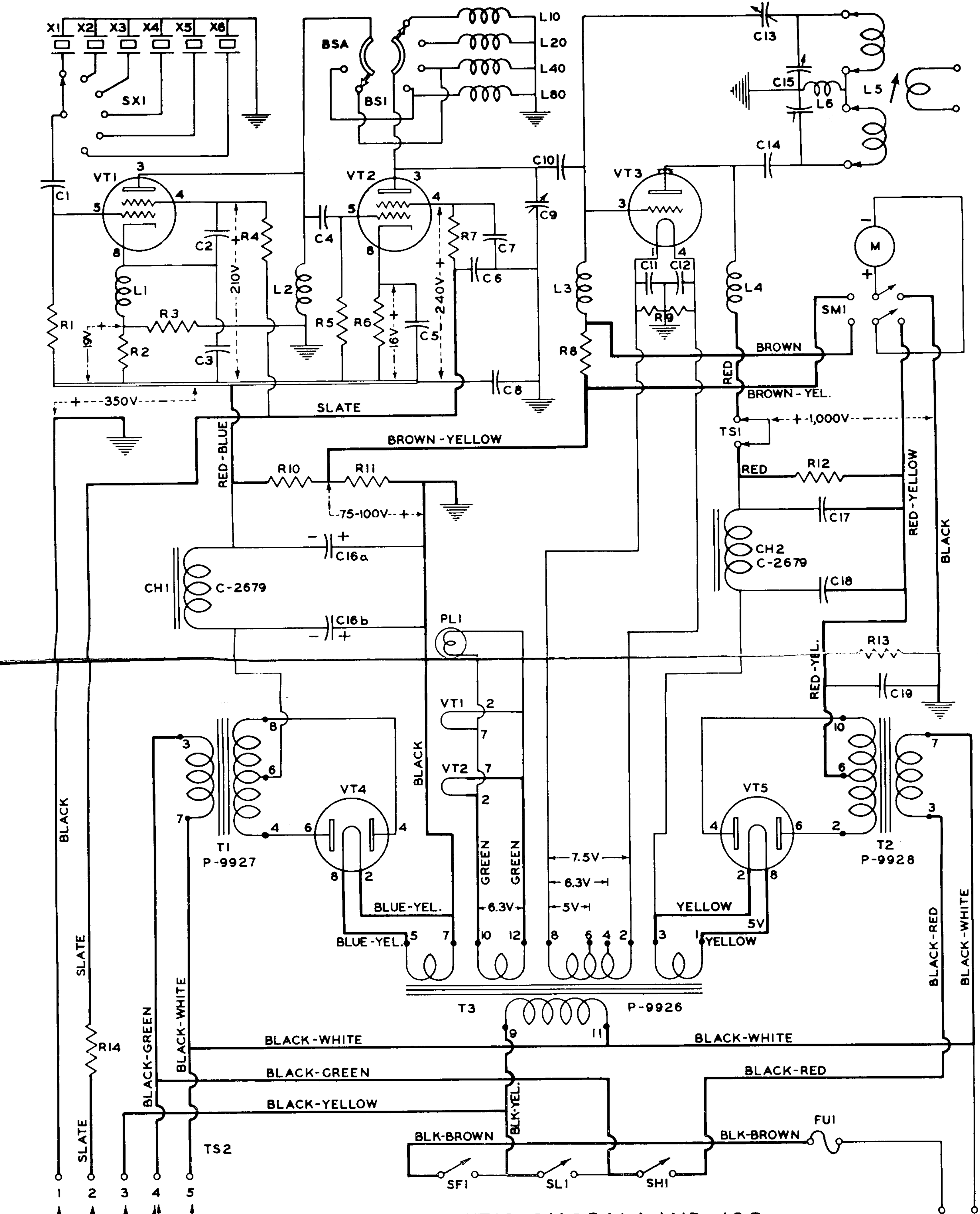
CAPACITORS—Fixed capacitors such as molded mica components display their coding with rows of colored dots to be read in a sequence indicated by the direction of an imprinted arrow. The code is decipherable in mmfds. (micromicrofarads).

If a capacitor has one row of three colored markers, the voltage rating is 500 volts and the value of the capacitance is expressed by the first color representing the first digit of capacitance, the second color represents the second figure, and the third color represeinting the number of zeros following.

Example: given a mica capacitor having a row of brown, black, and brown dots. The table gives brown as "1", black as "0" and brown as "1" (indicating one zero) or a composite figure of 100 mmfds.

When two rows of three colored markers appear on the capacitor, the first three colors of the top row indicate, from left to right, the first three digits of the value of capacitance. The bottom row indicates, from right to left, the number of zeros to be added to the figures represented by the top row and the tolerance and the voltage rating of the component.

Example: given a mica capacitor having a top row of markers with red dot, left, black dot, center, and black dot, right, and a bottom row of markers with brown dot, right, silver dot, center, and green dot, left. Referring to the top row, the table gives red as "2", black as "0", again black as "0". To complete the value designation, we must refer to the right marker of the bottom row which is brown, denoting the addition of one zero, or a composite value of 2,000 mmfds. The silver dot represents a tolerance of 10% of the specified capacitance and the green dot represents a working voltage of 500 volts.



SCHEMATIC DIAGRAM WD-190

FOR ST-202-A TRANSMITTER

DATE 7-1-47 APP'D.

INDICATED DC VOLTAGES MEASURED WITH A 5,000-Ω/VOLT INSTRUMENT (KEY CLOSED AND AMPLIFIER FULLY LOADED.)

Comment is invited concerning criticisms, suggestions, and experiences of Stancor kit users. Such correspondence should be addressed to The Electronic Equipment Division, Standard Transformer Corporation, Elston, Kedzie and Addison, Chicago 18, Illinois.

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STANCOR

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HERE ARE SOME PIX OF THE STANCOR ST-202-A TRANSMITTER
This unit was reworked and put on the air by Ben, W4JLC, who became a silent key at about the turn of the century. Ben liked to paint things red, and he put pink nail polish on any terminal that he had soldered. It has been subsequently used on the air by Al, W8UT, who now owns it and took the following pictures.

More info may be seen at
http://www.boatanchors.org/stancor.htm