

L-T-T
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DEPARTMENT OF TRANSPORT
RADIO DIVISION

REFERENCE DIAGRAM
AND
OPERATING INSTRUCTIONS
FOR

MARCONI 150 WATT RADIO TRANSMITTER
TYPE L-T-T-4 C.W. M.C.W.



DEPARTMENT OF TRANSPORT

RADIO DIVISION

INSTALLING AND OPERATING INSTRUCTIONS
FOR
MARCONI 150-WATT 3-CHANNEL
LONG WAVE MARINE TRANSMITTER
TYPE LTT-4.

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I. GENERAL DESCRIPTION

The type LTT-4 radio transmitter is a modern design for general marine communication purposes. It provides for operation on three preselected frequencies anywhere in the range of 260 - 520 kc (approximately 1150-580 metres) by means of a single wavechange switch lever. Another switch permits operation on either continuous waves or modulated continuous waves, the nominal power output being 150 watts on C-W and 110 watts on M-C-W. The modulating tone may be any one of the three frequencies 500, 700, or 1000 cycles, as selected by means of another switch. This is made possible by the use of a small valve (RVC-10) as a tone generator and grid modulator in place of the old style mechanical chopper with its associated rotating machinery.

The use of a master oscillator provides improved stability of carrier frequency and reduces the effect of variation of aerial constants (such as is produced by rolling, pitching, and tossing of ships in stormy weather) on the wavelength, so that even though the power output may vary considerably under such conditions the received beat note will not shift very much. The keying relay provides for "break in" operation at speeds up to 45 words per minute. This means that no "send receive" switch is necessary and the radio station communicated with can interrupt at any time during operation instead of waiting until the end of the transmission.

The transmitter is completely a-c operated and requires a nominal power input of approximately 6 amps, 115 volts, 60 cycles, at a power factor of 95%. D-C voltages required for high tension circuits are provided by copper-oxide rectifiers. The transmitter and power unit are mounted in a grey painted sheet iron cabinet with a hinged door in front permitting access to all units. This door is provided with a lock and when closed leaves accessible only the essential operating controls. All tuning controls and other permanent adjustments are inside the door and hence are protected against accidental or unauthorized shifting. Valves are accessible for removal or replacement from the front only and both transmitter and power units are conveniently removable from the front for inspection or servicing.

The cabinet is about 24" wide by 20" deep by 44" high and is designed to be secured by heavy bolts to a table or desk. It weighs approximately 360 pounds complete and unpacked.

The high tension copper-oxide rectifier unit is mounted separately. Ten feet of armoured cable are provided to make the necessary connections between the rectifier and power unit. This unit is approximately 21" x 11½" x 14" and is equipped with mounting brackets. It weighs about 84 pounds unpacked.

Where a suitable a-c supply is not available the source of power may be a rotary converter providing an output of 750-1000 volt-amperes at 115 v 60 cycles with an input of 32 v, 110 v, or 220 v d-c as required.

II. TRANSMITTER DESCRIPTION

The circuit of the transmitter comprises a self-controlled master oscillator stage using an RVC-10 valve, driving a neutralized amplifier stage using two RVC-211 valves in push-pull. A second RVC-10 valve acts as a tone generator stage and is transformer

coupled to the grid circuit of the power amplifier. Keying is accomplished by means of a high resistance (R6 in Dwg.) the negative plate return lead to all valves, which biases off t-g, m-o and p-a stages when the key is open and is short-circuited by the keying relay contacts when the key is closed. When using C-W, the CW-MCW switch disconnects both filament and h-t supply from the t-g valve and also short-circuits the secondary of the modulation transformer in the p-a grid circuit. It also reduces the value of the p-a grid leak resistance by shortcircuiting a portion of it for C-W operation.

A Leach keying relay provides break-in operation by automatically connecting the aerial to the receiver (by means of a normally closed back contact) every time the key is opened. The two pairs of heavy contacts on this relay are so arranged that one pair closes the aerial circuit to the transmitter (at its ground end) first and the other pair then closes the h-t circuit by shorting the bias resistor. Upon opening the key the relay keying contacts first open de-energizing the transmitter, the aerial circuit contacts then open, and finally the back contacts close reconnecting the aerial circuit to the receiver. Upon closing the hand key this sequence is reversed, the receiver aerial connection being first broken, the transmitter aerial connection then made, and the transmitter finally energized. As long as the relay contacts remain in proper adjustment so that this sequence of operation is maintained, no sparking should occur at either of the aerial contacts and but very slight sparking at the keying circuit contacts. A spark suppressor circuit (R9, C19) is connected across the keying circuit contacts to absorb any transients which might cause arcing. Another condenser (C30) is connected across the relay coil to absorb the inductive surges due to keying and hence to reduce sparking at the hand key contacts.

Wavechange switching is accomplished by means of a single nickel-plated lever which rotates a shaft linked to the two five-plate sections of the switch proper. This switch connects or disconnects both condensers and coil taps in the m-o and p-a tank circuits, taps in the aerial link and loading circuits, and selects the aerial tuning variometer belonging to the desired channel. A red, green, or yellow pilot lamp lights as the wavechange switch is placed in position for channel A, B, or C. A designation strip is mounted on the front door to permit lettering on a strip of bristol board the wavelength or frequency in use on each channel or any other suitable indication desired.

In addition to the blades connected in the various radio frequency circuits and the pilot lamp switch, the wave-change switch also incorporates a high tension interlock switch. The contacts on this interlock switch are connected in series with the operating coil of the h-t relay in the power unit and are closed only when the wavechange lever is in dead centre position for any one of the three channels A, B, or C. In moving from one position to another the contacts open as soon as the lever starts to move and remain open until the next position is reached, thus preventing any possibility of damage to the switch elements or other parts of the circuits due to arcing at the switch contacts. Thus the wavechange switch may be operated with high tension turned on without causing any damage.

The m-o valve is located in the left-hand side RVC-10 socket and the t-g valve in the right-hand side RVC-10 socket, the p-a valves being located in the two RVC-211 sockets. The three m-o tuning condensers are provided with scales which may be calibrated and are designated A, B, and C to identify the three channels. The p-a

tuning condensers and aerial variometers are similarly designated A, B, and C, and are provided with simple scales which indicate their approximate positions. Maximum variometer inductance occurs at maximum dial reading. Flexible tap leads permit connecting each channel to any portion of the m-o, p-a and aerial loading coils and are also designated A, B, and C. A variable aerial coupling coil facilitates aerial circuit testing and adjustment. Locks are provided on all controls requiring them.

A fixed condenser .002 uf is provided in series with the aerial circuit of Channel A only, so that if a very large aerial is being used the shortest wavelengths within the working range of the transmitter may still be reached and tuned properly. A short-circuiting link permits placing this condenser out of circuit when it is not required. The aerial ammeter is also provided with a short-circuiting switch. Fine tuning in the aerial circuit is accomplished by means of variometers, one of which is provided in each channel.

The aerial coupling and loading circuits are adequate for aerials of 10 to 50 ohms resistance, .001 uf or greater self-capacity and resonant frequency 3000 kc or less. Aerial resistances down to 4 ohms or even less, and shorter aerials with capacity down to .0005 uf or so may also be used, but the power output begins to fall somewhat as very low values of resistance or capacity are reached.

The tone generator and modulator valve is transformer coupled to the p-a grid circuit. Three modulating frequencies are provided by means of taps on the tone transformer, the three taps being brought out to a switch designated 500, 700, and 1000, these being the three frequencies available. Plate supply for the RVC-10 modulator valve is obtained from the 1000 v rectifier through a dropping resistor R8. The m-o RVC-10 valve plate supply is obtained from the same source through a separate potential dropping resistor R2.

A meter is provided which may be plugged into jacks connected in m-o, p-a or t-g cathode circuits or in the p-a grid circuit. Note that cathode current is read, not plate current, the cathode current being the sum of grid and plate currents. If it is desired to determine the actual plate current to the p-a stage, the grid current as registered in Jack 3 must be subtracted from the cathode current as registered in Jack 4, the difference being the true net plate current.

III. POWER UNIT DESCRIPTION.

The power unit incorporates a keying rectifier and the necessary power supply and filter components of the high tension rectifier. The rectifier for the keying relay circuit uses a small full-wave bridge-connected copper-oxide rectifier to provide a d-c output of approximately one-quarter ampere at 32 volts for the Leach keying relay coil circuit. The negative side of the output (and one side of the signalling key) are grounded. One transformer supplies all filaments, the pilot lamp and the copper-oxide rectifier, so that the keying relay can be operated whether h-t is switched on or not. An overload relay is provided in the negative h-t line with an adjustable resistor shunted across its coil to vary the value of current at which it trips. This relay is connected inside the filter condenser so that

it will operate in case of condenser break-down. The filter condenser has a capacity of only 1 uf so as to assist in preventing the key thumps sometimes caused by the use of large condensers in keyed circuits.

Line fuses are provided to protect against very severe overloads such as might be caused by accidental short circuiting of high tension or main line connections. A main line switch is provided and also a high tension switch. Door switches are connected in the h-t relay coil circuit so that h-t is automatically removed whenever the door is opened. A toggle switch is arranged so that h-t can be re-applied with the door open for test purposes. This switch is automatically opened when the door is closed again, so that normal gate switch protection is restored. Two terminals are provided (Nos. 16, 17) in series with the h-t relay coil to permit connecting an external switch at a remote point for h-t switching, if desired.

III-A. HIGH TENSION RECTIFIER DESCRIPTION.

The high tension rectifier is also of the copper-oxide type and hence no time delay is required between filament and h-t switching. On account of its bulk it is mounted in a separate case. It consists of thirty-two units connected to give full-wave rectification. The smoothed output of this unit is approximately 500 ma at 1000 volts d-c. Ten feet of 4-conductor armoured cable are supplied to connect the rectifier unit to the power unit: two for a-c and two for d-c.

If main line switching is also required at a remote point, it may be obtained by inserting a switch in the a-c line and locating it at the desired point. Where a rotary converter is used as the source of a-c power supply, an external switch, hand starter or automatic starter and push button, must be provided to control the converter.

IV. INSTALLING INSTRUCTIONS

A. General Installation Procedure.

When the type LTT-4 transmitter is packed for shipment the power unit, due to the weight of its components, is removed from the cabinet and packed separately to safeguard the frame of the cabinet against possible damage from careless handling in transit. The power unit must therefore be remounted in the cabinet by means of the screws provided. Before doing this the plate at the bottom of the cabinet should be removed and the cabinet bolted into position on the table or desk provided for it. Four 3/8" diameter holes will be found near the corners of the bottom of the cabinet for this purpose. Access to the two rear holes (located near the back of the side members of the framework) is obtained from the front through the space where the power unit will be mounted. The bolts can be dropped through these holes and the holes previously drilled in the table and tightened from underneath. If more convenient access to these mounting holes is desired, the two sides of the cabinet can be removed. The door will also come off at the same time.

In locating the transmitter it is not necessary that space be allowed behind the cabinet. The rear wall of the cabinet is welded to the frame and cannot be removed, hence access to the rear is not necessary. Since all controls are located on the front and all units removable from the front, access to the sides is not essential either. External connections are made to terminals as indicated on the diagram of connections. Three 7/8" diameter holes are provided at each end of the bottom front member of the cabinet frame to permit entry of the connecting leads. Holes are also provided in each side of the cabinet (covered with a small removable plate). Thus, external connections can be run straight

down through the bottom of the cabinet or out through either side. These holes will take standard $\frac{1}{2}$ " conduit fittings. Conduit should be used for the a-c supply line wiring which should be of No. 12 gauge or larger. If the leads or conduits are run down through the bottom openings, holes must be drilled through the table for them before the cabinet is bolted in place. Ground studs are provided on the frame at each end of the lower front cross-bar of the cabinet and a third stud at the bottom of the back of the cabinet. Any or all of these may be used as convenient. The aerial terminal is located at the top of the transmitter unit and is reached through a circular aperture in the top of the cabinet. The shielded aerial lead to the receiver should have not more than one inch of the shielding removed at the terminal and the sheath should extend within the receiver cabinet at the receiver end of the lead.

The high tension rectifier unit may be mounted in the wireless cabin as dictated by convenience, but the rectifier cooling fins must be in a vertical plane. It is recommended that the cable from this unit to the transmitter be run up through the floor of the transmitter rather than through the side. This avoids kinking of the high tension leads. Although ten feet of cable are provided, the cable may be cut to suit the installation.

The earth connection should be made to a large stud through the nearest convenient point on the steel framework of the ship, the paint being carefully scraped off to bare the metal where the stud is mounted. In wooden ships it may be necessary to secure a copper sheet 3 ft x 3 ft, or larger, to the hull below the water line to provide a good earth connection.

The aerial should be well insulated with one or two pyrex or porcelain insulators at each end. Its dimensions are not critical but, in general, it should be as high and as long as possible with the downlead kept as clear as possible of masts, funnels, stays and other grounded metal work. A single wire will be found adequate on all except very small vessels of less than 100 ft or so in length, when it is sometimes desirable to use a two-wire or four-wire aerial.

B. Tuning Procedure

(a) Continuous Waves (C-W).

After the transmitter has been assembled and completely set up and wired in position, it may be tuned to the three wavelengths desired. Leaving the main line and h-t switches open, insert two RVC-10 and two RVC-211 valves in their respective sockets. Pilot lamps should already be in their sockets.

Move the wavechange switch to Channel A (lever pointing towards red jewel). Connect the two flexible leads designed "A" (marked on white tape wrapped around spade lug end of lead) to terminals 1 and 2 on the m-o coil. The shortest wavelength should be used on Channel A and this will usually be 600 metres. If a different wavelength is to be used, the appropriate tap positions may be estimated from the following approximate table:-

<u>Taps</u>	<u>Waverange</u>
1 and 2	580 - 650 metres
3 " 4	630 - 730 "
5 " 6	710 - 810 "
7 " 8	790 - 890 "
9 " 10	870 - 970 "
11 " 12	950 - 1050 "
13 " 14	1030 - 1130 "
15 " 16	1110 - 1210 "

The taps should always be used in pairs, as listed, to keep the circuit symmetrical. For example, tap 1 should be always used in conjunction with tap 2 and not with tap 4.

Disconnect the lead from terminal 19 on the p-a tank coil and bend it clear of both the terminal and any surrounding metal parts. Start the rotary converter (if any) and close the main line switch, leaving the h-t switch open. Pull the door toggle switch forward so as to permit applying h-t with the door open. Turning the CW-MCW switch to MCW should light the filament of the modulator valve (right-hand RVC-10) and switching to CW should leave it unlit. Place this switch in the CW position. Secure all of the flexible tap leads to some coil terminals so as to prevent them dropping across live parts of the circuit.

Close the h-t switch. Provided the overload relay is not tripped, the door toggle switch is closed and the wave-change interlock switch centred properly, h-t will be applied to the m-o valve. With the key open the m-o will be biased off so that the current through Jack 1 will be about 12 ma. This current is the load drawn by the resistor R18 and is not valve current. The actual m-o cathode current with key open is practically zero. Be careful to avoid touching any live parts of the circuit when h-t is switched on whether the key is closed or open, as the high voltage is present in either case.

Now close the key. The meter should register about 75 ma in Jack 1. The m-o circuit may now be tuned to the desired wavelength by means of the "A" range m-o condenser, using the bakelite tuning key for adjustment. Release the locking device on the dial before attempting to rotate the condenser. A wavemeter loosely coupled to the m-o coil will permit placing the circuit on the required wavelength.

The p-a and aerial circuits may now be tuned to the m-o wavelength. Switch off the h-t and reconnect the h-t lead to terminal 19 on the p-a tank coil. Set the p-a coupling coil to minimum coupling (zero on the scale). Set the "A" range taps to the same terminal numbers on the p-a coil (one on top and one on bottom) as those on the m-o coil. Now close the h-t switch, press the key and resonate the p-a range "A" tuning condenser for minimum p-a cathode current (Jack 4). If the minimum reading is obtained at the minimum condenser capacity, set the coil taps to the next lower pair of terminals; if at maximum capacity set taps to next higher pair of terminals, until the minimum cathode current reading is obtained within the range of the condenser.

Now increase the coupling to about 30 degrees and adjust the link tap, aerial loading tap and aerial tuning variometer in range "A" until maximum current is registered in the r-f ammeter. The link tap is the flexible lead marked "A" at the right-hand end of the loading coil. It should be tapped not more than three or four turns from the end, to enable sufficiently tight coupling on longer wavelengths to be obtained without overcoupling on shorter waves. The loading tap should be moved up and down the coil until a position is found which gives a reading in the ammeter. The variometer must now be tuned to maximize this reading. If maximum current is obtained at minimum inductance of the variometer, the loading tap should be reduced to the next lower terminal (towards right-hand side) and the variometer retuned. If maximum aerial current is obtained at maximum inductance then the loading must be increased (towards left-hand side).

When the aerial circuit is in tune, the p-a tank tuning condenser should be readjusted to give minimum p-a cathode current (Jack 4). The aerial coupling must now be increased by rotating the coupling coil until the p-a cathode current, when aerial and p-a circuits are in resonance, has increased to about 320 ma. Due to the effect of stray capacities it will be found that the coupling coil gives greater

coupling when rotated in one direction from zero than the other. The tighter coupling direction should be used.

Check the wavelength now by coupling to the aerial circuit. It will have shifted somewhat, so shift the m-o tuning to the desired wavelength and realign other circuits again, as before, until maximum aerial current is obtained on the required wavelength, combined with stability when keying and a p-a cathode current of approximately 320 ma. If the coupling is too tight the output may jump erratically from a high to a low value and vice versa when keyed.

If the aerial is small enough to permit tuning to resonance with the series condenser C1 short-circuited by the link, channel "A" should be used this way. If it is not found possible to tune the aerial circuit in Channel "A" this way, then the link must be opened and the condenser connected in circuit.

Channels "B" and "C" may now be tuned to the wavelengths desired by tuning first the m-o and then the p-a and aerial circuits, as outlined in the foregoing paragraphs. Approximate tap positions can be estimated from the table given on page 7. At wavelengths up to 900 metres the p-a cathode current at resonance should be loaded to approximately 320 ma to give an output of 150 watts. At 1000 metres this must be increased to 350 ma, while at 1150 metres a cathode current of 370 ma is required for an output of 150 watts. At wavelengths above 900 metres it will be found that closing the door of the transmitter decreases the output of the transmitter slightly due to increased losses in the shielding and also partly due to the slight detuning caused by the reduction of inductance resulting from the proximity of the metal door to the coils. This effect can be partially compensated for by shifting the tuning slightly before closing the door until the desired meter readings are obtained with the door closed.

When all three channels A, B, and C, have been completely tuned for maximum output on the desired wavelengths, it will be necessary to go back and check them all again so as to obtain adjustments throughout which will permit switching from any one channel to any other with each channel remaining on the wavelength required and at full output. The coupling coil should be adjusted to the minimum position which will provide adequate coupling for the longest wave-length to be used. At shorter wavelengths the coupling can then be reduced by tapping down on the link circuit coupling taps, leaving the rotating coupling coil fixed at the above position.

Be sure that the aerial ammeter short-circuiting switch (toggle switch immediately below meter) is open when taking readings, as the meter still gives an appreciable reading even when shorted by the switch. This switch is in the closed position, short-circuiting the meter, when the toggle lever is upwards. Readings must be taken when the lever is pulled downwards thus opening the switch contacts.

A typical set of readings for 150 watts output on C-W at various wavelengths is given below.

FREQ. Kc.	WAVE- LENGTH	CHAN- NEL	T A P S		T U R N S		CURRENT M-A			
			M-O	P-A	LINK	LOADING	J1	J2	J3	J4
525	572	A	1-2	1-2	3	28	66	5	22	310
430	700	B	5-6	5-6	4	28	64	5	20	300
265	1130	C	15-16	13-14	8	67	58	5	27	360

With key up, the normal current in Jack 1 is 12 ma, 7 ma in Jack 2, and 0 in Jacks 3 and 4, on any wavelength.

The p-a plate input is greater (higher cathode current in J4) on Channel "A" than Channel "B" due to slightly lower efficiency in Channel "A" caused by the extra losses in the aerial circuit due to using the .002 uf series condenser, thereby requiring more series loading inductance than would otherwise be necessary. It will be noted that the same amount of loading was required for Channel "A" as for Channel "B", in spite of the difference in wavelength, on account of this condenser.

When all adjustments have been completed the flexible tap leads to the various terminals on the aerial loading should each be secured in position well clear of each other and of surrounding metal parts to prevent any danger of arcing. A bakelite rod is provided across the front of the coil and these six leads should be tied to it by means of narrow white surgical tape. All other flex leads should be bent so as to be well clear of their surroundings and should be tightened in place so that they cannot drop across each other or any other parts of the circuit.

b. Modulated Continuous Waves (M-C-W).

When all of the adjustments on all channels are completed for the C-W condition, operation on M-C-W may be checked. To switch from C-W to M-C-W it is merely necessary to place the CW-MCW switch in the MCW position. This will apply power to the modulator valve and change the necessary connections. The desired modulating tone frequency may be selected by means of the 500, 700, and 1000 cycle tone switch. The power output and the p-a cathode current on M-C-W will both be approximately three-quarters of their C-W values. A typical set of readings for 115 watts output on M-C-W is given below:-

FREQ. KC.	WAVE- LENGTH	CHAN- NEL.	TONE C-P-S	T A P S		T U R N S		CURRENT M-A			
				M-O	P-A	LINK	LOADING	J1	J2	J3	J4
525	572	A	500	1-2	1-2	3	28	67	75	17	240
"	"	"	700	" "	" "	"	"	67	60	19	245
"	"	"	1000	" "	" "	"	"	67	46	17	238
430	700	B	500	5-6	5-6	4	28	67	75	17	225
"	"	"	700	" "	" "	"	"	67	60	19	230
"	"	"	1000	" "	" "	"	"	67	47	18	225
265	1130	C	500	15-16	13-14	8	67	60	75	19	250
"	"	"	700	" "	" "	"	"	60	60	21	253
"	"	"	1000	" "	" "	"	"	60	46	18	245

With key up, the normal current in Jack 1 is 12 ma, 7 ma in Jack 2, and 0 in Jacks 3 and 4, on any wavelength and with any tone frequency.

In switching from CW to MCW always switch off the h-t, then turn the CW-MCW switch to the MCW position, then turn on the h-t switch again. This is to permit the modulator valve filament to heat up before h-t voltage is applied to its plate. It is permissible to switch from MCW to CW with the h-t turned on as the CW-MCW switch turns off both h-t and filament simultaneously from the modulator valve.

V. OPERATING INSTRUCTIONS

All operating controls appear outside the cabinet, so that when the tuning is completed, the small plate may be replaced at the bottom of the cabinet front and the door closed and locked to prevent unauthorized tampering.

To operate the transmitter, start the rotary converter (if one is used) and close the main line switch on the transmitter. The h-t switch may be left permanently turned on since no h-t delay is required when copper-oxide type rectifiers are used, but this procedure is not recommended; it is preferable to allow the filaments to heat for two or three seconds before h-t is applied. Place the wavechange switch on the desired channel and the transmitter is ready to be keyed. CW or MCW may be obtained by switching appropriately always remembering that the h-t switch should be opened before switching from CW to MCW. When MCW is used the modulating frequency may be 500, 700, or 1000 cycles as desired, by suitably placing the tone switch.

Because of the "break in" relay, reception is possible every time the key is open. If the transmitted signals are heard too loudly in the headphones or loudspeaker, their level may be reduced by turning down the volume control on the receiver while transmitting and turning it back up to normal when it is desired to receive.

A special Marconi M.S.L. receiver type 58938 is available especially for use with this type of transmitter. In it is included a W.L. type 251-36 relay, the coil of which should be connected across a 100-ohm 25-watt resistor placed in series with the earth side of the key, i.e. in series with the lead connecting the key and terminal number 17. The contacts of this relay ground the grid of the first valve, thereby desensitizing the receiver each time the key is pressed.

The dropping resistor should preferably be placed close to the key and connected to the relay by means of a twisted pair of No. 18 or No. 20 wire.

A .1 uf 400-volt-working condenser should be connected across the terminals of the manipulating key as close to this instrument as possible, in order to prevent the slight sparking which takes place at the contacts from causing clicks in the receiver. Should this condenser fail completely to eliminate the clicks, the key leads should be shielded using No. 14 lead covered wire.

Wherever possible a separate earth connection should be employed for the receiver and the shield of the type 35897 cable used for the receiver aerial lead connected to this ground. Where such a separate earth connection is used the shield of the aerial lead should be insulated from the frame of the transmitter.

To shut down the transmitter merely open the line switch. If a rotary converter is used it must also be shut down. In the latter case the converter input line switch may be used as the only power switch, the transmitter line switch being left permanently turned on.

If the overload relay trips it may be reset by pressing the nickel-plated reset button. Since the tuning condenser frames are not earthed, arcoverns due to mistuning do not short-circuit the rectifier but merely the r-f circuits, and hence do no damage. If the overload relay persists in tripping, the trouble should be investigated and corrected before attempting to operate.

RADIO DIVISION

LIST OF RESISTORS AND CONDENSERS
FOR
MARCONI 150-WATT 3-CHANNEL
LONG WAVE MARINE TRANSMITTER
TYPE LTT-4.

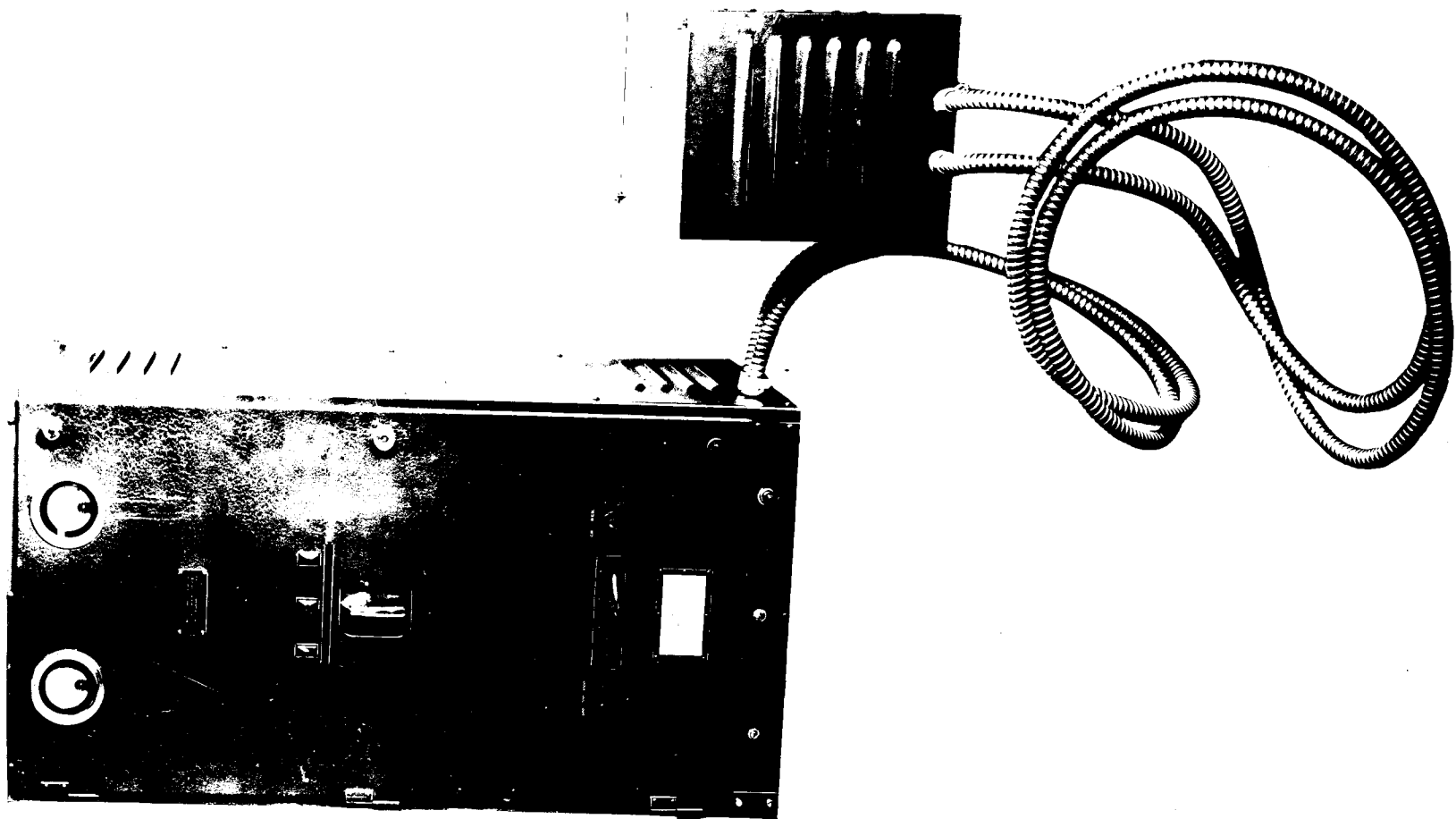
RESISTORS

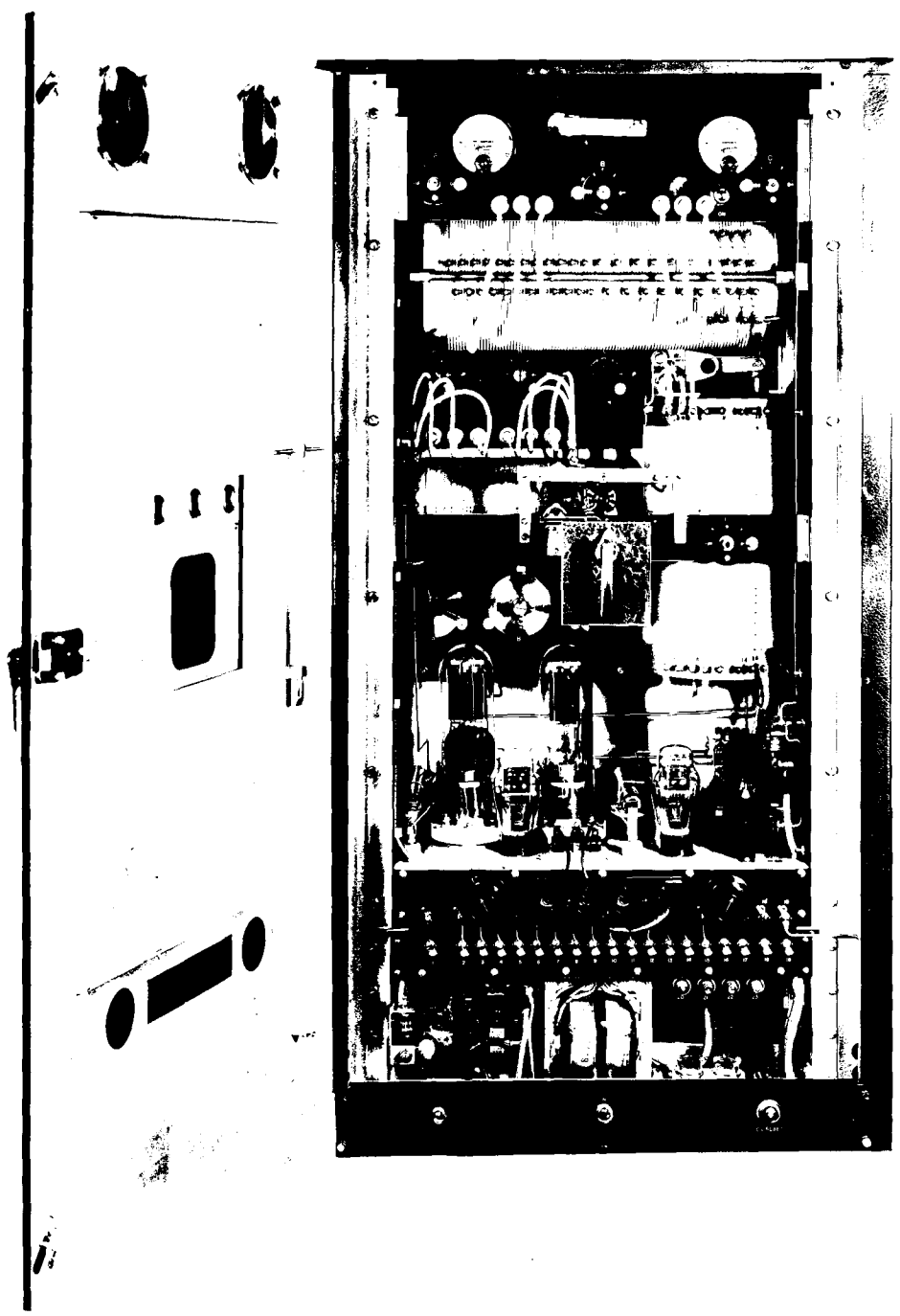
1					
2	7,500	Ohms - 100 Watts - Ohmite			
3	25	" 10 " "			
4	25	" 10 " "			
5	25,000	" 50 " "			
6	25,000	" 50 " "			
7	100,000	" 50 " "			
8	10,000	" 100 " "			
9	1,000	" 10 " "			
10	10,000	" 50 " "			
11	10,000	" 50 " "			
12					
13	25	Ohms - 10 Watts - Ohmite			
14	25	" 10 " "			
15					
16	1000	Ohms - 25 Watts - Ohmite			
17	1000	" 25 " "			
18	50,000	" 50 " "			
19	15	Ohms - Ohmite - Type #0364			
20	75,000	Ohms - 2 Watt - I.R.C.			

CONDENSERS

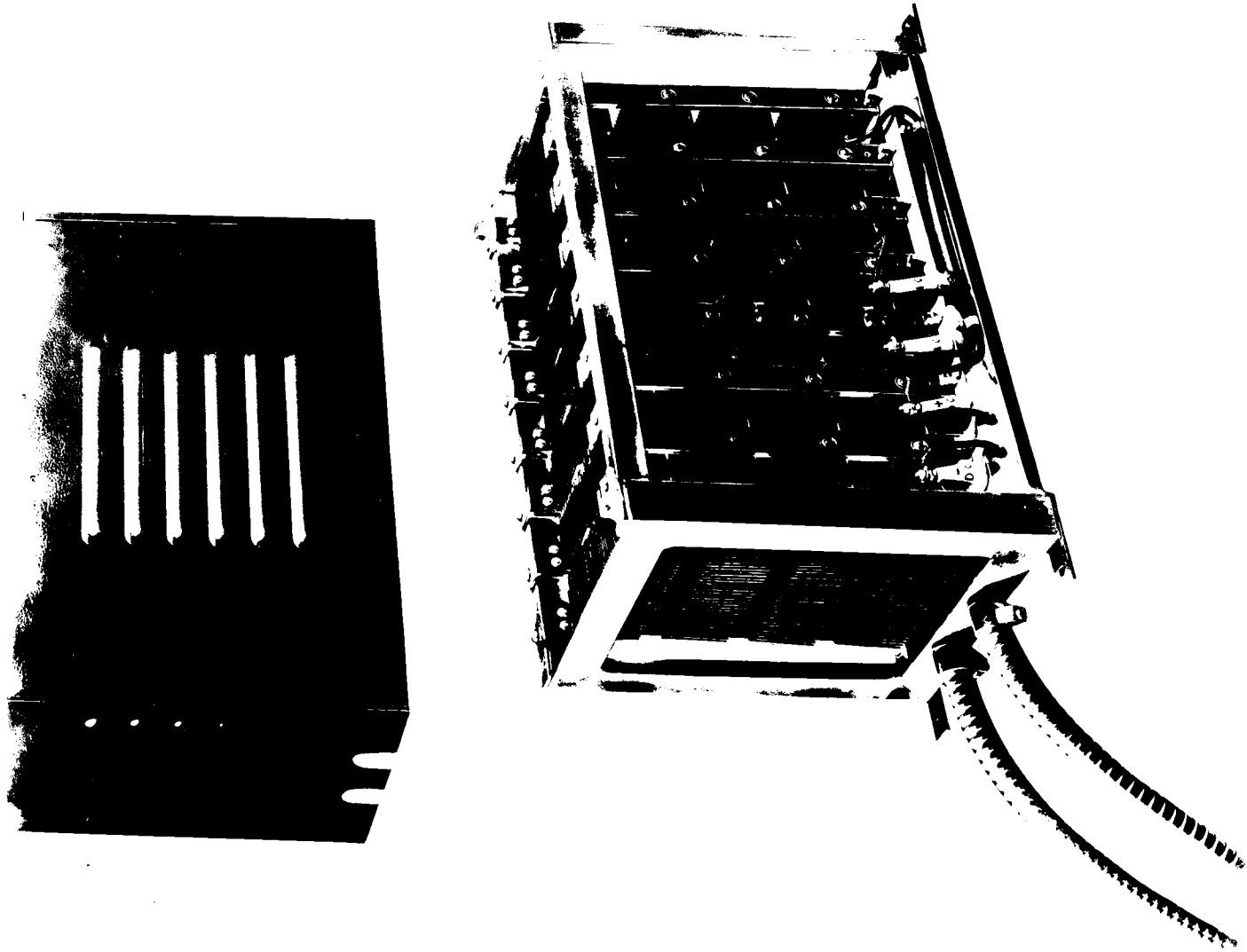
1	.002 uf 1250 V.H.F.	T.C.C. Type 1050			
2	.004 uf 1500 V.D.C.	" " 1039			
3	.0003 uf 2500 "	" " 1040			
4	.0003 uf " "	" " "			
5	Cardwell - Type XP-165-KD				
6	" " " " "				
7	" " " " "				
8	" " XT-210-PD				
9	" " " " "				
10	" " " " "				
11	.004 uf - 1500 V.D.C.	T.C.C. Type 1039			
12	.0005 uf 2500 V.D.C.	" " 1040			
13	.0005 uf " "	" " "			
14	.0003 uf " "	" " "			
15	.00015 uf " "	" " 1039			
16	.00015 uf " "	" " 1039			
17	10 uuf 5000 V.C-D Type 9A				
18	10 uuf 5000				
19	.5 uf - T.C.C. Type 80				
20	.0005 uf - 2500 V.D.C.	T.C.C. Type 1040			
21	0.1 uf 1000 V.D.C. - T.C.C. Type 111				
22	.01 uf " "	" " 1039			
23	.01 uf " "	" " "			
24	.01 uf " "	" " "			
25	.01 uf " "	" " "			
26	1 uf T.C.C. - Type 111				
27	4 uf " T.F.C. 62				
28	.01 uf 1000 V.D.C. T.C.C. Type 1039				
29	.01 uf " " " "				
30	.5 uf T.C.C. Type 80				
31					

1#





#3



55122

TOGGLE SWITCH #39572 - CONNECTS
OPEN WHEN DOOR CLOSED.

RE SWITCH #3591
CONTACTS CLOSED WHEN
DOOR CLOSED.

COND. ASSY 86766
" " 87606
T.C.C. TYPE 121B, 1 1/2
" " 2 1/2

RECTIFIER, WESTINGHOUSE
BRAKE (SIGNAL G (EMR))
TYPE 4 8-1B.

LEACH OVER-
LOAD RELAY
TYPE #1040

ONMITE DIVIDONM
TYPE #0364

ALLEN BRADLEY
BULL. 700 TYPE
B-208

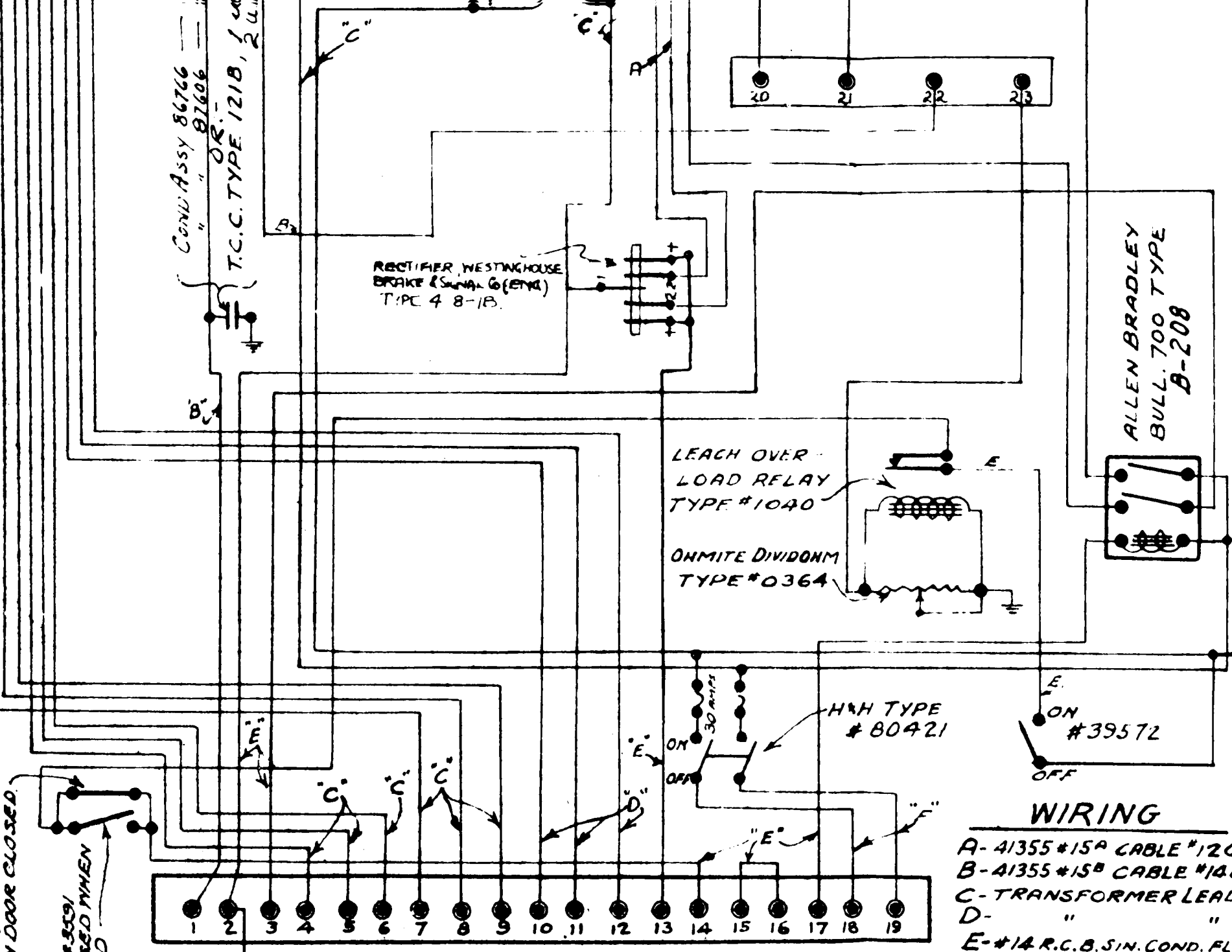
H&H TYPE
#80421

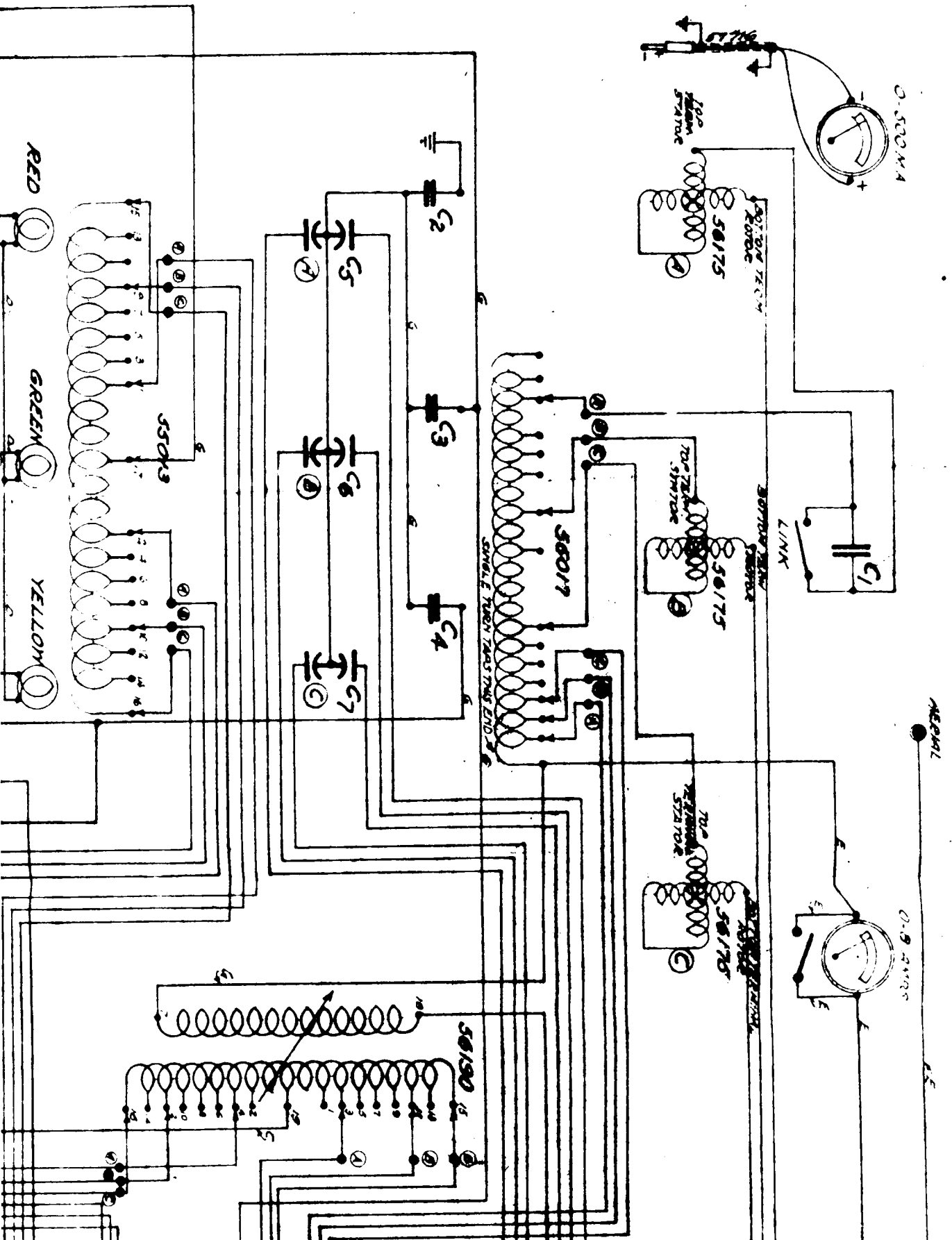
ON
OFF
#39572

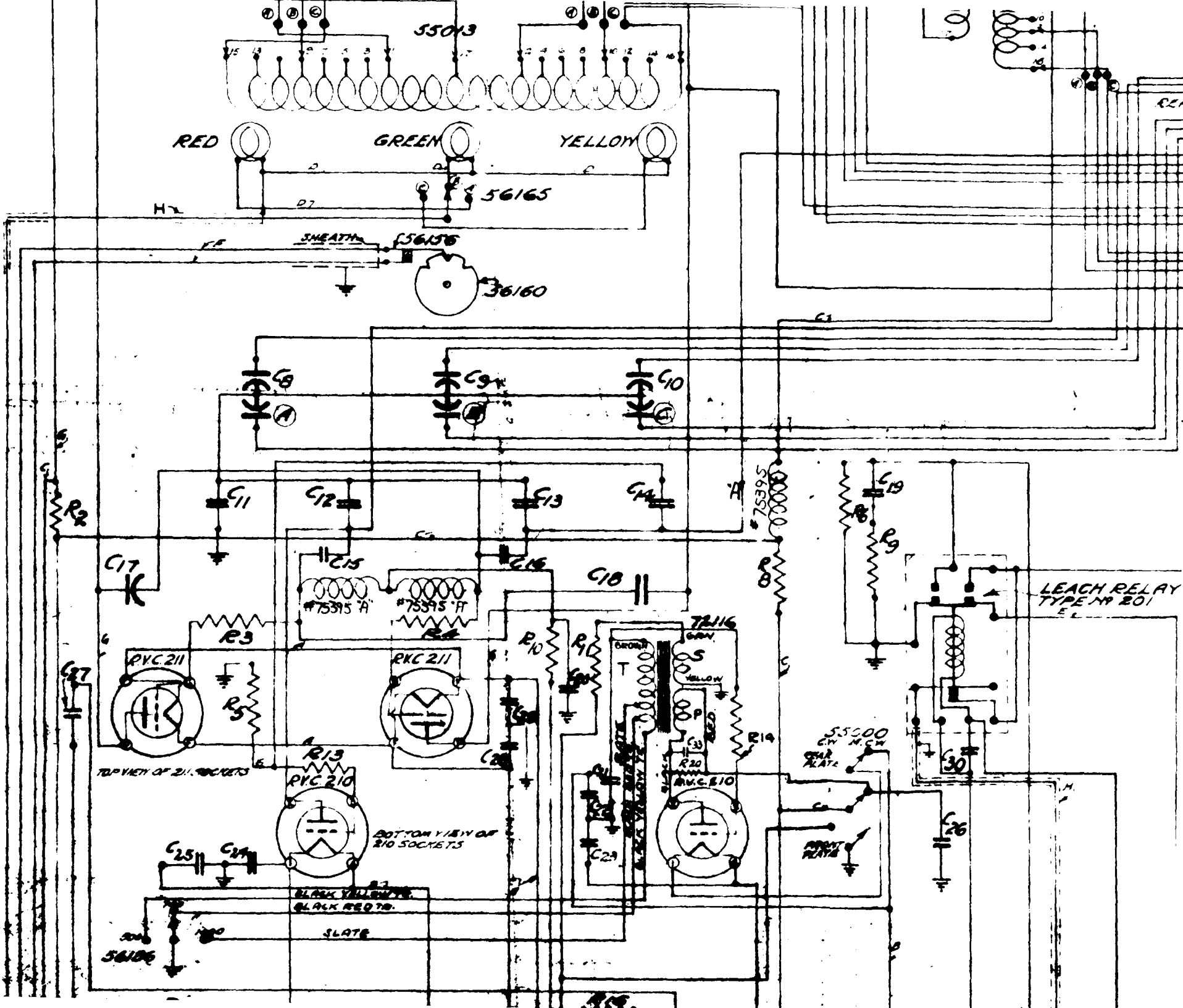
WIRING

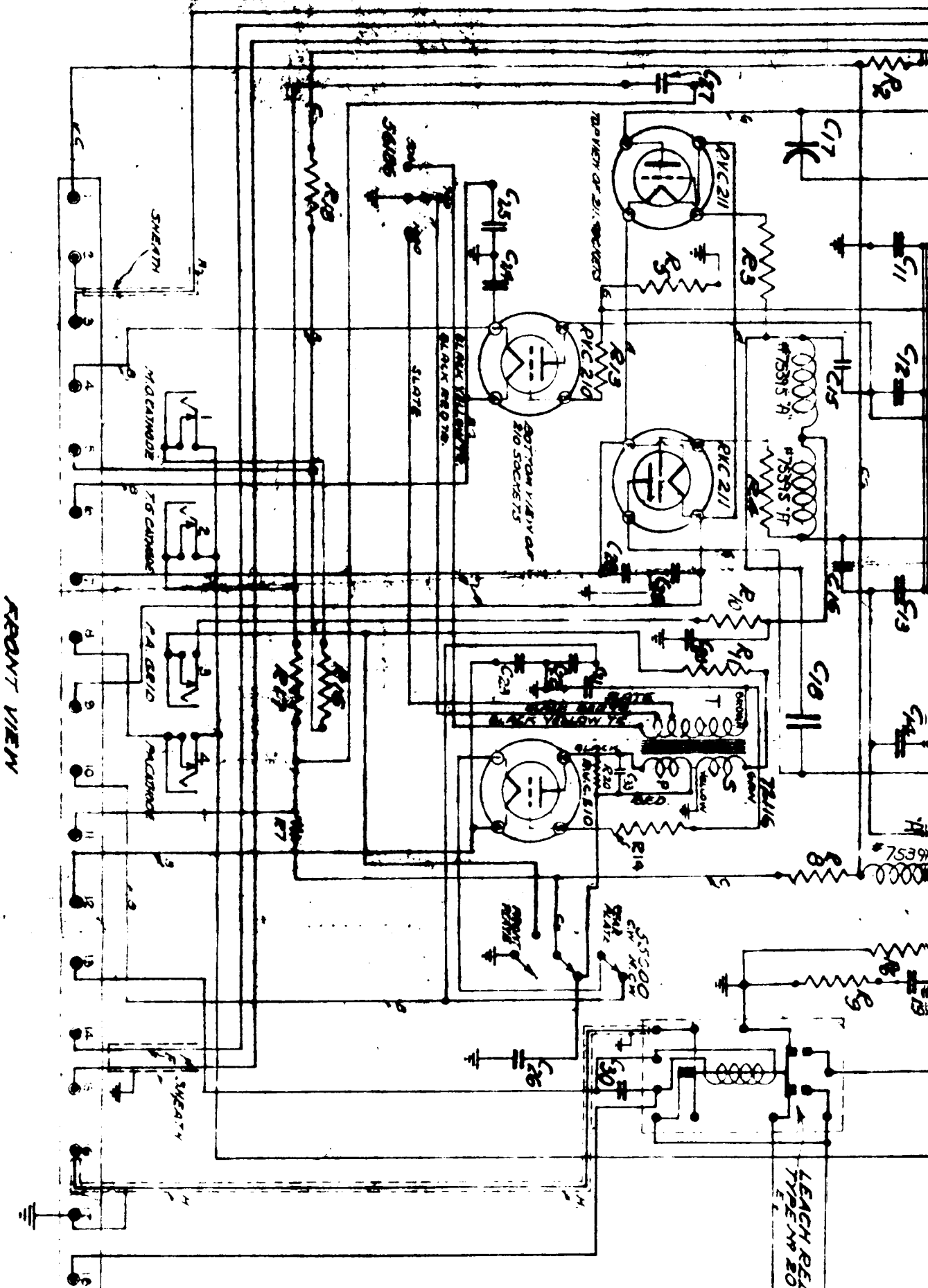
- A- 41355 #15A CABLE #120
- B- 41355 #15B CABLE #140
- C- TRANSFORMER LEAD
- D- " " "
- E- #14 R.C.B. SIN. COND. FL.
OR SOLID 1/32 OR 3/64 RUBB.
- F- #12 R.C.B. TVIN FLEX.

FRONT VIEW







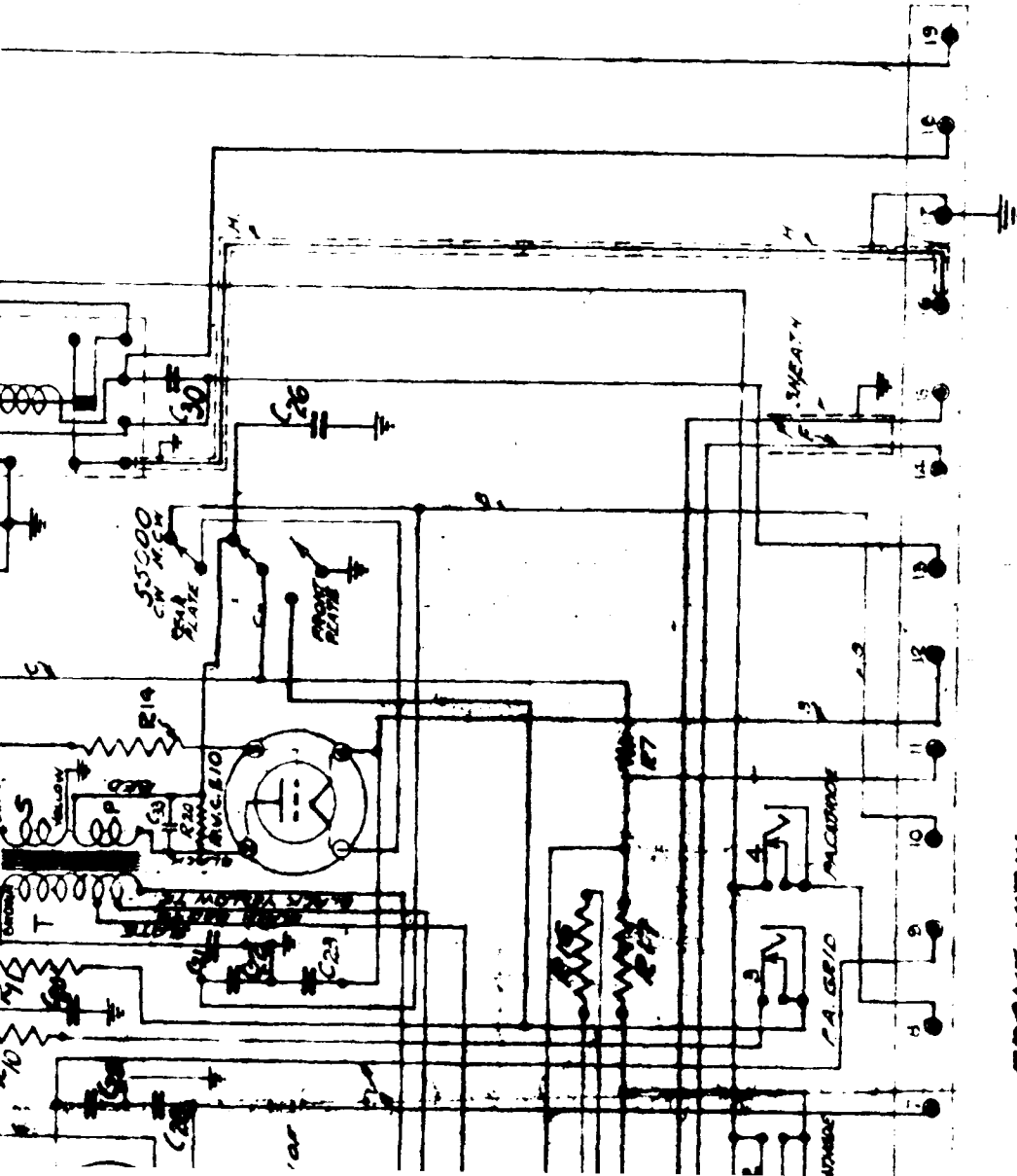


FRONT VIEW

DIAGRAM OF CONNECTIONS
 150W TRANSMITTER UNIT TYPE
 TYPE 81428/3774

WIRE LEGEND.

- A - #12 OR R.C. 18 FLEX - THIN COND
 - B - #18 G.
 - C - CABLE #A1355 - 15 B
 - D - #10 G. R.C. 18 SOLID OR FLEX WIRE
 - E - #10 G. BARE, SOLID, TINNED, COPPER WIRE.
 - F - #10 G. BARE, SOLID, TINNED, COPPER WIRE.
 - G - #10 - 14 G. BARE, SOLID, TINNED COPPER WIRE AS REQUIRED FOR STIFFNESS
 - H - #35897 CABLE
- ALL WIRING, NOT OTHERWISE SPECIFIED TO BE "D" OR "G" AS CONVENIENT.

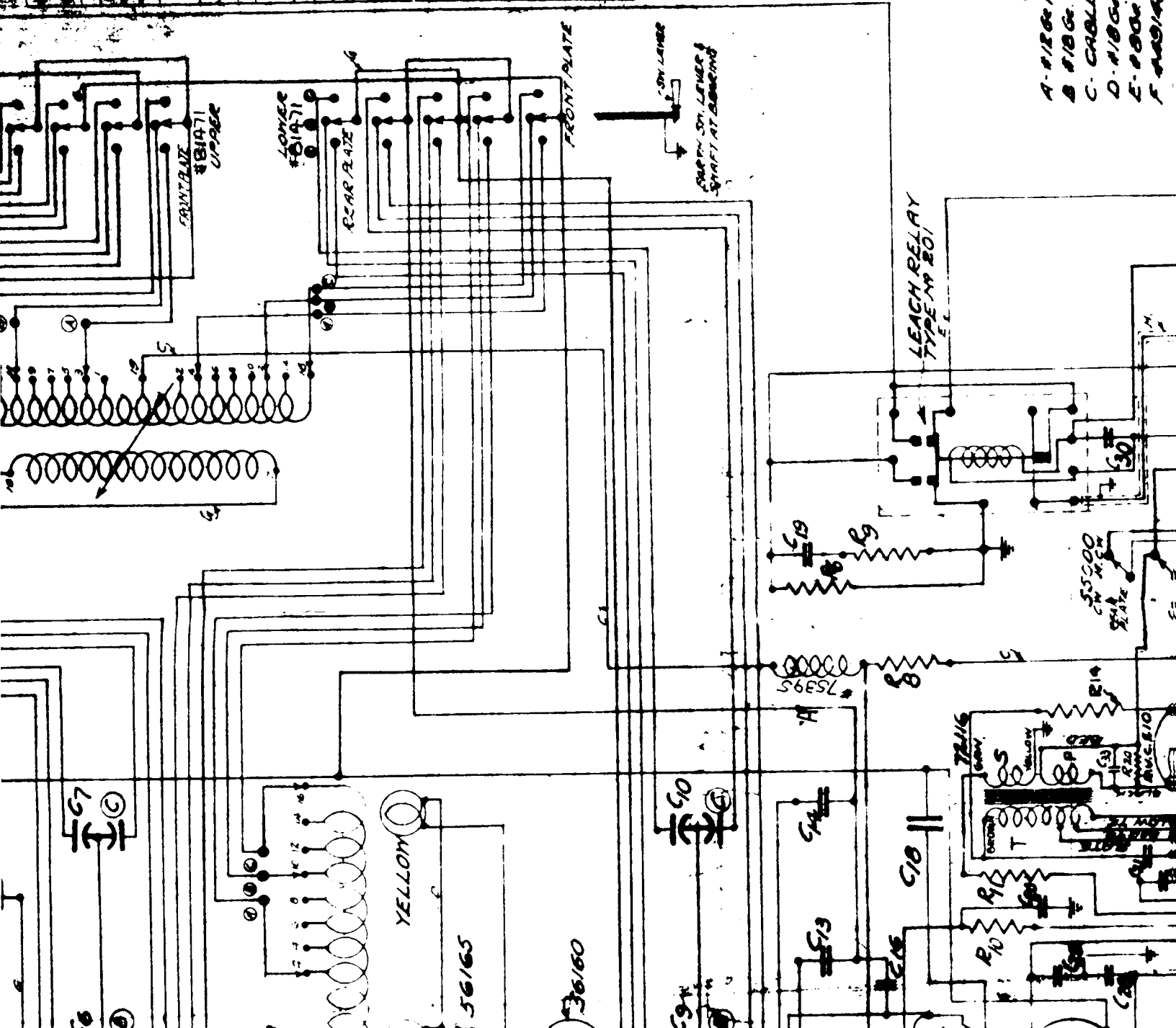


FRONT VIEW

DIAGRAM OF CONNECTIONS
 150W TRANSMITTER UNIT, TYPE LTT-A
 TYPE 81928/377A

1	COND ASSY 87600 OR	10	5000UF - 500VDC - TCC TYPE 9A
2	" " 87600 OR	11	COND ASSY 87600 OR
3	" " 87600 OR	12	COND ASSY 87600 OR
4	" " 87600 OR	13	COND ASSY 87600 OR
5	" " 87600 OR	14	COND ASSY 87600 OR
6	" " 87600 OR	15	COND ASSY 87600 OR
7	" " 87600 OR	16	COND ASSY 87600 OR
8	" " 87600 OR	17	COND ASSY 87600 OR
9	" " 87600 OR	18	COND ASSY 87600 OR
10	" " 87600 OR	19	COND ASSY 87600 OR
11	" " 87600 OR	20	COND ASSY 87600 OR
12	" " 87600 OR	21	COND ASSY 87600 OR
13	" " 87600 OR	22	COND ASSY 87600 OR
14	" " 87600 OR	23	COND ASSY 87600 OR
15	" " 87600 OR	24	COND ASSY 87600 OR
16	" " 87600 OR	25	COND ASSY 87600 OR
17	" " 87600 OR	26	COND ASSY 87600 OR
18	" " 87600 OR	27	COND ASSY 87600 OR
19	" " 87600 OR	28	COND ASSY 87600 OR
20	" " 87600 OR	29	COND ASSY 87600 OR
21	" " 87600 OR	30	COND ASSY 87600 OR
22	" " 87600 OR	31	COND ASSY 87600 OR
23	" " 87600 OR	32	COND ASSY 87600 OR
24	" " 87600 OR	33	COND ASSY 87600 OR
25	" " 87600 OR	34	COND ASSY 87600 OR
26	" " 87600 OR	35	COND ASSY 87600 OR
27	" " 87600 OR	36	COND ASSY 87600 OR
28	" " 87600 OR	37	COND ASSY 87600 OR
29	" " 87600 OR	38	COND ASSY 87600 OR
30	" " 87600 OR	39	COND ASSY 87600 OR
31	" " 87600 OR	40	COND ASSY 87600 OR
32	" " 87600 OR	41	COND ASSY 87600 OR
33	" " 87600 OR	42	COND ASSY 87600 OR
34	" " 87600 OR	43	COND ASSY 87600 OR
35	" " 87600 OR	44	COND ASSY 87600 OR
36	" " 87600 OR	45	COND ASSY 87600 OR
37	" " 87600 OR	46	COND ASSY 87600 OR
38	" " 87600 OR	47	COND ASSY 87600 OR
39	" " 87600 OR	48	COND ASSY 87600 OR
40	" " 87600 OR	49	COND ASSY 87600 OR
41	" " 87600 OR	50	COND ASSY 87600 OR
42	" " 87600 OR	51	COND ASSY 87600 OR
43	" " 87600 OR	52	COND ASSY 87600 OR
44	" " 87600 OR	53	COND ASSY 87600 OR
45	" " 87600 OR	54	COND ASSY 87600 OR
46	" " 87600 OR	55	COND ASSY 87600 OR
47	" " 87600 OR	56	COND ASSY 87600 OR
48	" " 87600 OR	57	COND ASSY 87600 OR
49	" " 87600 OR	58	COND ASSY 87600 OR
50	" " 87600 OR	59	COND ASSY 87600 OR
51	" " 87600 OR	60	COND ASSY 87600 OR
52	" " 87600 OR	61	COND ASSY 87600 OR
53	" " 87600 OR	62	COND ASSY 87600 OR
54	" " 87600 OR	63	COND ASSY 87600 OR
55	" " 87600 OR	64	COND ASSY 87600 OR
56	" " 87600 OR	65	COND ASSY 87600 OR
57	" " 87600 OR	66	COND ASSY 87600 OR
58	" " 87600 OR	67	COND ASSY 87600 OR
59	" " 87600 OR	68	COND ASSY 87600 OR
60	" " 87600 OR	69	COND ASSY 87600 OR
61	" " 87600 OR	70	COND ASSY 87600 OR
62	" " 87600 OR	71	COND ASSY 87600 OR
63	" " 87600 OR	72	COND ASSY 87600 OR
64	" " 87600 OR	73	COND ASSY 87600 OR
65	" " 87600 OR	74	COND ASSY 87600 OR
66	" " 87600 OR	75	COND ASSY 87600 OR
67	" " 87600 OR	76	COND ASSY 87600 OR
68	" " 87600 OR	77	COND ASSY 87600 OR
69	" " 87600 OR	78	COND ASSY 87600 OR
70	" " 87600 OR	79	COND ASSY 87600 OR
71	" " 87600 OR	80	COND ASSY 87600 OR
72	" " 87600 OR	81	COND ASSY 87600 OR
73	" " 87600 OR	82	COND ASSY 87600 OR
74	" " 87600 OR	83	COND ASSY 87600 OR
75	" " 87600 OR	84	COND ASSY 87600 OR
76	" " 87600 OR	85	COND ASSY 87600 OR
77	" " 87600 OR	86	COND ASSY 87600 OR
78	" " 87600 OR	87	COND ASSY 87600 OR
79	" " 87600 OR	88	COND ASSY 87600 OR
80	" " 87600 OR	89	COND ASSY 87600 OR
81	" " 87600 OR	90	COND ASSY 87600 OR
82	" " 87600 OR	91	COND ASSY 87600 OR
83	" " 87600 OR	92	COND ASSY 87600 OR
84	" " 87600 OR	93	COND ASSY 87600 OR
85	" " 87600 OR	94	COND ASSY 87600 OR
86	" " 87600 OR	95	COND ASSY 87600 OR
87	" " 87600 OR	96	COND ASSY 87600 OR
88	" " 87600 OR	97	COND ASSY 87600 OR
89	" " 87600 OR	98	COND ASSY 87600 OR
90	" " 87600 OR	99	COND ASSY 87600 OR
91	" " 87600 OR	100	COND ASSY 87600 OR

CONDENSERS



- WIRE LEGEND.**
- A - #120 R.C. 18 FLEX TWIN COND
 - B - #10G
 - C - CABLE #A1355-15B
 - D - #10G R.C. 18 SOLID OR FLEX WIRE
 - E - #10G 2 WIRE, SOLID TWINED, COPPER WIRE.
 - F - #10G 18 CABLE.

