

GATES

INSTRUCTIONS FOR INSTALLATION, OPERATION AND MAINTENANCE
OF THE GATES' MODEL FMR-250B
250 WATT FM TRANSMITTER

IB-833

Gates Radio Company,
Quincy, Illinois
U. S. A.

INDEX

	Page
1. Description	1
2. Unpacking	4
3. Installation and Readyng for Operation	5
4. Initial Operating Procedure	7
5. Normal Daily Operation	9
6. Micromatch Instructions	
7. Exciter Tune-Up	10
8. Maintenance	14
9. Guarantee	1-2
10. Factory Test Data Sheet	
11. Parts List	1-6
12. Diagrams and Drawings:	
(a) A-4165 - Test Setup for FM	
(b) A-7648 - Wiring Chart	
(c) A-9006 - Padding Chart	
(d) B-13969 - Block Diagram of Broadcast FM Exciter	
(e) D-21888 - Overall Schematic FMR-250B	
(f) E-25431 - Exciter Schematic M5353	

DESCRIPTION

- 1.01 The FM-R-250B is an FM Transmitter with 250 watts maximum output, operating on one fixed frequency between 88 Mc to 108 Mc. When properly installed, the operating characteristics exceed those required by the Federal Communications Commission for FM Broadcast service. The transmitter is designed for continuous Broadcast operation.
- 1.02 Basic Circuits of the transmitter consist of the following: Exciter, Modulator Panel; Regulated Low Voltage Power Supply; Control Circuit Panel; Power Amplifier; and Cabinet Assembly consisting of High Voltage Power Supply and Meters.
- 1.03 The Exciter Modulator consists of a crystal controlled oscillator, pulse time modulator, audio amplifier and proper frequency multipliers to provide proper input to the final amplifier. The crystal frequency is multiplied 864 times to reach an operating frequency between 88 to 108 Mcs. This produces a crystal frequency between 102 to 125 Kc. A block diagram in the drawing section gives the sequence of multiplication. Pulses are developed from the output of the oscillator and applied to the modulator tube. Output from the audio amplifier applied to the modulator tube causes a phase shift in the spacing between the pulses occurring at crystal frequency. The series of frequency multipliers restores the linearity to original signal and the phase shift results in frequency modulation. A meter on the exciter panel measures the relative plate current of tubes V1 through V12. The meter switch index number corresponds to the tube "V" number. (Pos. #2 measures V502, etc.).
- 1.04 The Low Voltage Power Supply is a regulated power supply supplying $\frac{1}{2}$ B voltage to the exciter unit and the screens of the final amplifier. There is a control for setting the output voltage and a control for hum cancelling.
- 1.05 The Power Amplifier is two 4X150A tetrodes operated in a push-pull circuit. The grid circuit is essentially a half wave tuned line with some of the circuit contained within the tubes themselves. Tuning is effected with a variable condenser across the far end of the tuned lines. The plate circuit is a quarter-wave linear element tank using a shorting bar for great changes in operating frequency and a tuning vane for small changes. The tuning vane varies the electrical length by varying the surge impedance of the quarterwave transmission line. Since the electrical length of this line is determined by the capacity across the open end, presented by the tube inter-electrode capacity, the lower the surge impedance the longer (physically) the line must be for a given frequency. As the vane is moved toward the tank elements, the surge impedance decreases. Therefore, the electrical length is increased or decreased with the physical relation of the tuning vane with respect to the tank elements.

- 1.06 CIRCUITS for controlling and operating the transmitter are affected by controls located on the front panel. Two main switches apply primary power to all transmitter circuits and apply high voltage to the Power Amplifier. A switch on the left side of the panel switches the P.A. grid current meter to measure the individual screens of the Power Amplifier. The switch on the right side of the panel adjusts the line voltage to provide proper primary input to all circuits. Three controls adjust the grid circuit, plate circuit, and coupling to antenna of the power amplifier. There are three relays of the telephone type located on the front panel. The one on the left side is a low voltage overload, the one in the middle a P.A. plate current overload and the one on the right a P.A. drive failure. Energizing or de-energizing of these relays in turn energizes the trip coils of circuit breakers of the circuits involved. Five trouble lights are located on the panel. When "AIR" is lit there is sufficient air flowing past the anodes of the final amplifier. When "LOW VOLTAGE OVERLOAD" is lit intermittently with switching on the filament and L.V. switch an overload of the low voltage power supply is indicated. When "PLATE CURRENT OVERLOAD" is lit intermittently with switching on the plate voltage switch an overload of the P.A. plate circuit is indicated. When "P.A. GRID EXCITATION" is lit there is not sufficient drive to the P.A. grid circuit. When "DOOR" is lit the rear door is closed, closing the interlock circuit that will not allow the application of high voltage to P.A.
- 1.07 The plates of the P.A. tubes are cooled by pressurizing a chamber below the deck their sockets are mounted in and allowing the blown air to pass through the radiators of the anodes and out the plate tank elements. A pressure switch in the chamber insures enough air for recommended cooling. Another blower provides cooling for all remaining tubes in the L.V. power supply and exciter unit. A fan in the top of the cabinet exhausts the rest of the transmitter.
- 1.08 Protection against electrical shocks from the high voltage circuits is provided for by a door interlock. The closing of this switch energizes the trip coil of the "PLATE VOLTAGE" circuit breaker, removing primary input voltage from the primary of the H.V. transformer.
- 1.09 A service circuit provides 115 Volts A.C. for test equipment, soldering iron, etc., and voltage to the heaters in the crystal ovens. A light for servicing and inspection is switched on when the rear door is opened.
- 1.10 An Instruction Book for the R.F. power and standing wave ratio coupler and meter is included following this section.

1.11 SPECIFICATIONS:

- (1) Power Output - 100 to 250 Watts.
- (2) Frequency Range - 88 to 108 Mcs.
- (3) R.F. Output Impedance - 51.5 ohms with maximum standing wave ratio of 1:2.
- (4) Type of Oscillator - Direct crystal control.
- (5) Frequency Stability - $\pm .001\%$ on carrier frequency.
- (6) Type of Modulation - Phase shift.
- (7) Modulation Capability - ± 100 kilocycles.
- (8) Audio Input Impedance - 600 ohms.
- (9) Audio Input Level - Approximately 10 DBM
- (10) Frequency Response - ± 1 DB, 50 to 15,000 cycles with ± 75 Kc Swing as reference.
- (11) Distortion - Maximum 1-1/2% 50 to 15,000 cycles.
- (12) Tube Complement - One Type 6BA6
Four Type 12AT7
Five Type 6AH6
Three Type 5763
One Type 6146
Three Type 6AS7
One Type 6SH7
One Type VR105
Two Type 5U4G
Two Type 866A
Two Type 4X150A Eimac
- (13) Power Input - 1250 Watts, approximately.
- (14) Power Source - 115 Volts, 60 cycle, single phase.
- (15) Ambient Temperature - 20° C. to 55° C.
- (16) Dimensions - 78 inches high, 28-1/2 inches wide, 36 inches deep, approximately 75 Cu.Ft. boxed for export Shipment.
- (17) Weight - Net approximately 900 pounds.
Gross, packed for export, approximately 1100 pounds.

UNPACKING

- 2.01 Upon receipt and uncrating the FM-R-250B should be carefully inspected for arrival in good condition. If any damage is noticed to any section of the equipment, an immediate claim should be filed with the delivery transportation company and replacement items immediately ordered from the Gates factory.
- 2.02 The complete transmitter should be thoroughly inspected and checked for loose screws or connections which may have been loosened due to rough handling in shipping. Time spent at this point may save many hours when the equipment is put into operation.
- 2.03 Near the socket of each tube in the FM-R-250B Transmitter, the tube type is stencilled to assist in tube replacement.
- 2.04 For safe shipment, the large power transformer and certain other apparatus are removed from the FM-R-250B. Where these are removed, drawings, pictures or following discussion on the individual items will make replacement an easy matter.
- 2.05 Exhaustive work is done in the individual checking of each FM-R-250B Transmitter before shipment to ascertain that it performs correctly both electrically and mechanically and will arrive at its destination in excellent condition. Each transmitter is subjected to an operational period of several hours and given an individual test for distortion, noise, frequency response, stability, adjustment and all operating conditions.

INSTALLATION

- 3.01 Before an attempt is made to install the FM-R-250B, certain preliminary planning should be done. Providing and checking the following items will insure a good installation job.
- 3.02 A low reactance power source of 115 volts, 60 cycles, single phase, with a peak demand of 3 KW should be installed and terminated in a conduit directly under the proposed FM-R-250B location. This power source should have a minimum lead length from the last point of distribution and should use wire conductors of size 10 or larger. This transmitter power source should be fused separately and feed no other apparatus. Running this power source in lead encased wires inside steel conduit is highly recommended to obtain both audio and radio frequency shielding near the transmitter unit. Connect to terminals 1 and 2 of TB101 located on left side of main deck viewed from rear.
- 3.03 A secondary power source of 115 volts, 60 cycles, single phase, with a peak demand of approximately 500 watts should be provided. This is the service circuit and also provides heater voltage for the crystal ovens. There is no switch for this circuit so the crystal ovens will maintain temperature when the transmitter is shut down. Connect to terminals 3 and 4 of TB101 located on left side of main deck viewed from rear.
- 3.04 A jack and plug on the left side of the P.A. enclosure is provided for monitoring. An RG8/U coaxial cable may be connected here and extended through the bottom or back of the cabinet, wherever preferred. No feedthru hole is provided for the monitor cable.
- 3.05 The audio frequency input to the transmitter should be connected to the audio input terminal block through a separate conduit, here again using lead encased wires inside steel pipe. This audio frequency input line should be separated from the power input line and the FM monitor lead with the best isolation possible. Connect to terminals 1, 2, and 3 of TB102 located on right side of main deck viewed from rear.
- 3.06 A ground strap should be provided of 2 inch copper strapping, .064 inches thick preferably. This strap should be as short as possible and if very long, more than one provided. The strap may be connected to the transmitter by scraping the paint off and drilling and tapping screw threads at the point of grounding. A large surface area of contact will produce best results.
- 3.07 Floor space directly under the transmitter should be capable of supporting 125 pounds per square foot and as level as practical. Four leveling bolts are in the base of transmitter to assist in leveling. After leveling, the base should be

shimmed up so the screws will not continually be supporting the weight of the transmitter. If it is not practical to provide a channel in the floor under the transmitter for power, audio, and monitor leads, a frame could be made of two by four lumber to set the transmitter on. With the back of the frame open, all leads could be cabled out the back. This frame should be painted black for appearance.

- 3.08 The output impedance of the Micro-Match coupler unit is 51.5 ohms. A plug is provided for RG/8U coaxial transmission line for connection to the antenna.
- 3.09 If the ambient temperature in the transmitter exceeds 55° C., air conditioning or other means of cooling should be provided.
- 3.10 To ease the installation of parts removed for shipment, the sides may be taken off by blocking up the sides and removing the eight hex head machine bolts. The top plate the fan is mounted on will have to be removed to install the plate tank elements of the P.A. The top plate of the Power Amplifier enclosure must also be removed to install the plate tank circuit. The plate tank elements are held in place by two wing fasteners that secure the bypassing plate to the top deck of the P.A. enclosure. Care should be used in seating the elements on the plates of the tubes. Chimneys around the plate radiators insure that a sufficient amount of air passes through them. After slipping the P.A. tank elements through the upper deck, the flexible high voltage lead may be connected to the element supporting plate by removing a 6-32 round head screw (that goes through the plate to a bypass condenser) and connecting the high voltage to this point. The shorting bar may now be placed on the tank elements. The factory test data sheet will indicate how far from the top deck the shorting bar is to be placed for the frequency the transmitter is shipped on.

INITIAL OPERATING PROCEDURE

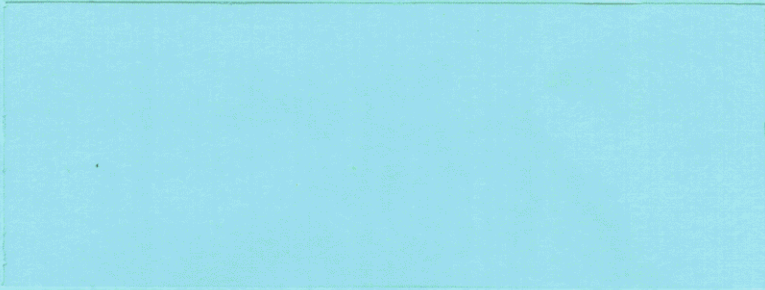
- 4.01 After the installation is complete and the crystal oven heaters have been on heat for two hours or more, primary power may be turned on. Placing the low voltage and filament switch in the "ON" position applies voltage to all filaments, control circuits, and ϕB to exciter stages and final screens.
- 4.02 As the exciter heats up, an increase in the P.A. grid current meter will be noticed (with meter switch on the left of the front panel in that position). The final multiplier C557 and C558 of the exciter are left tunable. They should be adjusted for maximum P.A. grid current. If the P.A. grid is far mistuned a small peak may only be obtained; however, returning the P.A. grid will bring the drive up to the required amount. The P.A. plate voltage cannot be applied and will be switched off if the grid drive is not sufficient or fails. The P.A. grid current energizes E303, opening a set of contacts that removes voltage from the trip coil of S304 (the high voltage switch and circuit breaker).
- 4.03 The exciter should be allowed to warm up for fifteen minutes or so before applying the P.A. plate voltage. After warm-up the P.A. grid and C557 and C558 of exciter should be retuned for maximum grid current.
- 4.04 The plate voltage is applied to P.A. by placing the plate voltage switch in the "ON" position. If the plate tank is far out of tune the plate circuit will overload energizing relay E302, whose contacts apply voltage to the trip coil. The P.A. plate voltage may be lowered by removing a plate cap from an 866A and P.A. plate circuit tuned to resonance. The grid circuit should be retuned and the plate cap placed back on the 866A. Retouching up the grid and plate tuning, the coupling may be increased to the antenna. At the ends of the vane tuning range there is a mechanical stop on the drive shaft. Care should be exercised that these stops are not hit with too great a force as they might loosen up or shear off.
- 4.05 The loading to the antenna is increased by bringing the coupling loop closer to the plate tank elements. As the coupling is increased the plate circuit should be retuned for minimum P.A. plate current. At these VHF frequencies it will be noticed that maximum output will not exactly coincide with minimum plate current. The plate circuit should be tuned slightly on the side of plate current dip that gives an increase in R.F. output. At the lower end of the frequency band, one side of the coupling loop is grounded. At the higher end of the band the grounding bracket is used as a variable capacity to assist in coupling to the antenna. The factory test data sheet will indicate how the bracket is used per frequency the transmitter is shipped on. The loading to the antenna should be increased to the desired power output up to 250 watts.

Power out is indicated by the R.F. output meter with the switch, S201, in the "FOR." position. VHF experience dictates a standing wave ratio of no greater than one to one point three must be maintained between the transmitter and antenna. S.W.R. is indicated on the R.F. output meter with S201 in S.W.R. position. Before reading S.W.R., the meter should be adjusted to full scale reading by adjusting the V.S.W.R. control (R202). The switch S201 is placed in the "CAL." position for this adjustment. The final plate circuit should not be loaded in excess of 300 Ma plate current.


- 4.06 The five lights on the front panel are to indicate trouble in the circuits involved as discussed previously.
- 4.07 There are two controls on the regulated power supply. R609 is adjusted for \sqrt{B} output voltage as given on the factory test data sheet. R604 is adjusted for minimum noise when a noise measurement is made on the transmitter. R604 cancels out hum in the regulated power supply. R604 should be adjusted for minimum hum after R609 is adjusted for \sqrt{B} as given on the factory test data sheet.
- 4.08 C502 on the exciter unit is used to adjust the crystal oscillator to exact operating frequency. A monitor loop is provided on the final amplifier enclosure to give a sampling R.F. voltage to operate a frequency and modulation monitor. C502 is adjusted for exact final operating frequency by comparing against a monitor or an external monitoring source that offers a frequency checking service.
- 4.09 Provision is provided for pre-emphasis plug-in pad arrangement.

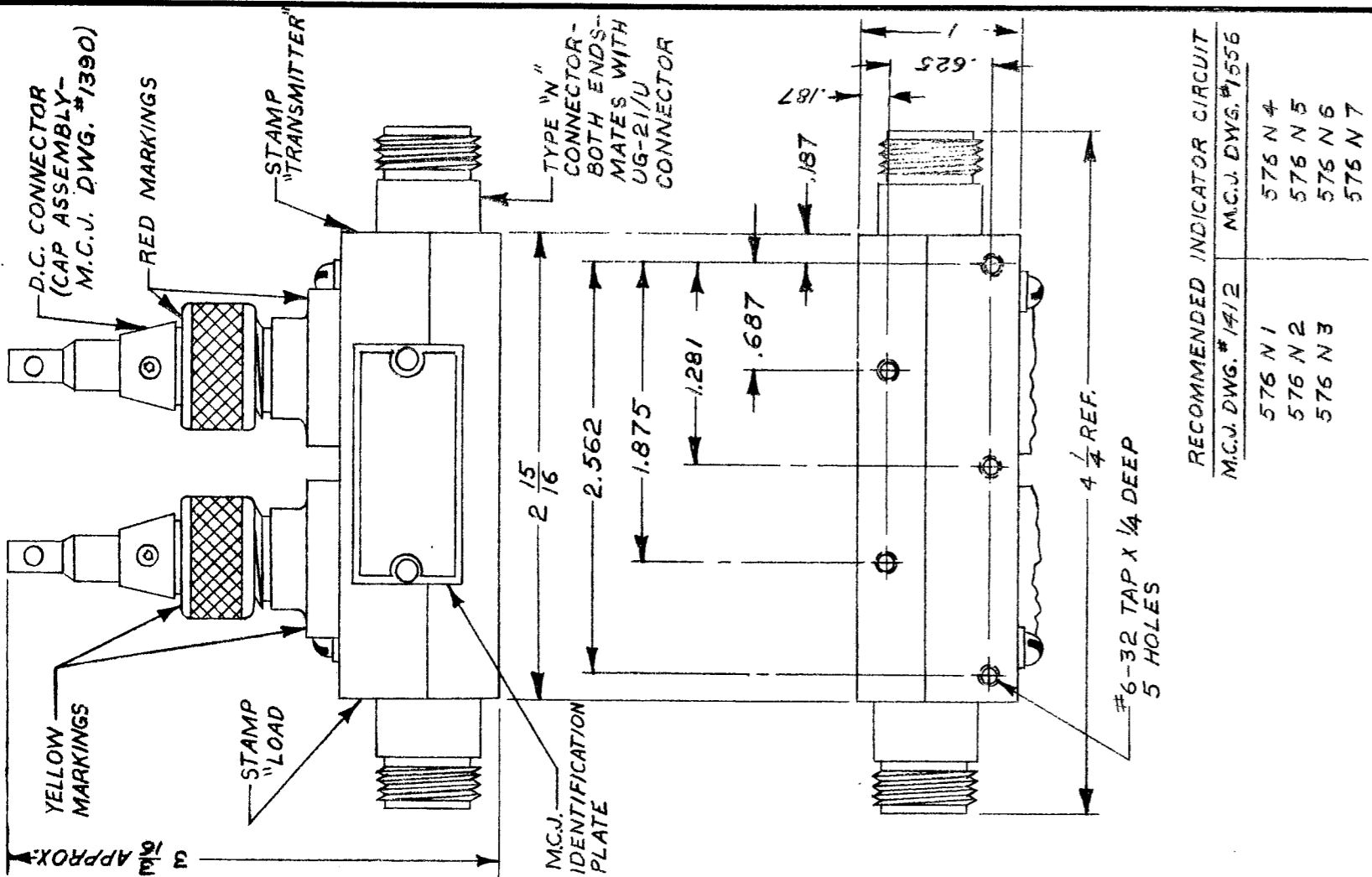
NORMAL DAILY OPERATION

- 5.01 Normal daily operation should consist of a routine recording of all meter reading and comparing them against previous readings. The following points should also be checked.
- 5.02 S302, the LINE VOLTAGE ADJUST switch should be set to give 6.0 volts P.A. filament voltage.
- 5.03 If a frequency and modulation monitor is used, daily checks of operating frequency and frequency deviation may be made.
- 5.04 Tuning of the final grid and plate circuit and output coupling may be checked. These are front panel controls and only slight adjustment if any may be needed daily.
- 5.05 Power output and standing wave ratio may be checked daily. Any change in daily readings will serve as an indication to correct trouble that might cause "off the air time" in the near future.
- 5.06 If primary power should fail or be shut off, the secondary power source will maintain the operating temperature of the crystal oven. When the primary power source is again in operation, application of the high voltage to the power amplifier will place the transmitter back in operation. Checking the P.A. filament voltage and checking the tuning of the final should be done. If the crystal oven heater circuit should fail, time must be given for the oven to come up to temperature before the transmitter is placed in operation.
- 5.07 The "screwdriver" adjustments in the coil cans and multiplier stages of the exciter are factory tuned circuits and do not require any adjustment on installation or daily operation. The exciter tune-up is covered in the following section.



Drawings 2388 and 1556
Series: 570

 *Electronics Co.*
INCORPORATED
BRISTOL, CONN.



RECOMMENDED INDICATOR CIRCUIT	M.C.J. DWG. #1556
576 N 4	
576 N 5	
576 N 6	
576 N 7	
576 N 1	
576 N 2	
576 N 3	

Power Ranges:		Specifications (cont.)		
Model No.	Power Level in watts Full Scale	*Cut-off Frequency in mcs.	Recommended Meter Characteristics	
			Sensitivity ua full scale	Internal Resistance Ohms
576N1	0-1.2	42	20	2000
576N2	0-4	28	20	2000
576N3	0-12	20	20	2000
576N4	0-40	46	200	750
576N5	0-120	42	200	750
576N6	0-400	28	200	750
576N7	0-1200	20	200	750

*Cut-off frequency is defined as that low frequency at which the indicated power falls 3db (2 times) below the actual power.

Ordering Information (Specify the following):

1. Coupler Unit Model No. _____
2. R. F. Power in watts full scale.
3. Transmitter's Frequency Range in megacycles.

Description

The M. C. Jones MicroMatch 576N Series is a small, compact, light-weight, low-cost directional coupler which can be built directly into your transmitter to monitor incident and reflected R. F. Power.

The MicroMatch Coupler contains a patented circuit designed to produce an output essentially independent of frequency.

Specifications

Frequency Range: 20-2000 Mcs.
 Impedance: 51 ohms
 R. F. Input and Output: Type "N" connectors (mate with UG-21/U connectors)
 D. C. Output: Type 1N21 crystal
 Accuracy of Incident and Reflected R. F. Power Readings: Plus or minus 5% of full scale.
 Reflection Coefficient: Negligible
 Weight: 10 ounces

MIL-STD-125 (DP-241b) (Description.)

(1.) Coupler, directional. A double directional coupler assembly capable of providing separate simultaneous D. C. voltages sensitive to incident and reflected R. F. power at the point of insertion into the transmission line. (2.) Terminal fitting data. (2.b) Connectors. (2.c) Type No. "N" on each end. (2.d) for main line. (3.) Frequency Range: 20-2000 Mcs. (4.) Coupling loss negligible throughout frequency range. (5.) Insertion voltage standing wave ratio negligible. (6.) Overall dim. (6.a) 4 1/4" long. (6.b) 1 1/4" wide. (6.c) 3 3/16" high. (7.) Special markings: Identification plate. (8.) Special features: (8.a) 51ohms impedance. (8.b) The incident and reflected power indications are independent of frequency throughout the greater portion of the 20-2000 Mcs. frequency range. (A) for coaxial transmission line. (D) Data regarding the manufacturer: (D.1) M. C. Jones Electronics Co., Inc. (D.2) Bristol, Conn. (D.3) Model No. 576N Series. (E) for general purpose. Requirements 2.a, B, B.1, B.2, B.3, C, C.1, C.2, C.3 are N/A

BREAK ALL SHARP EDGES

REVISIONS
 REV. & REDRAWN
 5/9/56
 WJB

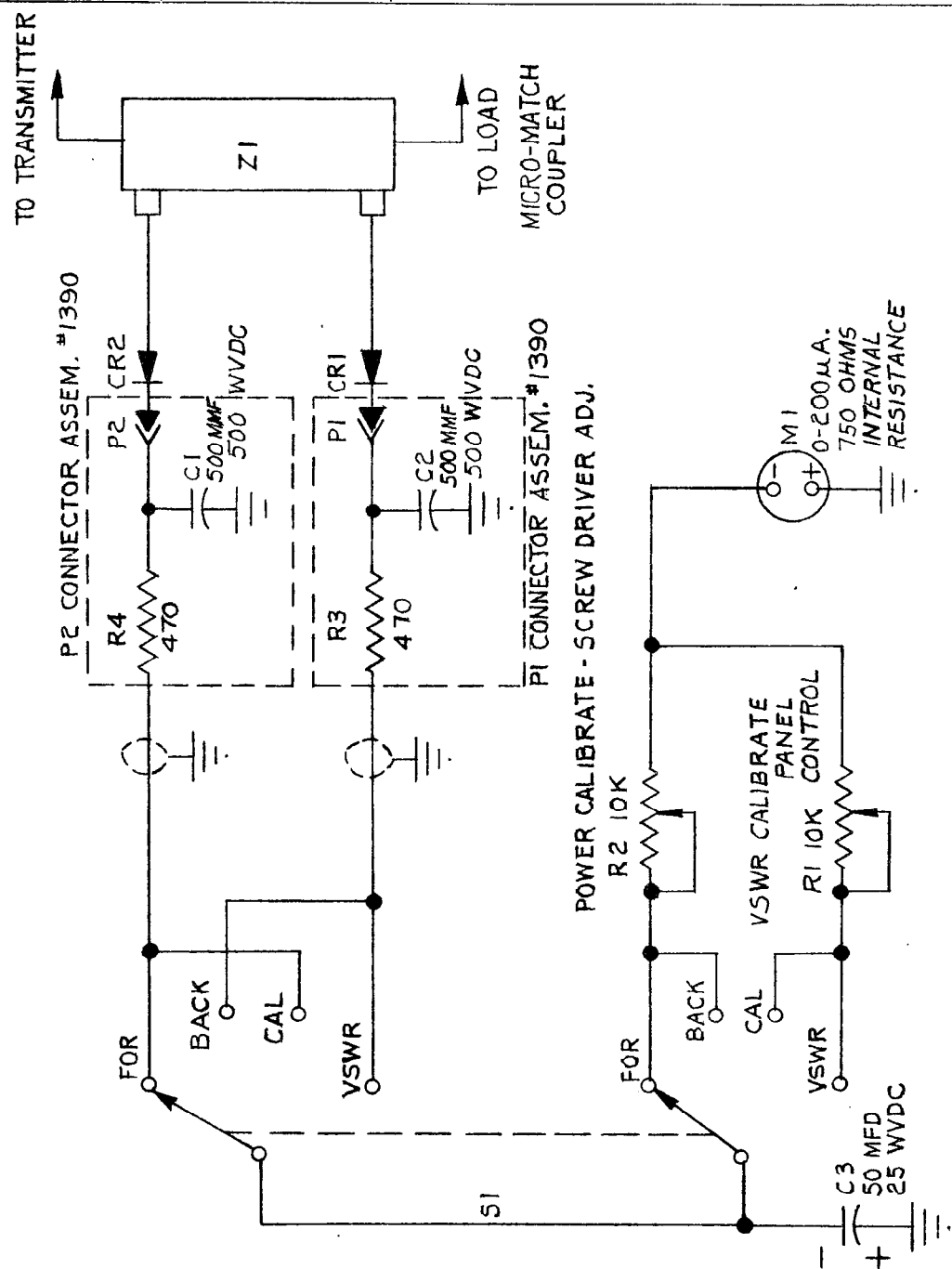
COUPLER UNIT - OUTLINE DWG.

FIRST USED ON 576 N SERIES REF. ASS'Y #219/ ITEM NO.

MAT'L	PER	M. C. JONES ELECTRONICS CO., BRISTOL, CONN., U. S. A.		
MAT'L REQ'D	PER	DWN. WJB	CHK. S. J.	APP.
FINISH				DATE 5/9/56
TOLERANCES UNLESS MARKED		SCALE		
FRAC. ± 1/64	DEC. ± 0.005	1:1		
ANG. - 1/2°		2388		

REVISIONS

QUANTITY				PART NO.	DESCRIPTION	ITEM
G4	G3	G2	G1			



- NOTES:
1. C3 FOR PEAK-READING INDICATOR ONLY.
 2. 1.0 VOLT D.C. ACROSS TOTAL INDICATOR CIRCUIT RESISTANCE OF 5000 OHMS, (WHICH INCLUDES R2 ADJUSTMENT, R4 & M1 RESISTANCES) WILL PRODUCE FULL SCALE DEFLECTION OF METER.

BREAK ALL SHARP EDGES

<p>SCHMATIC-INDICATOR (DOUBLE COUPLER)</p> <p>FIRST USED ON 410 SERIES</p>		REF. ASS'Y	ITEM NO.		
MAT'L		<p>M. C. JONES ELECTRONICS CO., INC. BRISTOL, CONN., U. S. A.</p>			
MAT'L REQ'D	PER				
FINISH					
<p>TOLERANCES UNLESS MARKED—DIMENSIONS IN INCHES</p> <p>FRAC. ± 1/64 DEC. ± 0.005</p> <p>ANG. ± 1/2°</p>		DWN. <i>EUB</i>	CHK.	APP.	DATE <i>12/27/54</i>
SCALE		1556			

EXCITER TUNE-UP

The exciter is the most important section of the transmitter. Good operation of the entire equipment is dependent upon the exciter operating properly. Inasmuch as the exciter operation is so important, it is completely adjusted at the factory to obtain the optimum characteristics, and the adjustments which affect its operation, are sealed and should not be touched under any circumstances without consulting the Gates Radio Company at Quincy, Illinois. It is possible to adjust the exciter in the field if the engineer doing the work has proper knowledge of the operation of this portion of the equipment and is well versed in the operation of, and has available the proper test equipment in good condition that is necessary to accomplish tune-up of the exciter. The following list of test equipment must be on hand for this purpose:

1. One Audio Signal Generator providing the frequencies of 50, 100, 400, 1000, 2500, 5000, 7500, 10,000 and 15,000 cycles per second. The important characteristics of this Audio Signal Generator are as follows:
 - (a) Distortion - Not more than .2% at an output level of ± 10 DBM.
 - (b) Noise - 70 DB below an output level of ± 10 DBM.

It must have a meter suitably calibrated to read output levels indicated above.

2. A Frequency Modulation Monitor designed so that it will deliver recovered audio from the frequency modulated signal that it monitors to the test equipment, having distortion of not more than .25% in output signal and noise level of 70 DB below 100% modulation at 15,000 cycles.
3. A Distortion and Noise Meter capable of making measurements at all the audio frequencies listed for the Signal Generator and having distortion of not more than .15% at 50 cycles and a noise level of -70 DB.
4. A Vacuum Tube Voltmeter equivalent to the Hewlett-Packard 410B which is equipped with an R.F. probe. Drawing A-4165 shows the complete factory test setup connections and should be carefully observed before connecting the test equipment to the transmitter. The following is the procedure used at the factory for tuning up the exciter:

7.01 Before starting to tune the exciter, refer to the Padding Chart, drawing 671-PE-101. If the final operating frequency

is to be changed to a different band other than originally shipped on, the padding capacities across the primary and secondary coils of the transformers must be changed as shown on the Padding Chart. The condensers are located on terminals outside the coil cans that extend through the exciter panel.

- 7.02 To facilitate in ease of tune-up of the multiplier transformers, the exciter may be removed from the transmitter and a three-conductor cable made up to supply filament, B_f voltage and ground return. This will made metering and adjustment easier.
- 7.03 Adjust R517 to approximately mid-position.
- 7.04 Adjust C513 to maximum capacity.
- 7.05 Place R.F. probe of HP V.T.V.M. on grid (Pin 2) of V504. A reading of about 4 volts R.F. will indicate the oscillator V501, V502 and V503 are operating properly.
- 7.06 Place probe of VTVM on grid (Pin 1) of V505. A reading of about 14 volts R.F. will indicate V504 is operating.
- 7.07 In all other adjustments of the exciter a piece of spaghetti is slipped over the R.F. probe of the VTVM to lessen the capacity loading of the circuits by the diode probe. The coupling is through the capacity of the spaghetti only and not direct to the naked probe tip.
- 7.08 Place probe of the VTVM on plate (Pin 5) of V505. Take a short length of wire with an alligator clip on each end and short the secondary coil of T502. Pins that the primary and secondary coils of T502 through T505 are connected to extend through the chassis. With the aid of the schematic and an ohmmeter, the correct terminals can be located. Now tune the primary or plate side of T502 to resonance as indicated by a maximum reading on the VTVM. If the padding is correct, the correct harmonic of the oscillator will be the frequency the circuit tunes to. Remove the short from the secondary coil and tune this circuit for a minimum reading of the VTVM with the probe still on the plate of V505. The primary tuning is the screwdriver adjustment on the left side on top of the shield can and the secondary tuning is on the right. T502 is now tuned for proper bandpass characteristics and to the correct multiplier frequency.
- 7.09 Place probe of VTVM on plate (Pin 5) of V506. Follow same procedure as in Section 7.08 and tune T503.
- 7.10 Place probe of VTVM on plate (Pin 5) of V507. Follow same procedure as in Section 7.08 and tune T504.

- 7.11 Place probe of VTVM on plate (Pin 5) of V508. Follow same procedure as in Section 7.08 and tune T505.
- 7.12 Place probe of VTVM on grid (Pin 8 or 9) of V511. Tune T506 for maximum reading on the VTVM.
- 7.13 Place probe on grid (Pin 8 or 9) of V512. Tune primary and secondary of T509 for maximum reading on VTVM.
- 7.14 Place probe on grid (Pin 5) of V513. Tune primary and secondary of T510 for maximum reading on VTVM.
- 7.15 With C570 at maximum capacity, adjust C569 for minimum plate current as observed by a dip in meter reading (M507) with switch (S501) in position 13.

Decreasing capacity of C570 will increase loading to the antenna circuit. Meter M604 will increase in reading as the antenna is loaded into. Continue to decrease the value of C570 in steps and resonate the plate circuit with C569 until desired output is obtained.

- 7.16 The exciter is now tuned up and the transmitter is ready for a check at the final operating frequency.
- 7.17 The frequencies of T509, T510 and C569 should now be checked with a wave-meter or grid dipper as it is possible to tune these stages to other multiples of the crystal than the correct one.
- 7.18 Set up the test equipment in the manner shown in the drawing A-4165.
- 7.19 Install C573, .005 mfd. and C580, 130 mmfd. These capacitors are low and high frequency compensation respectively. The values of these capacitors may require some slight adjustment after preliminary frequency response checks, due to variance in components and wiring.
- 7.20 Set the audio generator to 400 Cps. and the output to a point that gives 100% modulation on the modulation monitor. Adjust R517 and C513 for minimum distortion.
- 7.21 Set the audio generator to 50 Cps. and the output to give 100% modulation. Readjust R517 and C513 for minimum distortion.
- 7.22 Check the distortion at 50, 100, 400, 1000, 2500, 5000, 7500, 10,000 and 15,000 cycles.

- 7.23 If the distortion should be excessive at 15,000 cycles, but satisfactory at lower frequencies, this would normally indicate that one or more of the double tuned stages are not tuned properly. If excessive, adjust very slightly the primary or secondary, or both of T502, T503, T504 and T505 for a reduction in distortion. If any great amount of mistuning is done at this point, the complete exciter tune-up must be gone through again.
- 7.24 When the distortion is within specifications at all frequencies, the frequency response is checked. This is done by holding the output of the audio signal generator constant and measuring the percent of modulation on the modulation monitor. The response of the transmitter should follow the standard 75 microsecond pre-emphasis curve (See drawing A-4197). Decreasing C573 will increase the low frequency response and decreasing C580 will increase the high frequency response. If there was any adjustment made in Section 7.24, this also will affect the high frequency response, either increasing or decreasing it, due to side-band cutting in these stages.
- 7.25 Noise is measured with 100% modulation at 400 Cps. as reference. The modulation is removed and the FM and AM noise on the carrier is measured with the monitor and distortion noise meter. Final tests and operation must be done with all covers on, sides on and doors closed.
- 7.26 The modulator circuits are in general relatively insensitive to tube changes and replacements. In rare instances it may be necessary when replacing the 12AT7 tubes in V503, the sawtooth generator, to adjust R517 and C513 (normally only R517), for minimum low frequency distortion. This adjustment should be made only when the proper test equipment is available as the distortion will normally be within specifications and F.C.C. requirements even without adjustment.
- 7.27 When replacing V513 (6146) the output tuning control C569 and the loading control C570 should be retuned for maximum power output.
- 7.28 Replacing any or all other tubes in the exciter can be done without any appreciable change in noise, distortion, bandpass or power output of the exciter.

MAINTENANCE

- 8.01 Maintenance of the FMR-250B should consist of a periodic checking of tubes, meter readings, cleaning, visual inspection, and lubricating places requiring same.
- 8.02 All tubes in the exciter except V511 may be replaced without retuning the circuits they involve. V511 requires replacing the tuning of it's plate circuits should be checked for maximum P.A. grid current.
- 8.03 The P.A. tubes are removed by releasing the wing fasteners in the top deck and pushing the elements up, taking care not to put undue strain on the tubes. Remove the old tubes and seat the new ones in the sockets. Place the chimneys around the tubes and gently seat the P.A. elements on the tubes. Fasten the wing fasteners and retune the P.A.
- 8.04 The three relays should have the dust cleaned out as required and the contacts burnished with a knife blade. These relays are of the telephone type and will require little attention.
- 8.05 The blowers should be lubricated every three months with a few drops of S.A.E. 20 oil. The fan in the top of the cabinet requires no lubrication.
- 8.06 The indicator lamps are neon and will not require replacement unless broken.
- 8.07 Once a month the transmitter should be cleaned of dust. The sides may be removed for this if desired. Remove the cover of the P.A. enclosure and the blower mounting plate for the P.A. The P.A. enclosure should be thoroughly wiped clean of dust. The points of high electrostatic fields are dust collectors and if allowed to accumulate **may cause arc-overs**. Remove the cover from the exciter and check for dust and effect a general visual inspection.
- 8.08 The air filter in the rear door should be removed and cleaned when filled with dust and foreign matter. Take off the perforated plate, remove the air filter and brush off the dirt. Complete the cleaning by washing in kerosene or gasoline and then dipping or pouring on S.A.E. 40 or 50 oil. Allow the filter to drain completely before installing back in the transmitter.
- 8.09 A good preventative maintenance schedule will provide best insurance of trouble-free transmitter operation.
- 8.10 Should a breakdown occur in the exciter or low voltage power supply the bad part may be replaced and the transmitter placed back on the air. For optimum performance the exciter tune-up should be checked with the equipment and with the set up as given in the exciter tune-up section.

8.11 If a frequency change is to be made in the field the exciter padding must be changed according to the chart. The transformers of the exciter may be roughly tuned by tuning the plate circuits for plate current dip and the following grid circuit for an increase in plate current of the stage being tuned. C557 and C558 are tuned for maximum P.A. grid current. The shorting bar of the P.A. plate elements may now be set for the new frequency. If the new frequency is lower the shorting bar is moved away from the tubes. If higher the bar is moved nearer. Adjusting the vane nearer the plate elements raises the frequency. The best position for the shorting bar will be where the vane tunes the P.A. plate circuit when it is about 2 inches away from the elements. After a frequency change the transmitter should be checked out with the test equipment and test set up shown in the exciter tune-up section, at the earliest opportunity for optimum operating results.

GUARANTEE

This equipment is fully guaranteed by the Gates Radio Company of Quincy, Illinois, to be free from all defects in materials and workmanship and will be repaired, replaced or adjusted in accordance with the manufacturer's option and terms as outlined below.

- 1 - Gates believes the purchaser has every right to expect first-class quality materials and workmanship and has created rigid inspection and test procedures plus excellent packing methods to assure good arrival at destination.
- 2 - Gates agrees to supply daily factory service, and will make emergency shipments at any time where possible.
- 3 - Gates fully guarantees, under normal and proper usage, all component parts in Gates equipment, except as noted. These parts will be replaced or repaired at the option of Gates as follows:

Transmitter Parts: main power or plate transformer, modulation transformer, modulation reactor, main tank condensers.

(replacements or repairs) - where less than 1 year old...no charge, between 1 and 2 years old 50% or new price

Moving Parts: Guaranteed for six months.

Electron Tubes: Subject to manufacturer's warranty at the time of shipment. Adjustment will be made to the customer as given to Gates Radio Company by the tube manufacturer.

All other component parts: (Except as listed above or below)
Guaranteed for one year.

Abuse: Damage resulting from an Act of God, or by fire, wind, rain, hail, or any other condition other than normal usage is not covered by the guarantee.

- 4 - Date of invoice to original user-purchaser and date of receipt by Gates Radio Company of notification from the customer will determine the age of equipment or parts.
- 5 - In case of adjustment, as on certain transmitter parts listed above "new price" is Gates' current price at time of replacement and/or adjustment.
- 6 - This guarantee covers only Gates manufactured parts and complete Gates equipments including all parts therein, with exceptions as noted. Any purchased part not manufactured by Gates will be subject to the manufacturer's guarantee, unless such part is a unit incorporated in Gates manufactured equipment.

- 7 - Transcription pickups, regardless of make, are guaranteed for ninety days - said guarantee including every associated part of the pickup except the stylus, which because of its fragility is not guaranteed by Gates.
- 8 - Where the replacement part in question must be supplied under the guarantee before the defective part can be returned for inspection, as might sometimes be required, the customer will be billed in full and credit or adjustment will be given on receipt of the defective part in accordance with this guarantee and the terms herein. In order for credit adjustment to be received in line with this guarantee the defective or replaced part must be shipped prepaid to Gates Radio Company or to any other destination requested by Gates within two weeks of the date of the invoice covering the replacement part. Any item alleged defective shall not be returned to Gates until after written permission has been first obtained from Gates' home office at your request.
- 9 - All shipments under this guarantee will be made f.o.b. Quincy, Illinois and all materials returned will be shipped prepaid by the customer f.o.b. Quincy, Illinois
- 10 - As a material part of this guarantee the customer agrees to employ capable technical personnel to maintain all equipment under this guarantee in good, normal condition, properly serviced and cleaned and to use said equipment as and for the purpose intended by seller. This guarantee does not extend to the supply by Gates of any personnel to make any replacement, repair or adjustment.
- 11 - Gates shall not be responsible for damages to items in transportation or careless handling; or injuries to persons or damage to property arising out of the use or operation of Gates equipment or parts, but Gates will supply repair or replacement items speedily, which will be billed to the customer who, in turn, will place claim with the carrier, with assistance from Gates if necessary and when so requested.
- 12 - Delays in fulfilling any part of this guarantee because of depleted stock, floods, war, strikes, power failures, transportation delays, or failure of suppliers to deliver, or because of Acts of God or any other conditions beyond the control of Gates, does not in any way render Gates liable under this guarantee; however, every effort will be made to render prompt service.
- 13 - Gates agrees that this equipment sold is manufactured, where need be, under Royalty License Agreements with Western Electric Company and Radio Corporation of America.
- 14 - This Guarantee is not transferable from the original user-purchaser, and no right of subrogation is given herein.
- 15 - This Guarantee is effective on all standard Gates cataloged items sold after June 11, 1951.

Gates Radio Company
Quincy, Illinois

OVERALL ELECTRICAL PARTS LIST FOR
FMR-250B BROADCAST TRANSMITTER

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
A101		Lamp, 100W., 110V.
A102		Micro-match, 400W., 51 Ohm
A103		A.C. Outlet
A104		Fan, 115V., 50/60 cycle, 1500 R.P.M. 650 CFM
A301, A302, A303, A304, A305 A306, A307, A308, A309, A310		Pilot Light Assembly, Clear Neon Lamp
A401		Blower, 115V., 50/60 Cycle
A601		Blower, 115V., 50/60 Cycle
C101, C102		Capacitor, 10 mfd., 1500 volt, Oil Filled
C405, C406		Capacitor, 100 mmfd., 5000V., Ceramic
C407		Capacitor, Variable
C408, C409, C410, C411		Capacitor, 750 mmfd.
C412		Variable Capacitor
C601		Capacitor, 10 mfd., 600V.
C602		Capacitor, .1 mfd., 400V.
E301, E302, E303	A-11926	Relay complete with cover, 200 ohms, 8400 turns of #31 Wire
J401		Jack
J402, J403		Jack
L101, L102		Reactor
L401, L402	A-8670-1	Choke Coil
L403		Plate Tank (Part of C-18807-101)
L404A	A-8944-101	Grid Tank Coil
L405, L406		Choke
L407	A-8946-101	R.F. Choke
L408	A-9741-101	Monitor Loop Coil
L404B	A-8944-102	Grid Tank Coil
M201		Meter, 0-10V. A.C. (Cal. for Non- Magnetic Panel)
M202		Meter, 0-30 MA. D.C. (Cal. for Non- Magnetic Panel)
M203		Meter, Similar to 0-1 MA D.C. except with 0-2000V. D.C. Scale (Cal. for Non- Magnetic Panel)

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
M204		Meter, 0-500 MA D.C. (Cal. for non-Magnetic Panel)
M205		Meter, 0-200 Micro Amp. D.C. with special scale to Drawing A-7575
P101, P102		Plug
P401		Plug
P402, P403		Plug
R101		Resistor, 100K ohm, 110 W. Ferrule Type
R102		Resistor, 2 megohm 2KV, 1 MA, Meter Multiplier
R201, R202		Control, 10,000 ohm
R301, R302, R303		Resistor, 100 ohm, 1W., 10%
R304, R305		Resistor, 10 ohm, 10W.
R306	A-7685-1	Resistor, .1 ohm
R401		Resistor, 3000 ohm, 10W. P.T.
R402, R403		Resistor, 10,000 ohm, 10W., P.T.
R404, R405		Resistor, 4700 ohm, 2W., 10%
R601, R602		Resistor, 50 Watt, Adj. 400 ohms
R603		Resistor, 680K ohm, 1W., 10%
R604		Control, 500K ohm, adjustable
R605		Resistor, 47K ohm, 1W., 5%
R606		Resistor, 270K ohm, 1W., 10%
R607		Resistor, 15K ohm, 10W.
R608		Resistor, 110K Ohm, 1W., 5%
R609		Adjustable, 70K ohm, 4W.
R610		Resistor, 47K ohm, 1W., 10%
R611		Resistor, 100 Ohm, 20W., Wirewound, P.T.
S101, S102		Switch
S201		Switch, 2 pole, 2 section, Ceramic
S301		Switch, 2 pole, 2 section, Ceramic
S302		Switch, Rotary Power, 2 section, 5 Position
S303, S304		Circuit Breaker, 25 Amp., 115V., 60 Cy. back connected Curve B with 115V. 60 Cy. Relay Coil
S401		Coral Designs, P104 Control Close at .25, Oper at .1, water column pressure
T101		Transformer
T301		Transformer
T302		Transformer
T601		Transformer
T602		Transformer
T603		Transformer

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
TB101		Terminal Board
TB102		Terminal Board
TB103		Terminal Board
TB401		Terminal Board
TB402		Terminal Board
TB601		Terminal Board
V301, V302		Tube, 866A
V401; V402		Tube, 4X150A
V601, V602		Tube, 5U4G
V603, V604, V605		Tube, 6AS7
V606		Tube, 6SH7
V607		Tube, VR105
X101		Lamp Socket
X301, X302		Socket, 4 Prong
X401; X402		Socket, SK-610, with chimney SK-606
X601, X602, X603;		
X604, X605, X606;		
X607		Socket

EXCITER UNIT FOR FMR-250B (500 Series)

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
A501		Lamp, 6-8 Volt
C501		Capacitor, .1 mfd., 200(W)V.
C502		Variable Capacitor, 5-100 mmfd.
C506, C539,		
C575		Capacitor, 50 mmfd., $\pm 10\%$
C504; C505, C508,		
C510; C571		Capacitor, .1 mfd., 600(W)V.
C507; C512, C519,		
C520, C521		Capacitor, .01 mfd., 1KV
C509; C522, C523;		
C524; C525, C526;		
C527; C528; C529;		
C530, C531, C532;		
C533; C549, C551;		
C552, C555, C556,		
C576, C577		Capacitor, .005 mfd., 1KV
C511		Plug-In Capacitor, 20-20-20 mfd., 450V.
C513		Variable Capacitor, 4-50 mmfd.
C514		Capacitor, 120 mmfd., $\pm 10\%$
C515		Capacitor, 1 mfd., 200(W)V.

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
C516		Capacitor, 15 mmfd., $\pm 10\%$
C517, C518		Capacitor, .001 mfd., 1KV
C539		Capacitor, 20 mmfd., $\pm 10\%$
C553, C554		Capacitor, 33 mmfd., (Part of T509)
C557		Capacitor, (Det. by Freq.) (For T510)
C558		Capacitor, (Det. by Freq.) (For T510)
C559, C562, C563, C564, C568, C582		Capacitor, 500 mmfd., $\pm 20\%$
C565, C566		Variable Capacitor; 3-20 mmfd., (For T510)
C567		Feedthru Capacitor; .001 mfd.
C569		Variable Capacitor, 4-25 mmfd.
C570		Variable Capacitor; 6-100 mmfd.
C572		Capacitor, .5 mfd., 400(W)V.
C573		Capacitor, .02 mfd., 200(W)V.
C574		Capacitor, 1 mfd., 400(W)V.
C580, C503		Capacitor, 150 mmfd., $\pm 10\%$
C581		Capacitor, .5 mfd., 600(W)V.
HR501		Crystal Oven & Heater w/Internal Octal Socket (Det. by Customers Order)
J503		Receptacle
L501; L502, L509		RF Choke
L504, L505		Coils (Part of T409)
L506, L507	A-11298-1	50/100 MC Coil
L508	A-10981-2	6146 Plate Circuit Coil
M501		Meter, 0-1 MA D.C. (Non-Magnetic Panel)
P503		Plug
PAD501	M5486	Pre-Emphasis Network Pad
R501; R577, R578		Resistor, 2.2 Megohm, 1/2W., 10%
R502, R513, R524		
R527, R530, R533, R536		Resistor, 4700 ohm, 1/2W., 10%
R503		Resistor, 24K ohm, 1/2W., 5%
R504; R509, R512; R525, R528; R532; R561, R570, R571, R576		Resistor, 100K ohm, 1/2W., 10%
R505		Resistor, 270K ohm, 1/2W., 10%
R506, R518		Resistor, 10K ohm; 1/2W., 10%
R507		Resistor, 68K ohm, 1W., 10%
R508		Resistor, 1500 ohm, 1/2W., 10%
R510		Resistor, 2200 ohm, 1/2W., 10%

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
R511, R519, R521; R523, R541, R573, R574 R515 R516, R520, R566 R517 R522 R526, R531, R534, R535, R537 R529 R562 R563, R565, R569 R564 R567 R568 R572 R575 R579 R580 R581, R582 R583 R584, R587 R585 R586, R588 R590, R591 R592 R593		Resistor, 220K ohm, 1/2W., 10% Resistor, 5100 ohm, 1/2W., 5% Resistor, 4.7K ohm, 1/2W., 10% Control, 5CK ohm Resistor, 6200 ohm, 1/2W., 5% Resistor, 470K ohm, 1/2W., 10% Resistor, 1 Megohm, 1/2W., 10% Resistor, 1500 ohm, 1W., 10% Resistor, 22K ohm, 1W., 10% Resistor, 4700 ohm, 2W., 10% Adj. Resistor, 2500 ohm, 25W. Adj. Resistor, 25K ohm, 25W. Resistor, 8200 ohm, 1/2W., 10% Resistor, 2700 ohm, 1/2W., 10% Resistor, 8000 ohms, 10W. Resistor, 15K ohm, 1W., 10% Resistor, 10K ohm, 1W., 10% Resistor, 12K ohm, 1W., 10% Resistor, 33K ohm, 1W., 10% Resistor, 47K ohm, 1W., 10% Resistor, 8200 ohm, 1W., 10% Resistor, 1000 ohm, 2W., 10% Resistor, 350 ohm, 10W. Resistor, 82K ohm, 1W., 10%
S501		Adj. Stop Rotary Switch
T501	AI-10386T	Input Transformer
T502, T503	B-10479-103	Transformer
T504	B-10481-103	Transformer
T505	B-10482-103	Transformer
T506		Variable Inductance Coil 5-9 Microhenries
T509	C-19529-101	RF Transformer
T510		RF Transformer (Components Separate Items)
T511		Heater Oven Transformer
TB501		Terminal Board
V501		Tube, 6BA6
V502, V503, V504, V517		Tube, 12AT7
V505, V506, V507, V508, V509		Tube, 6AH6
V511, V512, V518 V513		Tube, 5763 Tube, 6146

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
XA501		Pilot Light Assembly (Clear)
XC511, XPAD501		
XV513		Socket
XHR501		Crystal Oven Socket
XV501		Turret Socket
XV502, XV503, XV504, XV517, XV518		Turret Socket
XV505, XV506, XV507, XV508, XV509		Socket
XV511, XV512		Socket
Y501		Crystal (Det. by Customers Order)

A-7648

WIRING CHART

Wire No.	From	To
1	TB101-1	S303-A1
2	TB101-2	S303-A2
3	T602-7(sec)	S303-B1
4	S302(com #1)	S303-B1
5	S302(com #2)	S303-B2
9	T301 / (pri)	T302 / (pri)
10	TB601-1	T302-115(pri)
11	TB601-2	T302 / (pri)
12	TB402-1(A401)	T302 / (pri)
13	TB103-2(A104)	T301 / (pri)
14	T602-5(sec)	S304-A1
17	T602-5(sec)	T301 / (pri)
18	T302-115(pri)	T301-115(pri)
19	TB103-1(A104)	T301-115(pri)
20	TB402-2(A401)	T302-115(pri)
21	S304-D	S101-closed
22	TB103-2(A104)	S101-common
23	A305	S101-open
24	S304-D	S401-closed
25	TB402-1	S401-common
26	A301	S401-open
27	T101-1 & 3(pri)	S304-B1
28	T101-2 & 4(pri)	S304-A2
29	R-102(mtr. mult.)	M203 / (Ep)
30	GRN.	M203-(Ep)
31	E302(coil)	C101 & C102(neg)
32	E302(coil)	M204-(Ip)
33	GRN.	M204 / (Ip)
34	TB601-6(T601, C.T.)	E301-1(coil)
35	TB601-5(B /)	TB501-10(exciter B /)
36	S301-B	TB501-10(exciter B /)
37	TB601-3(6V)	TB501-8(exciter Fil)
39	T301-7(sec)	TB401-2(PA Fil)
40	T301-5(sec)	TB401-3(PA Fil)
41	S301-C	TB401-5(PA Screen)
42	S301-A	TB401-6(PA Screen)
43	S301-E	TB401-4(PA Grid)
44	S301-D	E303-1(coil)
45	M201(Ep)	TB401-2(PA Fil)
46	M201(Ep)	TB401-3(PA Fil)
47	S301-(Rotor #1)	M202 / (Ig, Isg)
48	S301-(Rotor #2)	M202-(Ig, Isg)
49	T602-115(pri 4)	S302-Rotor #1
50	T602- / (pri 3)	S302-Rotor #2
51	T602-115(pri 2)	S302-Rotor #3
52	T602- / (pri 1)	S302-Rotor #4
53	TB101-3	TB501-1
54	TB101-4	TB501-2
55	TB102-1, 2, 3, (Twin Shielded Audio Pair)	TB501-4, 5, 6
38	TB601-4 (6V)	TB501-7 (Exciter Fil.)

- Sheet 1 of 2 sheets -

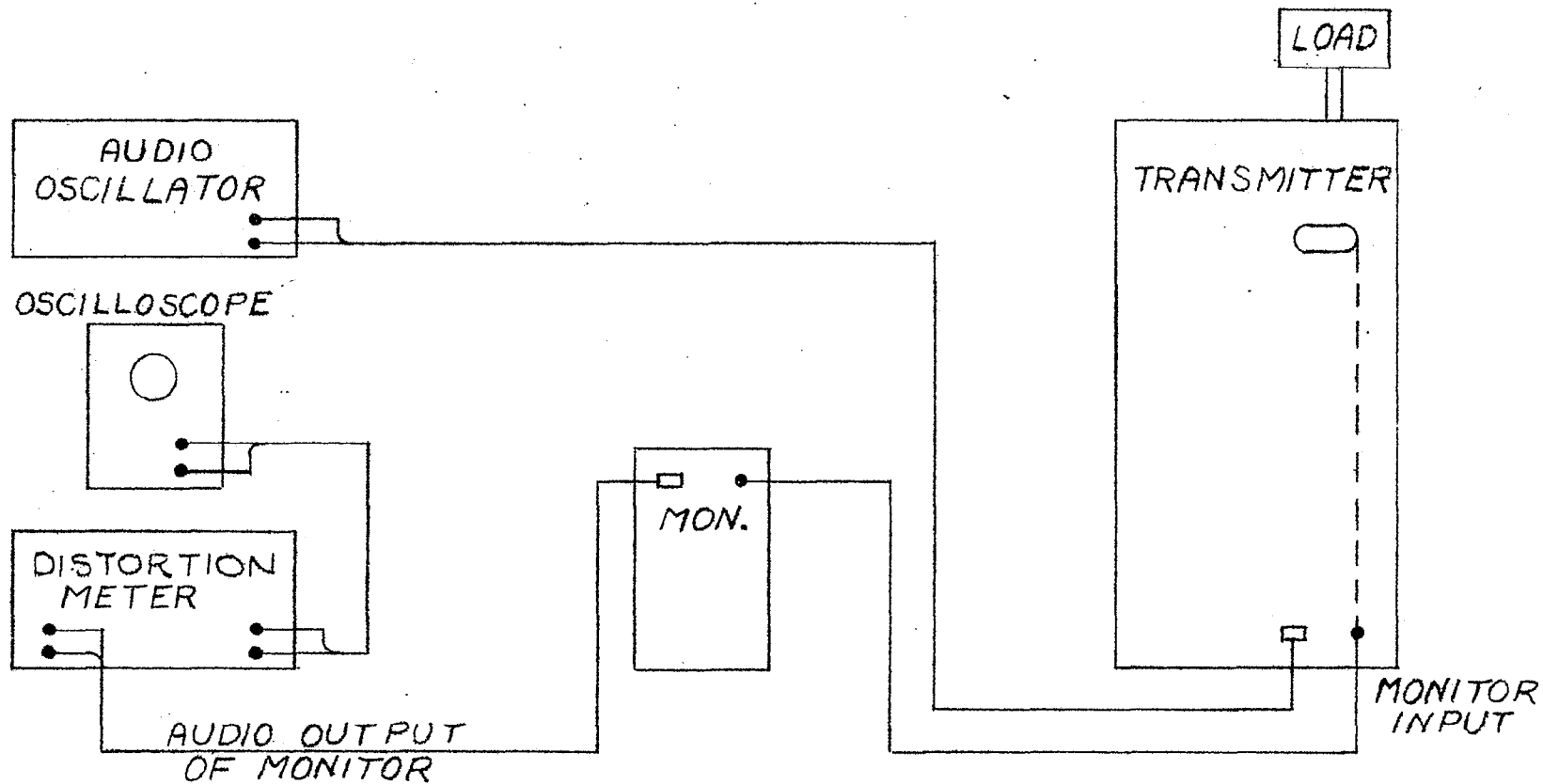
FM-R-250 Transmitter (MO-4052) Engr. Hoyt

MATL.	FIN.	PART NO.	DWG. NO.
DRAWN BY		A-7648	
DATE		GATES RADIO COMPANY	
CHECKED BY		QUINCY, ILLINOIS	
DATE			

Variations on Finished Dimensions unless otherwise marked

Basic Dimensions	Fractional Dimensions	Decimal Dimensions
Up to 1/4	± 1/128	± .005
Above 1/4 to 6	± 1/64	± .005
Above 6 to 24	± 1/32	± .010
Above 24	± 1/16	± .015

Changes per
ECN-2990
12/19/51
Sub 1
Wire #38
added.
ECN-3144
2/4/52 Sub 2



REDRAWN 1-7-56 W.L.S.	TEST SETUP FOR F.M.		
	MTL _____	FIN. _____	UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES PER GATES SPEC GSM102.
	DR. BY DATE C.R.B.	CH. BY DATE B.E.P.	
	GATES RADIO COMPANY QUINCY, ILLINOIS		

WIRING CHART

<u>Wire No.</u>	<u>From</u>	<u>To</u>
56	TB101-3	A103-1(utility socket)
57	TB101-4	A103-2(utility socket)
58	A101-1(utility light)	A103-1(utility socket)
59	S102-(closed)	A103-2(utility socket)
60	S102-(common)	A101-2(utility light)
61	T101-6(sec)	V301-plate
62	T101-8(sec)	V302-plate
63	L101-1(input)	T302-C.T.(sec)
64	L102-2(output)	PA Plate Tank
65	P201(#230)(twin shielded coupler unit)	(Pos 1 & 3 S201 Deck 2)
66	GND on frame	M205-Pos
67	R201, R202(stator) S302 (Sec. 1, Term. 3)	M205-Neg A1-S304

#55, (Twin shielded audio)
#65, " " "

#61, 62, 63, 64, (Belden #7777 high tension cable)

All other wires #14 stranded, black hook up wire.

12-6-51

Sheet 2 of 2 sheets..

Variations on Finished Dimensions unless otherwise marked			
Basic Dimensions	Fractional Dimensions	Decimal Dimensions	
Up to 1/4	± 1/128	± .005	
Above 1/4 to 6	± 1/64	± .005	
Above 6 to 24	± 1/32	± .010	
Above 24	± 1/16	± .015	

EM-R-250 Transmitter (MO-4052) Engr. Hoyt

MATL.

FIN.

DRAWN BY

DATE

CHECKED BY

DATE

PART NO.

DWG. NO.

GATES RADIO COMPANY
QUINCY, ILLINOIS

A-7648

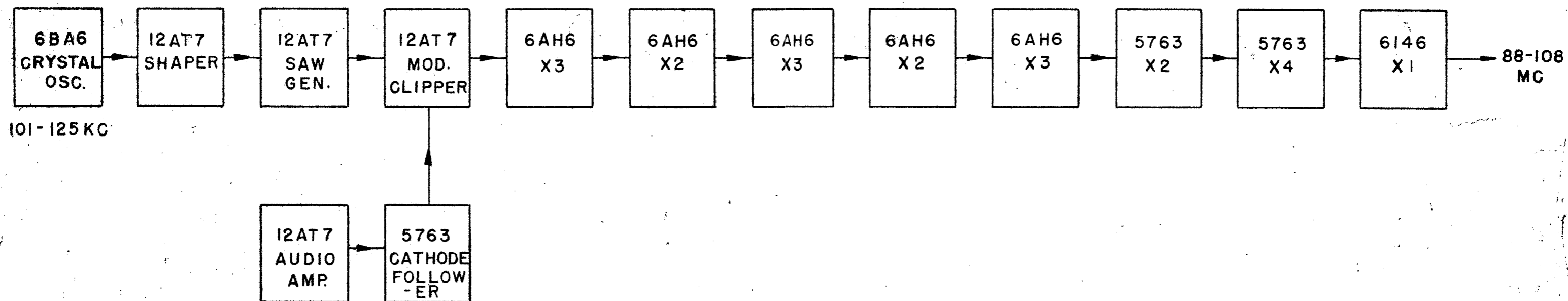
Padding Chart for FMR250B-M4673 Exciter

Freq.	T501		T502		T503		T504	
	Pri.	Sec.	Pri.	Sec.	Pri.	Sec.	Pri.	Sec.
88 to 89.3 mc.	250 mmf.	250 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.
89.5 to 93.3 mc.	220 mmf.	220 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.
93.5 to 99.3 mc.	200 mmf.	200 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.	20 mmf.
99.5 to 103.7 mc.	150 mmf. 25 mmf.	150 mmf. 25 mmf.	none		none		none	
103.7 to 108 mc.	150 mmf.	150 mmf.	none		none		none	

Capacitors 150 mmf. to 250 mmf. to be C-D 22R "Silver Mike" \pm 5%, Midget Mica Capacitors (or type RR Sangamo)

20 and 25 mmf. Capacitor to be GPLK Erie Ceramicons, 10%

Date: 7-13-53
Engineer: H.W.K.



BLOCK DIAGRAM
OF BROADCAST FM EXCITER
FOR FMR 250 B
BFE-10A AND BFE-50 A