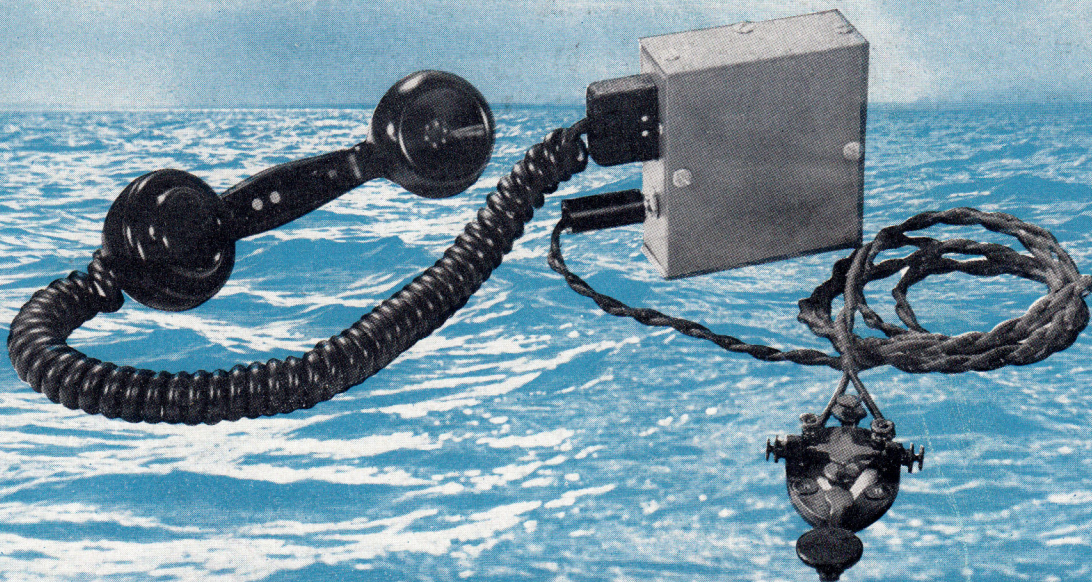


# COMMUNICATIONS RADIO TRANSMITTERS

Scanned and Prepared  
by Dale H. Cook

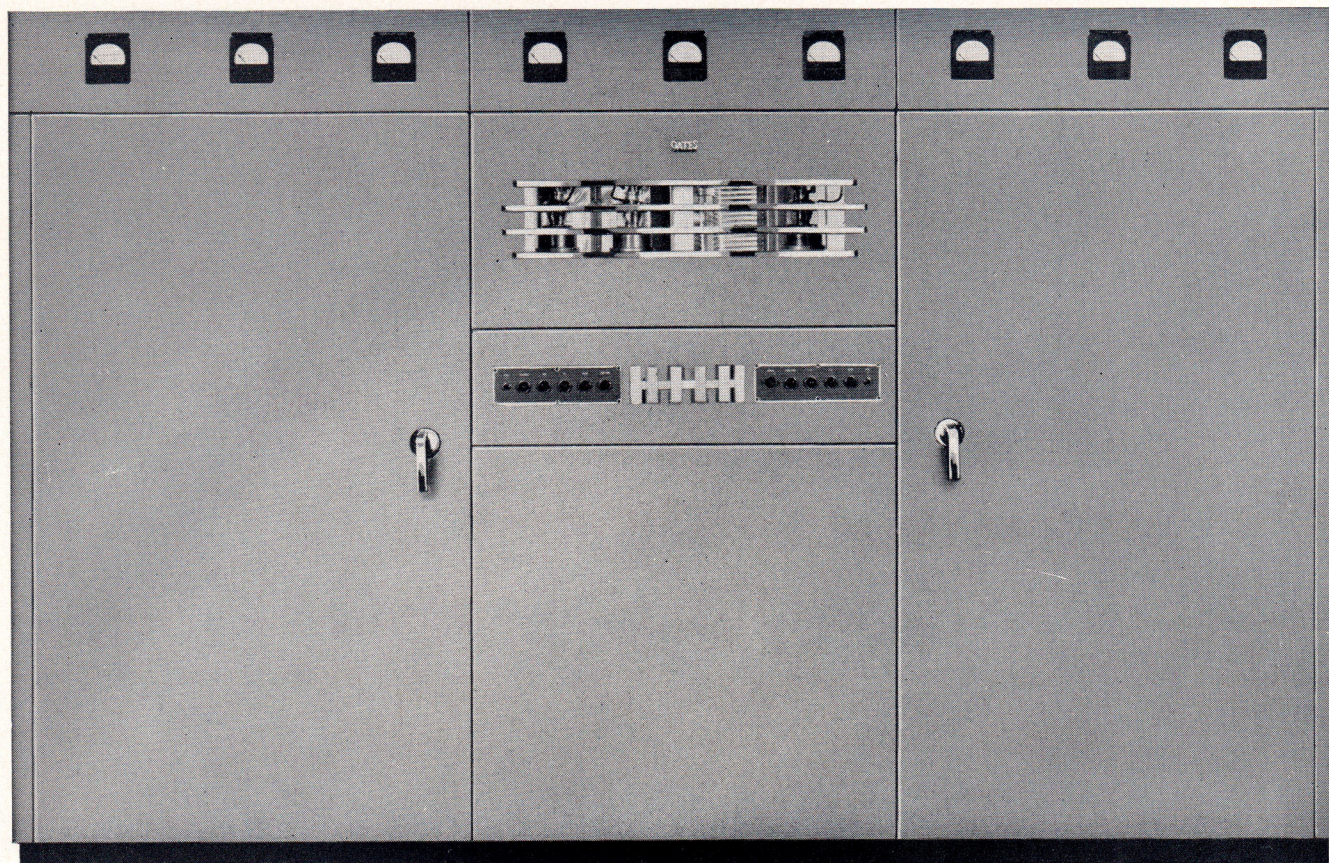


# GATES RADIO COMPANY

MANUFACTURING ENGINEERS SINCE 1922

QUINCY, ILLINOIS, U. S. A.

## 5-10 Kw. Telephone and Telegraph



### New and Modern High Frequency Transmitters for 5 Kw. or 10 Kw. available in several models for both Telephone, Broadcast and Telegraph.

**HF-5B**, a 5000 watt high frequency broadcast transmitter employing high level modulation and operating from 2-22 Mc. with uniform audio frequency response within 2 Db. from 30 to 10,000 cycles. Employs the new 3X2500F3 tubes as power amplifiers and Class B modulators, providing both better performance and economy in tube cost.

**HF-10B**, identical in all respects to the HF-5B but providing 10,000 watts output from 2-22 Mc. with high level modulation and uniform audio frequency response within 2 Db. between 30 and 10,000 cycles. For international radio broadcasting at high frequencies, no finer 10,000 watt equipment has ever been constructed. Uses the famous 3X2500F3 tubes with thoriated tungsten filaments in both power amplifier and modulator sockets.

**HF-5BX**, the same transmitter as the HF-5B, for high frequency international broadcasting but has high speed keyer added so transmitter may be utilized for both high quality telephone and high speed telegraph service.

**HF-10BX**, a 10,000 watt radio transmitter identical to the HF-10B but having added a high speed electronic keyer, providing a high quality 10,000 watt telephone and telegraph transmitter for use between 2-22 Mc.

**HF-5C**, a telephone type communications transmitter similar in all respects to the HF-5B but with the audio fre-

quency portion designed for communications service only. This allows elimination of the modulation reactor and other alterations in audio frequency components, providing economies where only voice communications will be employed and the wide frequency response and extremely low distortion content of the HF-5B is not necessary.

**HF-10C**, a 10,000 watt communications type telephone transmitter with its audio components designed for voice quality transmission only and in other respects identical to the HF-10B transmitter. For international telephone communications no finer 10,000 watt radio transmitter has ever been constructed.

**HF-5CX**, an identical transmitter to the HF-5C but with high speed electronic keyer added, providing telephone and telegraph transmission.

**HF-10CX**, an identical transmitter to the HF-10C but with high speed electronic keyer added and providing a 10KW telephone and telegraph transmitter.

**HF-5TX**, a 5000 watt telegraph transmitter only with high speed electronic keying up to 600 W. P. M.

**HF-10TX**, a telegraph transmitter producing 10KW power over a wide band of frequencies between 2-22 Mc. The high speed electronic keyer is part of the equipment.

## TELEPHONE OR BROADCAST—

Gates high frequency transmitters in the 5-10 Kw. range are available in two models. Those followed by the letter "B" or "BX" are broadcast models with the same audio frequency characteristics that will be found in the finest Gates standard commercial broadcast transmitters and highly suitable for either high fidelity radio broadcasting or voice communications. Those transmitters followed by the letter "C" or "CX" are designed for voice use only such as normally employed in telephone communications. These transmitters have a more limited frequency response in the voice range and are actually preferred where only voice communications will be utilized. In addition, because of the reduced requirements in audio components for only voice communications, the cost of these transmitters is lower.

## TELEPHONE AND TELEGRAPH—

These popular 5 and 10 Kw. radio transmitters are available with high speed electronic keyers added, providing not only excellent high frequency voice transmission but keying speeds up to 600 W. P. M. with perfect square top wave form in excess to 400 W. P. M. Provision is also made in the electronic keyer for modulated CW operation. Both the broadcast and communications voice models of these transmitters may be obtained with electronic keyers added.

## TELEGRAPH ONLY—

Where the need is telegraph communications only, the HF-5TX for 5000 watts and HF-10TX for 10,000 watts is available. These transmitters, designed

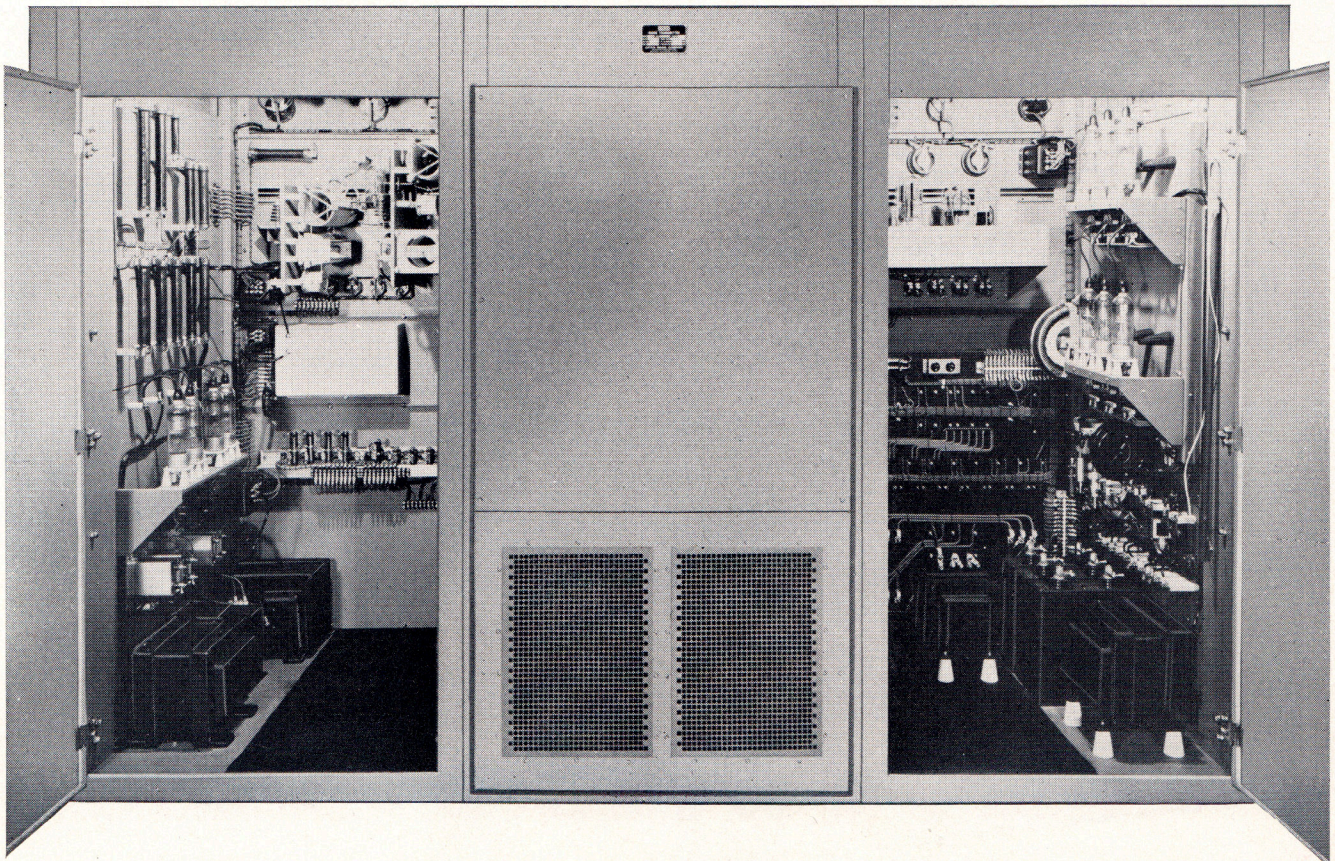
for 24-hour around-the-clock service, will provide excellent wave form at keying speeds up to 600 W. P. M. along with complete reliability, quick frequency change, and 100% front-of-panel control. Telegraph transmitters only are logically substantially lower in price than telephone transmitters.

## RADIO FREQUENCY—

Both 5 and 10 Kw. models use the same tube complement. The difference is in plate voltages applied. Dual 6L6 oscillators with four temperature controlled crystal positions; 807 intermediate, doubler and keying amplifier; P. P. 4-125A driver amplifiers and P. P. 3X2500F3 power amplifiers. Crisscross neutralization is employed in power amplifier. Neutralization is not required in any other radio frequency stage. Completely metered with individual meters in each R. F. driver and power amplifier tube circuit. Meter selector switches or pushbutton metering not employed in any major circuit.

## BAND CHANGING—

When changing from one frequency to another, operation is quick and positive. Complete frequency change can be made from the front panel by means of continuously variable coils and tap selectors on all stages including the transmission line matching network. Four coils, of the latch-on type, covering a range from 2 to 22 Mc., are supplied for the power amplifier tank circuit. These coils latch on with wing nuts, can be removed and the proper one inserted in a matter of seconds. At pre-determined frequencies complete band change can be made in less than a minute. Temperature controlled crystal ovens are



## 5-10 Kw. Telephone and Telegraph

pre-heated at all times so that, at frequency change, exact crystal frequency will be assured.

### AUDIO FREQUENCY—

In both the broadcast and communications models four audio stages are employed, all stages being P. P. with 6J7 first stage; 807 triode connected second stage; P. P. parallel 845 driver stage; and P. P. 3X2500F3 Class B modulators. The same tube complement is employed in either the 5 Kw. or 10 Kw. model. Inverse feedback is employed in the broadcast model to add to the low noise and distortion characteristics. The broadcast model incorporates an audio frequency reactor in the Class C circuit, while the communications model utilizes the secondary of the modulation transformer for direct connection to the Class C amplifier. Greater reduction in noise is obtained through the use of the thoriated tungsten filaments in the 3X2500F3 modulator tubes.

### POWER SUPPLIES—

Three power supplies are employed, the main rectifier incorporating six type 8008 tubes in a full wave 3-phase circuit for 5 Kw. In the 10 Kw., type 673 rectifier tubes are employed. In addition, there is a full wave low power rectifier providing all voltages to low power stages, utilizing two 8008 tubes. A third power supply is provided, also with two type 8008 tubes, to provide bias voltages for the modulators, power amplifier, and keyer. Individual filament transformers are generously supplied throughout the transmitter and the highest grade ceramic insulation is employed in power supply circuits. Primary voltage is standard at 230 volts 60 cycles, but other primary voltages and frequencies may be had without extraordinary delay or increase in cost.

### RELAYS AND PROTECTION—

The most complete relay and protection system found in any transmitter of its kind will be found in the HF-5 and HF-10 models. Primary thermal circuit breakers are employed in the main primary circuits. Individual supervisory overload relays are provided for not only the main transmitter in its entirety but individual stages of the transmitter, such as the radio frequency driver, power amplifier, audio driver, modulators, air failure, and exciter failure. These operate a secondary relay protection service in conjunction with time delay, door interlocks and air cooling in-

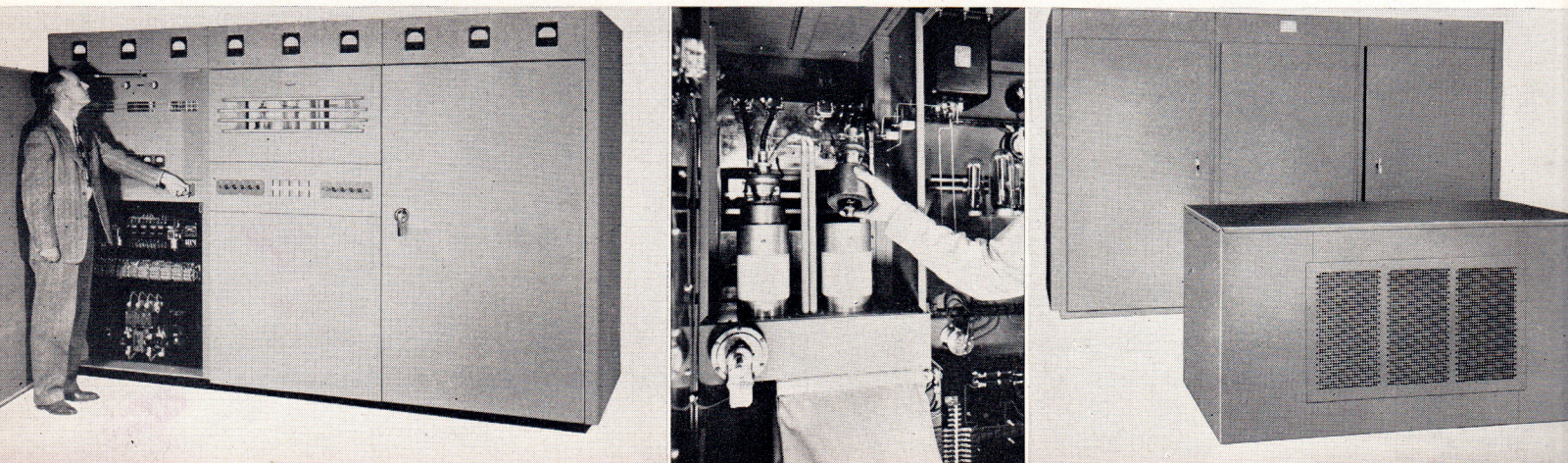
terlocks. All models provide recycling relays where the carrier attempts to reset itself four times before the protecting relay finally drops out. This is done so that, in case of momentary power dips or other circumstances causing a momentary carrier interruption, it will automatically reset itself without attention of the operator. A condenser discharge relay is also provided for operator protection. All relays are located directly behind the front doors and are accessible without entering the transmitter proper or removing the carrier from the air.

### KEYER—

The first radio frequency amplifier may be operated either direct or as a doubler amplifier. Keying is accomplished by an 812 tube so biased that with the key closed no current is drawn by this tube. With the key open the bias is made positive so that the tube draws high current. This tube, as well as the amplifier-doubler previously referred to, is supplied through a common dropping resistor, and the voltage drop is such that the amplifier does not deliver sufficient power to drive the following stage when the key is up. Extremely high speed keying is possible through this method, with complete absence of chirps or lag, and any speed keying up to 400 W. P. M. can be obtained with perfect square top wave form, and up to 600 W. P. M. with excellent performance.

### THE POWER TUBES—

The famous 3X2500F3 air-cooled thoriated tungsten filament tubes are employed, both as radio frequency amplifiers and Class B modulators. These tubes provide not only added efficiency and longer tube life but, because of their lower selling price and greater adaptability to cooling, likewise create a tremendous economy in operation. The 3X2500F3 has been proven over years of grueling high frequency service in FM and radar. In the conservative operation between 2-22 Mc. the tube life will be even greater, providing unusual reliability. No investment is required in cooling fins, as these are part of the tube itself. The thoriated tungsten filament assures lower noise level than heretofore expected in high frequency telephone transmitters. The 3X2500F3 tube in high frequency telephone and telegraph communications is one of the greatest advancements to come out of the Gates engineering laboratories in years.



## COOLING—

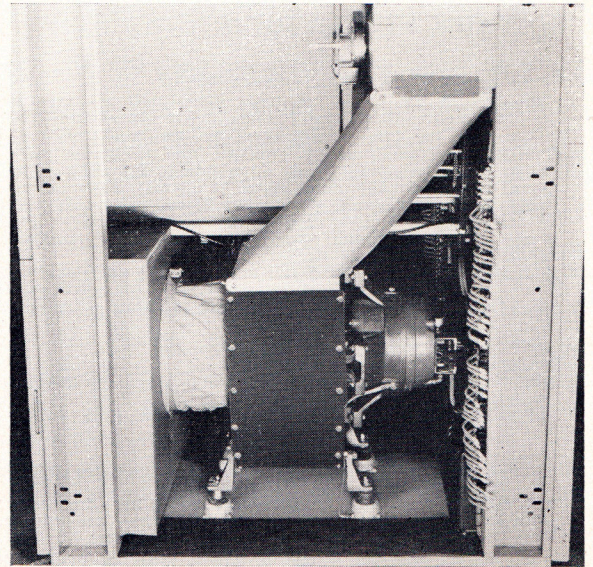
The power amplifier and modulator tubes are cooled by one large squirrel cage blower of cast construction, the incoming air being pulled through a spun glass filter and sent to an air chamber located directly under the four power tube sockets. The excess air circulated throughout the transmitter cabinet provides forced air ventilation to every part. A diaphragm type air pressure switch is located on the air chamber directly below the tube sockets and immediately operates a cutout relay in case of air failure. This type of air protection not only protects against blower failure but also clogging of the air filters. A small portion of this air is also extended to play upon each filament seal of the 3X2500F3 tubes. The design of these tubes makes possible the use of one blower to cool all tubes, developing lower maintenance cost and likewise lower power consumption from the primary lines. A second and much smaller blower develops air at the bottom of each of the high voltage rectifier tube glass envelopes to provide mercury condensation.

## LOADING—

The radio frequency output is sent to a balanced transmission line which may be between 300 and 800 ohms. Continuously variable coils, operated by Veeder counter dials on the front of the transmitter, make it possible to instantly adjust the coils in each leg of the pi-network to the fraction of a turn for operation on the frequency selected in conjunction with proper transmission line loading. These continuously variable coils are of edgewise ribbon and have greater spacing between turns at one end than at the other, providing same accuracy in matching at high frequencies as at lower frequencies.

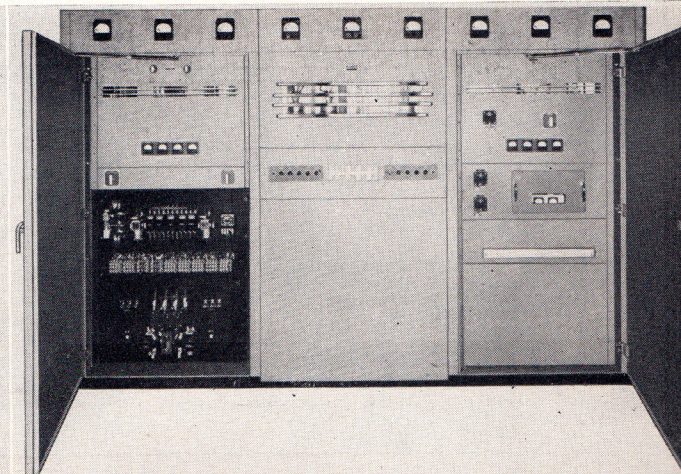
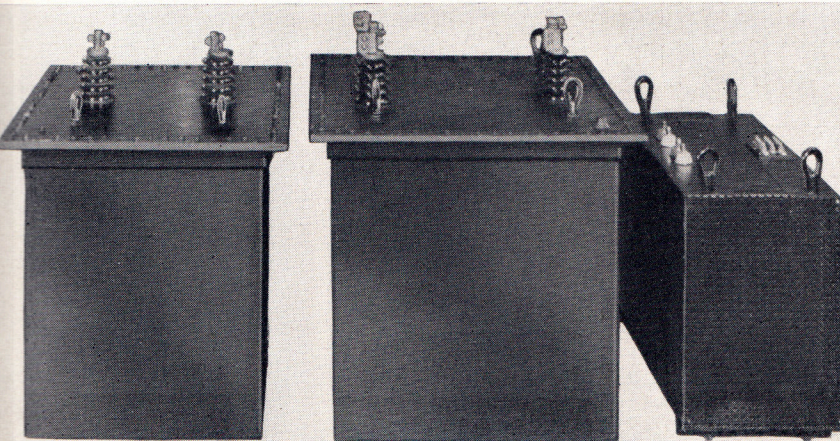
## CONSTRUCTION—

The 5 Kw. and 10 Kw., as well as the telegraph models, are all constructed in the same size enclosures. These consist of three cubicles which bolt together and separate only for reasons of shipping. No inner cabling between cubicles is required and connection from one cubicle to another is made by simple jumper straps from one terminal strip to another. The total floor space of the three cubicles, or the entire transmitter, is 125" wide and 49" deep. Additional space should be provided for a door swing of approximately 40" for the front and back doors. The telephone models have the power transformer, modulation transformer and modulation reactor, where used, as separate units which may be mounted directly behind the transmitter in the basement of the transmitter building or outside of the transmitter building in a

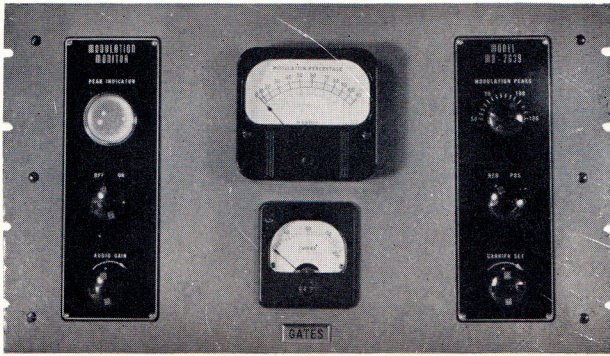


Illustrated above, the large squirrel cage blower with air intake from the left and air chamber at the top of the canvas boot. Note air pressure switch at top center of illustration.

small transformer enclosure. The telegraph models have the power transformer self-contained. All transformers are completely cased and designed to operate in unusually high temperature or humidity. The left cubicle contains the complete relay equipment; audio frequency driver equipment, where required; and high voltage rectifier. The center cubicle contains the power and modulator tubes, tank coil and matching network, cooling system, and the starting buttons with adjacent indicating lamps. The right cubicle contains the complete radio frequency section along with auxiliary relays and associate equipment. These transmitters are very roomy; one can walk in from the rear for any servicing required. They are provided with rubber matting on the floor and lights that automatically turn on when the door is opened. Utility receptacles for service light, vacuum cleaner, etc., are also provided on the inside of the cubicles. Finish is in attractive gloss gray two-tone with appointments in chrome and black. The entire design meets all specifications of the Rules of Good Engineering Practice as laid down by the radio departments of major governments throughout the world.







## GATES HIGH FREQUENCY MODULATION MONITOR

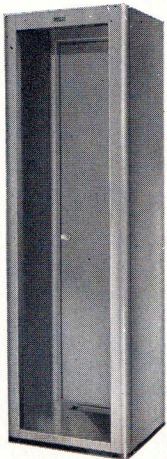
For accurate indication of modulation percentage Gates engineering has developed the MO-2639X modulation monitor which will operate without changing adjustment at any frequency between 1 and 23 Mc. Mounts on a standard relay rack panel 10½"x19" in size. Provided with large 4" direct reading meter, indicating modulation percentage up to 110% and a 3" carrier level meter with a range of 0-200%. Front panel controls include carrier adjustment, positive-negative peak selector, peak indicator range adjustment from 50-120%, On and Off switch, and audio frequency gain control (an exclusive gain control). An exclusive feature of this modulation monitor is provision of a separate amplifier to which a standard 6 ohm dynamic monitoring loud-speaker can be attached for direct high level off-the-air monitoring. The MO-2639X modulation monitor is approved by the United States Federal Communications Commission and several major governments to meet all rigid specifications for commercial service. Finish is in gray with anodized escutcheons in black and natural aluminum.

### SPECIFICATIONS

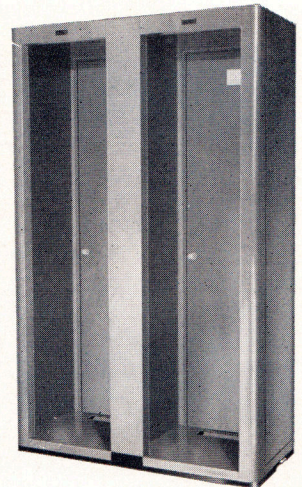
- FREQUENCY RANGE—1000-23,000 Kc.
- INPUT—high impedance bridging requiring about ½ watt.
- MODULATION PERCENTAGE RANGE—0-110%.
- DECIBELS SCALE RANGE—Calibrated to 15 Db. below 100% modulation.
- TUBES—Three each, 6X5 and 6C5; one each, 6F6, 885, and VR-150.
- LINE VOLTAGE—115 volts 50/60 cycles at 65 VA.
- WEIGHT AND CUBAGE—Packed, 40 lbs., 3.7 cu. ft.

Model MO-2639X Modulation Monitor with tubes. Code ZESAK.

### DE LUXE DM-1

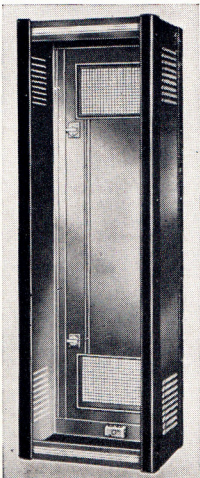


These are the finest available in superior quality rack cabinets, manufactured of heavy cold rolled steel and finished in high gloss. Each is provided with space for a lumiline lamp at the top front for casting an attractive glow over the front panel equipment mounted therein. Cabinet, which is provided with a base trim in black, is medium gray, hand rubbed and polished. Style strips are removable. Depth between front of style strip and front of rack panel is two inches, thus preventing any knobs or other control equipment from extending beyond the front of the cabinet. Multiple DM-1 deluxe cabinets are illustrated to the right. The DM-1-ST connecting strip is available for lining up two or more cabinets in a row with continuous unbroken modernistic effect. Size: 78 inches high, 23¾ inches wide, 20½ inches deep. Rack mounting space 71¾ inches high, 19 inches wide, tapped for 12/24 rack mounting screws.



DM-1 Rack Cabinet. Code ZACTY.  
DM-1-ST Connecting Strip. Code ZACYT.

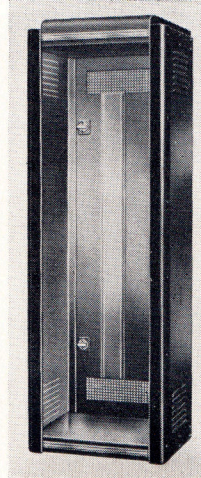
### TYPE "C" CABINET



A professional type of cabinet enclosure with rear corners finished with rectangular style trim and door trim at top and bottom, but with side louvers omitted so that more than one cabinet can be mounted side by side. Rack is of 1/16" cold rolled steel rigidly braced and bottom is of 7/64" steel. Where racks are to be set up in gangs of two or more they may be joined together by means of a flat trim fastened to the front. Finished in black ripple and gloss enamel.

- Type PG-3618—Stands 42¾ inches high, 22 inches wide, 18 inches deep, with 36¾ inch rack panel space. Code ZEBSE.
- Type PG-6618—Stands 67¾ inches high, 22 inches wide, 18 inches deep, with 61¼ inch rack panel space. Code ZEBVO.
- Type PG-8318—Stands 83¾ inches high, 22 inches wide, 18 inches deep, with 77 inch rack panel space. Code ZEBYX.

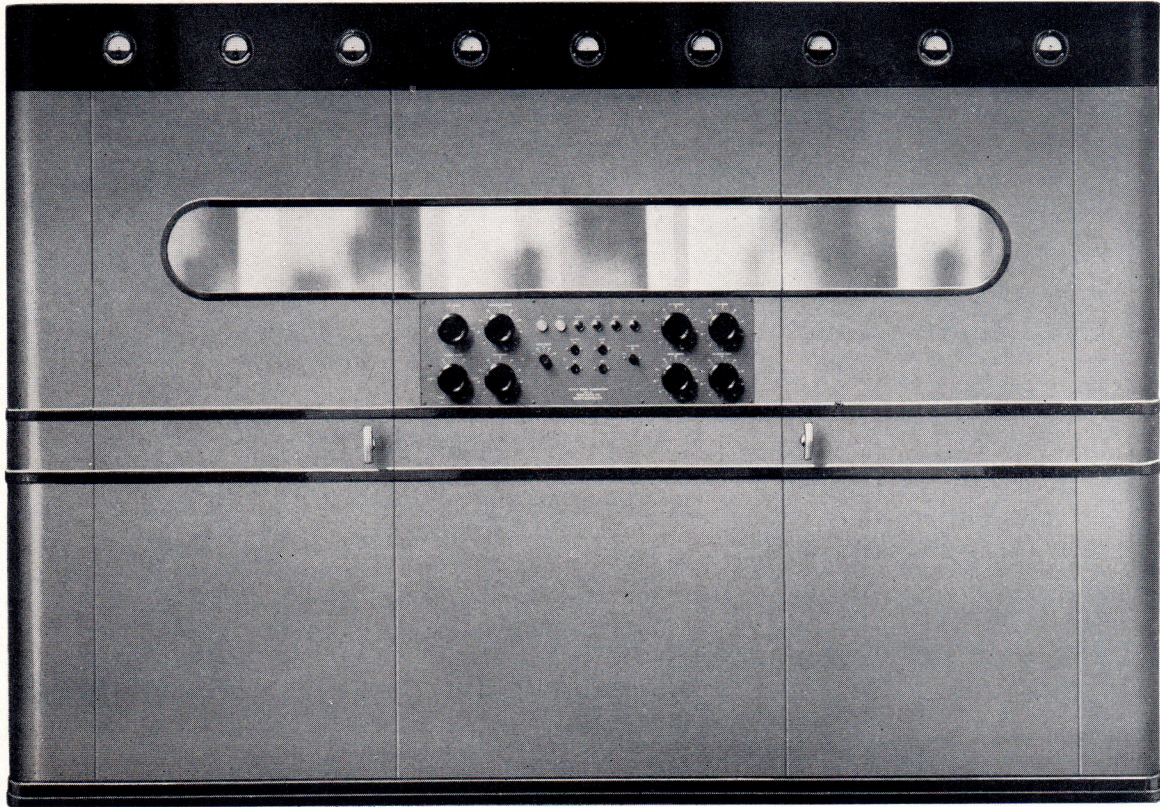
### TYPE "A" RACK CABINET



An excellent quality, medium priced cabinet, finished in black ripple enamel with quickly removable gloss black style trims. Has perforations at top and bottom of rear door and louvers on the side. Shipped knocked down. Constructed of 1/16" cold rolled steel with base 7/64" in thickness and employs 10/32 machine screws for rack mounting. Available in three popular sizes as listed below:

- Type ER-232—Stands 44¾ inches high, 22 inches wide, 18 inches deep, with 36¾ inch rack panel space. Code ZECAS.
- Type ER-225—Stands 67¾ inches high, 22 inches wide, 18 inches deep, with 61¼ inch rack panel space. Code ZECET.
- Type ER-227—Stands 83¾ inches high, 22 inches wide, 18 inches deep, with 77 inch rack panel space. Code ZECIV.

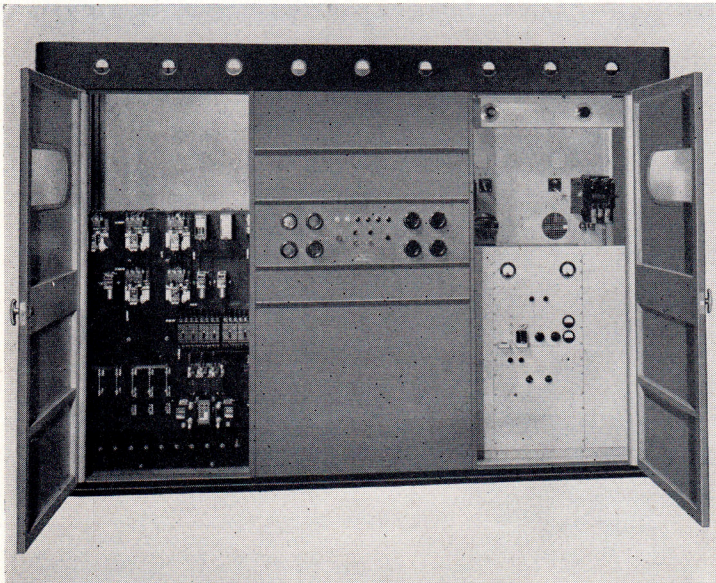
## 8 Kw. Telephone and Telegraph



### The HF-8 High Frequency Telephone and Telegraph Transmitter

Is one of the world's finest high powered international transmitting equipments and is in use around the world in daily inter-continent transmissions of high speed telegraphy and high fidelity telephone transmission such as broadcast or communications.

The Gates HF-8 transmitter is a large and massive piece of equipment designed to give unfailing service under continuous duty requirements at maximum rated power output. It employs high level modulation, is completely air-cooled, and all transformers, no matter how small or large, are completely cased and impregnated for all-climate operation. In addition, the Gates HF-8 transmitter is attractively constructed, in the belief that good operation is associated with attractive appearance. Nothing has been spared in making the Gates HF-8 eight thousand watt telephone and telegraph transmitter the very finest that money can buy.



The HF-8 transmitter illustrated to the left with front doors open provides complete dead front operation with all relays, tuning adjustments, low power tune up control, overload circuit breakers and primary adjustments available from the front panel. The front enclosure is 11 feet wide and 7 feet high overall. A total floor space of 115 feet is required unless power and modulation transformers are mounted outside, in which case space requirements are less.



## GENERAL CIRCUIT DESIGN

The Gates MO-2606 multi-channel crystal exciter unit, consisting of oscillator and 807 first intermediate amplifier, drives four 813 tubes in P. P. parallel. These drive two type 889R tubes in P. P. into a balanced network for coupling directly to a 600 ohm transmission line. In the audio portion, which is all push-pull, two 6C6 tubes drive two 807 tubes, driving four 845 tubes in P.P. parallel which, in turn, drive two 891R tubes as Class AB modulators. These couple through a large modulation transformer and associated modulation reactor to the radio frequency portion. The rectifier is actually two complete power supplies operating from a single power transformer and provides a full-wave double Y rectifier, delivering 6000 volts; and a half-wave double Y rectifier, delivering 4000 volts. The total of these two supplies is applied to the modulators, while the 6000-volt supply is applied to the R. F. power amplifier. Smaller intermediate supplies provide intermediate plate voltages.

## GENERAL MECHANICAL DESIGN

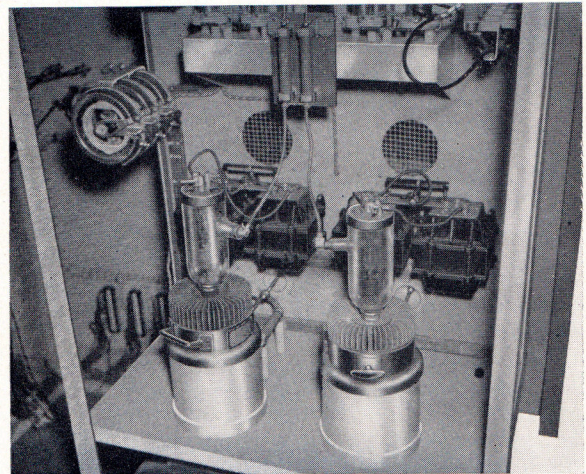
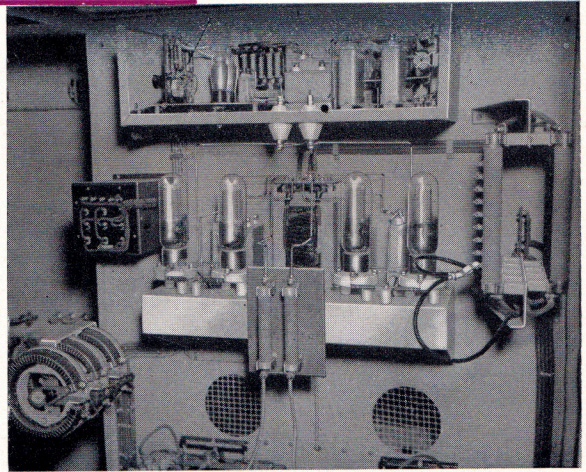
The main transmitter, exclusive of rectifier, power and modulation transformer components, is constructed in a three-unit enclosure which separates for shipping purposes only. The total size of these three units: 11 feet long, 7 feet high, and 55 inches deep. Individual illustrations of the various cubicles are shown on this and the following page. Construction is of heavy angle steel welded and fitted to an iron base plate to which attaches the attractive front enclosure with double front doors. Each front door may be opened, thereby giving full access to all tuning controls, relays and necessary functions of the transmitter for tuning and operation without disengaging interlocks because the dead front principle is employed. The rectifier frame is 48 inches square and 4 feet high. Total floor load of the entire transmitter is approximately 11,000 pounds, over 190 square feet. Finish is in hand-rubbed gloss two-tone gray with trims in chrome. Individual blowers, operated by  $\frac{1}{3}$  H. P. shock mounted motors, provide more than double cooling capacity for each of the air-cooled tubes. An additional blower is provided which supplies an air stream to the base of each mercury vapor rectifier tube.

## FREQUENCY CHANGE

The oscillator and first intermediate amplifier allows tuning from the front for any frequency between 2 and 20 Mc. Provision is made for two crystals and ovens with 0.005% accuracy and on the front panel, five pre-set crystal positions are provided so that ovens may be instantly changed to accommodate up to five frequencies. The second intermediate amplifier and final power amplifier are accommodated by latch-on changeable coils. These coils may be changed in a matter of seconds. As tuning capacitors are accommodated by accurately calibrated dials, after the settings of any one operating frequency have been determined, no additional time is required at time of frequency change for speedily getting the transmitter on the air. Complete frequency change from the extremes of 2 to 20 Mc. can be made in a minute's time.

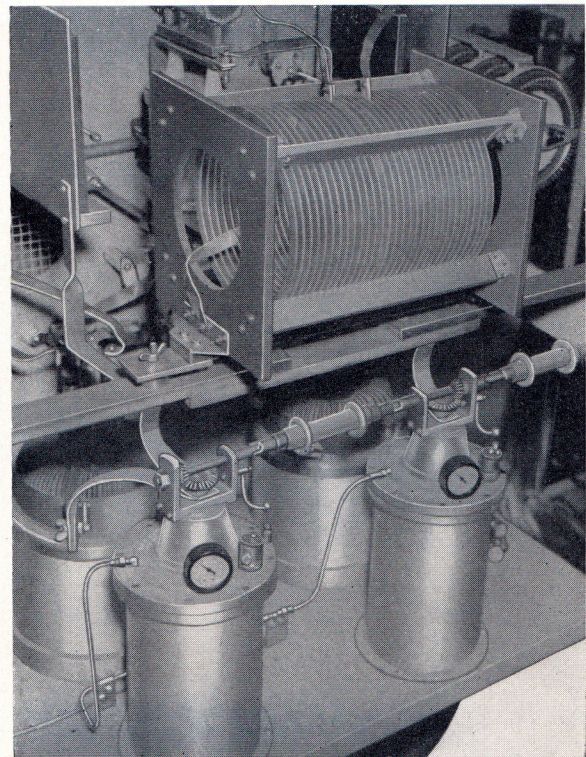
## KEYING

An electronic keyer is supplied where desired, allowing keying up to 400 words per minute.



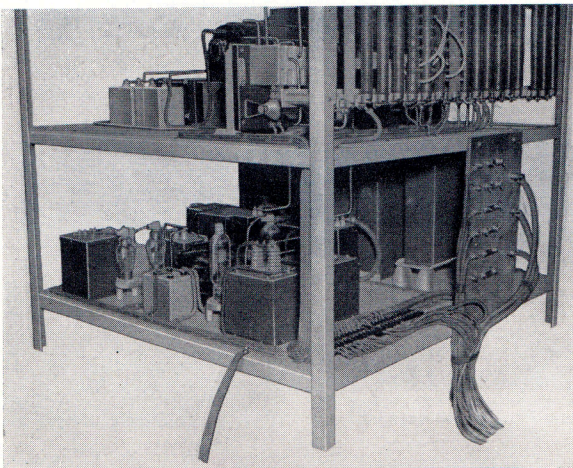
Illustrated above, the audio section including the P.P. parallel 845 driver amplifiers.

The modulator employs two 891R air-cooled tubes. As no grid current is consumed, the circuit may be considered Class AB.



The rectifier (bottom portion) illustrated to the left includes automatic condenser discharge switch and all power supplies. Note convenient way of circuit termination on mycalex terminal board.

To the right is illustrated the push pull R.F. tank circuit with latch on tank coil and gas filled 35,000 volt tuning capacitors.



# 8 Kw. Telephone and Telegraph

## OTHER ACCESSORIES

Consist of a hum frequency amplifier which may be used to further improve the noise reduction down to levels actually lower than that commonly used in the best broadcast circuit. Without the hum frequency amplifier the HF-8 transmitter will meet all requirements for low noise operation. A standard manually operated telegraph key is provided as part of the equipment. Installation materials are also standard equipment, including all necessary high voltage lead covered cable and low voltage wires, along with a miscellaneous hardware kit for complete installation of the transmitter—ready to attach to the transmission line and studio equipment.

## SPECIFICATIONS

**CARRIER POWER**—8000 watts maximum, telephone and telegraph.

**MODULATION**—Full 100% Class AB circuit push-pull 891R tubes.

**CARRIER FREQUENCY RANGE**—2 to 20 Mc.

**FREQUENCY STABILITY**—0.005%.

**AUDIO RESPONSE**—Plus or minus 2 Db., 30-10,000 cycles.

**NOISE LEVEL**—50 Db. below 90% modulation.

**DISTORTION**—4% or less at all frequencies, 50-7500 cycles.

**R. F. OUTPUT IMPEDANCE**—400-800 ohms balanced line.

**AUDIO INPUT**—6 DBM to a 500 ohm line for 100% modulation.

**TUBES**—807 Osc.; 807 First R.F. Amp.; four 813 Second R.F. Amp.; two 889R P.P. Final Amp.; two 6C6 First Audio Amp.; two 807 Second Audio Amp.; four 845 P.P. Par. Third Audio Amp.; two 891R Modulators; two 8008 Bias Rectifiers; six 8008 Main Rectifiers; three 8008 Auxiliary Rectifiers; two 866/866A Bias Rectifiers.

**METERING**—Individual meters are supplied for power line voltage; filament voltage; final R.F. Amp. grid current; plate voltage; final R.F. Amp. plate current (two supplied); modulator plate current (two supplied); and test meter (connected to rotary switch for testing currents in several portions of transmitter.) In addition, other smaller meters are provided throughout the transmitter, such as on the oscillator, keyer, etc.

**POWER CONSUMPTION**—100% modulation 40 KVA; average modulation 30 KVA; standby 24 KVA. For telegraph only key down 24 KVA; standby 8.5 KVA.

**WEIGHT AND CUBAGE**—Packed for export 22,700 lbs. and 1400 cu. ft.

**MODEL HF-8 TRANSMITTER**—Less tubes, crystals, and keyer, but complete with hum frequency amplifier and all installation materials for 220V, 3-phase, 60 cycles. Code YUSOV.

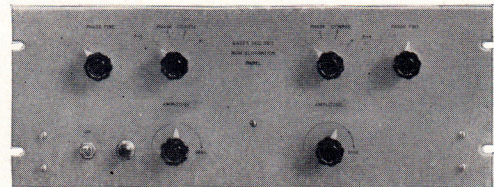
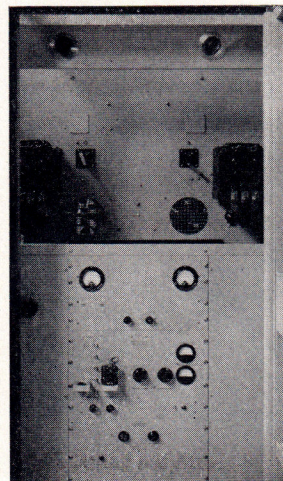
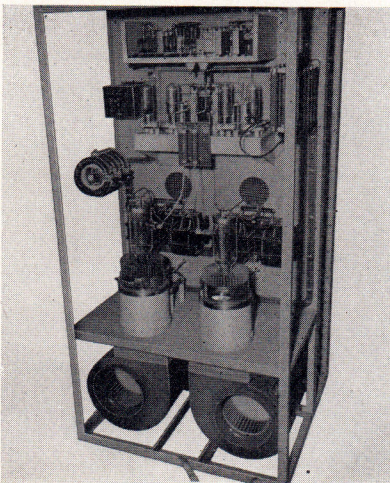
**MODEL HF-8 TRANSMITTER**—Same as above but for 220V, 3-phase, 50 cycles. Code YUSAK.

**SA-133 KEYER UNIT**—Complete. Code ZEKCE.

Complete 100% set of tubes for HF-8 Transmitter. Order MO-2665,

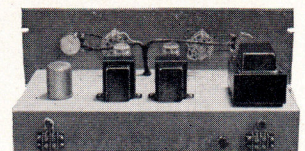
Crystal and temperature control oven to exact frequency. Order MO-3.

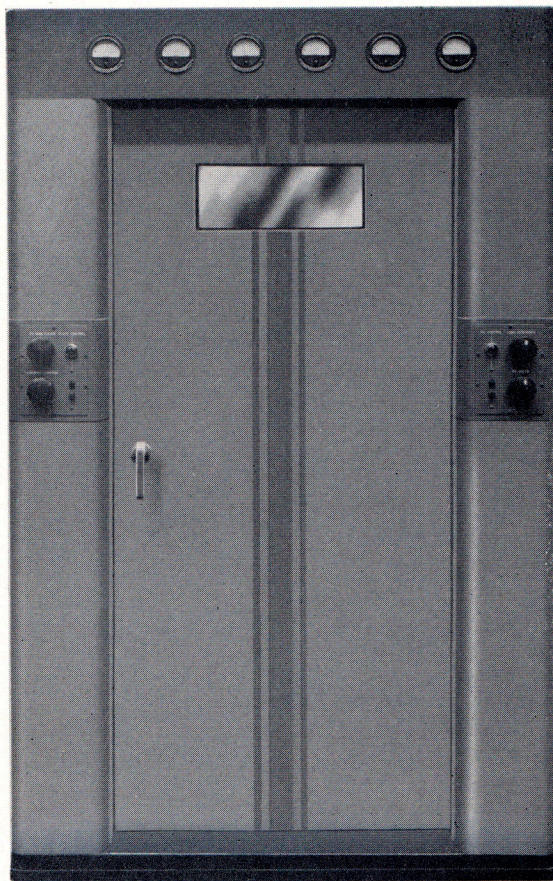
**NOTE:** The HF-8 Transmitter may be had for primary voltages and frequencies other than listed above at only slight additional cost.



Above and to right, front and rear illustrations of MO-2613 hum elimination panel.

To extreme left, complete rear illustration of audio portion of HF-8 transmitter. Note large size squirrel cage blower. To near left, front of R.F. panel directly behind front door, showing location of hum elimination unit, R.F. exciter, intermediate amplifier, and tuning of final amplifier and pi-network.





## HF1-2 HIGH FREQUENCY TRANSMITTER

This popular Gates telephone and telegraph transmitter is available in two models, one of which is for high fidelity telephone and medium speed telegraph, and the other is for communications voice fidelity and medium speed telegraph. The HF1-2 transmitter is constructed in an attractive cabinet 78" high, 48" wide, and 36" deep, having full-size front and back doors. High level Class B modulation is employed. Dual power supplies operating from a single power transformer, providing approximately 3000 volts to the power amplifier and 1500 volts to intermediate stages, plus several smaller power supplies, assure complete reliability in continuous duty service.

The radio frequency portion consists of the Gates MO-2606 multi-channel exciter with five pre-selected crystal controlled frequencies, oscillator, and first intermediate amplifier. The second intermediate amplifier is P.P. 813 tubes with P.P. 450TH tubes in the power amplifier, coupled into a pi-network to connect to a 400-800 ohm balanced line. Inductors for the final intermediate and power amplifiers are of the latch-on type. Complete frequency change between 2 and 22 Mcs. can be made in a matter of seconds. Forced air cooling is employed by a squirrel cage blower mounted in the bottom of the cabinet. The audio portion includes two 6V6 tubes driving two push-pull 845 tubes, which drive the two push-pull 450TH Class B modulators.

The high fidelity model HF1-2 is provided with a modulation reactor, while the standard fidelity for voice communication uses the secondary of the modulation transformer for handling the current to the radio frequency power amplifier. All operating controls are on the front, including tuning, starting, metering, and voltage controls. Tuning circuits that require adjustment only occasionally are behind the closed front door. For a 1000-watt transmitter that must operate under all conditions and continuously if called upon, the Gates HF1-2 or HF1-3 will be an excellent choice.

## SPECIFICATIONS

**FREQUENCY RANGE**—2-22 Mc.

**POWER OUTPUT**—2-18 Mc. 1000 watts; 18-22 Mc. 800 watts.

**R.F. OUTPUT IMPEDANCE**—400-800 ohm balanced line.

**FREQUENCY RESPONSE**—HF1-2; Plus or minus 1.5 Db., 30-10,000 cycles; HF1-3; Plus or minus 3 Db., 100-4000 cycles.

**DISTORTION**—4% or less at 90% modulation.

**POWER REQUIREMENTS**—230V, 50/60 cycles, single phase, grounded neutral, 5250 watts telephone (average modulation), 4000 watts telegraph key down.

**KEYING SPEED**—60 WPM.

**FREQUENCY TOLERANCE**—0.005% when ordered with MO-3 crystal holders and temperature controlled ovens; or 0.02% when ordered with MO-2 non-temperature controlled crystal holders.

**TUBES**—Two each, 807; 813; 8008; 845; 6V6; 575A; Four 450TH; one 5Z3.

**METERING**—Individual meters for following circuits; oscillator; first I.P.A. plate; second I.P.A. grid; second I.P.A. plate; Pwr. Amp. grid; Pwr. Amp. plate (two meters); Fil. volts; Plate volts; audio driver plate; modulator plate.

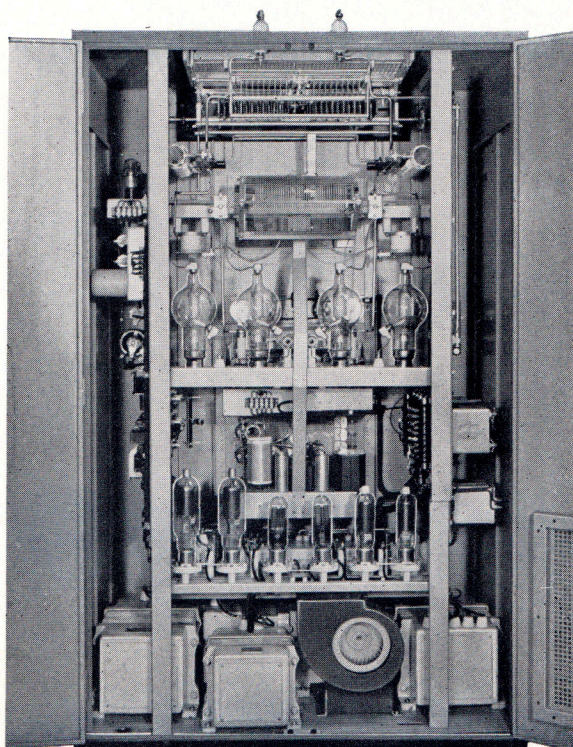
**SHIPPING DETAIL**—Packed for export, weight 3053 lbs.; cubage, 275

**Model HF1-2 High Fidelity High Frequency Telephone Transmitter**, less tubes and crystals. Code YUREF.

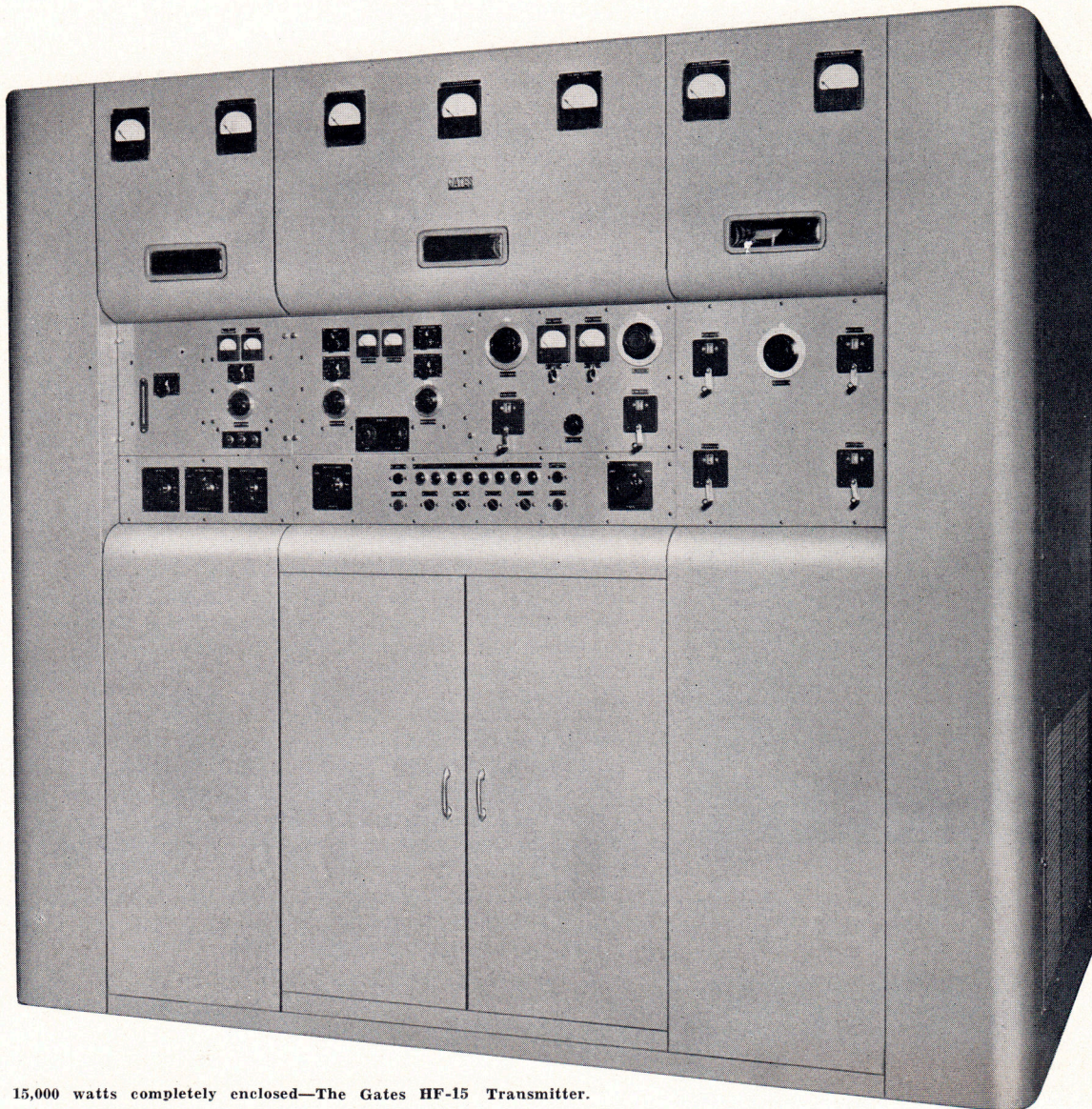
**Model HF1-3**, same as above only for voice frequencies. Code ZEKEC. Complete 100% set of tubes for HF1 transmitter (either model). Order MO-3607.

Crystal and holder to exact frequency and 0.02% accuracy. Order MO-2.

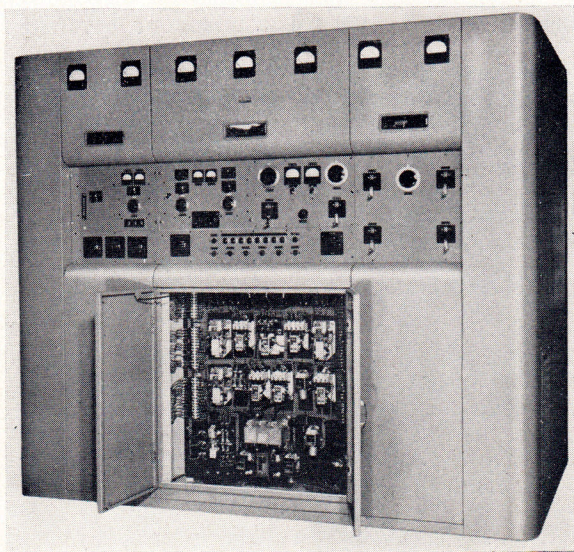
Crystal and holder in temperature controlled oven to exact frequency, 0.005% accuracy. Order MO-3.



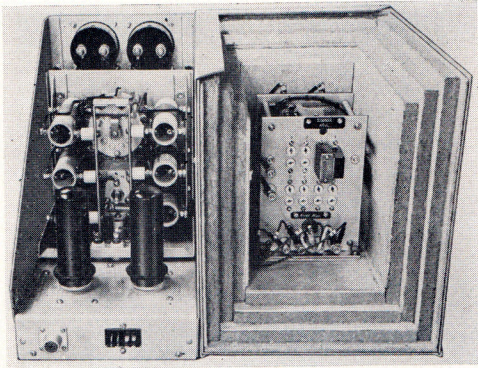
# 15 Kw. Telegraph Transmitter



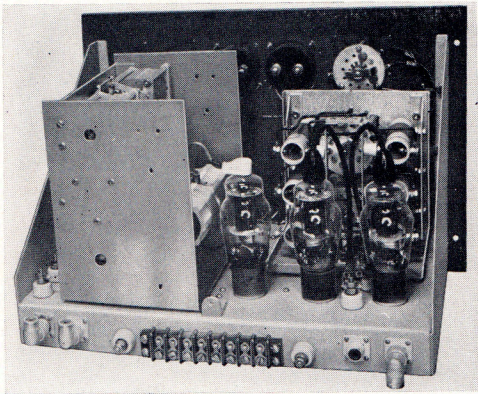
15,000 watts completely enclosed—The Gates HF-15 Transmitter.



Inter-continent telegraph transmission demands reliable performance. Gates heavy construction is best exemplified in the HF-15 C. W. transmitter. Complete circuit control from the front, no coils to change from 4-22 Mc. except final tank. New tube complement, temperature control of 8 crystals and a new high speed keyer are a few of many distinguished features of a great Gates product—the HF-15, fifteen thousand watts telegraph transmitter.



The oscillator with view of oven design. Eight crystal positions at .005% stability.



Above, the combination keyer and second intermediate amplifier unit.

## CIRCUIT—

Five radio frequency stages operate from eight instantly selectable crystals located in a closely regulated, thermostatically controlled oven. All stages up to the final power amplifier are tuned from the front over the entire range from 4 to 22 Mc. The final tank is a latch-on quick-change coil. Output couples into a balanced transmission line of 300-600 ohms impedance.

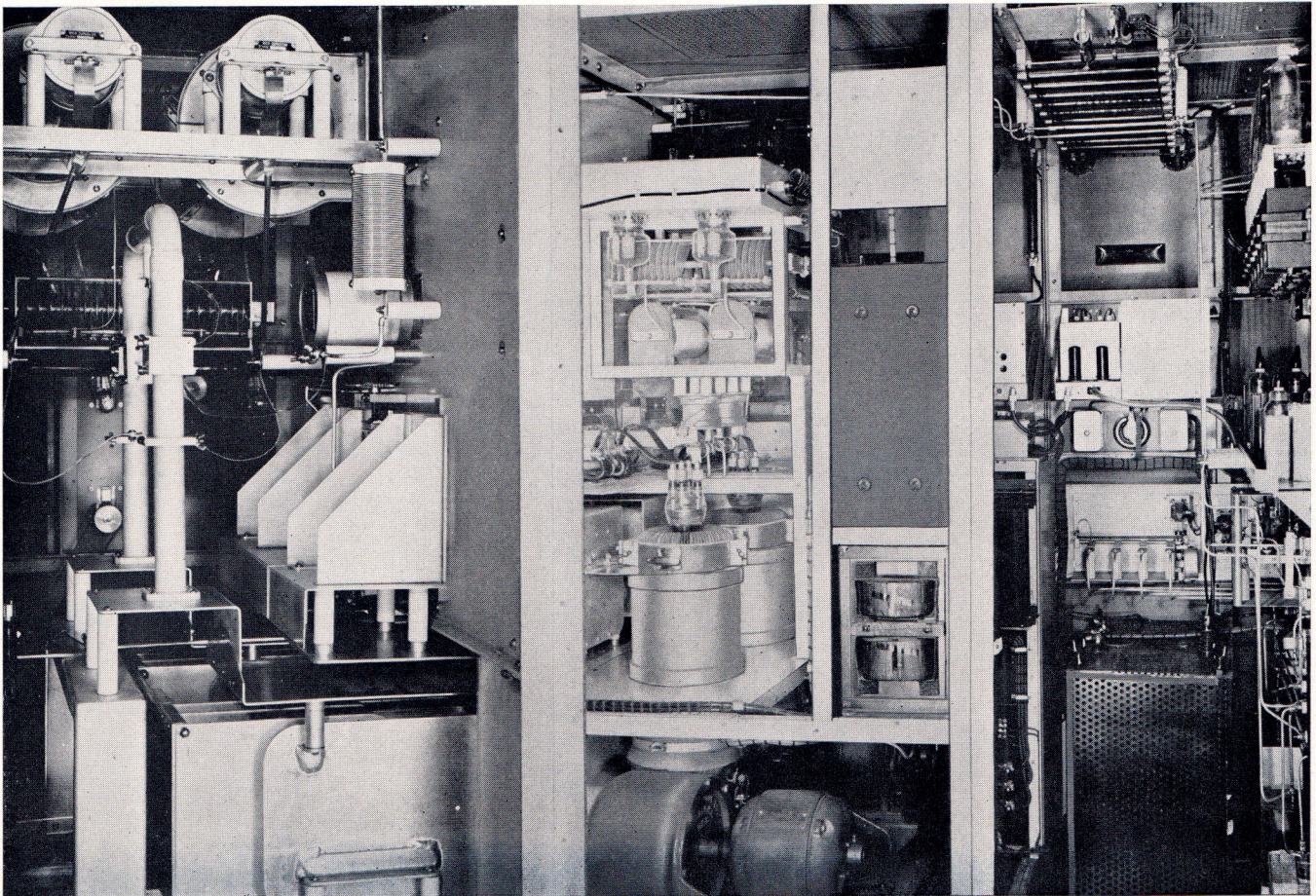
## KEYING—

Is accomplished by two 807 tubes in parallel so biased that with the key closed no current is drawn. With key open, bias is reduced to a low value and tubes draw high current. This operates in conjunction with the second intermediate amplifier and, with key up, no power is delivered to succeeding radio frequency amplifiers. Keying up to 400 W. P. M. with square-top wave form is without flaw. Practical speeds up to 600 W. P. M. are easily possible.

## POWER—

Three power supplies provide excellently regulated direct current; a 3 phase full wave main rectifier delivering 8500 volts; a low voltage 500 volt supply for the oscillator, first and second amplifiers; and a 500 volt bias supply. Operation is from 230 volt, 3 phase, 60 cycle line, with 50 cycles as well as other primary voltages and frequencies available.

Below, panoramic view HF-15 rear design. From left to right, final tank and pi-net; driver and power tubes; rectifier section.



# 15 Kw. Telegraph Transmitter

## MECHANICAL—

Construction is in 3 frames totalling for all three, 8 feet long, 7 feet high and 5 feet deep. The largest frame is 3 feet wide, 4½ feet deep and 7 feet high. Full-size back doors are provided and walk-in construction is employed. Made of heavy cold rolled steel, copper plated where required.

## GENERAL—

Heavy squirrel cage blowers cool the 889R tubes and 4-250A driver amplifiers. Pi-network to transmission line is continuously variable. All tuned circuits provided with Veeder counter type dials for accurate logging. All power resistors are in top of enclosure. Three tank coils cover the range of 4-22 Mc. Final tank variable capacitor of drawer construction with wide plate spacing. The Gates HF-15 transmitter has been designed for 24-hour-a-day service under the severe commercial traffic required of such equipment.

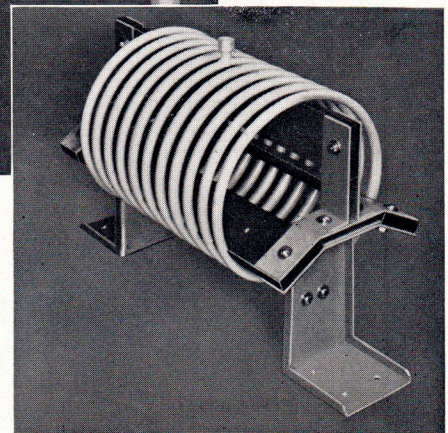
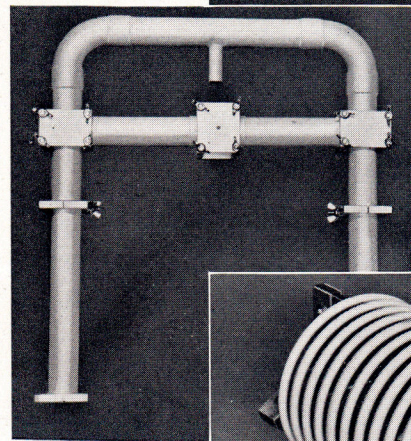
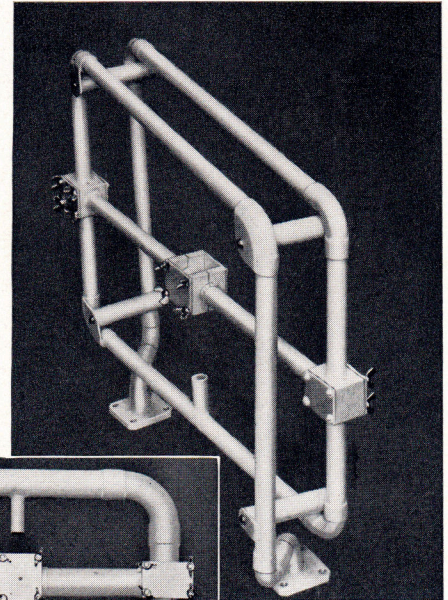
## SPECIFICATIONS

- CARRIER OUTPUT—15KW; 4 to 16 Mc., 12KW; 16 to 22 Mc.
- FREQUENCY RANGE—4 to 22 Mc.
- R. F. STABILITY—.005% or better.
- R. F. OUTPUT IMPEDANCE—300-800 ohms balanced line.
- POWER DEMAND—30KW.
- KEYING SPEED—400 W.P.M.
- SIZE—8 ft. long, 7 ft. high, 4½ ft. deep.
- TUBES—6L6 osc.; 6L6 First Int. Amp.; 807 Sec. Int. Amp.; two 4-250A driver amps.; two 889R Pwr. amps.; two 807 keying tubes; six 8008 main rectifiers; two 8008 bias rectifiers; and two 866/866A low voltage rectifiers.
- POWER LINE VOLTAGE—230 volts, 3 phase, 60 cycles, or as ordered.

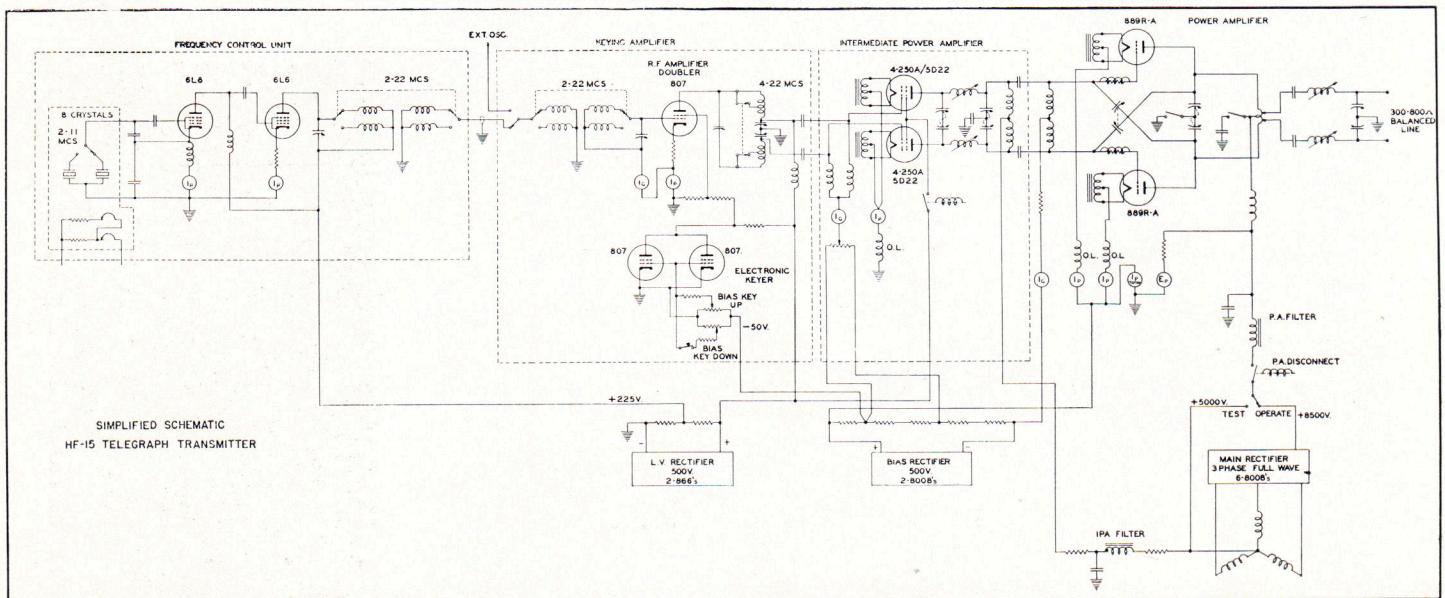
Model HF-15 Transmitter with tubes and crystals. Code KEPKO.

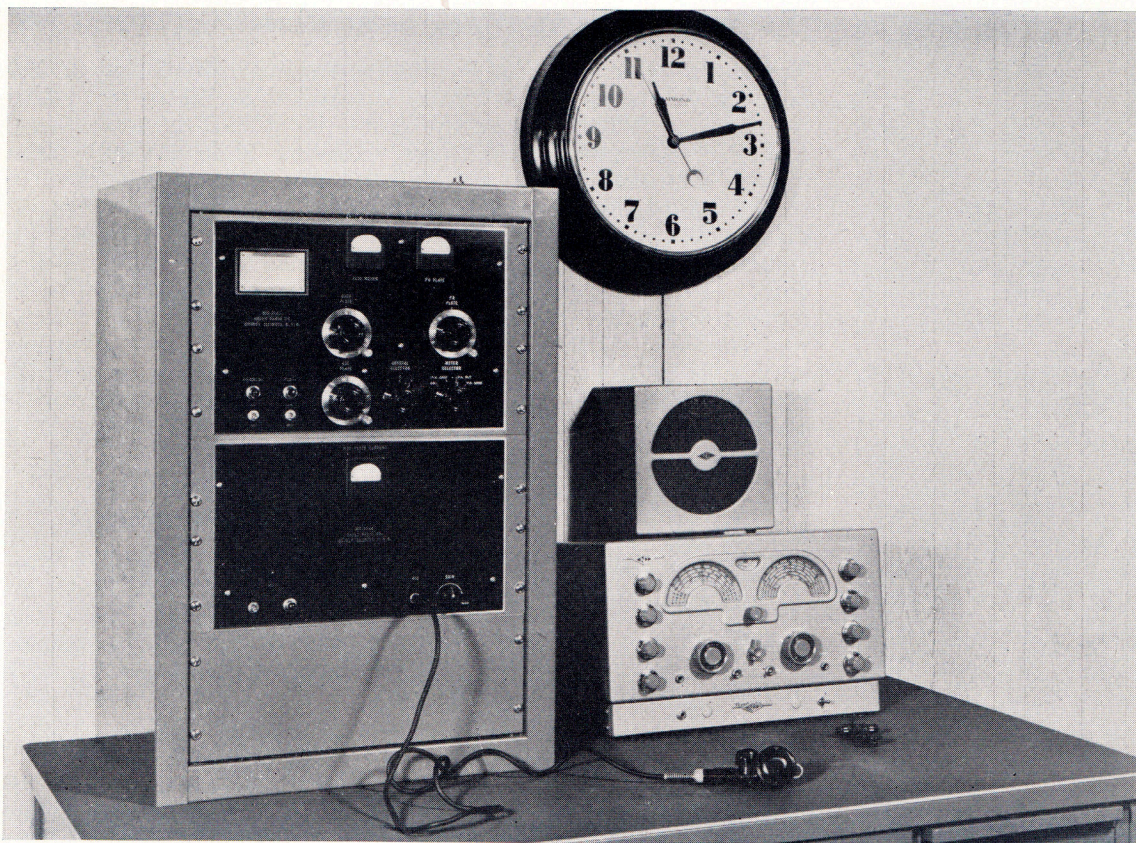
Spare 100% set of tubes for HF-15. Code ZEPKO.

NOTE: State carrier frequencies when ordering. If 8 carrier frequencies will not be used, order duplicate crystals as spares.



Simplified schematic below indicates wide capabilities of Gates HF-15 Transmitter





## MO-3546 (50-watt) TRANSMITTER—

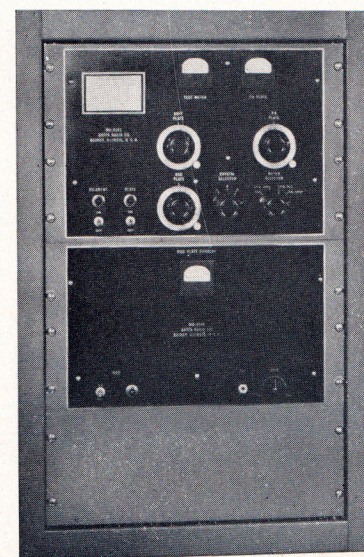
Is a complete self-contained telephone and telegraph transmitter having a carrier power of 50 watts and for operation at all frequencies between 2 to 22 Mc. employing high level modulation, push-to-talk facilities, keying speed up to 60 W.P.M., in excellent commercial quality. It is of such size that it may be mounted on a standard desk along with a typical receiver and comprises a complete operating station of the finest commercial quality.

Three crystal positions are provided so that three different frequencies within the range of any set of coils may be selected from the front panel and a chart located on the front panel allows logging of dial settings for any of these pre-determined operating frequencies. As both the radio frequency unit and the modulator unit have separate power supplies, it can be said that the radio frequency portion is a complete independent section and will operate as such, which is also true of the audio portion. Plug-in coils are provided, four sets being required to cover the entire band from 2 to 22 Mc. Coils may be changed in a matter of seconds. This provides full operating efficiency at any frequency, as well as strict economy in selling price.

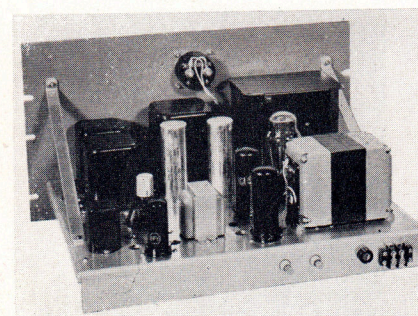
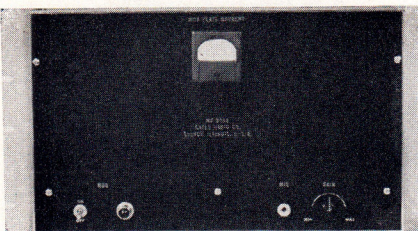
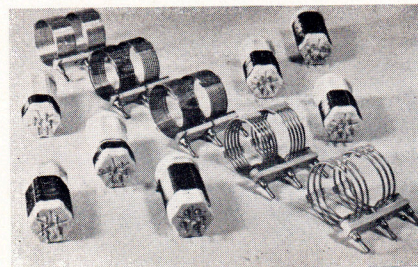
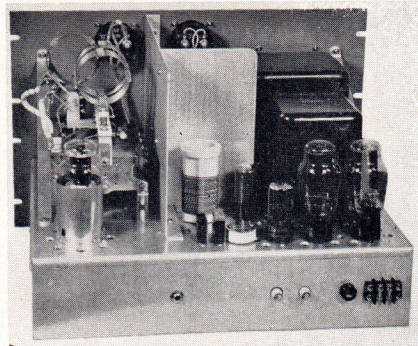
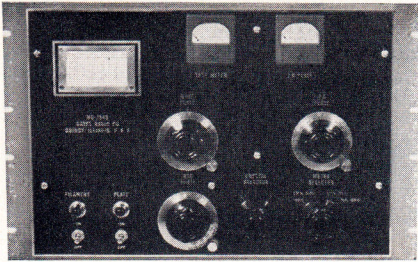
For telegraph operation, the purchaser need only purchase the MO-3453 radio frequency section described on Page 16. This may be mounted either in the cabinet illustrated or in still a smaller cabinet that will accommodate a 19"x10½" panel. A blank panel which is 19"x10½" in size is provided at the bottom of the complete MO-3546 telephone and telegraph transmitter. This may be removed in favor of a standard communications type receiver, thus making a complete self-contained single unit for transmitter and receiver.

**Model MO-3546**—Complete 50-watt telephone and telegraph transmitter including one set of coils, one set of tubes, but less crystal and push-to-talk microphone. Code ZEMEF.

For description of individual units see Page 16.



# 50 Watt Telephone and Telegraph



## MO-3543 RADIO FREQUENCY SECTION

The top portion of the MO-3546 transmitter illustrated on Page 15 has three R.F. stages; 6V6 crystal controlled oscillator with three crystal positions switchable from the front panel; 807 intermediate amplifier; and P.P. 807 power amplifiers. Keying is in cathode circuits of all stages. One set of coils is supplied. Four sets are required to tune the entire band from 2 to 22 Mc. An adjustable link on the output tank coil allows for proper loading in antennas up to approximately 400 ohms in resistance and is ideal for doublet antennas or balanced transmission lines. Front panel has all tuning controls, frequency log chart, two meters selectable into all measurable plate and grid circuits, plus plate and filament switches. Panel is of attractive etched aluminum. Power supply is self-contained. The MO-3543 radio frequency section is a complete self-contained (50-watt) carrier CW transmitter. Panel size: 19"x10 $\frac{1}{2}$ ". Two 5Z3 rectifier tubes are employed.

**Model MO-3543**—Radio Frequency section with tubes, and one set of coils, less crystal. Code ZEMFE.

**MO-3651**—Plug-in coil set (1.9-4.5 Mc.) Code ZEMHO.

**MO-3652**—Plug-in coil set (4-9 Mc.). Code ZEMIG.

**MO-3653**—Plug-in coil set (7.5-15 Mc.). Code ZEMKY.

**MO-3654**—Plug-in coil set (11-24 Mc.). Code ZEMOH.

## MO-3544 MODULATOR SECTION

A unit matching in size and characteristics the MO-3543 radio frequency section, constructed on a 19"x10 $\frac{1}{2}$ " panel with an attractive etched aluminum face panel employed. Provides all amplification to operate from a carbon type microphone, including microphone voltage, and is provided with relay for push-to-talk operation; has three amplifier stages; 6F5 first audio stage; 6F6 triode connected driver stage; and 6L6G modulators in P.P. Class AB2. A fixed bias supply for the modulator tubes is self-contained. Where the modulator is not being used, such as for CW operation, a relay is provided, shorting out the modulator output. Power supply employs one 5Z3 tube in a full wave circuit. Front panel includes modulator meter, gain control, starting switch, and microphone jack. Unless otherwise stated, modulator is supplied with audio frequency peaked to voice frequencies.

**MO-3544**—Modulator unit with tubes. Code ZEMUJ.

## TECHNICAL DETAIL

**MO-3546 TRANSMITTER CARRIER OUTPUT**—50 watts all frequencies.

**FREQUENCY RESPONSE**—Normally supplied peaked for voice frequency; may be had, however, at no added cost, plus or minus 3 Db., 100-5000 cycles.

**DISTORTION**—5% or less.

**NOISE**—45 Db. or better below 90% modulation.

**POWER REQUIREMENTS**—400 watts at 115 volts, 60 cycles (special voltages or frequencies may be had as required).

**AUDIO INPUT IMPEDANCE**—200 ohms for carbon microphone with microphone voltage supplied.

**R. F. OUTPUT IMPEDANCE**—Up to approximately 400 ohms resistance, such as to a doublet antenna.

## ACCESSORIES

Typical operating accessories in addition to the coils heretofore mentioned are Type H crystal and holder for any operating frequency. Code ZEMYK.

**Type T-17-B**—Carbon microphone with plug, cable and push-to-talk switch.

**Type 114**—320 telegraph key. Code ZENEG.

NOTE: For receivers see Page 24.



## WHAT IS THE UNIT SYSTEM?

A design where various complete divisions of a 250-watt communications transmitter are constructed on individual chassis and can be assembled into the rack cabinet in any combination desired. This completely eliminates any superfluous equipment that might otherwise be purchased with a complete transmitter. Wiring cables for any combination of units as shown at the bottom of this page and on following pages are instantly available. The complete transmitter assembly consists of bolting the various chassis to the cabinet, connecting the wiring harness supplied and the transmitter is ready for use.

## STANDARDIZATION

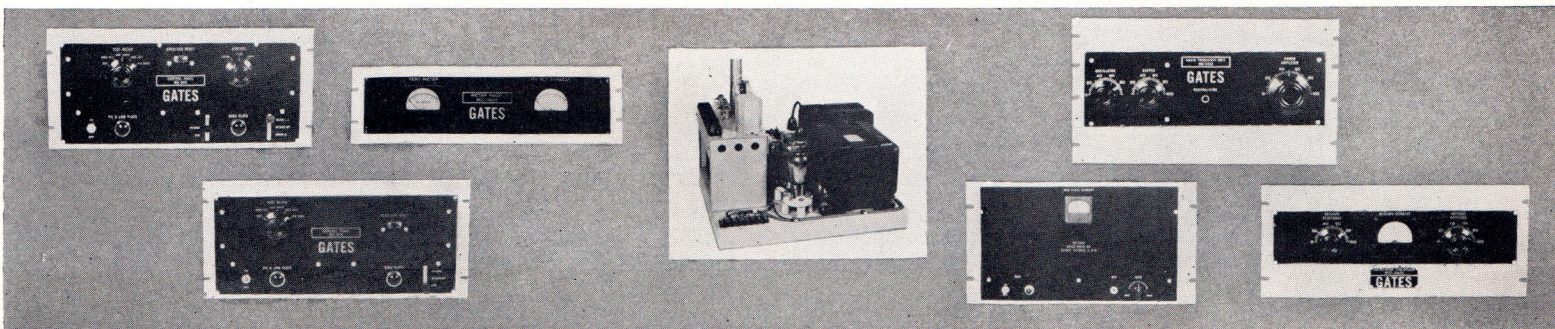
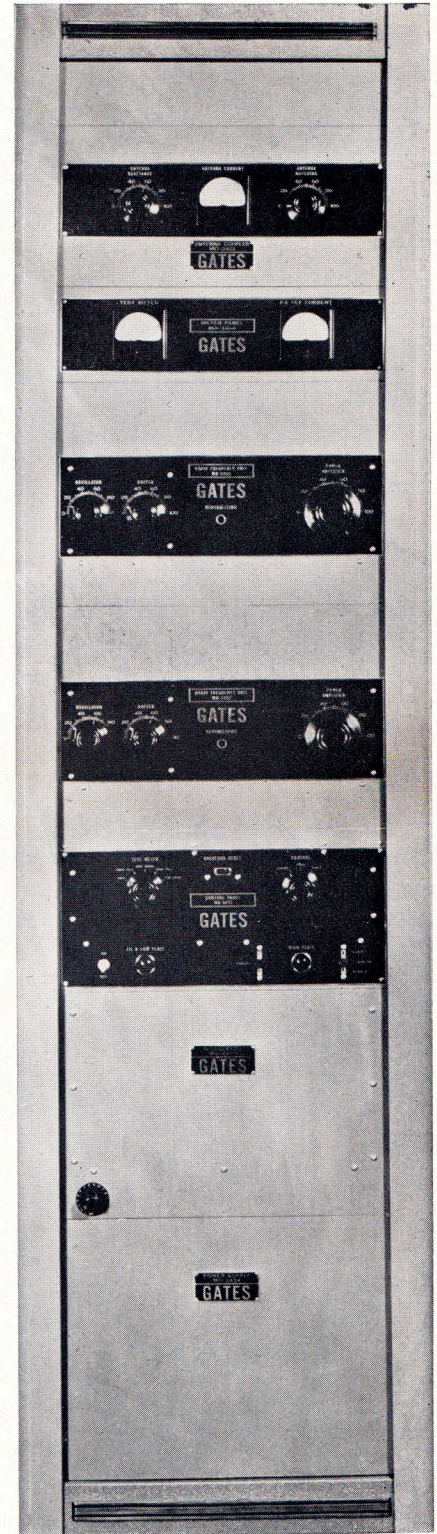
Where several communications transmitters are employed some locations may call for multi-channel operation, both voice and telegraph, while another location may call for only a simple telegraph or telephone transmitter. By employing the unit system, complete standardization of the entire installation is maintained. Though one transmitter may be a simple telegraph equipment, that portion of the transmitter would be identical to a complex multi-channel unit with modulators and other accessories. Through this standardization a minimum of spare parts is required. Replacement chassis may be carried at one centralized point and where repairs are necessary exchanged with the faulty one in use. The faulty one, brought in and repaired, then becomes the replacement unit.

## MULTI-CHANNEL

For multi-channel operation Gates has, with these transmitters, employed the practice of switching the complete radio frequency portion of the transmitter where a frequency change is desired in excess to the range of a single set of coils. This is done instantly from the front panel and allows full efficiency of the radio frequency portion of the transmitter at any operating frequency. It likewise provides economy with assured reliability as there are no band changing switches to become dirty with age or wear with arcing contacts. A transmitter with two radio frequency units would then provide instantaneous band switching from the lowest to the highest operating frequency. For those that can tolerate the few seconds required to change coils, one radio frequency unit will, of course, handle the entire frequency spectrum between 2 to 22 Mc.

## THE COST

Realizing that communications equipment is oftentimes a sizeable investment where many transmitters are required, the economies effected in the unit system can easily be understood. No matter which transmitter is finally selected by the customer, the units have already been manufactured in large quantities and the customer realizes the advantages of quantity production. Whether he buys one or several complete transmitting equipments, the unit system outlined herein has not only slightly reduced the price of communication transmitters in the 250-watt field, but investigation of the Gates price list will disclose a substantial economy in selling price when compared to similar commercial equipment.



# 250 Watt Communications

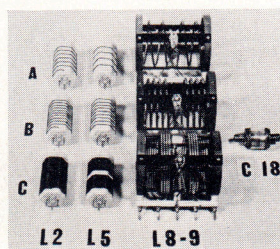
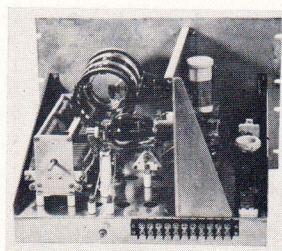
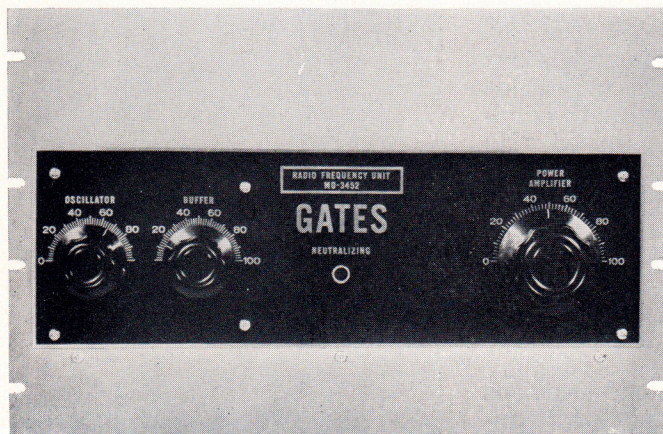


Figure A. Above illustrates MO-3452 radio frequency unit, front and back views, with typical plug-in coil sets.

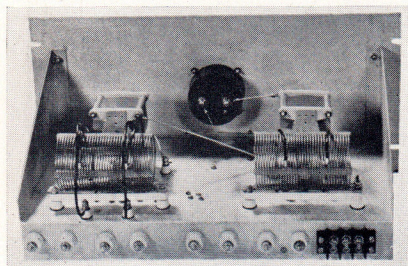
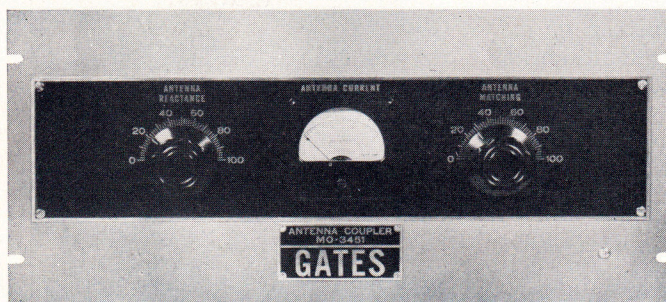


Figure B. Above and to left, front and rear illustrations of MO-3451 antenna tuner.

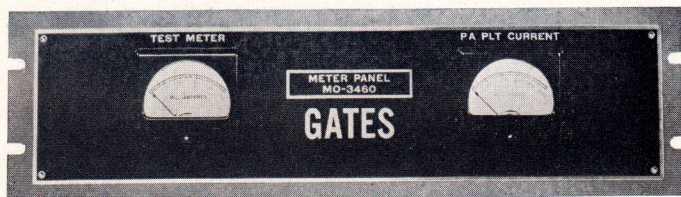


Figure C. Above, the MO-3460 meter panel.

## MO 3452 RADIO FREQUENCY UNIT (2-22 Mc.)

The heart of all Gates unit system 250-watt transmitters. A complete three-stage self-contained radio frequency unit employing a 6V6GT crystal controlled oscillator, 807 intermediate amplifier, and P.P. 812A power amplifiers. Will produce 250 watts carrier power at all frequencies. All stages capacity tuned and capacity coupled, with the output tank circuit provided with a variable link to couple either a transmission line (50-300 ohms) or to the Gates MO-3451 antenna tuner, described below. Oscillator, intermediate and power amplifier tank circuits are tuned from the front and an accurately calibrated dial is provided so that pre-set tuning conditions can be logged. Keying is accomplished in the cathodes of all three radio frequency stages. Keying relay is located in the control panel (see opposite page). Keying speed is up to 60 WPM with good clean commercial quality. Supplied with one set of coils — five sets are required to cover the entire range. Panel size: 19" wide, 12 $\frac{1}{4}$ " high, with etched aluminum control plate attached. Rear chassis is of aluminum, as are individual shields. The MO-3452 unit must be used with the MO-3454 power supply described on the opposite page and either the MO-3461 or MO-3576 control panel, also described on the opposite page. Metering is accommodated by the MO-3460 meter panel shown at the bottom of this page.

**MO-3452**—Radio Frequency Unit, with one set of coils, less tubes. Code ZEKFO.

**MO-3641**—Plug-in Coil Set (2-3 Mc.). Code ZEKID.

**MO-3642**—Plug-in Coil Set (2.8-4.2 Mc.). Code ZEKOF.

**MO-3643**—Plug-in Coil Set (4-7.2 Mc.). Code ZEKUG.

**MO-3644**—Plug-in Coil Set (7-13 Mc.). Code ZEKYH.

**MO-3645**—Plug-in Coil Set (12-22 Mc.). Code ZELAC.

## MO-3451 ANTENNA TUNER—

Designed to handle into a common or two different antennas, either one or two MO-3452 radio frequency units. This antenna coupler provides a wide range of impedance matching to either balanced or unbalanced antennas or transmission lines. It should be employed where the antennas are of odd wave lengths or unknown characteristics and will match antennas having a resistance as low as 10 ohms. Where used with one radio frequency unit, actually only one-half of the antenna tuner is utilized. When used with two radio frequency units by a relay provided and operating in conjunction with either control panel shown on Page 11, these two radio frequency units may be coupled either into a common antenna, and yet operate at different frequencies, or into separate antennas as desired. Provided with a thermocouple type 3-inch square case antenna meter —tuning is from the front panel. Panel size: 19"x8 $\frac{3}{4}$ " with etched aluminum control plate attached.

**MO-3451 Antenna Tuner.** Code ZELCA.

## MO-3460 METER PANEL—

Is considered a necessity with any transmitter combination. The left meter, known as the test meter having a 150 MA. range, indicates oscillator and intermediate amplifier plate current plus intermediate amplifier and final amplifier grid current. The right meter indicates final power amplifier plate current at all times. Use either model control panel shown on Page 11 on which the meter selector switch is used. Panel size: 5 $\frac{1}{4}$ "x19". Meters, 3-inch square case mounted on attractive etched aluminum panel attached.

**MO-3460 Meter Panel.** Code ZELDE.

See Page 12 for Typical Complete Transmitters.

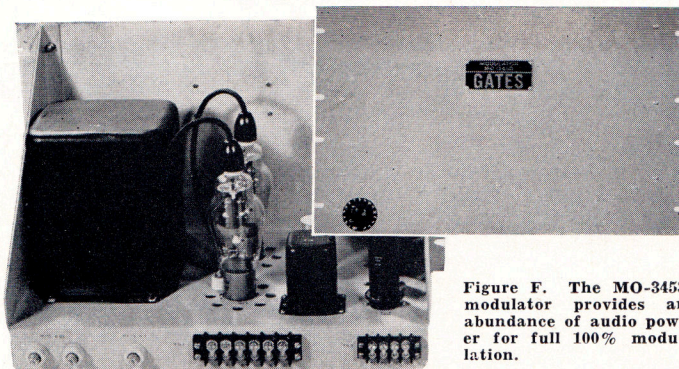


Figure F. The MO-3453 modulator provides an abundance of audio power for full 100% modulation.

### MO-3454 POWER SUPPLY—

Provides all filament plate and bias voltage and will accommodate one MO-3452 radio frequency unit, one MO-3453 modulator, or two MO-3452 radio frequency units. This power supply therefore will accommodate either a single or two-channel telephone and telegraph operation. The bias rectifier is used for fixed bias on the radio frequency unit. Employs two 866/866A tubes and one each 5U4G and 6X5G tubes. Provided with a panel 19"x14" in size. Power supply, however, is always mounted in the bottom of the rack cabinet.

MO-3454 Power Supply. Code ZELGO.

### MO-3453 MODULATOR—

To high level modulate the MO-3452 radio frequency unit; has four audio stages with adjustable front panel level control; may be used with either low level or high level microphones and voltage is provided for carbon type microphones. 6J7 first audio, 6J7 second audio, 6L6 third audio driver, and P. P. 811A Class B modulators comprise the tube line-up normally supplied with audio peaked for voice frequencies. Where this is not desired, so specify when ordering. Panel 19"x12¼".

MO-3453 Modulator. Code ZELED.

### MO-3461 CONTROL PANEL—

This control panel is used where remote control operation in conjunction with the MO-3455 remote station listed below is desired, the basic control unit for the entire transmitter giving complete control for two-channel operation providing starting switch; phone - CW switch; channel selector and standby switch; test meter selector switch; control location switch; overload relay; filament and plate indicator lights; time delay relay; plate primary relay; keying relay; phone-CW relay; and channel selector relay. Panel size: 19"x8¾".

MO-3461 Control Panel. Code ZELIF.

### MO-3576 CONTROL PANEL—

This control panel is similar to the MO-3461 described above except that the provisions for remote control operation have been eliminated as well as provision for two-channel operation; otherwise it offers identically the same control functions as the MO-3461.

MO-3576 Control Panel. Code ZELJY.

### MO-3455 REMOTE STATION—

Illustrated in Figure I, K and J below. To provide complete remote operation of the transmitter with dependable operation up to 300 feet of cable. Requires five pairs, one pair shielded, operates in conjunction with MO-3461 control panel. Remote station illustrated in Figure I is placed on desk; controlling band change, standby and phone-CW, and control functions with indicating lights. Terminal board in Figure K attaches to desk for termination of cable from transmitter. Jack box illustrated in Fig. J accommodates telegraph key and telephone handset. Handset and key are not part of remote station, but supplied separately.

MO-3455 Remote Station. Code ZELOG.

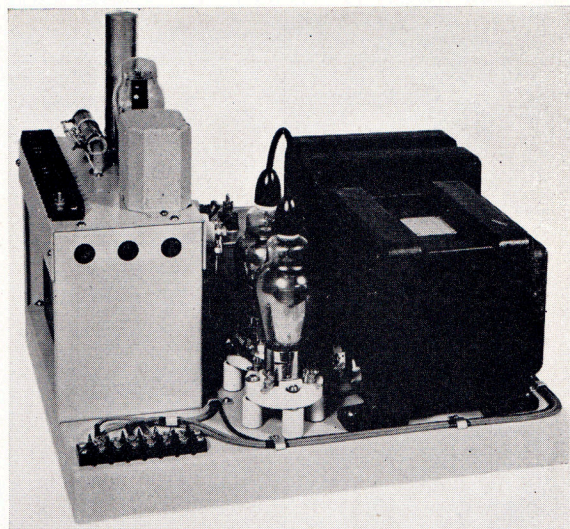


Figure E. The MO-3454 power supply is constructed for heavy service under wide climatic conditions.

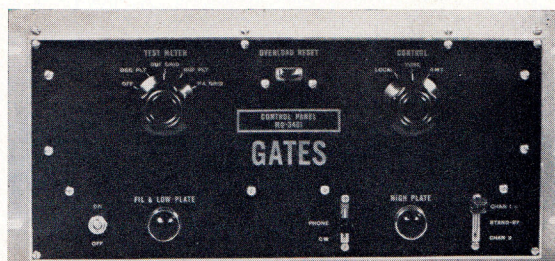


Figure G. For dual channel operation as well as remote operation, the MO-3461 control panel is suggested.

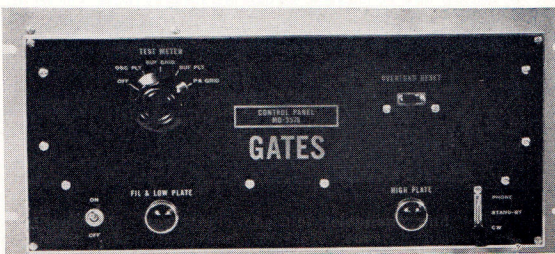


Figure H. For single channel telephone and telegraph operation, the MO-3576 control panel is always used.

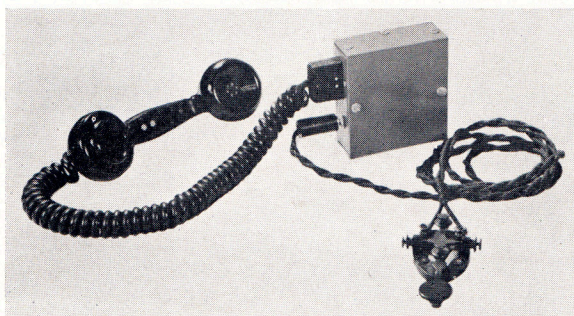


Figure J. Usually fastened to the side of the desk, this jack box accommodates a microphone, handset and telegraph key.

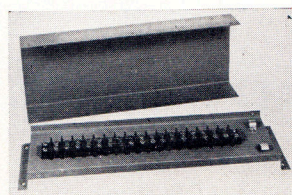


Figure K. This terminal board is used in conjunction with the MO-3455 remote station and is attached to the control desk.

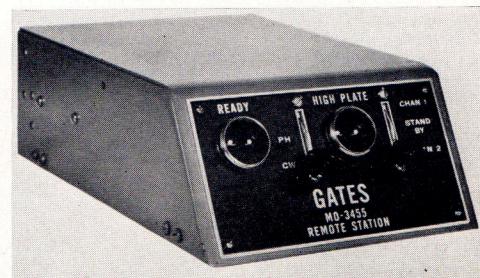


Figure I. Where the transmitter must be located remotely from the control point, the Gates MO-3455 remote station is convenient and complete.

# 250 Watt Communications

## MICROPHONE AND KEY—

Any type microphone of the low impedance variety may be employed. Illustrated in Figure J, the 51-C handset containing 75 ohm carbon microphone and receiver with push-to-talk provision. Also the 114-320 telegraph key with plug.

## RACK CABINETS—

Two sizes of rack cabinets are available such as illustrated in Figures 1 and 2 at the bottom of the page. These cabinets are made of heavy 16 gauge cold rolled steel, one model being 84" high and the other model 68" high. They are finished in gray ripple enamel provided with attractive styling and full-size back door which is ventilated from top to bottom by large size louvers. Where blank panel space prevails, filler panels are available in matching color.

Type PG-8318 Rack Cabinet, 84" high, 22" wide, 18" deep, with 77" of rack panel space. Code ZEBYX.

Type PG-6618 Rack Cabinet, 67" high, 22" wide, 18" deep, with 61¼" of rack panel space. Code ZEBVO.

Standard Blank Panels 19" wide, per running inch. Code ZECWO.

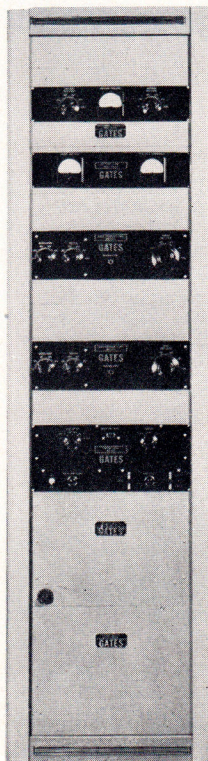
## TYPICAL COMPLETE TRANSMITTERS—

Listed below are four suggested complete communications transmitters. These are illustrated only for representative purposes and, of course, any other combination or combinations can be assembled as desired.

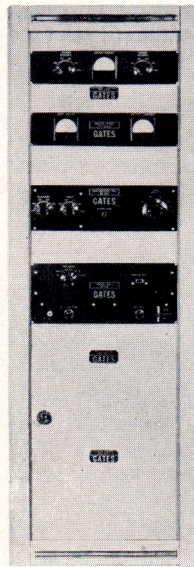
- 1 Illustrated Figure 1 below: A deluxe two-channel telephone and telegraph transmitter matching nearly all conceivable antennas. May be used with MO-3455 remote station. Consists of 8318 rack cabinet; MO-3451 antenna coupler; two type MO-3452 radio frequency units; MO-3461 control panel; MO-3453 modulator; MO-3454 power supply; and cable for complete inter-unit wiring.  
**Model MO-3449 Two-Channel Telephone and Telegraph Transmitter. Code ZELUH.**
- 2 Illustrated Figure 2 below: A complete 250-watt single channel telephone and telegraph transmitter with antenna coupling equipment to match nearly every conceivable antenna consisting of 6618 rack cabinet; MO-3451 antenna coupler; MO-3460 meter panel; MO-3452 radio frequency unit; MO-3576 control panel; MO-3453 modulator; MO-3454 power supply and complete inter-unit cable.  
**Model MO-3491 Single Channel Telephone and Telegraph Transmitter. Code ZELYJ.**
- 3 Illustrated Figure 3 below: A complete single channel telephone and telegraph transmitter with the antenna coupling equipment removed. In this model the transmission line is connected directly to the radio frequency unit and may be anything from 50 to 300 ohms. Consists of 6618 rack cabinet; MO-3460 meter panel; MO-3452 radio frequency unit; MO-3576 control panel; MO-3453 modulator; MO-3454 power supply; and complete cable for inter-unit wiring.  
**Model MO-3680 Single Channel Telephone and Telegraph Transmitter. Code ZEMAD.**
- 4 Illustrated Figure 4 below: A single channel telegraph transmitter so designed that the modulator may be added at a future date, converting it to a telephone transmitter. Consists of 6618 rack cabinet; MO-3460 meter panel; MO-3452 radio frequency unit; MO-3576 control panel; MO-3454 power supply; and complete cable for inter-unit wiring.  
**Model MO-3629 Single Channel Telegraph Transmitter. Code ZEMDA.**

## HOW TO ORDER—

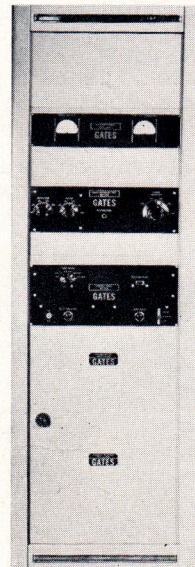
The ordering of a transmitter may be either as a complete transmitter as in the four combinations listed above or by units to assemble the combination desired by you. Compute the cabinet size required for the number of units that you will require. Determine the necessary functions. If the antenna is such that it will not couple directly to the radio frequency unit, then order the antenna tuner. If remote control is not desired, then order the MO-3576 control panel. If remote control is or will be desired in the future, order the MO-3461 control panel. In every instance, either of the control panels, the meter panel and the power supply are mandatory. In addition, one or more radio frequency units for either single or multi-channel telegraph operation, and if telephone operation is required then order the modulator panel, remembering that the power supply will accommodate one modulator and one radio frequency unit simultaneously; thus for band changing operation in case two radio frequency units were required, if both radio frequency units would not be used at the same time, still only one power supply would be required. The cable is always computed (see price list) by a formula of 7% of the total equipment selling price. For example, if the total cost of all units of the transmitter is \$1000 the complete inner-wiring cable, which includes fuse blocks, terminal blocks, etc., would cost \$70.00. Other items such as microphones, telegraph keys, tube sets, etc., are fully covered on the price list accompanying this catalog.



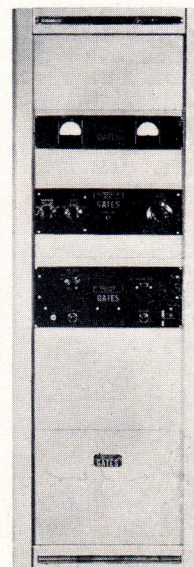
1



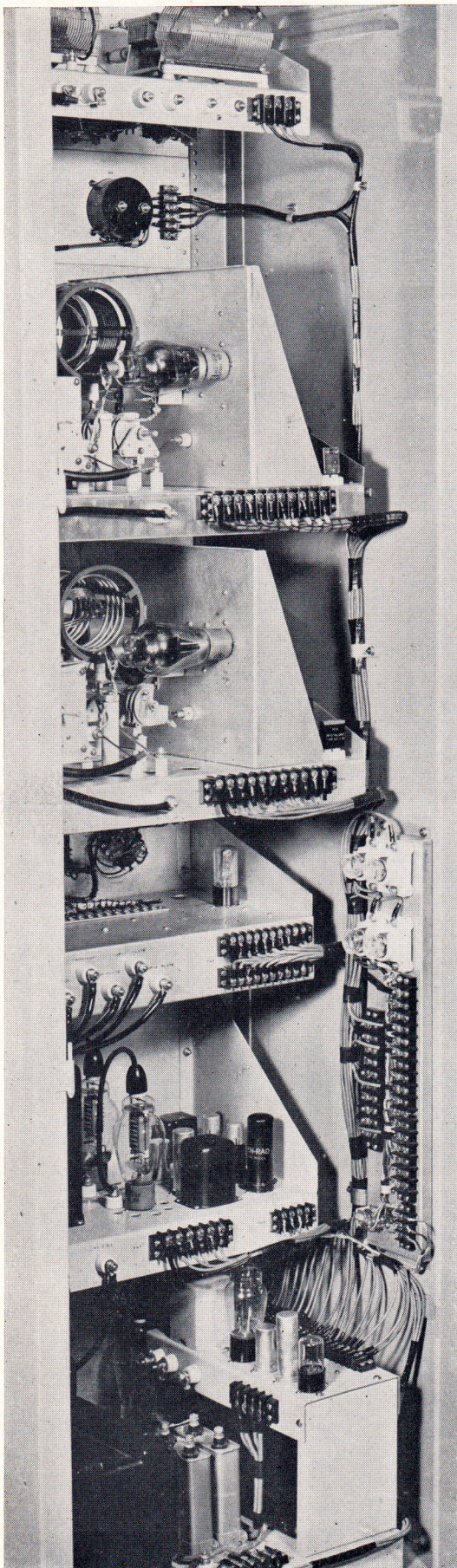
2



3



4



## Gates MO-2535 Telephone—

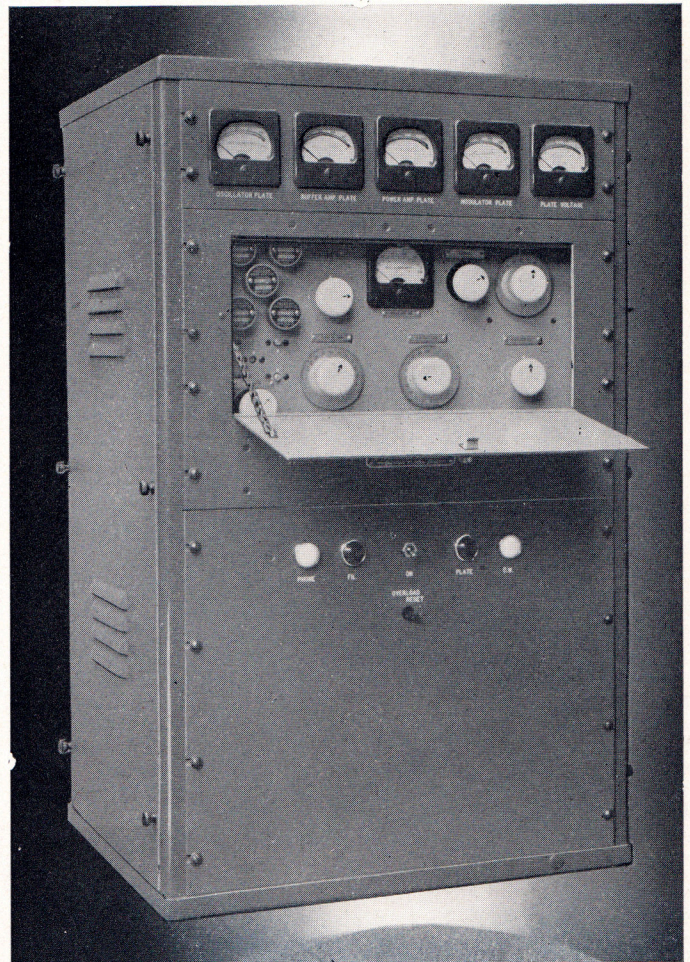
A complete 200-watt band switching transmitter compactly built with high level Class B modulation to cover the complete frequency range between 2-20 Mc. Provided with accessory control cabinet with audio amplifier and external microphone (see Page 22). This popular Gates transmitter may be desk mounted in its entirety and, because of its minimum space requirements, finds great adaptability in certain types of inland marine operation as well as stationary operation for airports and general communications. Size of transmitter cabinet only 36" high, 21" wide, and 19" deep; audio accessory cabinet 21" wide, 11" high, and 14" deep. Supplied complete with one set of tubes and ready to use.

## Gates MO-2535A Telephone and Telegraph—

This is identical to the MO-2535 telephone transmitter outlined above, but provided with keying relay and keying rectifier so that the transmitter becomes a combination 200 watt telephone and telegraph transmitter. Keying speeds up to 60 W. P. M. are possible. No additional space is required for the added telegraph facilities and the cost increase is only slight.

## Gates MO-2535X Telegraph—

This transmitter is for 200 watts telegraph service between 2-20 Mc. and at keying speeds up to 60 W. P. M. The audio equipment cabinet described on Page 22 is not required and the entire telegraph transmitter stands only 36" high, 21" wide and 19" deep. Jack is provided for attachment of key. Complete band switching from the front of panel. The MO-2535X transmitter is a unique, dependable and highly commercial equipment that may be used over the entire commercial high frequency range.



## General Design—

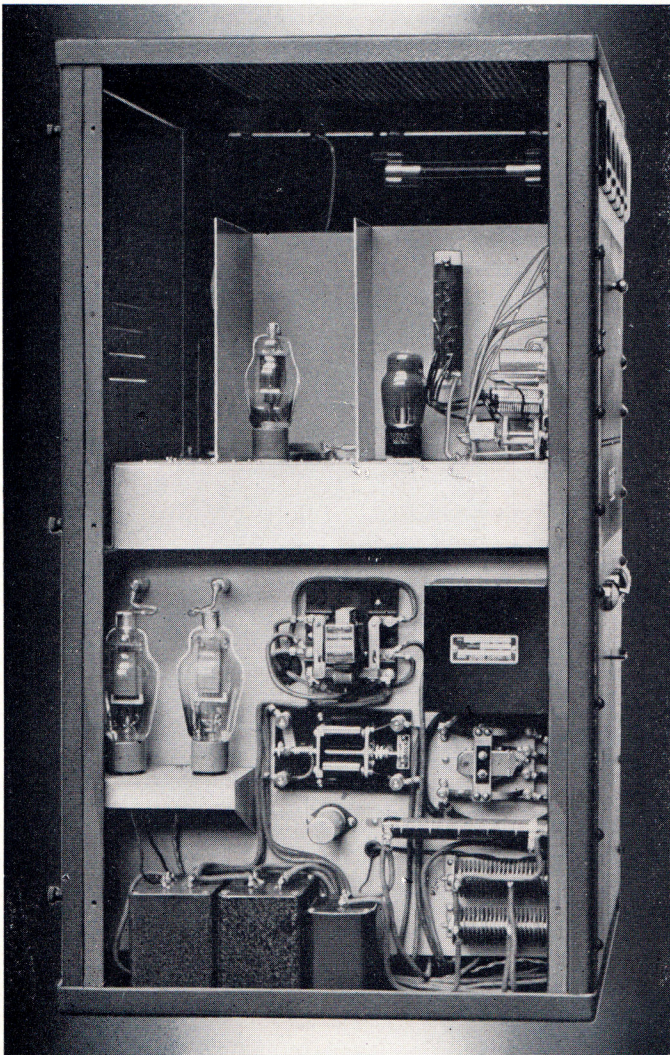
The main cabinet is constructed of heavy steel with both sides and back removable. Top is heavily perforated and the sides are provided with louvers for ventilation. Frequency change is from the front panel. Five crystal positions are provided. Accurately calibrated dials and firm gripping silver plated band switches make possible setting up to any pre-determined frequency within a few moments. Finish is in rugged orange peel that will stand the abuse of hard handling or unusual climates. All coils are silver plated, where necessary, and the chassis is copper plated. Though these transmitters are highly compact, their design allows amazing convenience for serviceability to all parts by means of the removable sides and back. The audio accessory cabinet connects to the transmitter cabinet by simple wiring between terminal strips of the transmitter and audio cabinets. The audio cabinet may be spaced several hundred feet from the transmitter cabinet, if necessary.

## Radio Frequency—

Consists of three stages: 6F6 oscillator; 807 intermediate-doubler amplifier; and 813 power amplifier. Oscillator accommodates five plug-in crystals and covers the entire range from 2-11 Mc. Frequencies above 10 Mc. are doubled due to low driving requirements of the intermediate and final amplifier tubes. Excessive grid excitation is had at all frequencies. Final tank coil is in two sections, switched in and out of circuit, providing full efficiency at higher frequencies. All tuning is from front panel.

## Band Change—

Is accommodated by four heavily built selector switches, selecting crystal position, oscillator tank coil, buffer tank coil and power amplifier tank coil. Dials for tuning of various circuits accurately calibrated to allow almost instant setup of pre-determined operating frequencies.



## 200 Watt Phone and C. W.

### Audio Frequency—

The speech amplifier is in the accessory cabinet described on this page. Consists of a 6J7 first stage, 6C5 second stage, and P. P. 2A3 driver amplifiers. The power supply for this amplifier is self-contained, using a 5Z3 tube. This drives the P. P. Class B 811 tubes, located in the main transmitter cabinet. The 813 Class C amplifier is high level modulated. The audio frequency cabinet also provides complete control of the transmitter for telephone-telegraph and standby service. Likewise, the telegraph key and microphone may be operated from the audio console. This console also provides push-to-talk operation directly from the microphone stand.

### Power Supplies—

Two major power supplies are incorporated, plus two secondary power supplies. The major power supply is a pair of 8008 rectifier tubes, supplying voltage for the entire transmitter. A full wave selenium rectifier provides bias voltage to the radio frequency power amplifier and modulator. Additional secondary power supplies include the 5Z3 power rectifier tube and a 12-volt copper sulphide rectifier which operates the keying relay. This latter unit is supplied in telegraph models only.

### Loading—

The output coupling circuit is completely self-contained and consists of a continuously variable coil with Veeder counter type dial on the front panel. The inductive relationship to the power amplifier is fixed and the impedance match is accomplished by means of a variable capacitor and the variable coil. Antennas as low as 15 ohms in resistance can be easily matched. Particular attention has been paid to the broadest possible range of the antenna coupling system.

### Controls and Relays—

Controls consist of filament start switch, plate start switch, overload relay, secondary contactor, time delay relay, and keying relay. In telephone models an additional pilot relay is provided for push-to-talk operation. Front panel primary controls consist of supervisory lights indicating the mode of operation in use, such as telephone, telegraph, filaments on, and plate on. Metering consists of five 3" meters, indicating oscillator plate, intermediate amplifier plate, power amplifier plate, modulator plate, and antenna current.

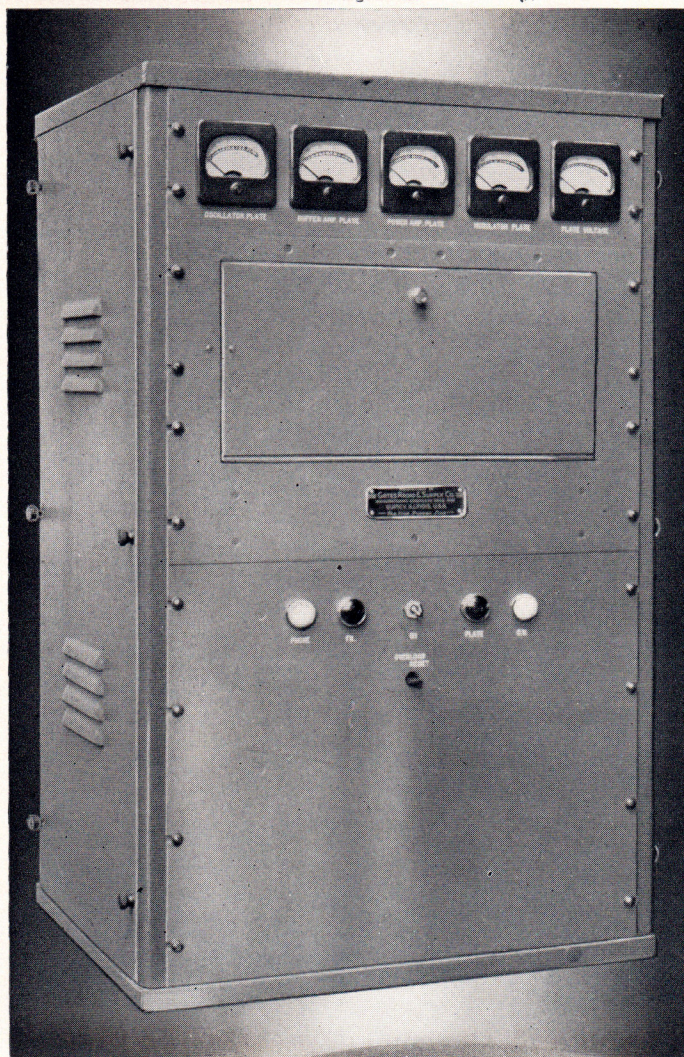
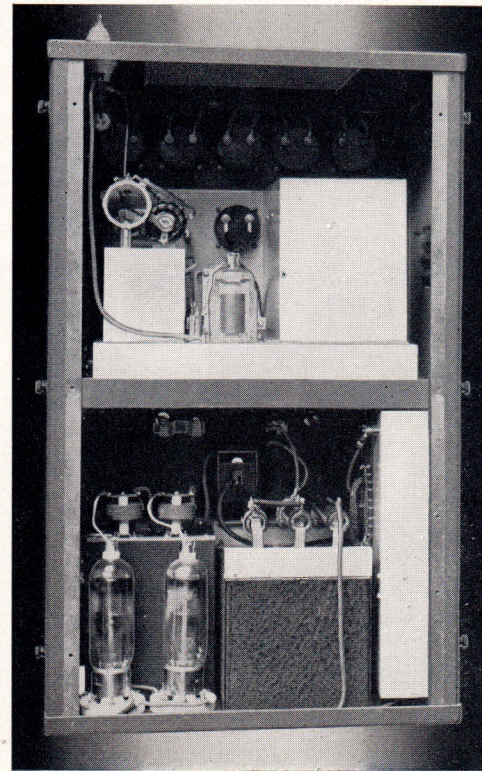
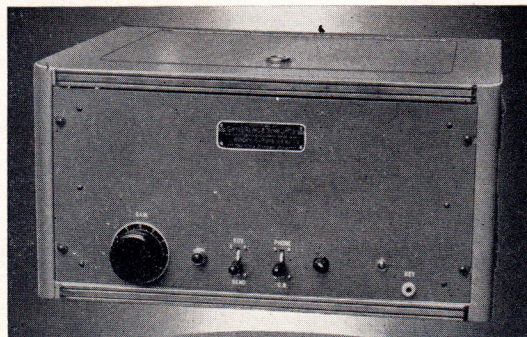
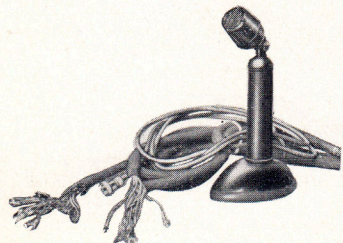
### ORDERING DETAIL

**Model MO-2535** complete telephone transmitter, 2-20 Mc., with complete set of tubes, five crystals and holders to your specified frequency. Audio control cabinet and microphone with push-to-talk desk stand. Code ZESEL.

**Model MO-2535A**, same as Model MO-2535 in entirety, with telegraph operation added, including telegraph key. Code ZESKA.

**Model MO-2535X** telegraph model only, 2-20 Mc., complete with tubes, five crystals and holders and telegraph key. Audio cabinet and microphone are not supplied with this model. Code ZESLE.

From left to right, below. Microphone hand set with push-to-talk stand; audio control console complete with supervisory switches; and rear view of MO-2535 transmitter showing power supply and R. F. power amplifier tube.

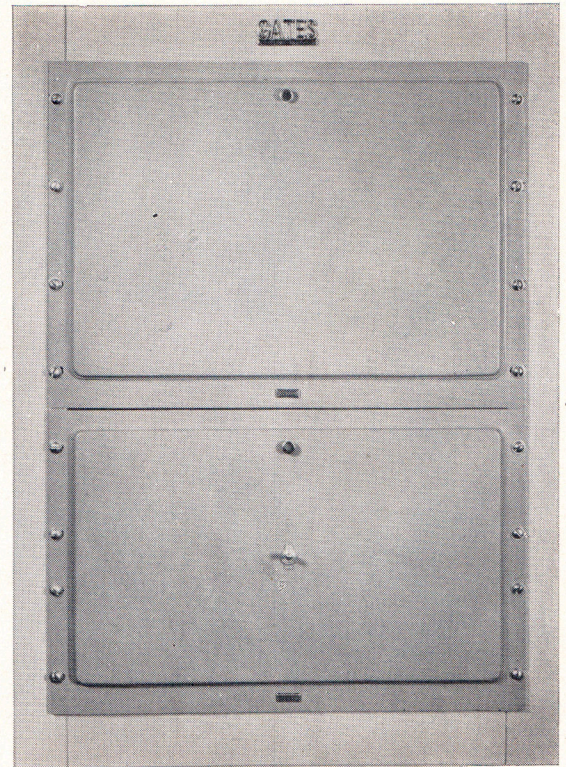


Above. The complete transmitter cabinet of the MO-2535 200-watt telephone and telegraph models.

**Point to Point** communications at high frequencies are often best handled with a transmitter such as the Gates FM-35, a thirty-five watt narrow band complete FM equipment. When operated into a directional antenna such as the corner reflector type herein illustrated, radiated power several times that of the transmitter power results.

The crystal frequency is multiplied 36 times to arrive at the carrier frequency, assuring stability of operation by a low frequency oscillator circuit. Lumped constants or LC circuits are employed in low frequency stages. Transmission line is coupled inductively by means of a pickup loop. Phase modulation is employed, allowing direct crystal control operation. The 200 ohm audio input, sufficient for a carbon microphone, feeds into the grids of the 6SA7 balanced phase quadrature tubes which operate at the crystal frequency.

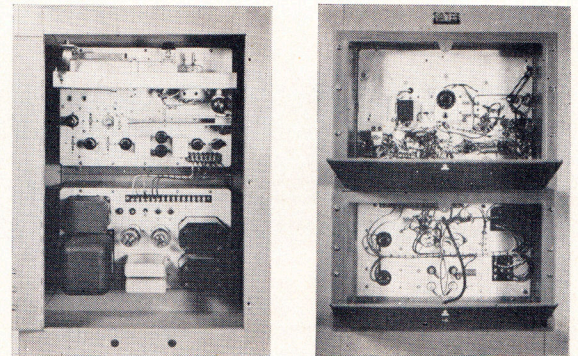
A coaxial relay is supplied which operates with the push-to-talk relay, switching the antenna over to the receiver and also mutes the receiver during the transmit sequence.



### SPECIFICATIONS

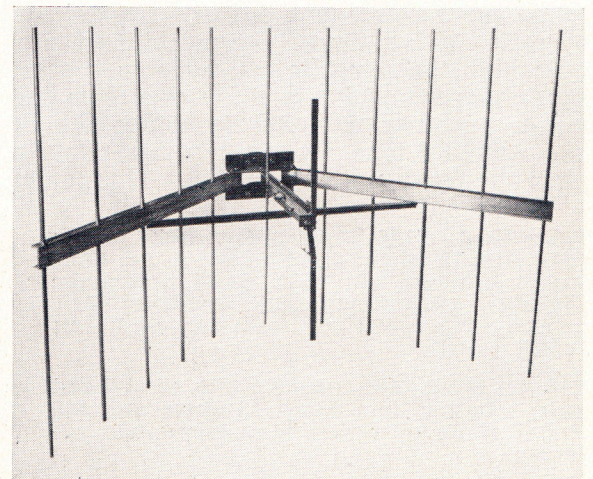
- POWER OUTPUT—35 watts.
- TUBES—6SJ7 oscillator, two 6SA7 phase quadrature modulators, 6SJ7 tripler, 6SJ7 tripler, 6A67 doubler, 2E26 doubler, 829B amplifier, two 5Z3 rectifiers.
- BAND WIDTH—Plus or minus 20 cycles.
- FREQUENCY RANGE—150 to 175 Mc. (as ordered).
- OUTPUT IMPEDANCE—51.5 ohms.
- INPUT IMPEDANCE—200 ohms (0 Dbm).
- POWER REQUIREMENTS—115 volts, 60 cycles, 200 watts.

**Model FM-35 Transmitter with tubes. Code ZEPGA.**



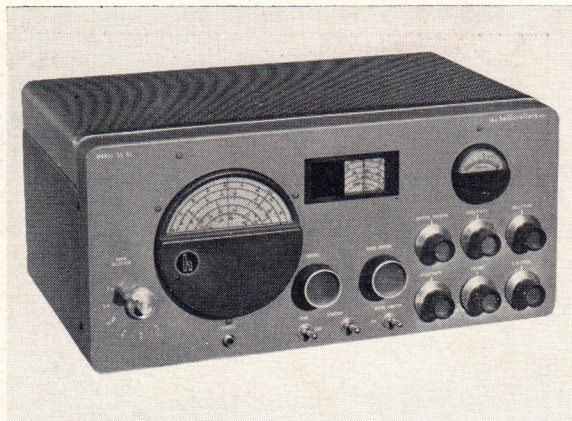
### Corner Reflector Antenna

To the right is illustrated the corner reflector antenna providing a gain of 8, equivalent to a power gain of 6.3 Db. When used, for example, with the FM-35 transmitter, would provide a radiated power of about 175 watts or more, depending on transmission line length. When used with a receiver, results are equally effective. The corner reflector concentrates radiation in a narrow beam, requires no tuning and is easy to erect. Frequency range 152 to 162 Mc. Polarization is vertical. Beam width, 60 degrees at half power points. VSWR is 1.4 maximum. Size: 4 feet high, 4 feet on each side. 2-inch support pipe required. Weight: 26 lbs.



**Model 3605 Corner Reflector. Code ZEPHE.**

## Communications Receivers



### S-38 Communications, 540-32 Mc.

Low cost receiver. Will operate on AC or DC. Has four separate bands, 540 KC to 32 Mc. continuous. The main tuning dial is calibrated megacycles. In addition the S-38 has electrical band spread dial, headphone jack, noise limiter and standby switch. Input either doublet or single wire. Metal housing. PM Dynamic speaker in top of cabinet.

TUBES USED—12SA7 converter, 12SK7 IF, 12SQ7 second detector AVC and first audio, 12SQ7 BFO and noise limiter, 35L6/GT audio output and 35Z5/GT rectifier.

Operates on 105 to 125 volts AC or DC. Supplementary line cord available for 220 volt operation.

Physical Size—12 $\frac{7}{8}$ " wide, 7 $\frac{1}{8}$ " wide, 8 $\frac{5}{8}$ " deep.

Shipping weight: 16 lbs.

Model S-38 Communications Receiver. Code ZEOWR.



### S-40A Communications, 550-43 Mc.

550 Kc. to 43 Mc. Full vision main tuning dial directly calibrated. Electrical band spread separate dial. Both dials illuminated. Individual audio and RF sensitivity controls. AVC On-Off switch, noise limiter switch, CW pitch control, standby switch and phone jack. Antenna terminations, single wire or doublet provisions. Provision for battery or vibrator power supply. Metal cabinet.

Nine high gain tubes and they are as follows: 63G7 RF, 6SA7 converter, two type 6SK7's IF's, 6SQ7 second detector, 6F6G audio output, 6H6 AVC and noise limiter, 6J5/GT BFO, 80 rectifier.

Operates from 105 to 125 volts, 50/60 cycles AC.

(Also available is an S-40AU called a universal model, same as above, but it operates on 110, 130, 150, 220 or 250 volts, 25 to 60 cycles AC.)

Model S-40A Communications Receiver. Code ZEOZT.



### MO-3685 Crystal Controlled Communications Receiver

For fixed frequency reception of telephone and telegraph communications, two models of crystal controlled and highly compact receivers are available from Gates. The MO-3685 receiver operates at any selected frequency as ordered between 2-22 Mc. and the MO-3685A between 10-28 Mc. The receiver occupies only 3 $\frac{1}{2}$ " of rack panel space, is completely self-contained with power supply included. Maximum depth behind the panel is only 10 $\frac{1}{2}$ ". Sensitivity of less than one microvolt for loud-speaker operation is obtained with a conventional super-heterodyne circuit. Crystal control of the receiving frequency insures stability and dependable operation at all times. Permeability tuning of both radio frequency and intermediate frequency stages permits high "Q" circuits and adds to the stability. Loudspeaker muting is accomplished with an electronic squelch circuit which is adjustable from one microvolt. A relay is provided to mute the receiver where a transmitter push-to-talk switch is employed. Front panel controls provide for adjustment of sensitivity, audio gain and BFO tone. A power switch, pilot light, squelch cutout switch, BFO switch, and standby switch complete the front panel apparatus. This communications receiver may be used with any conventional antenna.

**Tubes Used**—6BA6 RF amplifier; 6BE6 mixer; 6BA6 first IF stage; 6BA6 second stage; 6AL5 second detector and AVC; 6AU6 first audio amplifier; 6AQ5 output audio amplifier; 6AU6 squelch control; 6C4 beat frequency oscillator; 5Y3GT rectifier.

Receiver is supplied complete with crystal and tubes. Output impedance: 6 ohms and 500 ohms. State operating frequency when ordering.

MO-3685 Receiver, 2-22 Mc. Code ZETLA.

MO-3685A Receiver, 10-28 Mc. Code ZETME.

