

SECOND EDITION



# SHORT WAVE APPARATUS

KITS PARTS DATA



**RADIO ENGINEERING LABORATORIES**

100 WILBUR AVENUE

LONG ISLAND CITY

N. Y., U. S. A.



Price 25 cents.



# Foreword

Handwritten: *Heap*  
*7/5/31*  
*7-6-31*

**T**HE RADIO ENGINEERING LABORATORIES takes pleasure in offering this, its first catalogue, 2nd Edition, to the fraternity of radio amateurs and experimenters. During the past few years the transmitting amateurs have been seriously hampered in the building of short wave stations due to the inability of purchasing modern equipment. REL now offers a complete line which will satisfy all.

REL is proud of its apparatus which it has developed, and is solicitous of its reputation; and in line with its policy it will be glad to have called to its attention any defect in material or workmanship which may be noted by the purchaser. It is the aim of REL to serve the radio amateur, and to establish its trademark as a symbol of quality.

Keep this loose-leaf booklet up-to-date by inserting the timely bulletins which are issued periodically.

## RADIO ENGINEERING LABORATORIES.

1st Edition, November 1, 1926.

2nd Edition, March 1, 1928.



### SHIPPING INSTRUCTIONS

Tell us exactly how goods are to be shipped. Unless instructions are received we will use our own judgment, choosing the quickest and cheapest route.

### PRICES

All prices are subject to change without notice. We are governed by conditions in the market and our prices will vary accordingly.

### TERMS

Our regular terms are 30 days NET, or 2% discount for cash in ten days. We will open ledger accounts for rated or properly recommended merchants only. If you have no account with us and wish to get prompt shipment on first order, we suggest that you allow us to ship C.O.D. and at the same time send us references.

### C. O. D. SHIPMENTS

We will make C.O.D. shipments without deposit only to persons known to us. To new purchasers we will make such shipments only with deposit of 25% on the order. We do not ship any special apparatus on C.O.D. basis. Be sure and accompany remittances with enough to cover transportation charges. We will refund any overpayment.

### LOSS OR DAMAGE IN SHIPMENT

We take the greatest care in packing and shipping orders. Our responsibility ends when we deliver the shipment to the Express Company, the Post Office or the Railroads. File claim immediately for any shortage or damage in transit and if you desire we will furnish any papers and assistance necessary.

### RETURNED GOODS

We will correct and be responsible for any errors that we may make in shipping. We will not accept from the carrier any goods returned without our consent. This rule will be adhered to without variation.

LIT

SOFI	304	ZAR	250
AGL	305	AGA	251
SAJ	306	VVA	252
SOI	307	41	
MOA	308		
BER	309		
IZAP	310		
ELB	311		
PKL	312		
LEV	313		
HRKL	314		
FRAL	315		
KZ	316		
JIPP	317		



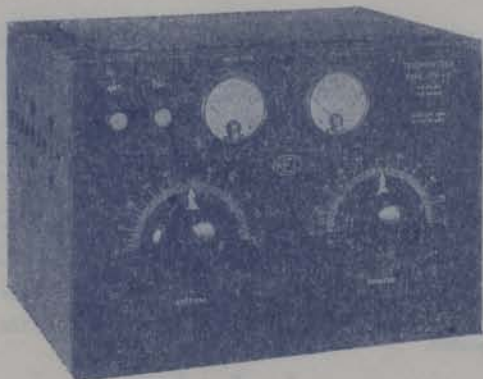
Special Amplifier

APPARATUS



## 10 WATT HARTLEY TRANSMITTER KITS

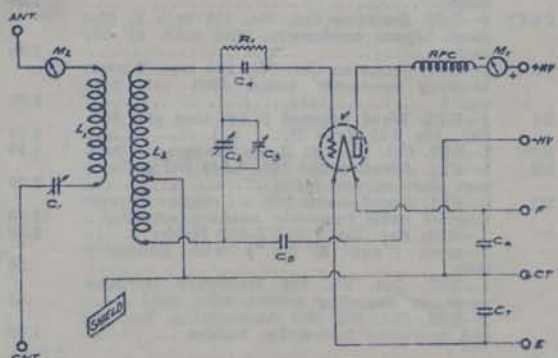
METAL ENCASED TYPE—CAT. 205



The REL Cat. No. 205, 10 watt Hartley transmitting kit will be found advantageous for amateurs who desire a compact, completely shielded low power telegraph transmitter. The type and size of the power supply depends upon the characteristics of the tube used. Any type of UX base tube may be used providing that the correct plate and filament voltages are supplied. The plate supply may be derived from dry or storage batteries; a half or full wave rectifier or a small motor generator unit. If alternating current is available, the most economical source of supply would be a half wave rectifier with an adequate filter system. In most cases where such a power supply is available it will be a simple matter to use a small filament transformer for heating the filaments. This transformer may either be part of the plate transformer or else a separate unit. The REL Cat. No. 185 power supply unit is ideal for operation in conjunction with this 10 watt transmitter. Data on this power unit and also on motor generators can be found elsewhere in the REL catalogue.

Various parts supplied have been designed to conform with the modern amateur radio requirements. The tank condenser is of large capacity so as to incorporate all features of the high C circuit, thus preventing creeping, key chirps and frequency variations by swamping out the internal capacity effects of the tube. The transmitter frequency will thus be rigidly held. Furthermore, the special tank condenser employs a small movable capacity which allows the spread of each band over the entire dial scale. Both of these condenser features are highly desirable and an almost absolute necessity for good results.

Three new type ribbed space wound plug-in coils are supplied with each kit. These cover the following frequency ranges:



Illustrated here is the schematic wiring diagram of the Cat. No. 205 kit. This shows how the kit may be connected up in the conventional shunt feed Hartley circuit. When this kit is used as an oscillator it is advisable to use the diagrams shown above. However, when it is used as an amplifier preceding another oscillator such as in a master oscillator power amplifier circuit, it would be advisable to employ the series feed circuit shown on the following page.

Coil type "C"—4200 K.C. to 3300 K.C.  
Coil type "B"—7500 K.C. to 6800 K.C.  
Coil type "A"—14600 K.C. to 13800 K.C.

Additional coils to cover other channels may be purchased separately.

For maximum results use a UX-210 type tube with 7½ volts on the filament and between 350 and 450 volts on the plate. When these transmitters are used with this tube and the power rating specified, they should easily be able to cover ranges up to 2000 miles. It is difficult to give an approximate range of the transmitter due to the many varying local conditions. However, similar transmitters have been reported to have operated stations 3,000 and 4,000 miles away. Due to the compactness and thorough shielding of this set, it will emit consistent, steady signals.

The complete transmitting kit is supplied with a neatly finished metal case measuring 13" x 9" front x 10" deep. Net weight of transmitter kit, Cat. No. 205 is 15 pounds.

The following parts are furnished with each REL Cat. No. 205, 10 Watt Coupled Hartley Transmitter Kit. The kit may be purchased complete or else any individual parts may be secured separately.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 205 Metal case with removable cover (finished in black crystalline lacquer) . . . . .	\$6.50
	Size—9" x 13" front x 10" deep	
	1—REL Cat. No. 205 Aluminum Front Panel Drilled and engraved (finished in black crystalline lacquer) . . . . .	3.00
	Size—9" x 13"	
	1—REL Cat. No. 205 Engraved bakelite rear terminal strip supplied with five connection screws and two mounting brackets. . . . .	1.00
	1—REL Cat. No. 205 Five ply veneer base-board finished in dull black lacquer. (Fitted with copper ground plate). . . . .	1.00
L1-L2	1—REL Cat. No. 240 Transmitter coil Type C covers 3300 K.C. to 4200 K.C. . . . .	3.00
L1-L2	1—REL Cat. No. 240 Transmitter coil Type B covers 7500 K.C. to 6800 K.C. . . . .	3.00
L1-L2	1—REL Cat. No. 240 Transmitter coil Type A covers 13800 K.C. to 14600 K.C. . . . .	3.00
	1—REL Cat. No. 183 Transmitter coil base. . . . .	2.00
C1	1—REL Cat. No. 181D Antenna Series variable condenser 210 mmfd. . . . .	4.50
C2-C3	1—REL Cat. No. 187F Primary tank variable condenser with special movable vernier for obtaining full tuning scale spread for each amateur band 100 mmfd. . . . .	6.50
	2—REL variable condenser knobs 40c each. . . . .	.80
C4	1—REL Sangamo Cat. No. 150 type "K" grid blocking condenser 2000 mmfd. . . . .	.50
C5	1—REL Sangamo Cat. No. 150 type "K" plate blocking condenser 2000 mmfd. . . . .	.50
C6-C7	2—REL Sangamo Cat. No. 150 type "K" filament bypass condensers 2000 mmfd. @ 50c each . . . . .	1.00
R1	1—REL Kroblak 5000 ohm transmitting grid leak . . . . .	1.00
RFC	1—REL Cat. No. 132 Radio Frequency Choke . . . . .	1.10
M1	1—REL Jewell model 135, 0-100 DC milliamperes plate current meter. . . . .	7.00
M2	1—REL Jewell model 165, 0-1 ampere Thermo coupled radio frequency antenna meter. . . . .	12.00
V	1—REL UX Base socket Cat. No. 122. . . . .	.35
	2—Posts ("ant. & cnt.") with insulating strip . . . . .	.30
	1—REL Cat. No. 205 Hardware (includes necessary mounting screws, wire, etc.). . . . .	.50
	1—REL Cat. No. 205 Assembling, building and operating instruction booklet. . . . .	1.00
	<b>TOTAL COST OF PARTS. . . . .</b>	<b>\$59.55</b>

Cat. No. 205, 10 watt telegraph transmitter kit complete (this includes all parts listed above) kit price when purchased complete . . . . . \$55.00

The Cat. No. 205 kit may be purchased completely assembled, wired and tested. This work is done under the supervision of capable instructors and engineers at our Laboratories. Additional charges for this service. . . . . \$18.00

RADIO ENGINEERING LABORATORIES

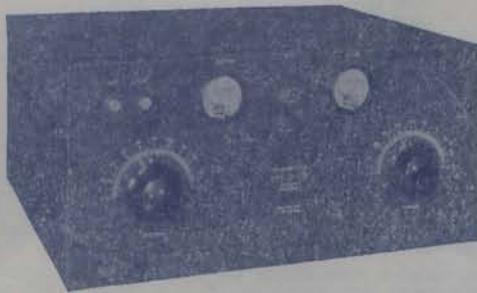
100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



# 75 WATT HARTLEY TRANSMITTER KITS

METAL ENCASED TYPE—CAT. 206



The REL Cat. No. 206, 75 Watt Hartley Telegraph Transmitter will fulfill all the requirements for a medium powered, efficient and modernly designed telegraph transmitter. This kit employs the UX852 tube. Plate supply may be derived from rectified AC, motor generator or any other source capable of delivering pure DC. The filament may be heated from a 12 volt storage battery, from a filament transformer or from a 10 or 12 volt motor generator.

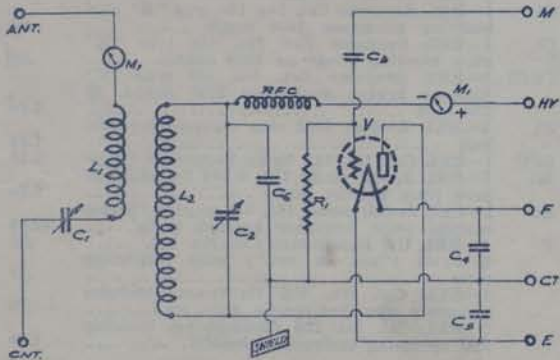
The REL Cat. No. 172 power supply unit, is recommended for those having 110 volt, 60 cycle alternating current available. The REL motor generators shown on page 17A will also be found very satisfactory for power supply.

The finest available parts are supplied with this kit. This includes two large REL Cat. No. 149, type K condensers, one of which is used for tuning the primary circuit and the other for the antenna circuit. The transmitting inductances are the well known REL flat wise wound on glass units.

The purchaser has an option to select whether he desires two Cat. No. 127 type S units or two Cat. No. 127 type L units. The S units are primarily designed for the 14,000 and the 7000 kilocycle bands, whereas the L units are mainly for the 3500 KC. band, although they will also very nicely function in the 7000 KC band. Therefore, when ordering an REL Cat. No. 206 kit, be sure to specify the type of inductance or else the frequency band on which the transmitter is to operate.

The plate and grid fixed condensers have a 5000 volt DC rating which is more than enough to insure a large factor of safety. Likewise all the other material employed has been carefully selected and tested.

The Cat. No. 206 kit when used with an efficient power supply and operated under favorable conditions can be depended on, to transmit over many thousands of miles. It will emit a steady clean cut signal of very pleasing tone character. For telephoning purposes the circuit may be



The illustration above is a series feed Hartley circuit adaptable to power amplifiers which are fed by separate oscillators. If a 75 watt Cat. No. 206 kit is to be used as an oscillator and directly connected to the antenna it is advisable to employ the shunt feed Hartley circuit shown on the previous page.

The binding post marked "M" is connected to the plate output of the preceding tube which may be an oscillator or another amplifier.

keyed in various advantageous places. Probably the best of these is in the center tap lead of the filament transformer.

Due to the convenient design of this kit it will lend itself for use in the Master Oscillator Power Amplifier circuit. It may be used as an amplifier which is being fed by a 7.5 watt oscillator tube, which in turn may be controlled by a crystal stage if desired. The total shielding of this unit is a great help in eliminating many difficulties in neutralizing an amplifier stage. This kit may be advantageously used as an oscillator to feed a tube of higher rating such as a 250 watt stage. This 75 watt Hartley will constitute a very efficient telephone transmitter when connected to a 75 watt modulator unit. The quality and steadiness of such a combination can be very favorably compared to that of many of the present day broadcasting stations.

This transmitter kit is supplied with a neatly finished metal case measuring 9" x 19" front x 16" deep.

The net weight of this transmitter kit Cat. No. 206 is 32 pounds.

The following parts are furnished with each REL Cat. No. 206, 75 Watt Coupled Hartley Transmitting Kit. The kit may be purchased complete or else any individual parts may be secured separately.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 206 Metal case with removable cover (finished in black crystalline lacquer) ..... Size—9" x 19" front x 19" deep	\$12.00
	1—REL Cat. No. 206 Aluminum Front Panel Drilled and engraved (finished in black crystalline lacquer) ..... Size—9" x 19"	4.50
	1—REL Cat. No. 206 Engraved bakelite rear terminal strip supplied with five connection screws and two mounting brackets.....	1.20
	1—REL Cat. No. 206 Five ply veneer Base-board-finished in dull black lacquer. (Fitted with copper ground plate).....	1.70
L1	1—REL Cat. No. 127 transmitting coil for antenna circuit. (Single unit).....	5.50
L2	1—REL Cat. No. 127 transmitting coil for primary circuit (single unit).....	5.50
	When ordering kits be sure to specify the frequency channel on which the transmitter is to operate so that the correct inductors may be supplied.	
C1-C2	2—REL Cat. No. 149 type K transmitting variable condensers (Antenna and primary tuning) .....	35.00
C3	2—REL variable condenser knobs @ 40c each	.80
	1—REL Sangamo Cat. No. 150 type T grid blocking condenser tested 5000 volt 2000 mfd. ....	2.00
C4-C5	2—REL Sangamo Cat. No. 150 type K filament bypass condensers, 2000 mfd. @ 50c each .....	1.00
C6	1—REL Sangamo Cat. No. 150 type T plate blocking condenser tested 5000 volt 2000 mfd. ....	2.00
R1	1—REL Ward Leonard 20,000 ohm grid leak Cat. No. 143 Type D.....	6.15
RFC	1—REL Cat. No. 132 Radio Frequency Choke	1.10
M1	1—REL Jewell model 135, 0-200 DC milliampere plate current meter.....	7.00
M2	1—REL Jewell model 165, 0-2 ampere Thermo Coupled radio frequency antenna ammeter..	12.00
V	1—REL Cat. No. 129 UX-852 Holder.....	2.50
	2—posts ("ant. & cnt.") with insulating strip .....	.30
	1—REL Cat. No. 206 Hardware (includes necessary mounting screws, wire, etc.).....	.50
	1—REL Cat. No. 206 Assemblying, building and operating instruction booklet.....	1.00
	<b>TOTAL COST OF PARTS.....</b>	<b>\$101.75</b>

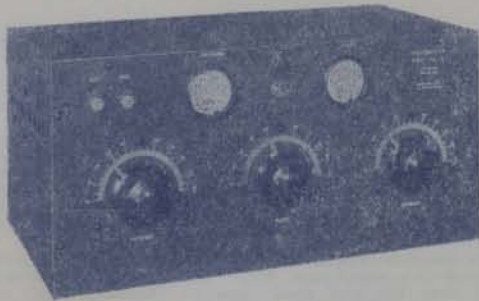
Cat. No. 206, 75 watt Hartley Radio Telegraph Transmitter Kit complete (this includes all apparatus listed above) Kit price when purchased complete.....\$94.00  
The Cat. No. 206 may be purchased completely assembled, wired and tested. This work is done under careful supervision at our laboratories.  
Additional charges for this service.....\$38.00

**RADIO ENGINEERING LABORATORIES**  
100 WILBUR AVENUE LONG ISLAND CITY, N. Y., U. S. A.



# 10 WATT TUNED PLATE TUNED GRID TRANSMITTER KITS

## METAL ENCASED TYPE—CAT. 207



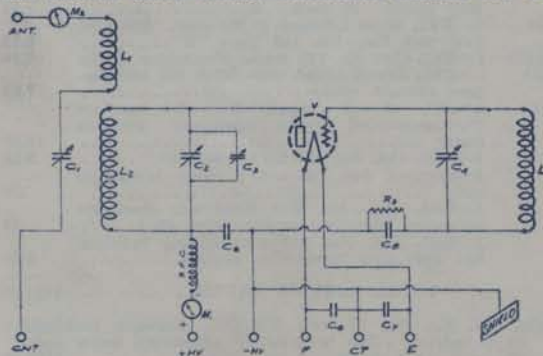
The REL Cat. No. 207 10 watt tuned plate-tuned grid transmitting kit is of modern design and conforms to the latest demands on amateur transmitters. It will perform efficiently and consistently in the new amateur bands as allotted by the International Radio Conference. The various component parts are of the highest grade and have been designed to fulfill the critical demands of modern transmitters which are to operate in narrow congested frequency channels.

Any type of UX base tube may be employed providing the correct plate and filament voltages are applied to the tube used. Power supply for this kit may be obtained from a number of "B" batteries connected in series; a half or full wave rectifier operating from AC source or A motor generator unit which may be driven from AC or DC source depending upon the primary power supply available. If 110 volt, 60 cycle, alternating current is available, a very efficient combined plate and filament power unit may be used by connecting the REL Cat. No. 185 AC power unit to this transmitter. Data on suitable motor generators will be found elsewhere in the REL catalogue.

Some of the outstanding features in this new modernly designed transmitting kit are the specially constructed REL high frequency variable condensers. These are of rugged construction and will eliminate many of the troubles found in previous transmitters which have employed inefficient, unstable tuning condensers. Furthermore, the main frequency control condenser is a combined large capacity semi-variable tank condenser shunted by a very small movable capacity thereby gaining the benefit of having both a high C plate circuit and at the same time also having a movable tuning control which will spread each of the amateur bands over its entire scale.

Three sets of new type one piece bakelite form plug-in coils (6 coils) are supplied with this kit. They cover the frequency ranges specified under the description of parts. Extra coils to cover other channels may be purchased separately.

For maximum power output it is recommended that the UX-210 type of tube be used. The plate supply should not exceed 450 volts when the filament receives 7½ volts. Using this specified power rating, considerable distance will be



Wiring diagram employed in the Cat. No. 207 and Cat. No. 208 kits. Connections are shown for connecting the filament to center tap AC transformer. Other methods of filament heating may be employed, providing necessary changes are made.

covered. The actual transmission depends largely upon the local absorption factors such as metallic subjects which tend to absorb the radiated energy. Similar transmitters have performed under average conditions and have transmitted over several thousand miles. The use of a plate supply which gives a pure DC or as nearly a pure DC as possible is a big factor in the distance the transmitter will cover. This transmitting kit is housed in a neatly finished metal case which affords complete shielding. This case is supplied with a removable top which allows quick inspection of the interior. This case measures 9" x 19" front x 10" deep. The net weight of transmitter kit Cat. No. 207 is 22 pounds.

The following parts are furnished with each REL Cat. No. 207, 10 Watt Tuned Plate-Tuned Grid transmitter kit. The kit may be purchased complete or any individual parts may be secured separately.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 207 Metal case with removable cover (finished in black crystalline lacquer Size—9" x 19" front x 10" deep)	\$8.80
	1—REL Cat. No. 207 Aluminum front panel drilled and engraved (finished in black crystalline lacquer) Size—9" x 19"	4.50
	1—REL Cat. No. 207 Engraved bakelite rear terminal strip supplied with five connection screws and two mounting brackets	1.20
	1—REL Cat. No. 207 Five ply veneer base-board-finished in dull black lacquer. (Fitted with copper ground plate)	1.45
L1-L2	1—REL Cat. No. 241 Transmitter coil, Type C covers 3300 K.C. to 4200 K.C. (Plate and antenna coils)	3.00
L3	1—REL Cat. No. 241 Transmitter coil, Type F covers 3300 KC to 4200 KC. (Grid coil)	3.00
L1-L2	1—REL Cat. No. 241 Transmitter coil, Type B covers 6800 K.C. to 7500 K.C. (Plate and antenna coils)	3.00
L3	1—REL Cat. No. 241 Transmitter coil, Type E covers 6800 K.C. to 7500 K.C. (Grid coil)	3.00
L1-L2	1—REL Cat. No. 241 Transmitter coil, Type A covers 13800 K.C. to 14600 K.C. (Plate and antenna coils)	3.00
L3	1—REL Cat. No. 241 Transmitter coil, Type D covers 13800 K.C. to 14600 K.C. (Grid coil)	3.00
	2—REL Cat. No. 183 Transmitter coil bases @ \$2.00 ea.	4.00
C1	1—REL Cat. No. 181D, antenna series variable condenser 210 mmfd.	4.50
C2-C3	1—REL Cat. No. 187F plate tank condenser with special movable vernier for obtaining full tuning scale spread for each amateur band	6.50
C4	1—REL Cat. No. 181C Grid tank variable condenser 100 mmfd.	4.50
	3—REL variable condenser knobs @ 40c each	1.20
C5	1—REL Sangamo Cat. No. 150 Type K grid blocking condenser 250 mmfd.	.40
C6-C7	2—REL Sangamo Cat. No. 150 Type K filament bypass condensers 2000 mmfd. @ 50c each	1.00
C8	1—REL Sangamo Cat. No. 150 Type K plate blocking condenser 2000 mmfd.	.50
R3	1—REL Kroblak 5000 ohm transmitting grid leak 40 watts	1.00
RFC	1—REL Cat. No. 132 Radio Frequency Choke	1.10
M1	1—REL Jewell Model 135, 0-100 DC mill-ampere plate current meter	7.00
M2	1—REL Jewell Model 165, 0-i ampere Thermo Coupled radio frequency antenna meter	12.00
V	1—REL De Jur UX type Base Socket	.35
	2—Posts ("ant. & cnt.") with insulating strip	.30
	1—REL Cat. No. 207 Hardware (includes necessary mounting screws, wire, etc.)	.50
	1—REL Cat. No. 207 Assemblying, building and operating instruction booklet	1.00
<b>TOTAL COST OF PARTS</b>		<b>\$79.80</b>

The Cat. No. 207, 10 watt T.P.T.G. telegraph transmitter kit complete (this includes all apparatus listed above). Price . . . \$73.00

The Cat. No. 207 kit may be purchased completely assembled, wired and tested. This work is accomplished in our laboratories by capable workmen and upon completion, the set is tested under actual operating conditions. Additional charges for this service . . . \$25.00

# RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## 75 WATT TUNED PLATE TUNED GRID TRANSMITTER KITS

METAL ENCASED TYPE—CAT. 208



The REL Cat. No. 208 Tuned Plate-Tuned Grid Telegraph Transmitting kit will in all respects perform the same as the 75 watt Hartley kit except that both the grid and plate circuits are controlled by variable capacity, thereby affording a simpler and more efficient method of obtaining maximum efficiency. This set has been designed to conform to the rigid specifications required for modern high frequency transmitters which are to operate in narrow congested bands. This transmitter will emit a consistent steady note. It will remain constant on the frequency to which it is set. This set employs one UX852, 75 watt output power tube. Power supply for this may be secured from a rectifier, either a full or half wave type or a suitable motor generator unit. In locations where 110 volts, 60 cycle is available, it is preferable to employ rectification. A very efficient power supply unit is the REL Cat. No. 172. This is complete and supplies AC for the filament and DC for the plate. In places where alternating current is not available the use of a motor generator becomes necessary. This motor generator unit may be of the double commutator type which would then supply both the plate and filament with direct current.

Data on such motor generator outfits will be found elsewhere in the REL Catalogue. A large capacity REL Cat. No. 149 condenser is supplied for tuning the plate circuit thus gaining the benefit of high Q circuit stabilization. This is really a necessity in order to obtain a steady output and at the same time eliminating creeping, key chirps and any frequency variations, which may occur in the oscillator circuit.

The grid and antenna circuit are each tuned by another similar large type REL transmitting variable condenser.

Three single REL transmitting inductors are regularly supplied with each kit. These may either be all of the type S or all of the type L depending upon the frequency channels to be covered. The type S units are mainly used for the 14,000 and the 7000 KC bands, whereas, the type L units are used for the 5200 KC band and may also be used if so desired for the 7000 KC band. Therefore, it becomes necessary that the purchaser specify the band on which the transmitter is to operate. It is needless to again call the amateur's attention to the merits of the REL flat wire wound on glass inductors. Their construction means absolutely the lowest dielectric losses possible in a coil used for their particular purposes. They also have a very low distributed capacity due to the flat rounded copper strip employed.



The above illustration shows the rear view of the Cat. No. 208 kit. This gives an idea of the general inside appearance of the average REL all metal enclosed kit.

The by-pass condensers, grid and plate blocking condensers, radio frequency choke coil and other component parts which constitute this kit have all been carefully selected and tested so as to secure the highest efficiency possible. The Cat. No. 208 kit may be employed as an oscillator to operate directly in the antenna circuit; it may be employed in conjunction with a 75 watt modulator unit to constitute a very efficient radio telephone transmitter or it may be employed to operate as an amplifier which is in turn controlled and fed by another oscillator or Piezo crystal stage. The telegraphic range of this transmitter when used under favorable conditions will at times approach 5000 and 6000 miles.

The complete transmitter kit is very compactly and neatly enclosed in a metal case, which not only affords protection from dust, but also gives thorough shielding. This case measures 8" x 28" front x 16" deep.

The net weight of the transmitter kit Cat. No. 208 is 44 pounds.

The following parts are furnished with each REL Cat. No. 208, 75 Watt Tuned Plate-Tuned Grid Transmitter Kit. The kit may be purchased complete or else any individual parts may be secured separately.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 208 metal case with removable cover (finished in black crystalline lacquer).....	\$16.00
	Size—8" x 28" front x 16" deep.	
	1—REL Cat. No. 208 aluminum front panel drilled and engraved (finished in black crystalline lacquer).....	4.50
	Size—8" x 28"	
	1—REL Cat. No. 208 engraved bakelite rear terminal strip supplied with five connection screws and two mounting brackets.....	1.75
	1—REL Cat. No. 208 Five ply veneer base-board finished in dull black lacquer. (Fitted with copper ground plate).....	2.00
L1-L3	3—REL Cat. No. 127 Transmitting Coils, single units.....	14.50
	When ordering kits be sure to specify the frequency channel on which the transmitter is to operate so that the correct inductors may be supplied.	
C1-C2	3—REL Cat. No. 149 type K transmitting variable condensers. (Antenna tuning, plate and grid tanks.) (\$17.50 each).....	52.50
	3—REL, variable condenser knobs 40c each.....	1.20
C4	1—REL Sangamo Cat. No. 159 type "T" plate blocking condenser tested 5000 volts 2000 mmfd.....	2.00
C5	1—REL Sangamo Cat. No. 159 type "T" grid blocking condenser tested 5000 volts 200 mmfd.....	2.00
C6-C7	2—REL Sangamo Cat. No. 159 type "K" filament bypass condensers tested 1000 volts 2000 mmfd. 50 each.....	1.00
R1	1—REL Ward Leonard 20,000 ohm. 200 watt grid leak Cat. No. 143 Type "D".....	4.15
RFC	1—REL Cat. No. 122 Radio Frequency Choke	1.10
M1	1—REL Jewell model 125—9-200 DC milliamperes current meter.....	7.00
M2	1—REL Jewell model 145—0-2 ampere Thermo-coupled radio frequency antenna meter.....	12.00
V	1—REL Cat. No. 129 UX852 Holder.....	2.50
	3—posts ("Ant. & ant.") with insulating strip.....	.30
	1—REL Cat. No. 208 Hardware (includes necessary mounting screws, wire, etc.).....	.50
	1—REL Cat. No. 208 assembling building and operating instruction booklet.....	1.00
	<b>TOTAL COST OF PARTS.....</b>	<b>\$122.40</b>

The Cat. No. 208, 75 watt T.P.T.G. telegraph transmitter kit complete. (This includes all apparatus listed above.)  
Kit price when purchased complete.....\$128.00

The Cat. No. 208 kit may be purchased completely assembled, wired and tested. This work is accomplished in our laboratories by capable workmen and upon completion, they are tested under actual operating conditions.  
Additional charges for this service.....\$42.00

RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



# 10 WATT TELEPHONE & TELEGRAPH

## METAL ENCASED TYPE—CAT. 209



The REL Cat. No. 209 transmitter fulfills all requirements for a reasonably priced, low powered high frequency radio telephone and telegraph unit. It is a combination of a single tube Hartley oscillator with a single tube Heising modulator. The set is so arranged that the oscillator may be used independently for straight CW telegraph transmission or else both tubes are operated together for telephony.

An ideal set for the amateur who desires simplicity in tuning and adjusting and yet appreciates a transmitter whose note and modulation can be favorably compared with that of high powered stations. Only the finest parts, subjected to many critical tests have been incorporated in this efficient little set, thereby making it adaptable for use in any location irrespective of the climatic conditions.

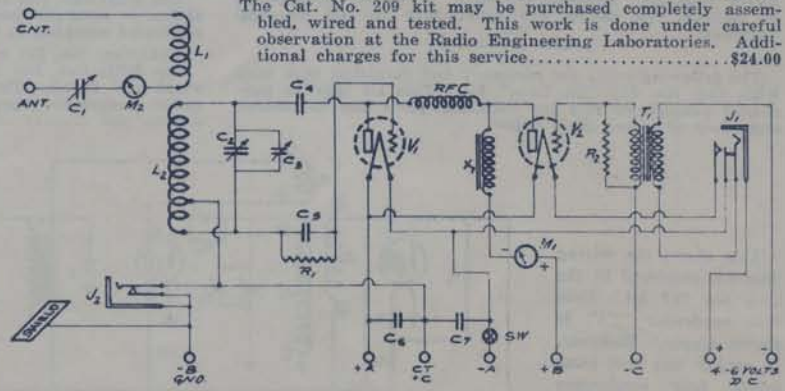
Any type of UX base tube may be used providing that the correct plate and filament voltages are applied. For maximum results UX-210 type tubes are recommended with 7½ volts on the filaments and between 350 and 450 volts on the plates. Filament supply may be secured from dry or storage batteries or better yet from a small filament heating transformer (alternating current must be available). The plate supply may be obtained from a quantity of 45 volt "B" batteries connected in series; from a half or full wave rectifier; or from a small dynamotor or motor generator unit. A very compact and inexpensive filament and plate supply source is the REL Cat. No. 185 power unit. This furnishes AC for the filaments and good clean DC for the plates. Data on a suitable motor-generator is given on page 17A of the REL catalogue.

The set is supplied with three coils which are designed to operate in the three popular amateur bands. The ranges they cover are specified under the description of parts. Additional coils to cover other channels may be purchased separately. The new REL high frequency type variable condensers are supplied. One is used for tuning the antenna circuit and the other for tuning the primary circuit. This latter condenser is the new semi-variable tank type which is shunted by a small vernier condenser for fine tuning and effective spreading of the band. The large tank capacity adds additional stability to the oscillator by employing the well known high C factor. The narrowing of the amateur frequency channels made it necessary to spread out the tuning range, not only in the receivers but also in transmitters. That is why this little transmitter may be considered modern and efficient in all respects. This transmitter will have a telephone range of approximately 5 to 500 miles and a straight CW telegraph range of from 50 to 2000 miles. It is difficult to give concise information on the range of the transmitter as the effecting elements vary so greatly.

This transmitting kit is supplied with a neatly finished metal case measuring 13" x 9" front x 10" deep. Net weight of transmitter kit, Cat. No. 209 is 18 pounds.

The following parts are furnished with each REL Cat. No. 209, 10 watt telephone and telegraph kit. The kit may be purchased complete or else any individual parts may be secured separately.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 209 metal case with removable cover (finished in black crystalline lacquer) . . . . .	\$6.50
	Size—9" x 13" front x 10" deep	
	1—REL Cat. No. 209 aluminum front panel drilled and engraved (finished black crystalline lacquer) . . . . .	3.00
	Size 9" x 13"	
	1—REL Cat. No. 209 engraved bakelite rear terminal strip supplied with 8 complete connection screws and two mounting brackets. . . . .	1.00
	1—REL Cat. No. 209 five ply veneer base-board finished in dull black lacquer (fitted with copper ground plate) . . . . .	1.00
L1-L2	1—REL Cat. No. 240 transmitter coil, type "C" covers 4200 K.C. to 3300 K.C. . . . .	3.00
L1-L2	1—REL Cat. No. 240 transmitter coil, type "B" covers 7500 K.C. to 6800 K.C. . . . .	3.00
L1-L2	1—REL Cat. No. 240 transmitter coil, type "A" covers 14,600 K.C. to 13,800 K.C. . . . .	3.00
	1—REL Cat. No. 183 transmitter coil base. . . . .	2.00
C1	1—REL Cat. No. 181D antenna series variable condenser 210 mmfd. . . . .	4.50
C2-C3	1—REL Cat. No. 187F tank condenser with special movable vernier for obtaining full spread of each amateur band—100 mmfd. . . . .	6.50
	2—REL variable condenser knobs—40c each. . . . .	.80
C4	1—REL Sangamo Cat. No. 150 type "K" plate blocking condenser 2000 mmfd. . . . .	.50
C5	1—REL Sangamo Cat. No. 150 type "K" grid condenser 2000 mmfd. . . . .	.50
C6-C7	2—REL Sangamo Cat. No. 150 type "K" filament by-pass condensers, 2000 mmfd.—50c each . . . . .	1.00
M1	1—REL Jewell model 135, 0-200 DC milliamperere current meter . . . . .	7.00
M2	1—REL Jewell model 165, 0-1 ampere thermo coupled RF antenna meter. . . . .	12.00
R1	1—REL Kroblak 5000 ohm grid leak. . . . .	1.00
R2	1—REL Daven 100,000 ohm resistance. . . . .	.50
RFC	1—REL Cat. No. 132 Radio frequency choke coil . . . . .	1.10
T1	1—Acme type A3 modulation transformer. . . . .	5.00
SW	1—Carter model No. 110 improved power filament switch . . . . .	.75
X1	1—Acme 1½ henry 150 mil. constant current choke . . . . .	4.00
J1	1—Pacnet type 65 microphone jack. . . . .	.65
J2	1—Pacnet type 62 key jack. . . . .	.65
V1-V2	2—REL UX base sockets Cat. 122, 35c each	.70
	2—Posts ("ant." & "cnt.") with insulating strip . . . . .	.30
	1—Package Cat. No. 209 hardware (includes necessary mounting screws, wire, etc.) . . . . .	.50
	1—REL Cat. No. 209 assembling, building and operating instruction booklet. . . . .	1.00
<b>TOTAL COST OF PARTS. . . . .</b>		<b>\$71.45</b>
Cat. No. 209—10 watt radio telephone and telegraph transmitter kit complete (this includes all parts listed above) . . . . .		\$68.00
Kit price when purchased complete. . . . .		\$68.00
The Cat. No. 209 kit may be purchased completely assembled, wired and tested. This work is done under careful observation at the Radio Engineering Laboratories. Additional charges for this service. . . . .		\$24.00

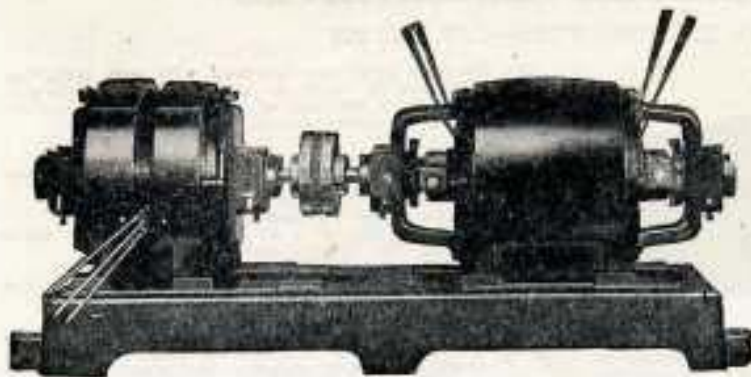


Schematic wiring diagram of the REL Cat. No. 209 10 watt telephone and telegraph kit. Jacks are provided for automatically controlling the types of transmission. When the key plug is inserted into Jack "J2" and the filament switch "SW" is turned on, only the oscillator tube lights, making the set ready for straight CW telegraph transmission. Removing the key plug from "J2" and inserting the microphone plug into "J1" automatically lights the filament of the modulator tube "V2" and puts the set in readiness for voice transmission. Such features go a long way to facilitate the operation of this modern transmitter.

**RADIO ENGINEERING LABORATORIES**  
 100 WILBUR AVENUE                      LONG ISLAND CITY, N. Y., U. S. A.



## MOTOR GENERATORS



The above illustrates a standard four bearing unit such being supplied as the Cat. Nos. 198, 199, 200, 201 and 202. The units supplied under Cat. Nos. 196 and 197 are of the two bearing type where the motor and generator are housed in one common frame. The Cat. Nos. 198, 199, and 200 have double commutator generators which are connected in series so as to deliver the rated voltage. The Cat. Nos. 201 and 202 have double commutator generators with one generator supplying the plate and the other the filament.

## LIST OF REL MOTOR-GENERATORS

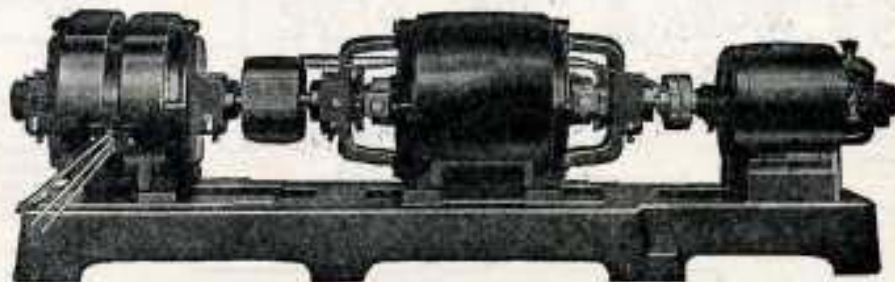
Unit Cat.	GENERATOR				MOTOR			
	Plate Volts	Watts	Filament Volts	Watts	22 Volt or 110 V.D.C.	Alternating 25 Cycle	Current—110 or 220V 50 Cycle	Single Phase 60 Cycle
196	350	40	..	..	\$55.00	.....	\$77.00	\$65.00
197	450	100	..	..	77.00	.....	85.00	82.00
198	1000	300	..	..	155.00	221.00	173.00	162.00
199	2000	300	..	..	184.00	294.00	210.00	216.00
200	2000	1000	..	..	330.00	442.00	420.00	356.00
201	450	50	10	40	80.00	.....	93.00	89.00
202	1000	300	12	125	195.00	255.00	226.00	195.00
203	2000	300	12	120	217.00	325.00	325.00	225.00
204	2000	1000	14	300	400.00	488.00	465.00	435.00

\* Starting boxes necessary and included, manually operated, enclosed type.  
Field rheostats for voltage control included in above prices. If not required, deduct \$14.00 for all motor generator sets supplied with AC motors except those marked ⊕ for which deduct \$6.00. Deduct \$6.00 for all motor generators with D.C. motors. Two field rheostats are necessary and supplied for the three unit sets. Cat. Nos. 203 and 204.  
Specifications and prices on other types and sizes of motor generator units will be gladly furnished upon request.

The following table gives specifications on the sizes of transmitters which may be operated by these motor generator units:

Unit Cat. No.	Set Equipped with	Generator Plate Rating
196	1 or 2 UX-210's (7.5-15 watts).....	40 watts
197	2 or more UX-210's (15-75 watts).....	100 "
198	1 or 2 UV-203A's (50-100 watts).....	300 "
199	1 and 2 UX-257's or 1 UV-204A (75-250 watts)...	300 "
200	1 or 2 UV-204A's (250-500 watts).....	1000 "
201	1 or 2 UX-210's (7.5-15 watts).....	50 "
202	1 or 2 UV-203A's (50-100 watts).....	300 "
203	1 and 2 UX-257's or 1 UV-204A (75-250 watts)...	300 "
204	1 or 2 UV-204A's (250-500 watts).....	1000 "

These motor generator units may be used to operate any type of transmitter. If desired, resistances may be placed in series with the output so that lower voltages may be obtained so as to operate tubes of lower rating in conjunction with transmitters using larger tubes thereby employing only one power supply. A simple type of single "T" filter will be found sufficient. The filter coil should have a rating of between 1½ and 6 henries and a current carrying capacity equal to the maximum output of the plate generator. On either side of this filter coil there should be placed one 2 mfd. condenser with a voltage rating high enough to enable the condensers to stand up under continuous operation.



The motor generator illustrated above is the three unit machine such as is supplied with the Cat. Nos. 203 and 204. It will be noted that the driving motor is situated on the left; the high voltage motor generator unit is in the center and the low voltage filament generator is on the right. Unless otherwise specified, the high voltage generator field windings will be so designed as to be excited from the low voltage D.C. Generator.

## RADIO ENGINEERING LABORATORIES

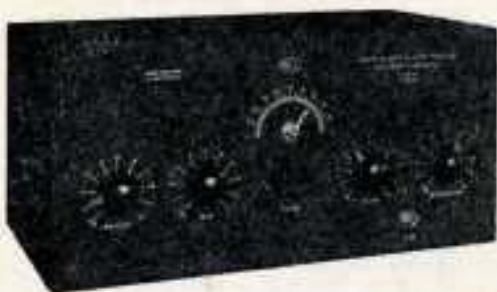
100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## AMATEUR "DE LUXE" RECEIVER KIT

EMPLOYS SCREENED GRID RF DETECTOR SCREENED GRID  
FIRST AUDIO (WITH TONE CONTROL) AND SECOND AUDIO



The amateur who desires a receiver with utmost selectivity and sensitivity will find that the REL Cat. No. 217 "De Luxe" set fulfills the most exacting requirements. It incorporates every feature of the regenerative receiver plus the following:

**SCREEN GRID TUBE RADIO FREQUENCY STAGE** which helps to sharpen tuning and increase the strength of weak DX signals. This R. F. stage also eliminates the re-radiating effects which are produced with regenerative sets.

**TUNED PEAK AUDIO AMPLIFICATION** employs a screen grid tube in conjunction with a special high impedance air choke which is tuned by four condensers. The audio system may thus be peaked at 5000, 1000, 500 or 200 cycles. This means additional selectivity gained by the ability to pick out only such stations whose note falls in any of the tuned audible frequency ranges.

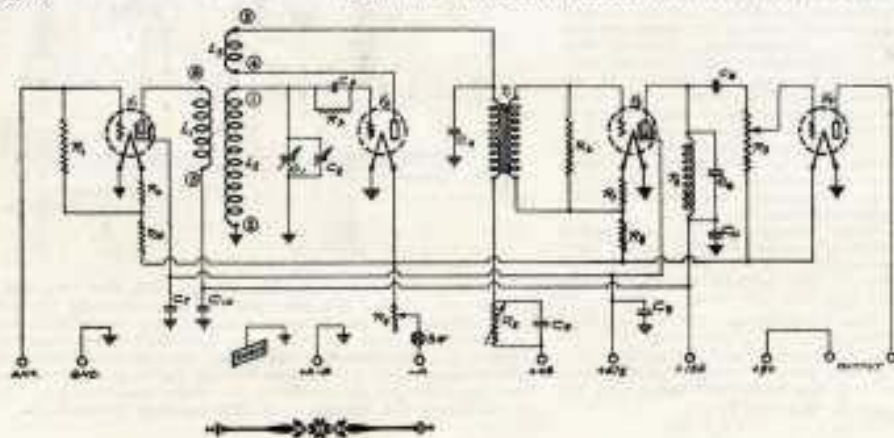
**FULL SPREAD TUNING** is gained by using the new REL combined tank and vernier condenser in conjunction with the specially designed plug-in coils. Three coils are supplied with these receivers. These cover the 2500, 7000 and 14,000 KC amateur frequency bands. Each of these bands is spread over the entire tuning condenser dial scale. As there is only one major control, this set virtually becomes a one dial receiver.

**FREQUENCY CALIBRATION** of each coil can be very easily accomplished. When thus calibrated, the receiver becomes doubly valuable to the consistent "traffic handler." The new narrow bands will cause much interference, thereby frequently requiring stations to shift their frequency to other positions. The operator who possesses a calibrated receiver will quickly and accurately shift to the correct point. There is a thrill in doing this. Try it with an REL "De Luxe" Receiver.

The tuned peak audio frequency amplifier employed in the Cat. No. 217 kit limits the use of this set in the reception of telegraphic signals whose heterodyned frequency tone does not vary greatly in the audible frequency range. Tremendous amplification is realized when the heterodyned beat note coincides with the frequency to which the audio trap is tuned. The reception of voice transmission is greatly limited due to the narrow range of frequencies to which the audio amplifier responds. Although "quality" of speech reproduction is lacking, the results are satisfactory for all practical purposes.

The following parts are necessary and furnished with each REL Cat. No. 217 "De Luxe" kit. This kit may be purchased complete or else any individual parts may be secured separately at prices given below.

This shows the wiring diagram employed in the Cat. No. 217 kit. Note that condenser "C6" is shown singly. However, in reality this unit comprises four condensers which are controlled by a four point switch. This control allows the audio system to peak at 5000, 1000, 500 and 200 cycles.



Circuit Symbol	Description	Price
	1—REL. Cat. No. 217 metal case with removable cover (finished in black crystalline lacquer). Size 9" x 19" front x 10" deep.	\$8.00
	1—REL. Cat. No. 217 aluminum front panel drilled and engraved (finished in black crystalline lacquer). Size 9" x 19".....	5.50
	1—REL. Cat. No. 217 engraved bakelite rear terminal strip supplied with 10 connection screws and two mounting brackets.....	1.80
	1—REL. Cat. No. 217, 5 ply veneer base-board finished in dull black lacquer (fitted with copper ground plate).....	1.45
L1-L2-L3	1—REL. Cat. No. 123 receiver coil kit complete with base.....	10.40
	This coil kit constitutes three plug-in coils which are designed to cover the 3500, 7000 and 14,000 KC amateur bands.	
C1-C2	1—REL. Cat. No. 226E vernier tuning condenser, semi-variable tank capacity 115 mmfd. (complete with vernier control, pointer and knob).....	7.75
C3	1—REL. Cat. No. 150-K .0001 mfd. grid condenser with grid leak supports.....	.50
C4	1—REL. Cat. No. 150-K .002 mfd. plate by-pass condenser.....	.30
C5	1—REL. Cat. No. 123 .3 mfd. resistance by-pass condenser.....	.75
C6	Comprises 4 REL. Cat. No. 150-K condensers and one 4 point control switch. The capacity of the condensers are .005 mfd., .002 mfd., .002 mfd. and .002 mfd.....	4.05
C7-C8-C9-C10-C11	4—REL. Cat. No. 123 1 mfd. 250 volt test by-pass condensers.....	5.00
R1	1—REL. Cat. No. 150-K .005 mfd. condenser.....	.75
R2-R7	1—Daven .01 meg ohm resistance.....	1.25
	2—Carter 10 ohm strip resistances type H-10.....	.50
	2—Carter 5 ohm strip resistances type H-5.....	.50
R3	1—Daven 10 megohm grid leak.....	.50
R4	1—De Jur 10 ohm rheostat with knob.....	.75
R5	1—Frost 50,000 ohm variable resistor.....	2.00
R6	1—Daven .1 megohm resistance.....	.50
R9	1—Centralab 500,000 ohm volume control potentiometer.....	2.00
T1	1—REL. Cat. No. 191 second stage A. F. transformer.....	4.00
T2	1—REL. Cat. No. 217 tuned peak audio choke.....	4.00
V1-V2	4—REL. Cat. No. 222 UX base sockets.....	1.40
V3-V4	1—Carter power imp. snap switch.....	.75
SW	1—REL. Cat. No. 217 hardware which includes necessary mounting screws, wire, etc.	.50
	1—REL. Cat. No. 217 assembling, building and operating instruction booklet.....	1.00
	Total cost of parts.....	\$87.65

The REL Cat. No. 217 kit comprises all of the parts listed above, is carefully packed in a substantial carton. When purchased complete it is sold at a slight reduction.

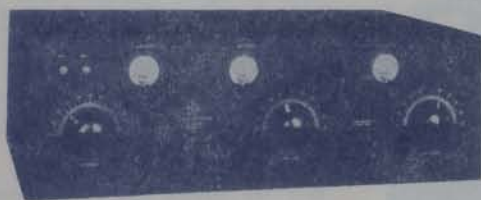
REL. Cat. No. 217 complete kit..... Price \$85.00  
The REL Cat. No. 217 kit may be purchased assembled, wired and tested. This work is done at our Laboratories under competent supervision. Additional charges for this service, net..... \$20.00

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# 75 WATT MASTER OSCILLATOR POWER AMPLIFIER TRANSMITTER KIT

METAL ENCASED TYPE—CAT. NO. 222



The Master Oscillator Power Amplifier type of transmitter is in many respects superior to sets employing only one tube as an oscillator whose output is fed directly into the antenna system. The M. O. P. A. insures steady signals, which are not affected by antenna swinging or other similar disturbances which tend to alter the frequency of directly connected oscillators. In short, the M. O. P. A. circuit may be favorably compared with a crystal controlled set. It possesses the added advantage of being readily accessible to any frequency within its range, whereas the crystal controlled set is limited to the fundamental and harmonic frequencies of the crystal.

The REL Cat. No. 222 M. O. P. A. kit will fill the requirements for a medium powered Short Wave Transmitter suited for CW telegraph transmission. Phenomenal distances have been covered with this set. Some of these have consistently exceeded 5000 miles. The set is designed to use one UX-210 as M. O. tube and one UX-852 (75 watt) tube as P. A. (With very slight changes, the UX-860 may be substituted for the 852. This is a 75 watt screen grid tube which may be used with still greater efficiency due to the perfect neutralization obtainable.)

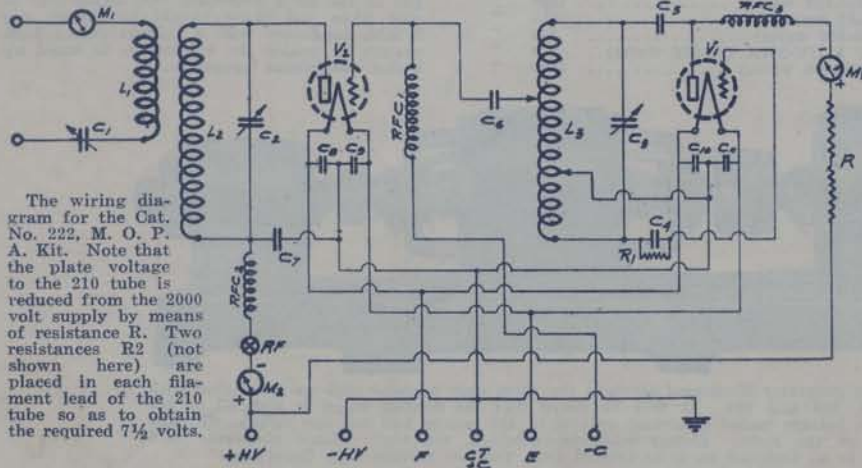
Any power supply delivering 2000 volts DC at 200 watts and 10 volts AC or DC at 5 amperes, will be satisfactory. This may be secured from batteries, rectifiers or motor-generators.

Three plug-in inductances are supplied for the M. O. tube circuit. These coils give widespread tuning in each of the following amateur bands: 3500, 7000 and 14,000 KC. The P. A. inductance may either comprise two type "S" or two type "L" units. The "S" are mainly for the 7000 and 14,000 KC bands whereas the "L" are for the 3500 and 7000 KC bands. As only one set of these are regularly supplied, it will be necessary for the purchaser to specify which he desires.

Although the REL Cat. No. 222, M. O. P. A. kits are mainly designed for telegraph purposes, it is a simple matter to adapt them for telephony. A standard REL Heising modulator unit can be coupled to the M. O. P. A. kits. A very efficient telephone transmitter will result.

The following parts are furnished with each REL Cat. No. 222, 75 watt M. O. P. A. kit. The kit may be purchased complete or else any of the parts may be secured individually at the prices quoted.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 222 metal case with removable cover (finished in black crystalline lacquer). Size—9" x 28" front x 16" deep.	\$16.00
	1—REL Cat. No. 222 aluminum front panel drilled and engraved (finished in black crystalline lacquer). Size—9" x 28".	7.00
	1—REL Cat. No. 222 engraved bakelite rear terminal strip supplied with seven terminal screws and two mounting brackets.	1.75
	1—REL Cat. No. 222 Five ply veneer baseboard (fitted with copper ground plate).	2.00
L1-L2	2—REL Cat. No. 127 type "S" or "L" transmitting inductance units at 5.50 each. (When ordering specify which type)	11.00
L3	1—REL Cat. No. 222 special M. O. inductance units with base. (3 coils for covering 3500, 7000 and 14,000 KC bands.)	10.00
C1-C2	2—REL Cat. No. 149 type K transmitting variable condensers. Maximum capacity 200 mmfd. \$17.50 each.	35.00
C3	1—REL Cat. No. 181-C transmitting variable condenser 100 mmfd. maximum capacity	4.50
C4-C5	6—REL Sangamo Cat. No. 150 type K .002 fixed condensers tested 1000 volts, at 50c each	3.00
C6	1—REL Sangamo .0002 fixed condenser K	.50
C7	1—REL Sangamo .002 fixed transmitting condenser—Cat.-150T	2.00
RFC	3—REL Cat. No. 132 Radio Frequency choke coils at \$1.10 each.	3.30
1-2-3	1—REL Jewell Model No. 135, 0 to 3 Thermo coupled ampere meter	12.00
M1	1—REL Jewell model No. 135, 0 to 100 DC milliammeter	7.00
M2	1—REL Jewell model No. 135, 0 to 100 DC milliammeter	7.00
M3	1—REL Ward Leonard 20000 ohm MO plate resistor Type D	4.25
R	1—REL Kroblack 5000 ohm grid leak.	1.00
R1	1—REL Cat. No. 122 UX-socket.	.35
V1	1—REL Cat. No. 129, UX-852 holder.	2.50
V2	2—posts ("Ant. & cnt.") with insulating strip	.30
R2	2—REL one ohm resistances (filament UX-210)	1.00
	1—REL Cat. No. 222 Hardware (includes necessary mounting screw, wire, etc.)	.50
	1—REL Cat. No. 222 assembling building and operating construction booklet.	1.00
Total Cost of Parts.....		\$132.95



The wiring diagram for the Cat. No. 222, M. O. P. A. Kit. Note that the plate voltage to the 210 tube is reduced from the 2000 volt supply by means of resistance R. Two resistances R2 (not shown here) are placed in each filament lead of the 210 tube so as to obtain the required 7½ volts.

The Cat. No. 222, 75 watt Master Oscillator Power Amplifier telegraph transmitter kit complete. (This includes all apparatus listed above.)

Kit price when purchased complete .....\$130.00

The Cat. No. 222 kit may be purchased completely assembled, wired and tested. This work is accomplished in our laboratories by capable workmen and upon completion they are tested under actual operating conditions. Additional charges for this service .....\$48.00

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## AMATEUR FREQUENCY METERS



The above illustration shows an REL frequency meter coupled and mechanically fastened to an REL frequency meter unit. The same indicator unit may be used with any number of different REL frequency meters. The indicator should always be fastened to the meter when taking readings.

The illustration below shows a frequency meter before the indicator has been attached.



The Radio Engineering Laboratories offers to the amateur the best constructed and most accurately calibrated frequency measuring instrument on the market. Extremely sensitive, permitting of very loose coupling to your transmitter. These meters should be the most important piece of equipment in every "ham station."

### CONSTRUCTION DATA ON FREQUENCY MEYER INDICATOR

The REL frequency meter indicators are housed in metal cases which are finished in black crystalline lacquer. The panels are of sanded bakelite having the various designations neatly engraved. The Weston DC milliammeter, rectifying crystal and pick-up coil are the parts which constitute the indicator. The crystal is permanently adjusted. The coil is of similar construction to those employed in the frequency meter. A mechanical coupling device is supplied with each indicator box so that it may be easily and quickly coupled and fastened to any frequency meter. Therefore, a number of frequency meters will require only one indicator. Case dimensions  $5\frac{1}{2}'' \times 5'' \times 4''$  high. Outer edge of coil projects  $6''$  beyond case. Net weight— $1\frac{1}{2}$  pounds.

Cat. No. 173 Frequency Meter	3500 to 4000 K.C. (85 to 75 meters)	Price \$15.00
Cat. No. 177 Frequency Meter	7000 to 7300 K.C. (41.8 to 41.0 meters)	Price \$15.00
Cat. No. 178 Frequency Meter	14000 to 14400 K.C. (21.4 to 20.8 meters)	Price \$15.00
Cat. No. 179 Frequency Meter	25000 to 30000 K.C. (10.7 to 10.0 meters)	Price \$15.00
Cat. No. 180 Frequency Meter Indicator		Price \$16.00

January, 1922, marks the beginning of a new era in amateur radio transmission and reception. The amateur will be operating under conditions which he has not experienced since the days of spark transmission. He will be required, by law, to stay within the frequency bands which have been assigned to him. These bands are of different widths and are not in harmonic relation. His greatest problem will be to know exactly where his transmitter frequency is located in the spectrum. The station whose frequency does not fall within one of these assigned bands, may possibly interfere with commercial stations in other bands and in all probability will have its license revoked.

The Radio Engineering Laboratories have designed and built a Frequency or Wavelength measuring instrument whose merits are such that its use in amateur transmitting stations will overcome this problem. It is of radically different design. It was found after copious experimentation and development work in the laboratories, that an ordinary wavemeter, employing one variable condenser and several shunt plug-in coils, simply will not be suitable for efficient frequency measurement in the new amateur bands. The new practical amateur bands are: 88-12 meters (3500-4000) kilocycles; 41.8-41.1 (7000-7300) kilocycles, and 21.5-20.8 (14,000-14,400) kilocycles. It is immediately observed that the coverage of the three bands; 80, 40, 20, are respectively: 506, 890 and 400 K. C. It can be easily seen from these figures that in order to have full scale coverage on all bands, a separate coil and condenser combination must be had for each channel.

### METHOD OF INDICATING RESONANCE

For frequency meters such as these which only cover a very small band, it was necessary to design a different type of frequency indicator. Flashlight lamps, neon tubes and galvanometers, the usual type of indicators, were tried out but found unsatisfactory. They were found unsatisfactory not only because they did not indicate sharply, but also because they were in the actual measuring circuit and the slightest variations of any of these would effect the calibration.

It was, therefore, necessary to use a resonance indicating device that was independent of the measuring circuit; one that would not in any way alter the calibration; one that would indicate sharply and precisely at one definite point only.

The REL frequency meter indicators, which have been designed to work in conjunction with these frequency meters fulfill each of these requirements. Furthermore, being an independent piece of apparatus, they can be used for other purposes.

### CALIBRATION

Each frequency meter is individually calibrated from a Piezo crystal control standard. A standard Cat. No. 180 indicator unit is always coupled to the frequency meter being calibrated to insure against external capacity effects. If frequency meters are to be used without indicators, compensation in the curve reading will have to be allowed. The points thus obtained are plotted on a large curve sheet. The original calibration curve chart and one blueprint curve may be used for regular reference work. The large calibration curves allow accurate readings to within .25% of the measured frequency.

### CONSTRUCTION DATA ON FREQUENCY METERS

The REL frequency meters are housed in metal cases which are finished in black crystalline lacquer. The panels are of sanded bakelite having the dial scale and other designations neatly engraved. The variable condensers are the new REL one bearing type with the patented rotary shaft contact. The bakelite pointer knob are securely fastened to the condenser shaft. A small extension handle gives better control of the dial knob. The coils are permanently fastened to the meter panel by means of heavy nickel plated extension arms. The coils themselves are made of heavy bakelite tubing. The coil forms are grooved to take the windings, thereby setting these windings below the outer surface of the bakelite forms, thus affording protection.

Case dimensions  $5\frac{1}{2}'' \times 5\frac{1}{2}'' \times 4''$  high. Outer edge coil projects  $6''$  beyond case. Net weight—2 pounds.

◆◆◆◆◆

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# AMATEUR FREQUENCY METERS

## OPERATING INSTRUCTIONS

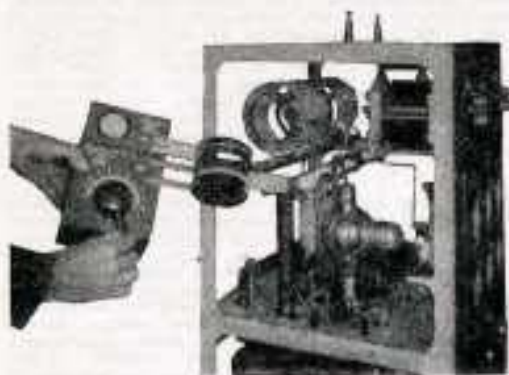


Illustration shows how to couple the frequency meter to the closed circuit inductance of the transmitter so as to measure the frequency at which the transmitter is operating. The illustration shows a modern 75 Watt Loose Coupled Harley Telephone and Telegraph Transmitter of all metal construction.

### RECEIVER

Set the receiver to oscillating, if an autodyne is employed.

Hold the frequency meter near the secondary winding of the receiver. As the knob and pointer is rotated across the scale, two clicks will be heard in the telephone. When the frequency meter is in resonance with the receiver secondary coil, the resonant load is so great the receiver will stop oscillating. This is the first click. When the frequency meter goes out of resonance with the receiver secondary coil, the receiver starts oscillating again, and the second click will be heard. Half way between these clicks is resonance. Bring the frequency meter further away from the receiver and the two clicks will be closer together. Finally the clicks will be heard very closely together. This is the ideal position for reading the frequency meter scale. Convert scale divisions to kilocycles by the calibration curve.

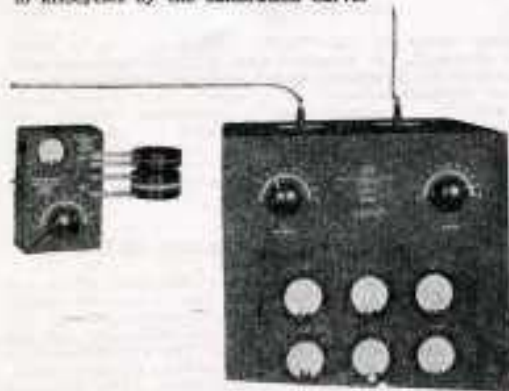


Illustration shows how to locate the frequency meter at some convenient point so that it will continuously indicate the frequency and stability of a transmitter. The illustration shows the front view of the same 75 Watt Loose Coupled Harley Telephone & Telegraph Transmitter of all metal construction.

### USING INDICATOR INDEPENDENTLY

The REL frequency meter indicator is probably one of the most sensitive types of radio frequency indicators ever designed. The indicator may be used independently to give relative proportion of field strength in transmitters. It may be used to detect metallic objects which are absorbing radio frequency currents from the transmitter or antenna system. It may be used to indicate the consistency at which a transmitter is operating and various other purposes where a field strength measuring instrument is necessary.

### TRANSMITTERS

An REL Frequency meter combined with the REL frequency meter indicator may be used to calibrate a transmitter to a definite frequency, or on the other hand, it may be used to find the frequency at which the transmitter is oscillating.

Place the frequency meter so that its coil is in close proximity with the closed circuit of the oscillator. The indicating needle will reach a maximum value as the dial and pointer are tuned across the scale. This maximum value is an indication of resonance. The indicating meter should not be brought too closely to the transmitter, since it is a very sensitive device, and excess resonance current may injure the meter. Keep the indicator at such distance that the maximum deflection is not over 2/3 the full scale. When resonance is determined, read the scale divisions and convert to kilocycles from the calibration chart.

### ZERO BEAT METHOD

Bring the transmitter to zero beat with a small oscillator. For amateur purposes this oscillator may be a standard REL "monitor set." Couple the REL frequency meter to this monitor. In bringing the frequency meter into resonance with the monitor, note that the frequency of the monitor will be pulled along out of zero beat. The beat will climb, return to zero beat and then again climb. At the center of the zero beat area between the two peaks, will be found the correct frequency reading.

Convert frequency meter scale divisions to kilocycles by use of the calibrated curve chart. This is by far the most accurate way to check the frequency of either a transmitter or a receiver.

For more details see Q.S.T., October, 1928, page 17 and also "Proceedings of the Institute of Radio Engineers," February, 1928, page 125.

### CONSTANT FREQUENCY CHECK

To keep a constant check on the frequency of the transmitter, place the frequency meter and indicator in a permanent position near the closed circuit of the transmitter. Tune the frequency meter to maximum deflection. Any frequency variation of the transmitter will show a decrease in the indicator deflection. A lower power input to the transmitter will be denoted likewise. This will also be apparent on the input meters.

A shift in frequency of the transmitter can be brought back to the original by adjustment of the transmitter frequency control and observation of the indicating meter.

A good ground should always be connected in the cases of all Frequency Meters used.

**RADIO ENGINEERING LABORATORIES**

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LONG ISLAND CITY, N. Y., U. S. A.



## FIXED RESISTORS



The above illustrates Cat. Nos. 233 and 239 resistors.



The above illustrates Cat. No. 238 resistors.



The above illustrates Cat. Nos. 243, 244, 245, 246, 247, 248 and 249 resistors which are regularly supplied with the end mountings shown.

REL FIXED RESISTORS are wire wound on Isolantite tubes. Each unit when completely wound is covered with enamel and baked. The terminal connectors are securely fastened to the resistance wire. The smaller units are supplied with solder lug type mountings. The smaller units are furnished with end brackets.

The standard line of REL fixed resistors is given here:

**Filament Voltage Resistances.** The Cat. No. 233 resistors are designed to be used in filament circuits where the tube draws  $1\frac{1}{2}$  amperes (types-10 or -50). These resistors will reduce a 10 or 11 volt circuit to  $7\frac{1}{2}$  volts. If AC is employed two resistances must be used, placing one at each filament terminal. Size  $2''$  long x  $\frac{3}{8}''$  diameter. Solder lug type mounting.

Cat. No. 233-A, 1 ohm resistor.....Price \$0.60

(Use two of these 1 ohm units for AC circuits when reducing from 10 to  $7\frac{1}{2}$  volts.)

Cat. No. 233-B, 2 ohm resistor.....Price \$0.60

(Use one of these units in the filament circuit when reducing from 10 to  $7\frac{1}{2}$  volts DC supply.)

Cat. No. 233-C, 3 ohm resistor.....Price \$0.60

(Use one of these units in the filament circuit when reducing from 11 to  $7\frac{1}{2}$  volts DC supply.)

**Filament Resistor for Type-23 Tubes.** Cat. No. 238 resistor has been designed for use in the filament circuit of type-23 tubes when such tubes are operated from a 5 volt DC source. Total resistance is 15 ohms. A tap is brought out at 10 ohms so that the grid return circuit may be carried to this tap, thereby obtaining correct C bias for the tube. Size  $1''$  long x  $\frac{1}{4}''$  diameter. Solder lug type mountings.

Cat. No. 238, 15 ohm tapped resistor.....Price \$0.70

**5,000 ohm 10 watt Resistor.** This unit may be used as a grid leak in small transmitters employing tubes up to the type-30. It may also be employed in other circuits for voltage reducing purposes. Size  $2''$  x  $\frac{3}{8}''$  diameter. Solder lug type mounting.

Cat. No. 239, 5000 ohm 10 watt resistor. Price \$0.70

**5,000 ohm 40 watt Resistor.** This unit may be used as a grid leak in low power transmitters. It is also adapted for voltage reducing purposes and for blocking uses in transmitter C battery circuits. Size  $4''$  long x  $\frac{3}{8}''$  diameter. End mounting brackets.

Cat. No. 243, 5,000 ohm, 40 watt resistor. Price \$1.50

**5,000 ohm 200 watt Resistor.** This unit may be used as a grid leak for 50 or 150 watt tubes. Other uses are voltage reducers, voltage dividers, etc. Maximum current 200 m.a. Size  $8\frac{1}{2}''$  long x  $1\frac{1}{4}''$  diameter. End mounting brackets.

Cat. No. 244, 5000 ohm 200 watt resistor.....Price \$2.50

**10,000 ohm 200 watt Resistor.** This unit may be used as a grid leak for 50 or 250 watt tubes. Also for numerous purposes where a large type resistance resistor is required. Maximum current 185 m.a. Size  $3\frac{1}{2}''$  long x  $1\frac{1}{4}''$  diameter. End mounting brackets.

Cat. No. 245, 10,000 ohm 200 watt resistor.....Price \$2.50

**15,000 ohm 200 watt Resistor.** This unit may be used as a grid leak or for numerous other purposes where a large type resistance resistor is required. Maximum current 120 m.a. Size  $8\frac{1}{2}''$  long x  $1\frac{1}{4}''$  diameter. End mounting brackets.

Cat. No. 246, 15,000 ohm 200 watt resistor.....Price \$2.50

**20,000 ohm 200 watt Resistor.** This unit may be used as a grid leak for UX-832 tubes. It may also be adapted to other purposes in the radio transmitter circuit. Maximum current 100 m.a. Size  $8\frac{1}{2}''$  long x  $1\frac{1}{4}''$  diameter. End mounting brackets.

Cat. No. 247, 20,000 ohm 200 watt resistor.....Price \$4.00

**50,000 ohm 200 watt Resistor.** This unit may be used as a grid leak for special types of high impedance tubes. It may also be employed in various other transmitter circuits for voltage reducing purposes. Maximum current 60 m.a. Size  $8\frac{1}{2}''$  long x  $1\frac{1}{4}''$  diameter. End mounting brackets.

Cat. No. 248, 50,000 ohm 200 watt resistor.....Price \$6.10

**100,000 ohm 200 watt Resistor.** This unit is expressly designed for use as a static drain resistor in transmitter antenna circuits. It may also be used for other purposes where required. Maximum current 20 m.a. Size  $8\frac{1}{2}''$  long x  $1\frac{1}{4}''$  diameter. End mounting brackets.

Cat. No. 249, 100,000 ohm 200 watt resistor.....Price \$8.50

RADIO ENGINEERING LABORATORIES, Inc.

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## RADIO FREQUENCY CHOKE COILS

CAT. NO. 132

FOR SHORT WAVE RECEIVERS AND LOW POWER  
SHORT WAVE TRANSMITTERS

The Radio Engineering Laboratories, Inc., have developed a very efficient radio frequency choke coil which may be adapted in all receiver circuits and also in all low power transmitter circuits which employ tubes up to and including the 250 type. This choke coil may also be used to good advantage in grid circuits of higher power tubes.

The Cat. No. 132 choke coil is of the "pie" wound type, having 5 small pancake windings. This design reduces the effective field of the choke coil and also reduces the distributed capacity of the windings. The choke coil will work efficiently at all wavelengths between 15 and 90 meters. Maximum current carrying capacity 50 milliamperes. Inductance .9 millihenries. DC resistance 12.9 ohms.

The Cat. No. 132 choke coil is designed for vertical type mountings. This conserves space and also helps in obtaining short connections to the other apparatus in the circuit. Connection may be made either by soldering to the solder lugs or else by using the terminal nuts supplied. The coil measures 2 1/4" high x 5/8" diameter.

Cat. No. 132 RF choke coil.....Price \$1.10



Cat. No. 132



Cat. No. 250

### CAT. NO. 250—FOR TRANSMITTERS

The REL Cat. No. 250 radio frequency choke coils have been designed for use in transmitter circuits of medium power. They can be used with efficiency and safety in all transmitters employing up to 1,000 watts. Although they are primarily intended for plate circuits they can with equal efficiency be used in grid circuits, in Piezo crystal circuits, or in any position where an efficient RF choke coil is required.

The Cat. No. 250 RF chokes are single layer wound on Bakelite tubes. Each choke coil is covered with transparent insulating lacquer, thereby assuring constancy under all climatic conditions. Special care is taken in the method employed for making terminal connections.

The Cat. No. 250 chokes are furnished in three types. Each one is capable of carrying 500 milliamperes. Each one is designed to operate on a particular wavelength. Therefore, when ordering be sure to specify the correct type number for your particular purposes.

The Cat. No. 250-A radio frequency choke coil is designed for transmitter circuits operating on wavelengths between 15 and 90 meters. Inductance .26 millihenries, DC resistance 5.2 ohms. Size 3/4" diameter x 4 1/4" long.

Cat. No. 250-A choke coil.....Price \$1.30

The Cat. No. 250-B radio frequency choke coil is designed for transmitter circuits operating on wavelengths between 90 and 200 meters. Inductance .73 millihenries, DC resistance 7.1 ohms. Size 6" long x 1" diameter.

Cat. No. 250-B RF choke coil.....Price \$2.20

The Cat. No. 250-C radio frequency choke coil is designed for transmitter circuits operating on wavelengths between 200 and 500 meters. Inductance 2.1 millihenries, DC resistance 22 ohms. Size 7 1/2" long x 1 1/8" diameter.

Cat. No. 250-C RF choke coil.....Price \$4.50

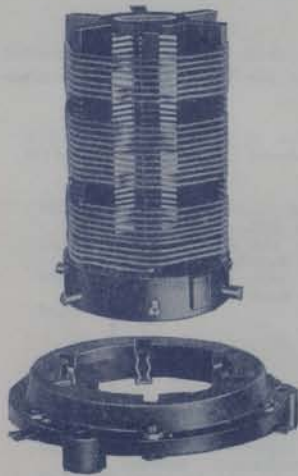


**RADIO ENGINEERING LABORATORIES, INC.**

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LONG ISLAND CITY, N. Y., U. S. A.





## PLUG-IN COILS

### FOR HIGH FREQUENCY RECEIVERS AND LOW POWER TRANSMITTERS

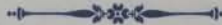
The REL plug-in coils have been designed to fill the demands for an efficient, ruggedly constructed plug-in coil for high frequency circuits. Careful consideration has been given to obtain an inductance of correct coil form factor. The coil form is a one piece bakelite moulding having six ribs, each of which is accurately threaded to allow space winding of the wire. The bakelite moulding has been designed to have a minimum amount of material in the actual coil field, thus, reducing dielectric losses to a minimum. The coils present a very neat appearance. The material employed will not in any way be effected by climatic conditions, thus assuring the continued attractive appearance of these coils for many years to come.

It will be readily appreciated that the one piece design of these coils eliminates the fragile construction encountered by the use of coils, whose coil forms are made up by various small parts fastened together by eyelids or other manner. The REL coils will hold their shape regardless of the rough handling which may be given them. The heavy copper enamel wire with which these coils are wound is securely held in the threaded ribs. It is impossible for any of the turns to slip out. This means that the coil characteristic is permanent. The heavily enameled wire insures the coil against any moisture effects which would tend to create corrosion between the turns. Provisions are made for bringing out independently the leads of the three separate windings. These lead wires are soldered directly to the coil plugs, thus assuring positive contact. As each of the coil windings are permanently located with relation to each other correct frequency calibration can be attained and held. This, incidentally is not, possible with coils where one of them is movable.

An efficiently designed moulded bakelite coil base fits these plug-in coils. This base is equipped with six phosphor bronze spring contacts which engage the coil jacks when the coil is inserted. Each jack has  $\frac{3}{8}$  square inches contact surface which means a positive low resistance connection. A bayonet and key slot is provided in the base so that it is possible to insert the coils in only one position. The base is supplied with three upright mounting bosses which will allow the base to be mounted on metal panels without shorting any of the contact springs.

These new REL plug-in coils may be purchased singly or in various kit combinations to operate in any circuits. Those wishing to construct their own coils may purchase the blank coil forms fitted with six plugs separately. The coils will be found admirably adapted to all popular high frequency (short wave) receiving circuits. They will also be found very satisfactory for low power transmitters which employ inputs of less than 30 watts.

Due to the small upright design these coils are very adaptable for mounting in shielded compartments. Each coil is plainly marked with the correct type number so that there can be no errors in using the wrong coils. The coil forms measure 2" dia. x  $4\frac{1}{8}$ " long. The base is  $3\frac{1}{4}$ " dia. by  $\frac{3}{4}$ " high.



#### UNIVERSAL SHORT WAVE RECEIVER COIL KIT, CAT. NO. 229.....PRICE \$10.00

The three REL plug-in coils and the coil base furnished with this kit constitute the ideal inductances for any short wave receiver circuit. When tuned with a condenser having a maximum capacity of approximately 115 mmfds., they will cover every wavelength between 15 and 100 meters—especially adaptable to any of the following circuits:—Three circuit regenerative receiver, screened grid RF amplifier, short wave converter and super-heterodyne — Each kit carefully packed in carton.

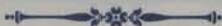
#### AMATEUR BAND RECEIVER COIL KIT, CAT. NO. 182.....PRICE \$10.00

The three REL plug-in coils and the coil base furnished with this kit constitute the ideal inductances for any amateur band receivers — adapted to 20, 40 and 80 meter bands — they are especially designed to operate in conjunction with the REL Cat. No. 187E combined tank and vernier type condenser. When used with this type of condenser they will allow the spreading out of each band over the entire tuning condenser dial scale — it may be used in three circuit regenerative receivers, screened grid RF amplifiers, super-heterodynes and in other circuits requiring inductances which comprise two or three windings.

#### HARTLEY TRANSMITTER COIL KIT, CAT. NO. 240 .....PRICE \$10.00

The three REL plug-in coils and the coil base constitute necessary inductors for operating in the 20, 40 and 80 meter amateur bands. Tuning condenser should have approximate maximum capacity of 200 mmfds. — If full spread tuning of each band is required, use REL Cat. No. 187F condenser — It may be used with all types of UX base tubes up to and including the UX-210 type — Primary coil accurately center tapped — No other taps necessary, as condenser shunts across entire coil — Each kit comes carefully packed in a strong carton.

Any coils listed in the above kits may be purchased separately. For single coil data refer to next page.



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## Information and Specifications on Individual Plug-in Coils

The following table gives data on various plug-in coils. These may be purchased individually to cover certain specified bands or else the coils may be purchased in kit combinations comprising three coils and one base. These kit combinations are illustrated on the opposite page.

COIL CAT. NO.	Description of Coil and Data on Circuits For Which It Is Adapted	Tuning Range	Type and Size of Tuning Condenser	PRICE EACH
182 A	Receiver—Exclusive amateur band only—comprises 3 windings suitable for 3 circuit receiver using pri., sec., and tlc.—Also adaptable to R.F. and screened grid circuits requiring only 2 coil windings. (One remaining winding not used.) For circuits refer to REL kits, Cat. Nos.—192—217—221	28,000 to 30,000 K.C. 10 Meter Band	Special combined tank and vernier type—Similar to REL Cat. 187E—Max. tank cap. 115 mmfd.—Max. vernier cap. 30 mmfd.—Two separate condensers with specified capacities can be used.	\$3.00
182 B		14,000 to 14,400 K.C. 20 Meter Band		\$3.00
182 C		7,000 to 7,300 K.C. 40 Meter Band		\$3.00
182 D		3,500 to 4,000 K.C. 80 Meter Band		\$3.00
229 A	Receiver—For all shortwave reception—(D.X. broadcast, amateur, television, etc.) Comprises 3 windings—suitable for 3 circuit regenerative, radio frequency, screened grid or any other standard circuit. For circuits refer to REL kits, Cat. Nos. 189—194—195—221	9,375 to 20,000 K.C. 15 to 32 Meters	Any standard type—either straight line frequency, straight line wave or straight line capacity—max. cap. 115 mmfd.—(condensers between 100 and 150 mmfd. can be used). Recommend REL Cat. 181B.	\$3.00
229 B		5,550 to 10,710 K.C. 28 to 54 Meters		\$3.00
229 C		3,000 to 5,770 K.C. 52 to 100 Meters		\$3.00
234	Receiver—For reception between 100 and 200 meters—similar to above coils—adaptable to same circuits.	90 to 200 Meters	Any standard type—max. cap. 115 mmfd.	\$3.00
235	Receiver—For standard broadcast band reception—comprises 3 windings—suitable for use in any of the above mentioned circuits.	200 to 550 Meters	Max. cap. 350 mmfd. (fixed condensers may be shunted across smaller cap. variable condensers to attain 350 mmfd.).	\$4.00
236	Receiver—2 windings—suitable for R.F. screened grid and other popular broadcast receiver circuits—can be used in combination with coil Cat. 235.	200 to 550 Meters	Max. cap. 350 mmfd. (See note on coil Cat. 235.)	\$4.00
237	Receiver—3 windings—suitable for ship to shore and compass station work—used in same circuits as coil Cat. 235.	500 to 1,500 Meters	Max. cap. 350 mmfd. (if a 1000 mmfd. capacity is used the range will be increased to 3,000 meters.	\$7.00
240 A	Transmitter—Coupled Hartley circuit—comprising two windings (Ant. and pri.)—Primary accurately center tapped—tuning condenser shunts across entire primary—no coil tapping necessary—for UX-210 tubes or smaller types. For circuits refer to REL kits 205—209—218	13,800 to 14,600 K.C. 20 Meter Band	Any standard type—max. cap. 200 mmfd. For complete spread only of each amateur band use REL combined tank and vernier condenser. Cat. 187F.	\$3.00
240 B		6,800 to 7,500 K.C. 40 Meter Band		\$3.00
240 C		3,300 to 4,200 K.C. 80 Meter Band		\$3.00
240 D		1,515 to 2,200 K.C. 150 Meter Band		\$3.00
241 A	Transmitter—Tuned plate, tuned grid circuit—comprises two windings—(Ant. and Plate.) Also adaptable to amplifier, crystal oscillator and similar circuits—for UX210 tubes—for circuits refer to REL kits, 218—207	13,800 to 14,600 K.C. 20 Meter Band	Any standard type—max. cap. 200 mmfd. or REL Cat. 187F.	\$3.00
241 B		6,800 to 7,500 K.C. 40 Meter Band		\$3.00
241 C		3,300 to 4,200 K.C. 80 Meter Band		\$3.00
241 D	Transmitter—Tuned plate, tuned grid circuit—comprises one winding—(grid coil). For Tptg. sets use with Cat. 241 coils—Also for circuits requiring single winding coils—for circuits refer to REL kits 218—222—207	13,800 to 14,600 K.C. 20 Meter Band	Any standard type—max. cap.—200 mmfd. or REL Cat. 187F.	\$3.00
241 E		6,800 to 7,500 K.C. 40 Meter Band		\$3.00
241 F		3,300 to 4,200 K.C. 80 Meter Band		\$3.00

Blank coil forms fitted with 6 plugs may be purchased separately.

Cat. No. 242 Blank Coil Forms.....Price \$2.00

Cat. No. 183 Plug-In Coil Base.....Price \$2.00

**SPECIAL COILS:** Besides the standard coils listed here, the Radio Engineering Laboratories are prepared to design and build special inductors for specific requirements. For prices, submit the circuit diagram, type and size of tuning condenser and frequency range to be covered.



## RADIO ENGINEERING LABORATORIES

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## INDUCTORS FOR TRANSMISSION

CATALOGUE NO. 127



TYPE S

Type "S" 3" diameter 6" long 11-2/3 turns. Expressly designed for extreme high frequency transmission. 15,000 kilocycles (20 meters) or more; however, it can be used down to 3000 kilocycles (100 meters) in circuits employing large shunt capacity.



TYPE L

Type "L" 5" diameter 6" long 11-2/3 turns. For transmission in the 2000, 3750 and 7500 kilocycle bands (150, 80 and 40 meter bands) depending on the amount of capacity shunted across the inductor.



TYPE LL

Type "LL" 8" diameter 6" long 11-2/3 turns. Specially designed for transmitters operating below 1500 kilocycles (above 200 meters) Broadcast Stations. A number of these units may be connected in series (see table below):

Adaptable to all circuits employing up to 2 K. W. input. Flatwise wound nickel plated copper ribbon assures low distributed capacity. Moulded crystal glass spacers of the highest insulating qualities mean low losses. Complete elimination of all unnecessary material makes the REL Inductors 95% air dielectric. They are unaffected by climatic conditions.

REL Inductors are employed and indorsed by the foremost radio manufacturers throughout the world. The U. S. Army and Navy make use of them in many of their short wave radio stations.

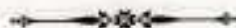
REL Inductors are so designed that each type may be telescoped in the next larger type. This will prove practical where close coupling is desired.

CLIPS.—Three REL sure grip clips are furnished with each unit.

Single units of either type S or L.....Price \$5.50  
Double units of either type S or L.....Price \$11.00

(Double units comprise one primary unit and one secondary unit with two 1/8" diameter by 15" long, glass coupling rods.)

Single units of type LL.....Price 11.00



Special designs of flatwise or edgewise wound inductors for broadcasting stations. Prices on application.

## Tuning Ranges of REL Inductors When Shunted by Various Capacities

All data in the following table was made with capacity shunted across total inductor. It is to be understood that if capacity is shunted across fewer turns or if a fewer amount of turns are used, the wavelength will be reduced proportionally.

## FREQUENCY READINGS GIVEN IN KILOCYCLES

Shunt Capacity In Mmfd.	One "S"	Two "S" In Series	One "L"	Two "L" In Series	One "LL"	Two "LL" In Series	Three "LL" In Series
0	13050 (23)	10350 (29)	7900 (38)	5355 (56)	5355 (56)	3705 (81)	
50	7690 (39)	5550 (54)	4550 (66)	3260 (92)	3335 (90)	2100(143)	
80	7145 (42)	5000 (60)	4170 (72)	2940(102)	3092 (97)	1935(155)	
132	5875 (51)	4050 (74)	3370 (89)	2220(135)	2400(125)	1538(196)	1235(243)
289	4050 (74)	2860(105)	2400(125)	1640(183)	1750(171)	1172(256)	955(314)
448	3370 (89)	2304(130)	1960(153)	1390(216)	1470(204)	987(304)	712(421)
606	2910(103)	2000(150)	1715(175)	1210(248)	1316(228)	777(336)	630(476)
766	2585(116)	1840(163)	1545(194)	1071(280)	1175(255)	705(425)	581(516)
926			1442(208)	987(304)	1071(280)	655(458)	532(564)
1085				920(326)	1007(298)	612(490)	497(603)

\*Equivalent wavelength readings in meters are given in parentheses after each frequency reading.



## RADIO ENGINEERING LABORATORIES

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## WAVEMETER

CATALOGUE NO. 125

WAVELENGTH RANGE 17 TO 550 METERS



## MAY BE USED FOR

- Tuning the Transmitter
- Checking the Transmitter
- Locating Antenna and Counterpoise Nodes
- Locating Coil Fields
- Calibrating an Oscillator
- Wavetrap—Absorption or Induction Method
- Calibrating a Receiver
- Measuring Capacity
- Measuring Inductance

EACH REL WAVEMETER IS INDIVIDUALLY CALIBRATED and is guaranteed to be accurate. Easy reading chart showing colored calibration curves, covers wavelength ranges. Curves readily indicate fractional meter variations.

## THE WAVELENGTH RANGES OF THE COILS ARE:

- Coil No. 1—Black Curve, 17 to 40 Meters
- Coil No. 2—Red Curve, 40 to 140 Meters
- Coil No. 3—Green Curve, 140 to 550 Meters

CURVE CHART is neatly covered with a transparent material making it oilproof.

THE REL TYPE "A" WAVEMETER will be found satisfactory for all general purposes. It is essential in every radio station both broadcast and amateur. Particularly adapted for short wave receiving and sending stations and other laboratory work.

THE COILS are wound on grooved bakelite forms. The windings are specially treated to insure constant characteristics under all atmospheric conditions.

THE CONDENSER is of rugged construction, of low loss design, and well insulated. The dial scale is engraved directly on the panel and has 100 accurately divided divisions. The indicator knob is securely locked to the condenser shaft so as to prevent possibility of loosening and thereby effecting calibration.

**EFFICIENT:** The design of the coils and condenser is such that the high frequency resistance is as low as possible, so that the losses in the wavemeter circuit are small. By thus keeping these losses small, the wavemeter is more sensitive, the sharper its tuning to resonance, and the lower its decrement.

**NEON TUBE INDICATOR:** A very sensitive resonance indicating device is supplied with REL type "A" wavemeters.

**ALL METAL CASE** is finished in black crystalline lacquer and supplied with a completely removable cover. The case measures  $9\frac{1}{2} \times 7 \times 2\frac{1}{2}$ " high. Net weight  $4\frac{1}{2}$  pounds.

Type "A" Wavemeter.....Price \$22.00 Complete  
Additional Neon Tubes .....Price \$ 1.50 Each  
Additional Neon Tube Bases .....Price \$ .45 Each

## INSTRUCTIONS FOR OPERATION OF WAVEMETER

## Calibrating a Transmitter with a Neon Tube Resonance Indicator

Plug in the coil that will cover the desired wavelength and couple this to the closed circuit of the transmitter. (It is always advisable to first tune the closed or primary circuit before the antenna is connected). If the transmitter is properly oscillating, a point will be found on the wavemeter dial where the Neon tube lights brightest. This is the resonance point which indicates that the wavemeter is tuned to the wavelength of the transmitter. This dial reading, when referred to the curve gives the correct wavelength.

Do not couple the wavemeter too closely to the transmitter. Keep it at such a point that the Neon tube will just glow. A sharper reading will thus be obtained.

**Using the Wavemeter at a Receiver**—At a receiver, under certain conditions, the wavemeter can be used to measure a wavelength without the use of a buzzer or other auxiliary device. This method can be applied if the receiver is provided with an oscillating tube detector or "autodyne." When the wavemeter is loosely coupled with the proper receiving circuit coil and it is being tuned to the receiver, or vice versa, a small amount of energy is withdrawn from the receiving circuit by the wavemeter. When the two circuits are in resonance there will be a small but sudden increase in the amount of energy withdrawn and a corresponding change in the current in the telephone of the receiving set. This will be indicated by two "clicks," separated somewhat, on the wavemeter dial. By moving the wavemeter further away from the receiver, these "clicks" will come closer together (if placed at too great a distance they will disappear entirely or else only one will be heard). A position will be reached where the "clicks" approach each other very closely. The dial reading directly in the middle of the two "clicks" will then give the correct resonance point and by referring to the curve will give the wavelength. This method can be used in setting a receiver at a predetermined wavelength and in calibrating a receiver.

**Measurement of Inductance or Capacity**—As stated previously, a wavemeter can be used with other apparatus to measure an inductance or a capacity. If a local resonant circuit containing either a known inductance and an unknown capacity, or an unknown inductance and a known capacity, is set into oscillation by convenient means, such as a buzzer, small spark coil, tube oscillator, etc., then accordingly—

$$\lambda = 59,600 \times \sqrt{LC}$$

If now the wavelength of the local circuit be measured by a wavemeter, then all but one of the quantities in the formula are known, and the unknown inductance or capacity can be found from either of the two following formulas which are derived by simple algebra from the formula above:

Where L is the inductance in millihenrys,  
C is the capacity in microfarads,  
 $\lambda$  is the wavelength in meters.

$$C = \frac{\lambda^2}{3,56 \times 10^8 \times L}$$

$$L = \frac{\lambda^2}{3,56 \times 10^8 \times C}$$

## RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



# VARIABLE CONDENSERS

## FOR HIGH FREQUENCY RECEIVERS AND LOW POWER TRANSMITTERS

The new line of REL variable condensers specially designed for high frequency (short waves) receivers and low power transmitters is radically different from the average type of condensers which are now offered for similar purposes. After careful investigation it was found that a condenser for tuning high frequency circuits can not be a redesigned or reduced large condenser but it must be of totally different construction.

There are three models of the new REL variable condensers which are shown below. Each of these models has the following outstanding features incorporated in their construction — heavy die cast aluminum end support with wide spread three point mounting arrangement. This mounting scheme assures condenser rigidity, especially when mounted on thin metal panels. This super foundation creates a substantial support for the balance of the condenser. — The condensers are supplied with insulated stand-off bushings allowing these units to be mounted on metal panels without grounding either the stator or rotor plates. — The rotor shaft revolves in a uniquely designed bearing which is of conical construction on both ends, thus assuring against any end thrust or side play of the rotor plates. A special spring is provided by means of which any degree of revolving tension may be supplied on the rotor. — A new patented rotor plate contact which insures absolute frictionless and noiseless connection to the rotor plates is employed. The rotor shaft is continually immersed in a pool of mercury which insures positive contact. This feature is highly important for receivers which operate on a very high frequency band because the difficulties usually encountered with other types of condensers are completely eliminated. The usual mechanical friction noises are not obtained with the REL positive contact shaft bearing. Both the stator and rotor plates are of heavy brass, thus preventing capacity changes due to plate vibration. Particular care has been taken to secure a positive bonding contact between the plates of each section. The plates are widely spaced so as to further insure the permanency. Each one of the types listed below which employs a single plate condenser for the vernier adjustment can be so controlled that the maximum capacity of this vernier unit may be varied to suit the particular requirements so that a definite frequency band may be spread over the entire tuning dial of the single plate vernier. Each of the condensers listed below with the exception of the Cat. No. 220 type is equipped with standard 1/4" diameter shaft which will take any type of present day knob or dial. The panel mounting space required for these condensers is 4 1/4" x 4 1/4". The total depth varies with the different sizes specified. These condensers will be found useful in spreading the narrow congested bands when used in either receivers or transmitters.

### STANDARD TYPE—CAT. 181

The Cat. No. 181 standard type condensers may in all respects be compared with the average present day single unit variable condenser with a movable element which equally varies the capacity through its complete rotation.

The following is a list of the standard types which may be secured:  
Cat. No. 181-A comprises one stator and one rotor plate; the stator plate is movable so that any maximum capacity may be secured by simply varying the distance between the stator and rotor plates; when the spacing is 1/4" between plates the capacity is 17 mmfds.; break down voltages at 1/4" spacing, 2000 volts.....Price \$4.00

Cat. No. 181B comprises four stator and three rotor plates; spacing between stator plates 1/8"; maximum capacity 115 mmfds.; break down voltage 1000 volts .....Price \$4.25

Cat. No. 181C comprises seven stator and six rotor plates; spacing between stator plates 1/4"; maximum capacity 100 mmfds.; break down voltage 2000 volts.....Price \$4.50

Cat. No. 181D comprises seven stator and six rotor plates; spacing between stator plates 1/8"; maximum capacity 210 mmfds.; break down voltage 1000 volts.....Price \$4.50

### COMBINED TANK AND VERNIER TYPE—CAT. 187

The Cat. No. 187 combined tank and vernier type condensers will be found useful in many modern high frequency circuits. The large semi-variable capacity is rotated by means of a bakelite disc. This disc may be notched so that the locking device supplied will fit these notches. In this manner it will be easy to always return the large capacity to a setting previously employed. The small vernier single plate condenser is used to obtain full spread tuning of each band.

Cat. No. 187E comprises the Cat. No. 181B condenser combined with a single rotor and single stator vernier control. The tank condenser has a maximum capacity of 115 mmfds.; employs 1/8" spacing between stator plates; break down voltage 1000 volts.....Price \$6.25

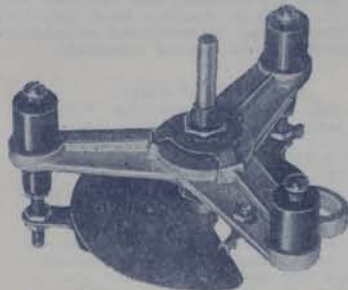
Cat. No. 187F comprises the Cat. No. 181C condenser combined with a single rotor and single stator vernier control. The tank has a maximum capacity of 100 mmfds.; employs 1/4" spacing between stator plates; break down voltage 2000 volts.....Price \$6.50

Cat. No. 187G comprises the Cat. No. 181D condenser combined with a single rotor and single stator vernier control. The tank condenser has a maximum capacity of 210 mmfds.; employs 1/8" spacing between stator plates; break down voltage 1000 volts.....Price \$6.50

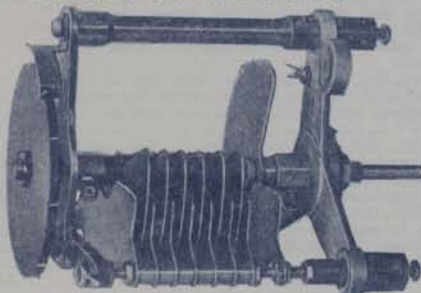
### TYPES WITH VERNIER DIAL CONTROL CAT. NO. 220

The Cat. No. 220 condensers are exactly the same as either the Cat. No. 181 or the Cat. No. 187 types, except that they are fitted with a vernier control dial pointer and etched scale. The vernier control is obtained by friction and has a ratio of approximately 6 to 1. The control is secured by having a small soft rubber disc turn a large hard bakelite disc. This type of friction is noiseless. For high frequency receivers it is absolutely necessary to eliminate metallic rubbing contacts which create noise. The following is a list of the vernier equipped condensers which are regularly carried in stock:

- Cat. No. 220-A same as Cat. No. 181-A.....Price \$5.50
- Cat. No. 220-B same as Cat. No. 181-B.....Price \$5.75
- Cat. No. 220-C same as Cat. No. 181-C.....Price \$6.00
- Cat. No. 220-D same as Cat. No. 181-D.....Price \$6.00
- Cat. No. 220-E same as Cat. No. 187-E.....Price \$7.75
- Cat. No. 220-F same as Cat. No. 187-F.....Price \$8.00
- Cat. No. 220-G same as Cat. No. 187-G.....Price \$8.00



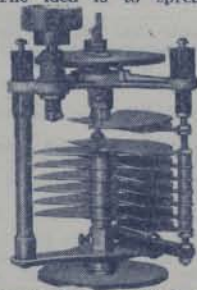
The above illustration shows a single plate Cat. No. 181A condenser. The other models listed under Cat. No. 181 are similar to this except that there are more stator and rotor plates.



The above illustration shows the Cat. No. 187F condenser which is a combined, large capacity semi variable condenser shunted by a single plate small capacity variable condenser. The uses for this type are obvious. The idea is to spread narrow bands over the entire condenser tuning dial scale.



The above illustration shows a combination tank and single plate condenser with vernier control dial mounted on the small condenser. This illustration shows Cat. No. 220-F.



**RADIO ENGINEERING LABORATORIES**  
100 WILBUR AVENUE LONG ISLAND CITY, N. Y., U. S. A.



# AMATEUR BAND HIGH FREQUENCY RECEIVER KIT—CAT. NO. 192

## EMPLOYS DETECTOR AND ONE STAGE AUDIO

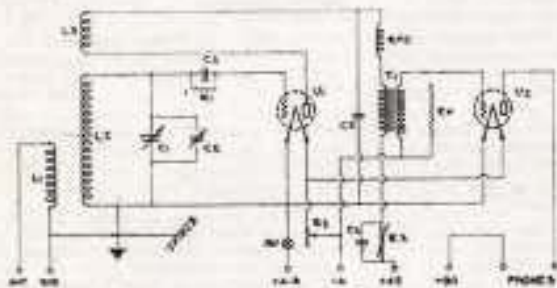


The REL Cat. No. 192 amateur band high frequency receiver kit has been designed for amateur band reception only. It can be considered as the exclusive set for receiving signals in the 3550, 7300 and 14,000 kilocycle bands. Every feature is new and unique. The modern amateur who desires to obtain maximum results in the new narrow bands will require a receiver of this type. In fact, it is the only set which will give selective tuning.

The Cat. No. 192 kit employs the two tube regenerative circuit which has found such popularity among amateur operators. To successfully spread out each of the three popular bands specified, it was necessary to completely redesign the plug-in coils and the tuning condenser. Probably the main feature is that each of the bands is spread over the entire tuning dial. This is accomplished by the use of the new REL variable condensers which have been designed expressly for high frequency circuits. This tuning condenser employs a semi-variable tank capacity shunted by a small vernier dial. This control is brought out on the front panel and can be considered as the main tuning or frequency variation adjustment. The three plug-in coils supplied are wound on new REL one piece bakelite forms. Each one is plainly marked designating the band covered by it.

Regeneration is controlled by means of a noiseless variable resistance connected in the detector plate battery supply. The other remaining parts which constitute this kit have all been carefully selected and tested so as to conform with the rigid specifications necessary for a precision receiver.

A neatly finished metal case houses the complete receiver. This means that thorough shielding is attained.



Schematic wiring diagram Cat. No. 192 amateur band receiver kit. Note that "C1" is the semi-variable tank condenser which is shunted by the tuning control vernier condenser "C2." This very unique condenser control xxxxx affords the accurate spreading of each of the three popular amateur frequency channels. The careful designing of the coils employed in this kit has resulted in a new higher degree of efficiency which has never before been attained with similar two tube circuits.

A brief description will be given showing how easily the amateur may change from one band to another. It is first necessary to plug-in the correct coil for the band. Next the large semi-variable tank capacity "C1" is set at the correct position so that the band is covered on the scale of the small vernier condenser "C2." The adjustment of the large tank capacity is easily accomplished by means of the bakelite disc which engages a spring locking device. This bakelite disc is notched at the desired settings of this condenser. The locking spring will then always fit these previously made notches. In this manner the tank condenser can always be quickly set to the desired capacity for the particular coil used. The amateur operator can very readily appreciate the huge benefit derived by spreading three bands over the entire scale of the tuning control condenser.

A detailed booklet giving full instructions on the building and operating of this set is furnished with each complete kit of parts. In this booklet will be found all data necessary for the correct calibration of these receivers.

The following parts are necessary and furnished with each REL Cat. No. 192, two tube amateur band high frequency receiver kit. This kit may be purchased complete or else any individual parts may be secured separately.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 192 Metal case with removable cover (finished in black crystalline lacquer) . . . . .	\$8.50
	Size 9" x 12" front x 10" deep.	
	1—REL Cat. No. 192 Aluminum Front Panel Drilled and engraved (finished in black crystalline lacquer) . . . . .	4.50
	Size 9" x 12"	
	1—REL Cat. No. 192 Engraved bakelite rear terminal strip supplied with 5 connection screws and two mounting brackets. . . . .	1.00
	1—REL Cat. No. 192 Five ply veneer Base-board, finished in dull black lacquer. (Fitted with copper ground plate). . . . .	1.00
L1-L2	1—set REL Cat. No. 182 coil kit complete with coil base . . . . .	10.00
LF	This coil kit constitutes three plug-in coils which are designed to operate only in each of the three popular amateur bands.	
C1-C2	1—REL Cat. No. 229—R vernier tuning condenser semi-variable tank capacity 220 mmfd. (Complete with vernier control, pointer and knob) . . . . .	7.75
C3	1—REL Cat. No. 156, type K, 100 mmfd. grid condenser with grid leak supports. . . . .	.50
C4	1—REL Cat. No. 123 .5 mfd. resistance bypass condenser . . . . .	.75
C5	1—REL Cat. No. 156 type K, 2000 mmfd. plate by-pass condenser. . . . .	.80
R1	1—Daven, 2 megohm grid leak. . . . .	.50
R2	1—De Jur 10 ohm rheostat with knob. . . . .	.75
R3	1—Frost 50,000 ohm variable resistor. . . . .	2.00
R4	1—Daven .1 megohm resistance. . . . .	.50
T1	1—REL Cat. No. 180 first stage AF transformer . . . . .	4.00
RFC	1—REL slotted type RF choke coil. . . . .	1.10
SW	1—Carter power "imp" snap switch. . . . .	.75
V1-V2	2—REL Cat. No. 122 UX base sockets at 35c ea. . . . .	.70
V3	1—REL Cat. No. 192 Hardware, which includes necessary mounting screws, wire, etc. . . . .	.50
	1—REL Cat. No. 192 assembling, building and operating instruction booklet. . . . .	1.00
TOTAL cost of complete parts. . . . .		\$44.80

The REL Cat. No. 192 kit comprising all of the parts listed above is carefully packed in substantial cartons. When purchased complete it is sold as follows:

REL Cat. No. 192 complete kit price. . . . . 48.00

The REL Cat. No. 192 kit may be purchased assembled, wired and tested. This work is done at our laboratories under competent supervision.

Additional charges for this service. . . . . 15.00

## RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## A. C. SHORT WAVE RECEIVER

TUNED SCREEN GRID RF.—SINGLE DIAL CONTROL—NO AC. HUM—  
TWO STAGE AUDIO—LOUD SPEAKER RECEPTION—UNEXCELLED TONE QUALITY

The Radio Engineering Laboratories, Inc., have developed their Cat. No. 260 AC short wave receiver after many months of careful experimental work. This AC model short wave receiver is without a doubt in a class of its own. The finest workmanship combined with the best procurable material makes this set an outstanding development in the radio art. The compact rugged construction of the receiver and its independent power unit will immediately please the most critical radio engineer.



The Cat. No. 261 power supply unit illustrated on the right employs one type-80 tube in a full wave rectifier circuit. Adequate and novel filter system insures pure DC supply to the receiver.

This unit is designed to operate directly from any 110 to 120 volt, 60 to 60 cycle single phase power line. If the above voltages are not available this power supply can be furnished at slight additional cost with a ballast tube whereby any voltage from 80 to 250 may be employed. By the use of this tube, line fluctuations, which cause erratic operation of the receiver, will be eliminated. However, for all general purposes where 110 to 120 volts is available this ballast tube is not necessary.

The Cat. No. 260 receiver has been constructed with the greatest care regarding the treatment of the individual parts and the metal cabinet and chassis. Each individual part is either sealed in moisture proofing compound or else coated with an insulating lacquer. Thus, these sets can be safely and efficiently employed in tropical climates and other locations where atmospheric conditions are extremely effective in deteriorating apparatus.

The single dial control which tunes both the RF and detector stages is a great improvement, as it simplifies operations and thereby brings this short wave receiver to the average public with the simplest method of tuning. Most other short wave receivers entail complicated two hand operation.

The REL Cat. No. 261 power unit is constructed with the same care as the receiver. The condensers, resistances and choke coils have a factor of safety well beyond 200 per cent of the normal operating requirements.

A heavy four foot plug and cable arrangement is supplied for connecting the power unit to the receiver.

Cat. No. 260 receiver, complete with 4 pair plug-in coils .....Price \$85.00

Cat. No. 260 receiver, same as above except for battery operation .....Price \$85.00

Size overall 17½" long x 8" high x 12" deep. Net weight 22 pounds.

Cat. No. 261 unit complete with plug-in cable and 6 foot lamp cord and plug.....Price \$30.00

Size overall 11" long x 7" high x 8" deep. Net weight 10½ pounds.

The Cat. No. 260 receiver illustrated on the left employs a tuned screen grid stage of radio frequency amplification, a detector with the smoothest possible control of volume and two stages of correctly designed audio frequency amplification. Four pair of plug-in coils are supplied, which cover all wave lengths from 11 to 82 meters. Each coil is clearly engraved showing the wavelength range and whether it is to be used in the RF stage or in the detector stage.

The set requires one type-24 screen grid tube and three type-27 tubes.



Only available in D. C.  
Battery operated model

**RADIO ENGINEERING LABORATORIES, Inc.**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## SHORT WAVE STATION LOG

The following is a list of short wave broadcast stations which are operating on regular schedule. From time to time new stations will appear. If their wavelength is known they can be easily located on the receiver dial by simply calculating their probable position from the stations that have already been logged.

The table gives data on the coils to be used, on the dial setting at which the station is to be heard and also the call letters, location and wavelength of the station.

Station Call Letters and Location	Wave Length	Receiver Which		
		Dial Setting	Coils to Use	
FMB	Bandoeng, Java	14.5	34½	11-18
DGW	Nauen, Germany	14.83	37	11-18
POO	Kootwijk, Holland	15.68	46	11-18
XDA	Mexico City, Mex.	16.9	48½	11-18
PKK	Kootwijk, Holland	16.3	52½	11-18
PCS	Kootwijk, Holland	16.4	56	11-18
PLF	Bandoeng, Java	16.3	59	11-18
PHI	Amsterdam, Holland	16.38	59½	11-18
W2XV	LONG ISLAND CITY, N.Y.	17.3	64½	11-18
PCL	Kootwijk, Holland	18.97	9	17-30
W2XAD	Schenectady, N. Y.	19.56	12½	17-30
W6XN	Oakland, Calif.	23.35	40	17-30
W6XE	E. Pittsburgh, Pa.	25.4	53½	17-30
CJRX	Winnipeg, Man., Can.	25.5	53½	17-30
G3SW	Chelmsford, England	25.53	58½	17-30
VK2ME	Sydney, Australia	28.5	7	28-49
GBW	Rugby, England	30.6	14	28-49
NRH	Costa Rica, C. A.	30.8	14½	28-49
W2XAU	Philadelphia, Pa.	31.23	21	28-49
PCJ	Eindhoven, Holland	31.4	21½	28-49
W2XAF	Schenectady, N. Y.	31.43	21½	28-49
VK2ME	Sydney, Australia	31.54	21½	28-49
PHI	Amsterdam, Holland	32.0	22	28-49
W2XV	LONG ISLAND CITY, N.Y.	34.49	23	28-49
W6XF	Los Angeles, Calif.	37.0	28½	28-49
VE2AP	Drummondville, Can.	47.5	54½	28-49
HKO	Bogota, Colombia	48.0	57	28-49
W6XE	New York City, N. Y.	49.62	4½	48-82
W2XAL	New York, N. Y.	49.18	5	48-82
W2XAU	Philadelphia, Pa.	49.5	5½	48-82
W2XAL	Cincinnati, Ohio	49.5	5½	48-82
W6XF	Chicago, Illinois	49.88	5½	48-82
W2XAL	New York, N. Y.	49.9	5½	48-82
WHP	Harrisburg, Pa.	56.0	6	48-82
W6XE	E. Pittsburgh, Pa.	62.5	30½	48-82
NAA	Arlington, Virginia	74.72	67	48-82

## OPERATING DATA

## CAT. No. 260 RECEIVER AND CAT. No. 261 POWER UNIT

The REL Cat. No. 260 Receiver and No. 261 Power Unit have been carefully packed in a specially constructed wooden protecting case. When unpacking the receiver and power unit it is merely necessary to remove the top cover by taking out the wood screws. Place the receiver in a location where a positive ground and good antenna lead-in are available. Connect the antenna and ground to their respective posts engraved at the rear of the receiver.

The antenna should be of the single wire type sixty feet long (20 meters) from its extreme end to the receiver. This wire should be strung in a clear unobstructed area free from electric light, power and telephone wires.

Any good magnetic type loud speaker may be employed. Plug the speaker cord tips into the two tip jacks at the rear of the receiver.

Plug the power pack cable into the receiver and connect the primary power lead into any standard 110 volt, 50 to 60 cycle electric light socket.

Insert a type 80 full wave rectifier tube into the socket of the power unit.

The other four necessary tubes are placed in the receiver sockets in the following order:

- Type 24 left rear.
- Type 27 left front.
- Type 27 right front.
- Type 27 right rear.

Do not turn the power on until every tube is in place and the control grid clip and lead are fastened to the top terminal of the type 24 tube.

Plug in the highest wavelength coils (45 to 82 meters) in their respective bases.

The plug-in coil with its wavelength range engraved in white is the RF coil and belongs in the rear compartment. The Detector coil (red engraving) is plugged in the front compartment base.

Turn on the filament switch and allow some time for the tubes to arrive at their operating temperature. This warm up requires about one minute.

Before attempting to tune the receiver let us state that there is a little more than just turning on the filament switch to pulling in long distance broadcast stations. Patience must be a prime factor. Secondly, the regeneration control (knob lower right) is of greater importance than the main tuning dial. By carefully adjusting this regeneration control to allow the detector to function right at its oscillation point, many a weak carrier will develop into a loud voice coming out of the loud speaker.

When bothered with unstable oscillation rearrange the three type-27 tubes until the best one is placed in the detector socket (left front).

Lastly, it is very important that listening be done at the correct time. REL cannot tell which time is best suited for reception of any particular station in as much as every receiving locality requires different data. This is due to the fact that short wave signals are affected by seasonal changes and the proportion of day and night between the transmitter and receiver. It is apparent that the time of the day is a very important factor.

Stations in various parts of the world may possibly be in different time belts. Do not confine listening to merely to evening hours, such as has been done in the past. Surprising results will be obtained in the early morning and afternoon hours.

The Radio Engineering Laboratories, Inc., is always anxious to hear from users of the No. 260 Short Wave Receiver. Send us your list of stations heard, with data pertaining to wavelengths and time.

◆◆◆◆◆

**RADIO ENGINEERING LABORATORIES, Inc.**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



# HIGH FREQUENCY BROADCAST RECEIVER KIT CAT. NO. 189

## EMPLOYS DETECTOR AND TWO STAGES AUDIO



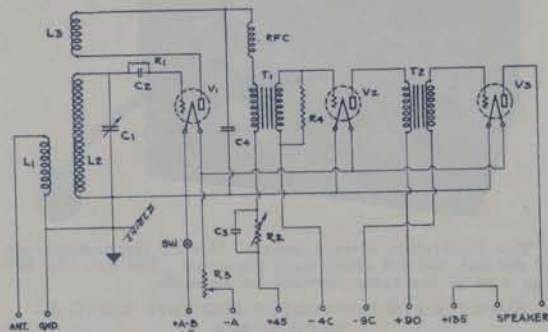
The REL Cat. No. 189 high frequency (short wave) broadcast receiver kit will answer the purposes for a receiver which is required to cover continuously, without interruption, all wavelengths from 15 to 100 meters. Included in this wave band are found many high power short wave foreign broadcasting stations which operate on regular schedules. With the REL Cat. No. 189 receiver it is easily possible to receive the interesting foreign broadcasting which may come from England, Holland, France, Russia, Germany, Australia and from any of the others irrespective of their location. Thus, the range of the short wave receiver really is unlimited. It will afford the thrill of ultra DX reception which is not encountered in the standard broadcast band above 200 meters. Besides the reception of short wave broadcasting, the receiver will also be very useful for television operation. It will also bring the dots and dashes from amateurs in every Continent. In tropical countries where static blankets the reception of broadcasting on the higher waves, the short waves will be found clear and pleasantly enjoyable. The band below 100 meters holds a continuous fascination which even the most ardent broadcast listener will want to eventually explore.

This kit, when completed, will make a modernly designed receiver which will receive long distant short wave signals with sufficient volume to operate a loud speaker.

The increased popularity of short wave broadcast reception has created a very popular demand for a receiver which has the electrical and mechanical specifications of the REL Cat. No. 189. Four years of pioneering work in the short wave field has enabled the Radio Engineering Laboratories to gain a vast amount of experience in the development work on short wave receivers. Therefore, with their actual experience it is no wonder that this receiver is a product of merit.

Three sets of plug-in coils are supplied to cover all wavelengths between 15 and 100 meters. The ranges of the coils are as follows:

- Coil A 9.375 to 20,000 K.C. (15 meters to 32 meters)
- Coil B 5.550 to 10,710 K.C. (28 meters to 54 meters)
- Coil C 3,000 to 5,770 K.C. (52 meters to 100 meters)



The schematic diagram employed in the Cat. No. 189 kit is shown here. Note the simplicity and the few controls necessary to operate this set. Actually, this receiver is a one dial unit which can be operated by anyone.

The tuning is accomplished by means of one of the new REL condensers especially designed for high frequency circuits. This is equipped with a noiseless friction vernier control. The scale for this is engraved directly on the front panel. Regeneration is controlled by means of a noiseless resistance. This allows very smooth operation which is highly desirable for the reception of modulated signals.

The set is so designed that type 201A tubes may be employed in the detector and first audio and a power tube of the 112A class may be used in the last stage. The terminal strip in the back clearly indicates the various battery voltages which are applied to the set.

A neatly finished metal case encloses all of the equipment. Due to the complete metallic construction, this set is not subject to body capacity effects. Furthermore, a completely shielded short wave set is very desirable to stabilize the reception of long distance signals.

A very complete and comprehensive instruction booklet is supplied with each kit. This plainly shows how to assemble, wire and operate this efficient receiver. The average radio beginner will encounter little difficulty in successfully constructing this set.

The overall dimensions of the case are 9" x 13" front x 10" deep. The net weight of the complete kit is 18 pounds.

The following parts are necessary and furnished with each REL Cat. No. 189, three tube high frequency (Short Waves) Receiver Kit. The kit may be purchased complete or else any individual parts may be secured separately.

Circuit Symbol	Description of Parts	Price
	1—REL Cat. No. 189 Metal Case with removable cover (finished in black crystalline lacquer) . . . . .	\$6.50
	Size 9" x 13" front x 10" deep.	
	1—REL Cat. No. 189 Aluminum Front Panel Drilled and engraved (finished in a black crystalline lacquer) . . . . .	4.50
	Size 9" x 13".	
	1—REL Cat. No. 189 Engraved bakelite rear terminal strip supplied with 11 connection screws and two mounting brackets. . . . .	1.50
	1—REL Cat. No. 189 Five ply veneer Baseboard, finished in dull black lacquer. (Fitted with copper ground plate). . . . .	1.00
L1-L2-L3	1—set REL Cat. No. 229 coil kit complete with coil base. . . . .	10.00
	This coil kit constitutes three plug-in coils which are designed to cover all wave-lengths from 15 to 100 meters. Additional coils may be purchased to cover higher ranges. See page 25A for data on such special coils.	
C1	1—REL Cat. No. 220B tuning condenser, capacity 115 mmfds. (Complete with vernier control, pointer and knob). . . . .	5.75
C2	1—REL Cat. No. 150 type K, 100 mmfd. grid condenser with grid leak supports. . . . .	.50
C3	1—REL Cat. No. 123—5 mfd. resistance by-pass condenser . . . . .	.75
C4	1—REL Cat. No. 150 type K, 2000 mmfd. plate by-pass cond. . . . .	.50
R1	1—Daven—2 megohm grid leak. . . . .	.50
R2	1—Frost 50,000 ohm variable resistor. . . . .	2.00
R3	1—De Jur 10 ohm rheostat. . . . .	.75
R4	1—Daven .1 megohm resistance. . . . .	.50
T1	1—REL Cat. No. 190 first stage AF transformer . . . . .	4.00
T2	1—REL Cat. No. 191 second stage AF transformer . . . . .	4.00
RFC	1—REL slotted type RF choke coil. . . . .	1.10
SW	1—Carter power "imp" snap switch. . . . .	.75
VI-2-3	3—REL Cat. No. 122 UX tube sockets at 35c each . . . . .	
	1—REL Cat. No. 189 Hardware, which includes necessary mounting screws, wire, etc. . . . .	.50
	1—REL Cat. No. 189 assembling, building, and operating instruction booklet. . . . .	1.00
<b>TOTAL of Complete Parts. . . . .</b>		<b>\$47.15</b>

The REL Cat. No. 189 kit comprising all of the parts listed above is carefully packed in a substantial carton. When purchased complete it is sold as follows:

REL Cat. No. 189 complete kit. . . . .	Price \$45.00
The REL Cat. No. 189 kit may be purchased, assembled, wired and tested. This work is done at our laboratories under competent supervision.	
Additional charges for this service. . . . .	\$17.00

**RADIO ENGINEERING LABORATORIES**  
 100 WILBUR AVENUE      LONG ISLAND CITY, N. Y., U. S. A.



**SHORT WAVE CONVERTERS**  
 DIRECT CURRENT TYPE CAT. NO. 194  
 ALTERNATING CURRENT TYPE CAT. NO. 195



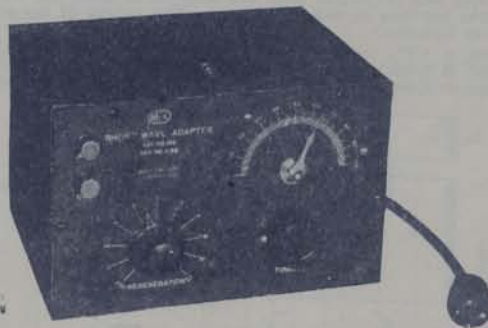
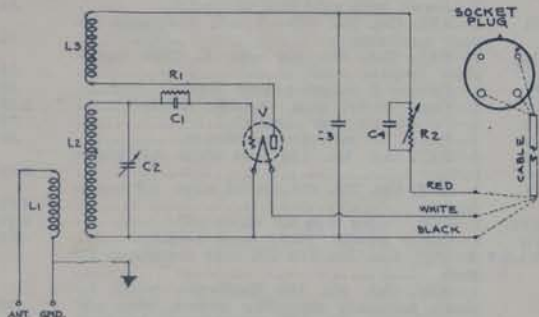
Radio Engineering Laboratories offers to the radio enthusiast two simple short wave converters which will enable the user to convert his present day broadcast receiver into a short wave set. The use of one of these one tube sets requires no particular knowledge of radio. The average beginner can install one in approximately 5 minutes. They are designed to operate with any type of receiver regardless of the tube used. If the detector tube in the receiver is of the UX base type such as 201A, 199, 112, etc., use the Cat. No. 194 DC type. If the detector tube is a UY-227 type, use the Cat. No. 195 AC unit.

A thrill not usually encountered in radio will be had when the voices from foreign countries are clearly heard. These little converters are not only very adaptable for the foreign reception of voice and music but they also lend themselves to the reception of television signals and the reception of amateur stations in all parts of the world.

Three plug-in coils are supplied with each unit. These cover all wavelengths between 15 and 100 meters. Each coil is clearly designated to show the wavelength range that it covers.

Each converter is housed in a metal case attractively finished in black crystalline lacquer. The front panel is of crackle finished bakelite. The tuning scale and other designations are clearly engraved on this front panel. The total size is 9½" x 6" front x 7" deep. Net weight is 7 pounds.

The above illustration very clearly shows how one of the REL alternating current type short wave converters is connected to a standard broadcast band receiver. In this manner it is possible to convert any present day broadcast band (that is 200 to 550 meters) receiver into a short wave set. It is a simple matter to remove the detector tube from the broadcast set and insert it in the converter and then plug the converter connection into the socket which previously held the detector tube. Remove the antenna and ground connections from the receiver and connect them to the converter. The broadcast set has now become a short wave receiver capable of picking up the many foreign short wave broadcasters.



The schematic wiring diagram employed in the direct current type REL short wave converter is shown above. The plug shown on the right is inserted in a detector tube socket on the standard receiver. The detector tube from the receiver is then placed in the tube socket of the converter.

**SHORT WAVE CONVERTER FOR SETS USING DC TYPE TUBES**

This unit is furnished with three plug-in coils and a 4 ft. cable with 4 prong socket plug. Each set is carefully packed in a strong carton. Completely built and tested.

Cat. No. 194 DC type converter.....Price \$40.00

This illustration gives a general idea of the compactness of the Cat. No. 194 short wave converter. The Cat. No. 195 has exactly the same outward appearance.

**SHORT WAVE CONVERTER FOR SETS USING AC TYPE TUBES**

This unit is furnished with three plug-in coils and a 4 ft. cable and 5 prong socket plug. Each set is carefully packed in a strong carton. Completely built and tested.

Cat. No. 195 AC type converter.....Price \$40.00

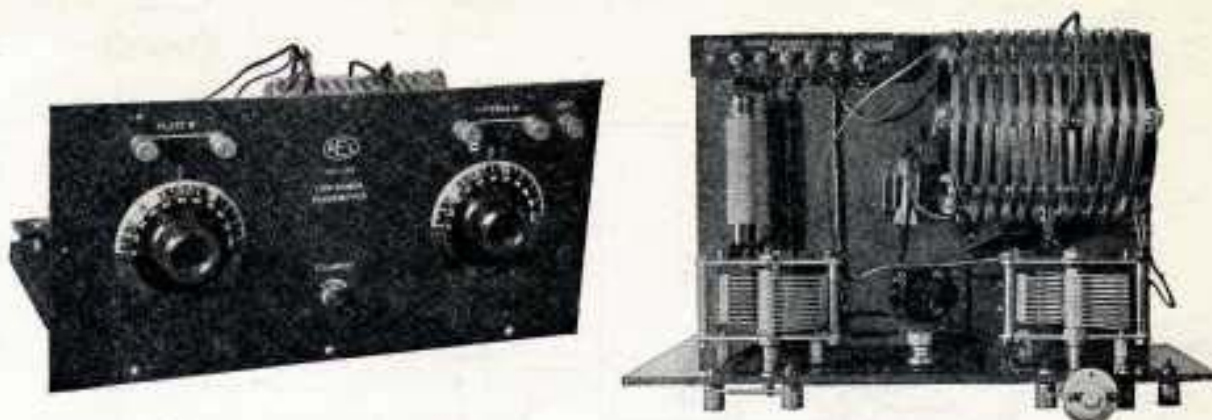
**RADIO ENGINEERING LABORATORIES**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



LOW POWER TRANSMITTING KIT  
CATALOGUE No. 175



Interest in short wave amateur radio telegraphy is increasing in leaps and bounds. The REL No. 175 short wave low power transmitting kit will be found ideal for those who are just becoming interested in transmission. It is presumed that the builder of a kit such as this would have the average experience that goes with the general design and operation of broadcast receivers.

This set is so designed that any type of UX base tube may be used. That is, a UX-199, UX-201A, UX-112, UX-171 or UX-210.

This kit when made up will be found exceptionally satisfactory for portable purposes such as camps, expeditions and other similar projects.

This low powered transmitter, although very moderately priced, should not be considered a mere toy. When properly connected, it will transmit over very great distances. Many users have successfully communicated over distances exceeding 3000 miles.

The beginner need not be perplexed over the power supply problem. Dry "A" and "B" batteries can be used. An ordinary "B" eliminator, such as used with broadcast receivers, will be found admirable. The wiring diagram of a half wave rectifier is given on the next page. This will supply both the filament and plate of the transmitter tube. It could also be utilized to feed the "BCL" receiver.

The following parts are furnished for this kit: Panel neatly drilled and engraved; two variable condensers; two dials; filament switch; tube socket; grid leak; grid and plate blocking condensers; RF choke; special inductance with necessary clips and leads; flash light lamp and base; binding post strip; wire; screws and base board.

Complete set of blueprints giving all necessary instructions furnished with each kit. Each kit is furnished with a correct inductance and tuning condenser for operation in the 20, 40 or 80 meter amateur wavebands.

This REL kit is an improvement over the original set as specified in the April, 1926 issue of Q. S. T. and also in the ARRL Handbook. These publications, recognized by all as the leading periodicals dealing with short waves, recommend this set for the beginner.

PRICE \$30.00

Complete Kit as Specified



**RADIO ENGINEERING LABORATORIES**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## BEGINNERS' RADIO TELEPHONE AND TELEGRAPH STATION

When the radio fan gets the "bug" and decides to break into the amateur game with a small telephone or telegraph short wave transmitter he usually does not know exactly where to begin so as to attain quickest results at the least expense. The REL. Cat. No. 175 beginners' telephone and telegraph transmitter kit, which forms the main portion of the radio station illustrated on this page, is a typical ruggedly constructed and efficient transmitter. The simple and clear instructions furnished with each kit will enable the average enthusiast to wire up this set and place it on the air in minimum time. Results are always guaranteed. The Radio Engineering Laboratories have designed the station illustrated below so as to show a typical low power amateur layout. With a small outfit such as this the beginner can secure many enjoyable evenings. A thrill is in store for anyone who has not previously had the pleasure of operating an efficient small station.



The illustration to the left clearly shows the placement of the various pieces of apparatus so as to obtain efficiency. The Cat. No. 231 amateur band receiver is shown on the right. This unit employs three tubes and is capable of covering the 30, 40 and 80 meter amateur bands. The REL wide spread tuning condenser feature is employed.

The Cat. No. 175 transmitter is shown in the center. More information on this is given on the next page. The REL Cat. No. 185 half wave rectifier power pack is shown on the extreme left. This unit supplies the plate and filament voltages to the tube employed in the transmitter. It will give maximum results when a type-10 tube is employed.

Note that the transmitter has two connecting wires, one from the antenna and the other from the counterpoise. The receiver is shown connected to its own separate antenna. For data on various types of antennae refer to pages 14 and 15 in the REL Booklet No. 50.

The following is a complete resume of the apparatus necessary to complete this station:

1—REL. Cat. No. 175 Transmitter Kit.....	Price \$38.00	2—Type-61A Tubes .....	Price \$2.50
1—REL. Cat. No. 185 Power Pack completely built.....	Price \$28.00	1—Type-22 Screen Grid Tube.....	Price \$4.50
1—Type-10 Transmitter Tube.....	Price \$9.00	1—Pr. Federal Brandes Headphones.....	Price \$3.50
1—Type-81 Half Wave Rectifier Tube.....	Price \$7.25	1—4 volt 108 ampere hour Storage Battery.....	Price \$12.00
1—Mounted Telegraph Key with leads.....	Price \$5.00	2—45 volt medium size B Batteries similar to Eveready type 772.....	Price \$3.25
1—Front Hand Microphone.....	Price \$6.00	2—4½ volt C Batteries similar to Eveready type No. 771.....	Price \$1.00
1—REL. Cat. No. 231 Amateur Band Rec. Kit.....	Price \$36.00		

In addition to this equipment the amateur will require suitable antenna system.

The station outlined above uses a type-10 tube with an AC power supply unit. If the beginner desires to employ similar UX base tubes such as the type-61A or type-12A; it will be satisfactory to obtain the power from dry B batteries similar to those employed in the receiver. In other words, the voltages of the power supply used depends upon the tube used in the transmitter. Follow closely the voltage specifications as given by the tube manufacturer. In this manner the user can employ the Cat. No. 175 set in conjunction with small type receiver tubes and B battery plate supply. Although the output will not be as much as when using the larger type of UX base tubes, it will be sufficient to obtain a working knowledge of the system and the results obtained should be interesting enough to spur the user to larger power.

Detailed information on the Cat. No. 185 half wave rectifier power pack is given on REL Catalog page 43. Detailed information on the REL Cat. No. 231 amateur band receiver is given on page 12 of the REL Booklet No. 50.



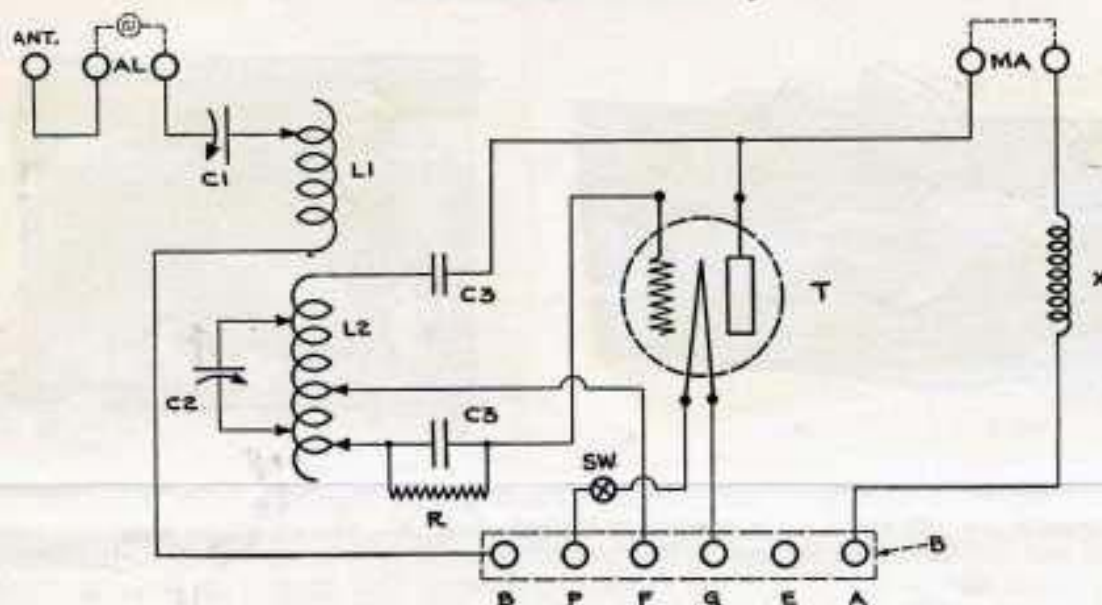
### RADIO ENGINEERING LABORATORIES, INC.

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## CIRCUIT DATA ON LOW POWER TRANSMITTER CATALOGUE NO. 175



### CIRCUIT SPECIFICATIONS

C1—Antenna Series Variable Condenser .0003 to .0105 mfd.  
C2—Primary Shunt Variable Condenser .00035 mfd.  
C3—Grid and Plate Condensers .002 mfd.  
AL—Antenna Resonance Indicating Lamp (position to insert antenna meter).  
L1—Secondary REL Special Inductance Unit.

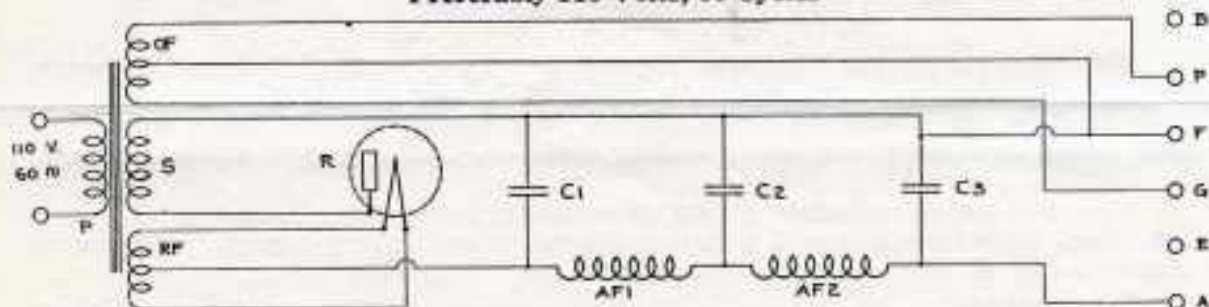
L2—Primary REL Special Inductance Unit.  
R—Grid Resistance 5000 ohms.  
SW—Filament Switch.  
X—Radio Frequency Choke.  
T—Transmitter Tube.  
MA—Posts for Insertion of Milliamperometer.  
B—Special Binding Post Strip.

Provisions are made for connecting meters. These, although not necessary in this kit, may be desired by some amateurs. The antenna current meter should not be greater than a 0-1 ampere and the plate current milliamperometer should not exceed 0-100 D. C. mfs. The center tap connection on "L2" should always be kept nearer to the grid end (bottom end as shown above). This will allow the tube to operate efficiently without becoming unnecessarily heated.

The telegraphing key is best inserted in the negative "B" lead. Telephoning can be accomplished by winding one turn of wire around the grid end of "L2." Connect any ordinary carbon microphone across the ends of this one turn coil. The set is now ready for voice transmission.

## CIRCUIT DATA ON "A" AND "B" POWER SUPPLY COMPLETE HALF WAVE RECTIFIER

Can Only Be Used with Some Form of Alternating Current,  
Preferably 110 Volts, 60 Cycles



### CIRCUIT SPECIFICATIONS

F—Primary Transformer.  
S—High Voltage Secondary.  
OF—Oscillator Filament Winding.  
RF—Rectifier Filament Winding.  
R—Rectifier Tube (UX-216B or UX-281).

C1—2 mfd. 1000 Volt Filter Condenser.  
C2—2 mfd. 1000 Volt Filter Condenser.  
C3—4 mfd. 1000 Volt Filter Condenser.  
AF1—20 Henry—150 mil. Filter Choke.  
AF2—30 Henry—150 mil. Filter Choke.

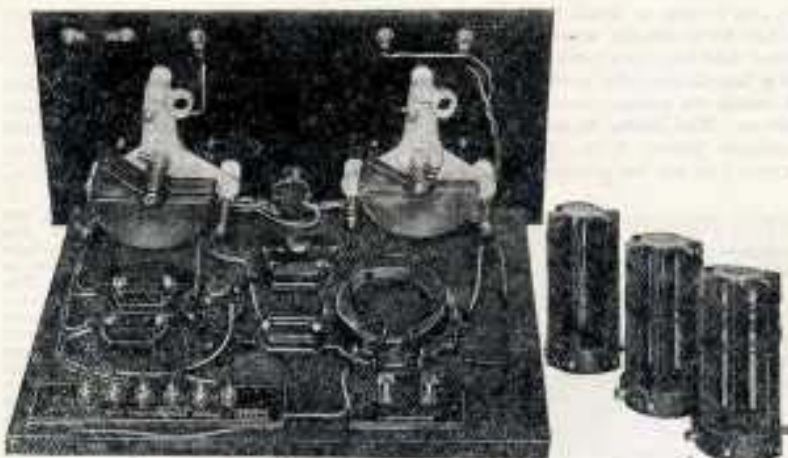
The power transformer employed must be capable of delivering about 500 to 700 volts at approximately 100 watts. The filament windings must deliver 10 volts each at about 5 amperes.

Prices on any parts employed in the above rectifier will be furnished upon application.

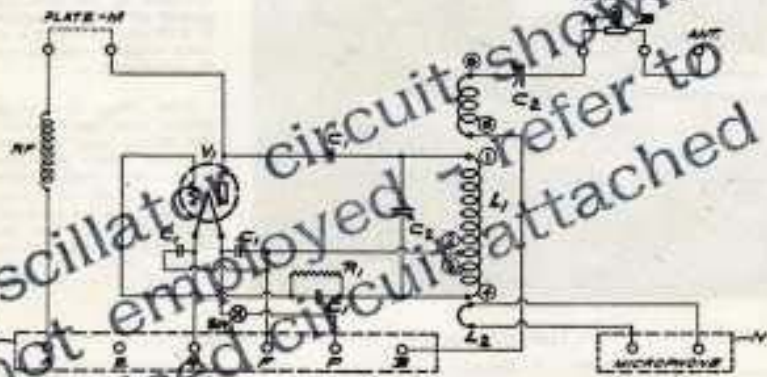
**RADIO ENGINEERING LABORATORIES**  
100 WILBUR AVENUE LONG ISLAND CITY, N. Y., U. S. A.



## BEGINNERS' TELEPHONE AND TELEGRAPH TRANSMITTER KIT—CATALOGUE No. 175



Illustrating the rear view of the Cat. No. 175 transmitter with all parts completely assembled and wired. The simple and practical mounting arrangement will immediately appeal to everyone.



Schematic wiring diagram of the Cat. No. 175 set. All grid and plate leads should be run short and direct. Other connections may be bunched and fastened together in cable fashion.

The following table gives data on the present international amateur assigned wave bands. Data is here given on each specific band showing at what time of the day or night it can be used to best advantage and also whether or not it is open for radio telephone communication.

Wave Channels	Kilocycle Spread	Wavelength Spread	Time Best Operation	CW or Phone	What Used for
160 meter	2,000 to 1,715	155.0 to 175.0	Night—local	{ CW total band phone 150 to 175	local traffic traffic
80 meter	4,000 to 3,500	75.0 to 85.7	Night & day—local & DX	{ CW 75 to 80 phone 84.5 to 85.7	traffic traffic
40 meter	7,350 to 7,000	41.0 to 42.8	Night & day—local & DX	CW	traffic
20 meter	14,400 to 14,000	20.8 to 21.4	Day—DX	{ CW total band Spec. phone 21 to 21.3	traffic traffic
10 meter	30,000 to 28,000	10.00 to 10.71	Day—DX	CW	experimental
5 meter	60,000 to 56,000	5.00 to 5.35		CW & phone	experimental
1½ meter	465,000 to 490,000	0.7477 to 0.7496		CW	experimental

The following is a complete list of parts furnished with each Cat. No. 175 Transmitter Kit:

- 1—Drilled and engraved bakelite panel, size 7" x 14"
- 1—5 ply veneer baseboard, size 14" x 10"
- 1—Rear terminal connection strip fitted with connection posts.
- L1—Set of Cat. No. 240 transmitter plug-in coils and base.  
(3 coils comprising one set. These are designed to function efficiently in the 28, 40 and 80 meter amateur bands. The interchanging of these coils allows quick shifting from one band to another.)
- L2—Microphone pick up coil for telephone transmission purposes.
- C1—Four REL Cat. No. 150 "K" .002 mfd. condensers.
- C2—REL Cat. No. 151-B and Cat. No. 151-C condensers.
- V1—Buffalo type IX tube socket.
- SW1—A. H. & H. filament switch.
- RPI—REL Cat. No. 132 RF choke coil.
- R1—REL Cat. No. 239, 5000 ohm grid leak.
- 2—3" KK pointer knobs.
- B—Porcelain miniature antenna lamp base.
- M—45 ampere miniature lamp.
- N—Microphone terminal strip with 2 Palmstock clips.
- 1—10 ft. roll No. 18 flexible red connection wire.
- 2—Lengths bushbar.
- 1—Complete set hardware, comprising necessary wood screws, bushings, machine screws, washers, nuts, etc.
- 1—Complete instruction booklet.

A word of caution must be given to the beginner in regard to the licensing of all amateur transmitters. Before the transmitter can be lawfully placed on the air the user must obtain an amateur operator's license either of the first or second class, and when he has secured this he can apply for a station license which authorizes him to transmit and employ a specific call. Information on such licenses may be secured from the nearest district radio supervisor. For data on how to pass the amateur license tests and also for other valuable information on how to "break in" to the amateur game can be obtained by reading the A.R.R.L. handbook and also by subscribing to the A.R.R.L. monthly publication, "Q S T." Both of these may be secured from the American Radio Relay League headquarters at Hartford, Connecticut.

**RADIO ENGINEERING LABORATORIES, INC.**

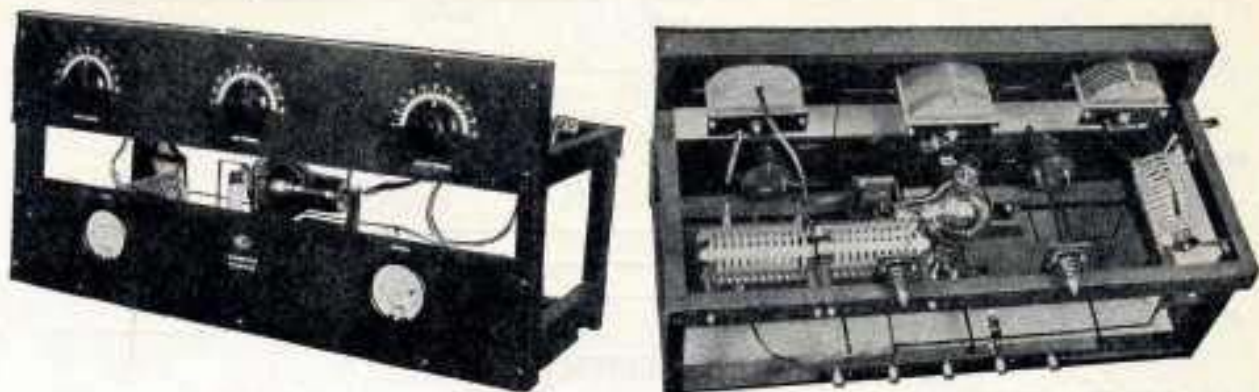
100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## TUNED PLATE TUNED GRID TRANSMITTING KIT

CATALOGUE NO. 139



This circuit has jumped into popularity among the transmitting amateurs because of the tremendous results obtained and the ease with which it can be tuned to perfect operation.

A transmitter of this type will emit a very stable signal.

Power supply can be had either through motor generator, rectified A. C. or "B" batteries.

### TRANSMITTER SPECIFICATIONS

Cat. 139 Type	Tube Used	Dimensions		Inches Deep	Plate Volts	Filament Volts	Kit Price
		Long	High				
TR- 5	UX-210	30	15	13	400	7.5	\$71.00
TR- 50	UV-203A	30	18	13	1000	10	80.00
TR- 65	DE F-H	30	18	13	1500	10	80.00
TR- 75	UX-852	30	18	13	2000	10	80.00
TR-250	UV-204A	30	18	20	2000	11	96.00

The following parts are supplied for these kits: frame neatly finished in black lacquer, two black dilled panels drilled and engraved, series antenna variable condenser, plate shunt condenser, grid shunt condenser, thermo coupled RF antenna current meter, DC plate milliampere, three Bakelite condenser knobs, vacuum tube socket, grid condenser, plate condenser, grid leak, two RF choke coils, rear binding post strip complete, three REL type "S" inductance units with clips and mounting brackets, screws and all necessary wire. Complete instruction booklet.



## SELF RECTIFIED T. P. T. G. TRANSMITTING KIT

CATALOGUE NO. 121

For those amateurs who do not desire to purchase a rectifier and filter system, REL has to offer the self-rectified T. P. T. G. kit. This is practically the same as the Cat. No. 139.

Two tubes of similar characteristics are employed. The transmitter will emit a rectified A. C. note equal to the average rectified set. The note is always pleasant and easily readable.

Additional parts which include one tube socket, one special double plate condenser and two RF chokes are supplied to complete this kit. (These are in excess of parts supplied with the standard Cat. No. 139 kits.)

The only remaining accessories necessary to place this transmitter in operation are the plate and filament transformers. These may vary in frequency from 60 to 500 cycles. (Transformer prices furnished upon request.)

### CATALOGUE NO. 121 KIT PRICES

TR-5—\$75.00

TR-50 }  
TR-65 } \$87.00  
TR-75 }

TR-250—\$115.00



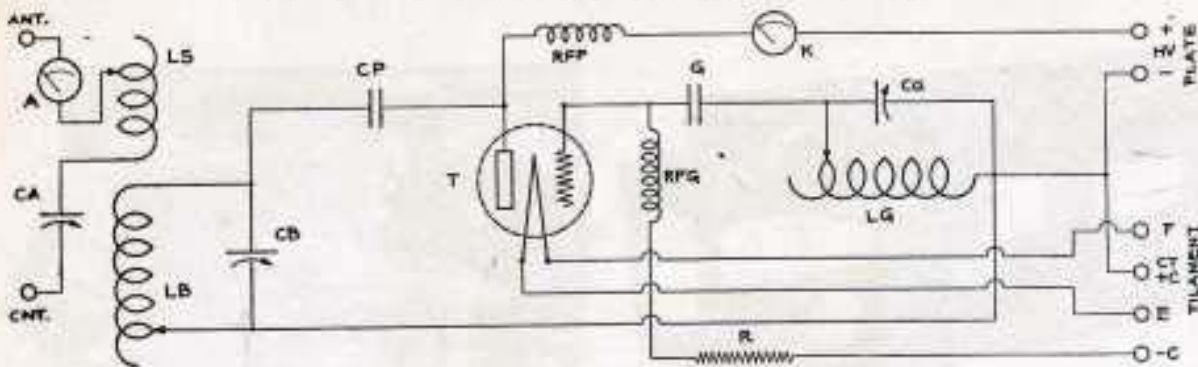
## RADIO ENGINEERING LABORATORIES

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## CIRCUIT DATA ON TUNED PLATE TUNED GRID TRANSMITTER USING CAT. NO. 139 KITS



### CIRCUIT SPECIFICATIONS

LS—REL Type "S" Inductance  
 LB—REL Type "S" Inductance  
 LG—REL Type "S" Inductance  
 CA—REL Series Variable Condenser .0002 mfd.  
 CB—REL Plate Variable Condenser .0002 mfd.  
 CG—REL Grid Variable Condenser .0002 mfd.  
 A—Thermo RF Meter 0-1 to 0-5 amp.  
 HV—To high voltage

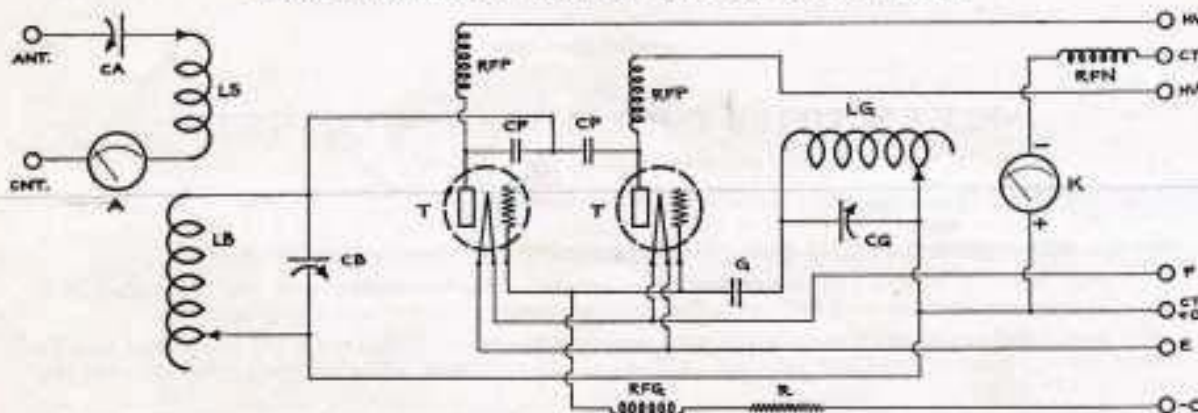
K—DC milliamperemeter 0-100 to 0-500 mls.  
 G—Grid Condensers .0002 mfd.  
 CP—Plate Condenser .002 mfd.  
 RFG—Grid REL RF Choke  
 RFP—Plate REL RF Choke  
 R—Grid Leak 5000 ohms  
 T—Transmitter Tube  
 F—To filament heating transformer  
 CT—To center tap on filament heating transformer  
 E—To filament heating transformer

A blueprint booklet supplied with each kit gives detailed data on assembly, wiring and operation.

In some cases it will be found advisable to eliminate the grid leak "R" and use a negative biasing battery. Better control will be had with such an arrangement. Whenever a "C" battery is used, leave out the grid leak and vice versa when a leak is used do not use "C" battery. For low powered sets use resistance only while for medium and high powered sets use "C" battery.



## CIRCUIT DATA ON SELF RECTIFIED T. P. T. G. TRANSMITTER USING CAT. NO. 121 KITS



### CIRCUIT SPECIFICATIONS

All circuit constants are identical to those given above with the following additions:

RFN—Negative High Voltage Lead REL RF Choke Coil  
 CP—Two plate condensers .0001 mfd. each or one REL (Cat. 150—Type R) special Duplex condenser. This condenser is furnished with all self-rectified kits employing over 1000 volts for plate potential.



## RADIO ENGINEERING LABORATORIES

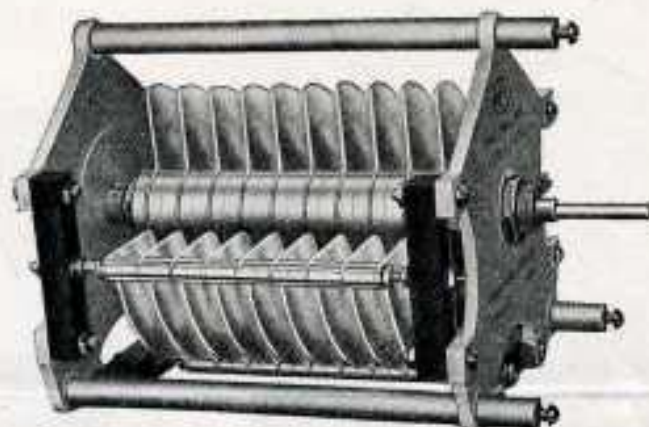
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LONG ISLAND CITY, N. Y., U. S. A.



## TRANSMITTING VARIABLE CONDENSERS

CATALOGUE NO. 149



These condensers are primarily designed for uses in transmitting circuits varying power from 100 to 2,000 watts. They will be found well suited for precision measurements in Laboratory work and numerous other places where condensers of low power factor, low dielectric losses and high potential break down are essential.

**MECHANICAL.** The plates are of heavy brass (about 1/16" thick) widely separated by accurately turned spacers and firmly clamped between substantial cast aluminum end plates. The edges and corners of the plates are carefully rounded thus minimizing brush discharge. All effective parts are buffed so as to assure absolutely polished surfaces and edges.

A steel shaft carrying the rotating plates, turns in cone shaped adjustable bearings. The adjustment is locked after the condenser has been subjected to a rotation test to insure the proper wearing in of the cone bearings. This is practically the only type of bearing that can compensate for wear. The shaft diameter in the bearings is 3/8". It is of one piece projecting thru each bearing. One end is turned down to 1/4" to take care of any standard knob. The other is 3/8" diameter and projects far enough to allow coupling to another condenser for tandem operation.

The weight of these condensers has been kept exceptionally low so that they may be mounted directly on rear of transmitter panels without additional rear supports. However, the largest model will require supports. The overall panel space required is about 6 1/2" diameter. Drilling templates supplied with each condenser.

**ELECTRICAL.** The stator plate assembly is insulated from the rigid end-plates, carrying the rotor assembly by blocks of the best obtainable hard rubber. As these blocks are small in volume and placed in a weak, non-varying electro-static field, the condenser has a very low power factor. The actual contact between the stator plates and the insulating blocks is almost small enough to be negligible. These blocks are highly polished—therefore offering considerable safety against creepage losses between the stator terminal rods and the end plates.

The temperature coefficient of these condensers is practically nil, and there is no change in capacity with frequency. The breakdown potential of the various types is given below:

Type No.	Breakdown Voltage	Number of Plates	Max. Cap. Mmfd.	Plate Spacing Inches	Overall Depth Inches	Wt. Lbs.	Price
K	3,000	19	200	.250	6.750	4.0	\$17.50
L	3,000	33	350	.250	9.100	8.0	21.00
M	3,000	59	650	.250	13.620	12.5	29.00
N	5,000	11	60	.500	6.750	3.5	17.25
O	5,000	19	100	.500	9.100	7.0	20.00
P	5,000	33	180	.500	13.620	10.5	28.00
R	10,000	7	25	1.000	6.750	3.0	17.00
S	10,000	11	45	1.000	9.100	6.0	19.00
T	10,000	19	80	1.000	13.620	9.5	27.00

NOTE: Three metal stand off bushings supplied with each condenser for back panel mounting. Insulation bushings can be supplied for condensers which are to be mounted on metal panels. Additional charges 50 cents per condenser.



RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## VARIABLE CONDENSERS

FOR HIGH FREQUENCY RECEIVERS AND LOW POWER TRANSMITTERS

The new line of REL variable condensers specially designed for high frequency (short waves) receivers and low power transmitters is radically different from the average type of condensers which are now offered for similar purposes. After careful investigation it was found that a condenser for tuning high frequency circuits can not be a redesigned or reduced large condenser but it must be of totally different construction.

There are three models of the new REL variable condensers which are shown below. Each of these models has the following outstanding features incorporated in their construction — heavy die cast aluminum end support with wide spread three point mounting arrangement. This mounting scheme assures condenser rigidity, especially when mounted on thin metal panels. This super foundation creates a substantial support for the balance of the condenser. — The condensers are supplied with insulated stand-off bushings allowing these units to be mounted on metal panels without grounding either the stator or rotor plates. — The rotor shaft revolves in a uniquely designed bearing which is of conical construction on both ends, thus assuring against any end thrust or side play of the rotor plates. A special spring is provided by means of which any degree of revolving tension may be supplied on the rotor. — A new patented rotor plate contact which insures absolute frictionless and noiseless connection to the rotor plates is employed. The rotor shaft is continually immersed in a pool of mercury which insures positive contact. This feature is highly important for receivers which operate on a very high frequency band because the difficulties usually encountered with other types of condensers are completely eliminated. The usual mechanical friction noises are not obtained with the REL positive contact shaft bearing. Both the stator and rotor plates are of heavy brass, thus preventing capacity changes due to plate vibration. Particular care has been taken to secure a positive bonding contact between the plates of each section. The plates are widely spaced so as to further insure the permanency. Each one of the types listed below which employs a single plate condenser for the vernier adjustment can be so controlled that the maximum capacity of this vernier unit may be varied to suit the particular requirements so that a definite frequency band may be spread over the entire tuning dial of the single plate vernier. Each of the condensers listed below with the exception of the Cat. No. 229 type is equipped with standard  $\frac{1}{4}$ " diameter shaft which will take any type of present day knob or dial. The panel mounting space required for these condensers is  $4\frac{1}{4}$ " x  $4\frac{1}{4}$ ". The total depth varies with the different sizes specified. These condensers will be found useful in spreading the narrow congested bands when used in either receivers or transmitters.



The above illustration shows a single plate Cat. No. 181A condenser. The other models listed under Cat. No. 181 are similar to this except that there are more stator and rotor plates.



The above illustration shows the Cat. No. 187F condenser which is a combined, large capacity semi variable condenser shunted by a single plate small capacity variable condenser. The uses for this type are obvious. The idea is to spread narrow bands over the entire condenser tuning dial scale.



The above illustration shows a combination tank and single plate condenser with vernier control dial mounted on the small condenser. This illustration shows Cat. No. 229-F.



### STANDARD TYPE—CAT. 181

The Cat. No. 181 standard type condensers may in all respects be compared with the average present day single unit variable condenser with a movable element which equally varies the capacity through its complete rotation.

The following is a list of the standard types which may be secured:

Cat. No. 181-A comprises one stator and one rotor plate; the stator plate is movable so that any maximum capacity may be secured by simply varying the distance between the stator and rotor plates; when the spacing is  $\frac{1}{4}$ " between plates the capacity is 17 mmfd.; break down voltages at  $\frac{1}{4}$ " spacing, 2000 volts.....Price \$4.40

Cat. No. 181B comprises four stator and three rotor plates; spacing between stator plates  $\frac{1}{4}$ "; maximum capacity 115 mmfd.; break down voltage 1000 volts .....Price \$4.25

Cat. No. 181C comprises seven stator and six rotor plates; spacing between stator plates  $\frac{1}{4}$ "; maximum capacity 190 mmfd.; break down voltage 2000 volts.....Price \$4.50

Cat. No. 181D comprises seven stator and six rotor plates; spacing between stator plates  $\frac{1}{2}$ "; maximum capacity 210 mmfd.; break down voltage 1000 volts.....Price \$4.50

### COMBINED TANK AND VERNIER TYPE—CAT. 187

The Cat. No. 187 combined tank and vernier type condensers will be found useful in many modern high frequency circuits. The large semi-variable capacity is rotated by means of a bakelite disc. This disc may be notched so that the locking device supplied will fit these notches. In this manner it will be easy to always return the large capacity to a setting previously employed. The small vernier single plate condenser is used to obtain full spread tuning of each band.

Cat. No. 187E comprises the Cat. No. 181B condenser combined with a single rotor and single stator vernier control. The tank condenser has a maximum capacity of 115 mmfd.; employs  $\frac{1}{4}$ " spacing between stator plates; break down voltage 1000 volts.....Price \$6.25

Cat. No. 187F comprises the Cat. No. 181C condenser combined with a single rotor and single stator vernier control. The tank has a maximum capacity of 190 mmfd.; employs  $\frac{1}{4}$ " spacing between stator plates; break down voltage 2000 volts.....Price \$6.50

Cat. No. 187G comprises the Cat. No. 181D condenser combined with a single rotor and single stator vernier control. The tank condenser has a maximum capacity of 210 mmfd.; employs  $\frac{1}{2}$ " spacing between stator plates; break down voltage 1000 volts.....Price \$6.50

### TYPES WITH VERNIER DIAL CONTROL CAT. NO. 229

The Cat. No. 229 condensers are exactly the same as either the Cat. No. 181 or the Cat. No. 187 types, except that they are fitted with a vernier control dial pointer and etched scale. The vernier control is obtained by friction and has a ratio of approximately 6 to 1. The control is secured by having a small soft rubber disc turn a large hard bakelite disc. This type of friction is noiseless. For high frequency receivers it is absolutely necessary to eliminate metallic rubbing contacts which create noise. The following is a list of the vernier equipped condensers which are regularly carried in stock:

Cat. No. 229-A same as Cat. No. 181-A.....Price \$5.50

Cat. No. 229-B same as Cat. No. 181-B.....Price \$5.75

Cat. No. 229-C same as Cat. No. 181-C.....Price \$6.00

Cat. No. 229-D same as Cat. No. 181-D.....Price \$6.00

Cat. No. 229-E same as Cat. No. 187-E.....Price \$7.75

Cat. No. 229-F same as Cat. No. 187-F.....Price \$8.00

Cat. No. 229-G same as Cat. No. 187-G.....Price \$8.00

## RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## PRECISION WAVEMETERS

### CATALOGUE NO. 142—TYPES "B" AND "C"



These wavemeters are designed to provide accurate instruments for laboratory work; for calibration of transmitting and receiving sets; and for all measurements which require utmost precision. They are supplied in two ranges:

Type "B" ..... 10-100 Meters (30000—3000 Kilocycles)  
 Type "C" ..... 100-600 Meters ( 300—500 Kilocycles)

**MECHANICAL.** The condenser is ruggedly constructed of low loss design. The plates are so shaped that a straight line wavelength curve will result. All parts are securely fastened to a heavy dulled bakelite panel. Geared Vernier indicating dial is locked to condenser shaft. The micrometer index is cemented in position. This definitely sets these two parts so that there will never occur any variations when once calibrated.

The coils are wound in threaded and slotted bakelite tubes. The wire is specially treated thus always keeping it in its original position. The plug connectors are heavily plated brass rods which fasten directly into the posts provided.

**ELECTRICAL.** The actual effective wavemeter circuit consists of only the coil and the condenser. This circuit is wired with heavy copper strip. Coil and condenser losses are at a minimum. This means low decrement resulting in extremely sharp tuning.

The indicating circuit is independent of the calibrated oscillating circuit. It consists of a small pickup coil in series with a crystal rectifier and a Weston direct current milliamper meter. This type of resonance indicating is more critical and sensitive than the method which employs a thermo galvanometer. The United States Bureau of Standards has recently indicated the superiority of this type of indicator.

A great advantage gained by this method is, that should the milliamper meter be damaged or burnt out, it could be replaced by another without any altering of the original calibration.

**SCALES AND CALIBRATION.** The rotating scale is provided with a special micrometer index. Each division on the large scale can be easily read in ten equal parts. This means that the large scale can be read to an accuracy of 1000 divisions.

Each wavemeter is calibrated against a standard Piezo Oscillator employing the various harmonics of the Quartz Crystal used. Absolute zero beat is used for determining each point. Furthermore a visible check is also had by means of a remotely located beat frequency oscillator. Calibration curves are furnished for each coil. These are plotted on large sheets allowing fine readings. Two blueprint copies of each chart are furnished thus enabling the user to file away the original. The calibrations supplied are accurate to .2 percent.

**MOUNTING.** The complete wavemeter is enclosed in a walnut case which has a removable cover. Provisions are made in the cover for holding the two wavemeter coils, the pick-up coil and the extension handle.

**CASE DIMENSIONS.** 9" high x 7½" wide x 10" long—**WEIGHT,** 3½ pounds.

Cat. No. 142 Type "B" 10 to 100 Meters ..... Price \$65.00

Cat. No. 142 Type "C" 100 to 600 Meters ..... Price \$65.00

Frequency Calibration charts can be furnished at \$5.00 extra for each meter.

## RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## TRANSMITTING TUBE SOCKETS



CATALOGUE-122

**UX BASE SOCKET** for all tubes with standard Navy bases or with UX bases. Ideal for all low power tubes.

Moulded Bakelite shell with one piece bronze bayonet spring prongs.

Cat. No. 122

Price 35 Cents



CATALOGUE-131

**50 WATT SOCKETS** for RCA UV-203A tubes; for RCA UV-217A rectifier tubes; for WE 211D tubes; for new De Forest 150-watt tube type "R."

Heavy high polished "Radion" base. All connections plainly engraved. Designed to minimize losses due to faulty insulation. Spring bayonet prongs insure positive contact. Low capacity between prongs. Ideal for short waves. Provided with heavy solder lugs which make direct contact with prongs.

Cat. No. 131

Price \$2.00 Each



CATALOGUE-148

**DE FOREST "H" TUBE HOLDER** for "H" tubes and "HR" rectifiers. So built that it can be efficiently employed with this ultra short wave tube.

Heavy "Radion" base, neatly engraved to show proper connections. Spring clamps rigidly hold tube in any position. Binding posts provided to take care of tube lead wires.

Cat. No. 148

Price \$2.00 Each



CATALOGUE-129

**UX-852 TUBE HOLDER.** This holder is expressively designed for this very popular tube.

Heavy "Radion" base with engraved terminals. Polished hard rubber pillars for grid and plate leads from tube. These wires are quickly fastened to bronze spring clips. The filament contacts plug into rigid prongs. The tube is tightly held in position. There is no chance of vibration.

Grid and plate condensers may be secured directly to the upright insulating pillars, thereby insuring short and direct connections to other parts in the transmitter.

Cat. No. 129

Price \$2.50 Each



CATALOGUE-128

**250 WATT TUBE END MOUNTINGS** for RCA UX-204A tubes; for RCA one K.W. UV-851 tubes; for De Forest "P" tubes.

Furnished only in pairs. One end mounting takes care of grid and filaments and other end mounting taking care of the plate connection. Heavy spring contacts throughout. Mounted on polished bases.

Distance between bases for 250 watt tubes 12 $\frac{1}{2}$ ". Distance between bases for 1000 watt tubes 15 $\frac{1}{2}$ ". These are inside dimensions.

Cat. No. 128

Price \$4.00 per Pair



## RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## TRANSMITTING TUBE SOCKETS



Cat. No. 122 Size—1-1/2" diameter, 3/4" high.

**UX Base Sockets** for all tubes fitted with the standard UX base type prongs. Ideal for all low power tubes.

Moulded Bakelite shell with one piece bronze bayonet spring prongs.

Cat. No. 122 UX.....Price \$0.35

**UY Base Sockets** for all tubes fitted with standard UY base type prongs. Ideal for all AC type tubes.

Moulded Bakelite shell with one piece bronze bayonet spring prongs.

Cat. No. 122 UY.....Price \$0.40



Cat. No. 131 Size—3 3/4" diameter, 1 3/4" high.

**50 Watt Sockets** for types-03A, -11, -45 and -72 tubes; for W. E. type-11 tubes, and for complete line of new De Forest 50 watt type tubes. Heavy high polish insulating base. All connections plainly engraved. Designed to minimize losses due to faulty insulation. Spring bayonet prongs insure positive contact. Low capacity between prongs. Ideal for short wave. Provided with heavy solder lugs which make direct contact with prongs.

Cat. No. 131.....Price \$2.00

**W. E.-212D.-250 Watt Tube Socket.** Similar in all respects to the REL Cat. No. 131 50 watt socket outlined above.

Cat. No. 251.....Price \$9.00



Cat. No. 129 Size—4 1/2" diameter, 4 1/2" base, 7" high.

**Type-52 Tube Holder.** This holder has been designed to be used with this very popular amateur short wave tube. It is adapted for use with type-52 and type-60 tubes. These are of the 75 watt type either with or without screen grid. When ordering for type-60 tube specify.

Heavy insulated base with engraved terminals. Polished hard rubber pillars for connecting grid and plate leads from tube. Fahnstock clips are provided for grid and plate lead connections. Filament contacts plug into rigid bayonet prongs, insuring positive contact. The tube is tightly held in position.

The ideal tube mounting for the ultra short wave transmitter.

Cat. No. 129.....Price \$2.50



Cat. No. 128 Size—Plate end size: base 4" x 2" x 1 1/2" high. Grid end Size: base 4" x 2" x 1 1/2" high.

**250 Watt Tube End Mountings** for type-04A, -49 and -41 tubes. Also adaptable to all new De Forest tubes of similar construction.

Furnished only in pairs. One end mounting takes care of the grid and filament and the other end mounting takes care of the plate connection. Heavy spring contact throughout. Mounted on polished insulating bases.

Distance between bases for 250 watt tubes, 12 3/4". Distance between bases for 1,000 watt tubes, 15 3/4". These are inside dimensions.

Cat. No. 128.....Price \$4.00 per pair

**RADIO ENGINEERING LABORATORIES, Inc.**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## TRANSMITTING FIXED CONDENSERS

CATALOGUE NO. 150



TYPES K & T



TYPE H



TYPE T



TYPE A



TYPES B-C-D

Good fixed condensers of various capacities are a necessity in every type of transmitter circuit. REL is ready to supply these for all types of tubes. These can be employed as grid condensers; plate blocking condensers; inter stage coupling condensers; by-pass condensers, etc.

Different types and sizes illustrated here will be found suited for use with the present popular tubes.

**TYPE K FOR LOW POWERED TRANSMITTERS**, using the various types of UX base tubes such as the 199, 201-A, 112 and 210. Suitable for circuits where plate voltages are less than 1000. A small condenser which easily lends itself to simple forms of mounting. Supplied in the following capacities:

.0001	.00025	.0005	Price 40 Cents Each
.001	.002	.005	Price 50 Cents Each

**TYPE T FOR MEDIUM POWERED TRANSMITTERS** using the 50 watt RCA 203-A tubes; 65 watt De Forest "H" tubes; 75 watt RCA UX-852 tubes and 150 watt De Forest tubes, and all others employing less than 3000 volts on the plates. Supplied in the following capacities:

.0002	.001	.002	Price \$1.75 Each
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**TYPE H FOR HIGH POWERED TRANSMITTERS** employing 250 watt to 2000 watt tubes with plate voltages under 5000. Mounted in aluminum cases which can be used as shields and grounded. Special insulating pillars insure absolute safety in making connections. Supplied in the following capacities:

.0001	.001	.002	Price \$7.50 Each
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**TYPE R DUPLEX DESIGN FOR SELF-RECTIFIED CIRCUITS.** A special new design of fixed condenser to be used in plate or grid circuits of self-rectified or push pull transmitters for voltages up to 3000. Actually two condensers in one with two outside posts and one common or center post. Supplied in two sizes which are correct for short wave operation.

30-0-30 mmfd. and 100-0-100 mmfd.	Price \$6.50 Each
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(Prices on special designs furnished upon application.)

## TRANSMITTING FILTER CONDENSERS

CATALOGUE NO. 123

Every type of power supply with the possible exception of that derived from batteries, must be properly filtered. The nearer a pure, clean D. C. supply is had the better and clearer will the note of the transmitter be. An adequate filter system comprising of correct values, chokes and condensers can be easily built.

REL filter condensers are available for all transmitters. Selections can be made from the following listings:

TYPE A	Operating Voltage 450	D. C. capacity 2 mfd.	Price \$ 1.30
TYPE B	Operating Voltage 1000	D. C. capacity 2 mfd.	Price \$ 2.90
TYPE C	Operating Voltage 2000	D. C. capacity 1 mfd.	Price \$ 3.10
TYPE D	Operating Voltage 2000	D. C. capacity 2 mfd.	Price \$ 5.50
TYPE E	Operating Voltage 3800	D. C. capacity 1 mfd.	Price \$10.50
TYPE F	Operating Voltage 6500	D. C. capacity 1 mfd.	Price \$30.00

Prices on special designs with operating voltages up to 14,000 furnished upon application.

RADIO ENGINEERING LABORATORIES

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## TRANSMITTING FIXED CONDENSERS

### CAT. 150-K—FOR LOW POWER TRANSMITTERS



Cat. No. 150 types K and T.  
Size 3/4" long, 1/2" thick.

The REL Cat. No. 150 "K" type fixed condensers may be used in low power transmitter circuits which employ the UX base type tubes such as the -99, -01-A, -15-A, -10 and -50 type tubes. Suitable for all circuits where voltages are less than 1,000. Ideal for grid condensers, plate blocking condensers, interstage coupling condensers, filament bypass condensers, etc. Completely sealed in Bakelite cases. A small condenser which easily lends itself to simple forms of mounting. Available in the following capacities:

.0001—.00025—.0005	Price \$6.40 each
.001—.002	Price \$8.50 each
.005	Price \$0.75 each
.01	Price \$1.10 each

The REL Cat. No. 150 "T" type fixed condensers may be used in high power transmitter circuits which employ 50, 75 or 250 watt type of tubes. Suitable for all circuits where voltages are less than 5,000. Completely sealed in Bakelite cases. A small condenser which easily lends itself to simple forms of mounting. Available in the following capacities:

.0001—.0002—.0005—.001—.002.....	Price \$2.00 each
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When ordering Cat. No. 150 condensers either of the "K" or the "T" type be sure to specify the capacity required.



Cat. No. 123 types G, H, J  
and A. Sizes 1 3/4" x 3".  
Thickness varies with capacity.

### CAT. 150-T—FOR HIGH POWER TRANSMITTERS

Radio Engineering Laboratories can supply fixed condensers having larger current carrying capacity or capable of working at greater voltages. These condensers are made up of multiple units employing several Cat. No. 250 type "T" condensers. This is similar to construction employed by the U. S. Navy. By this arrangement any capacity can be secured. Prices and specifications furnished upon request.

### CAT. 123—LOW VOLTAGE FILTER CONDENSERS

The REL Cat. No. 123 low voltage filter condensers are designed to be used either as bypass condensers in receivers or as filter condensers in AC or DC plate supply units. Rugged moisture proof construction throughout. These condensers are rated at the following DC operating voltages. They will be guaranteed only if used on the voltages specified.

Cat. No. 123-G .5 mfd. 250 volt DC.....	Price \$6.75
Cat. No. 123-H 1. mfd. 250 volt DC.....	Price \$8.50
Cat. No. 123-J 1. mfd. 450 volt DC.....	Price \$1.25
Cat. No. 123-A 2. mfd. 450 volt DC.....	Price \$1.75



Cat. No. 123 types K, B, C and  
D. Sizes furnished upon request.

### CAT. 123—HIGH VOLTAGE FILTER CONDENSERS

The REL Cat. No. 123 high voltage filter condensers are designed to be used in transmitter circuits of medium and high power. They may be employed as filter condensers in plate supply circuits, as coupling condensers in modulator units, as resistance bypass condensers in 100 per cent modulation systems, etc.

They are guaranteed to operate at the DC voltages specified below. If these voltages are exceeded the condensers cannot be guaranteed.

Cat. No. 123-K 1 mfd. 450 volts DC.....	Price \$3.50
Cat. No. 123-B 2 mfd. 450 volts DC.....	Price \$5.00
Cat. No. 123-C 1 mfd. 1,500 volts DC.....	Price \$4.50
Cat. No. 123-D 2 mfd. 1,500 volts DC.....	Price \$5.50
Cat. No. 123-L 2 mfd. 2,500 volts DC.....	Price \$13.50
Cat. No. 123-M 2 mfd. 3,500 volts DC.....	Price \$32.50

**RADIO ENGINEERING LABORATORIES, INC.**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## POWER SUPPLY UNIT

CATALOGUE NO. NOW DESIGNED FOR

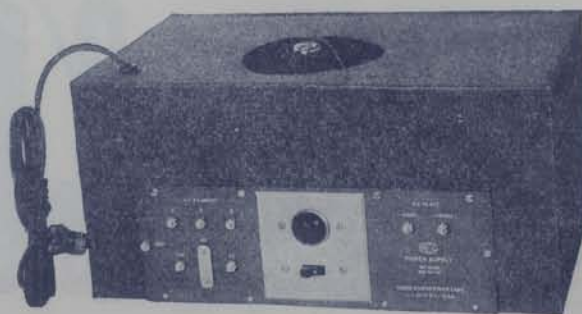
RCA UX-866 TUBE

**GENERAL SPECIFICATIONS:**—A complete power unit for medium power transmitters using either telephone or telegraph. Ready to place into immediate operation. Can be connected to any ordinary electric light outlet furnishing 105 to 125 volts—50 to 60 cycles—single phase—alternating current.

This new REL unit delivers sufficient direct current plate and alternating current filament power for transmitters employing one or two UX-852, 75 watt tubes; one UV-204A, 250 watt tube or any tube or number of tubes having similar characteristics.

One standard UX-852 tube is employed in a half wave rectifier circuit.

Parts of the highest quality, together with skilled workmanship, make this power unit a welcomed necessity in every station. Also a very useful addition to any Laboratory for general testing purposes.



Complete Power Supply for Medium Power Sets

**ELECTRICAL:**—This unit is conservatively rated at the following figures:

Direct Current	} 2000 volts at
Plate Supply	
Alternating Current	} 10 volts at 80 watts (8 amperes)
Filament Supply	
	} Accurately center tapped

Operates continuously at these ratings. Will operate on 50% overloads for short periods—separate plate and filament transformers of liberal design—employs 2 mfd. 2500 volt filter condensers—provisions for regulating plate and filament voltages—completely shielded.

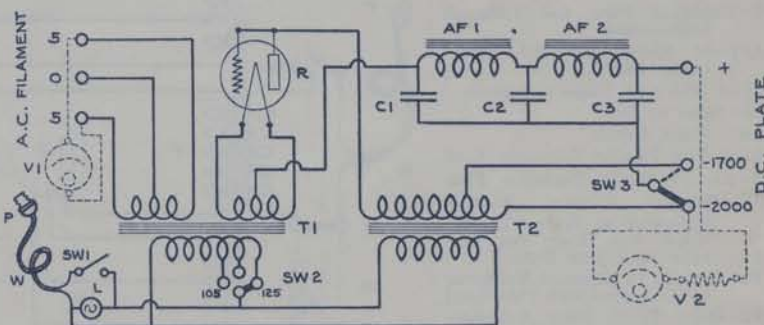
Meters have purposely been omitted in order to keep a low price. Their use is optional. A. C. filament voltmeter and D. C. plate voltmeter may be connected externally as shown in the circuit below. In most transmitters the filament voltmeter is already mounted in the set. The D. C. plate voltmeter may easily be dispensed with.

**MECHANICAL:**—Ruggedly built unit housed in heavy metal case which is finished in black crystalline lacquer—centralized plainly designated terminal post strip—main line toggle switch with “bull’s eye” pilot light—eight feet connector cord and plug—all parts securely bolted to five ply vernier baseboard—heavy rubber covered wiring throughout.

**CIRCUIT DATA:**—The diagram below, with accompanying explanations, illustrates the parts built into this well designed power unit. A brief summary clearly shows the values of the parts and the reasonable price of this completely wired and tested apparatus.

- R—UX-852 Tube Holder
- T1—Filament Transformer, Two Secondary Windings with Tapped Primary for Voltage Regulation
- T2—Plate Transformer with Tapped Secondary for Voltage Regulation
- AF1—30 Henry, 350 Mil Filter Choke Coil
- AF2—Same as AF1
- C1—2 Mfd. 2500 Volt Filter Condenser
- C2—Same as C1
- C3—Same as C1
- SW1—Toggle Switch
- SW2—Filament Voltage Regulating Switch
- SW3—Plate Voltage Regulating Switch
- L—Pilot Lamp for Indicating “Current On”
- W—8 Feet Parallel Connector Cord
- P—Electric Outlet Connector Plug
- V1—0-15 A. C. Filament Voltmeter, (Not Supplied with Unit)
- V2—0-2000 D. C. Plate Voltmeter & Resistor (Not Supplied with Unit)

Net Weight: 70 Pounds



Wiring Diagram of Cat. 172 Unit

Dimensions: 20" x 9½" Front x 13" Deep

**PRICE \$85.00**

Does Not Include UX-852 Tube



**RADIO ENGINEERING LABORATORIES**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## POWER SUPPLY UNIT

CATALOGUE NO. 185

**GENERAL SPECIFICATIONS:**— A complete power supply unit for low power transmitters using either telephone or telegraph. Ready to place into immediate operation. Can be connected to any ordinary electric light outlet furnishing 105 to 125 volts—50 to 60 cycles—single phase—alternating current.

This new REL unit delivers sufficient direct current plate and alternating current filament power for the transmitters employing one or two UX-210, 7½ watt tubes or any tube or number of tubes having similar characteristics.

One standard UX-281 tube is employed in a half wave rectifier circuit.

Parts of the highest quality, together with skilled workmanship, make this power unit a welcomed necessity in every station. Also a very useful addition to any Laboratory for general testing purposes. May also be used to supply power for large types of audio amplifiers.



Complete Power Supply for Low Power Sets

**ELECTRICAL:**—This unit is conservatively rated at the following figures:

Direct Current	}	400 volts at
Plate Supply		40 watts (100 mls)
Alternating Current	}	7½ volts at 2½ amps.
Filament Supply		Accurately center tapped.

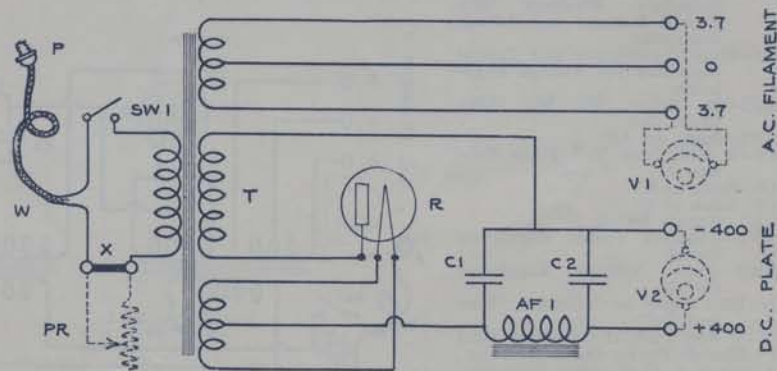
Operates continuously at these ratings. Will operate on 20% overloads for short periods—combined plate and filament transformer of liberal design—employs 2 mfd. 1500 volt filter condensers—provisions for adding external primary control resistance—completely shielded.

Meters have purposely been omitted in order to keep a low price. Their use is optional. A. C. filament voltmeter and D. C. plate voltmeter may be connected externally as shown in the circuit below. In most transmitters the filament voltmeter is already mounted in the set. The D. C. plate voltmeter may easily be dispensed with.

**MECHANICAL:**—Ruggedly built unit housed in heavy metal case which is finished in black crystalline lacquer—centralized plainly designated terminal post strip—main line “on-off” snap switch—eight feet connector cord and plug—all parts securely bolted to five ply vernier baseboard—heavy rubber covered wiring throughout.

**CIRCUIT DATA:**—The diagram below, with accompanying explanations illustrates the parts built into this well designed power unit. A brief summary clearly shows the values of the parts and the reasonable price of this completely wired and tested apparatus.

- R—UX Tube Socket
- T—Combined Plate and Filament Transformer
- AF1—30 Henry 120 Mil. Filter Choke Coil
- C1—2 Mfd. 1500 Filter Condenser
- C2—Same as C1
- SW1—Snap Switch
- W—8 Feet Parallel Connector Cord
- P—Electric Outlet Connector Plug
- PR—External Primary Resistor  
Connected at Posts “X” Optional with User Not Supplied with This Unit
- V1—0-10 A. C. Filament Voltmeter (Not Supplied with This Unit)
- V2—0-500 D. C. Plate Voltmeter (Not Supplied with This Unit)



Wiring Diagram of Cat. 185 Unit

Net Weight: 20 Pounds

Dimensions: 12½" x 8" Front x 9" Deep

**PRICE \$38.00**

**Does Not Include UX-281 Tube**



### RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



# 10 WATT RADIO TELEPHONE & TELEGRAPH TRANSMITTER

CATALOGUE NO. 186

(Combined Transmitter and A. C. Power Supply Unit)



Front View



Rear View (Top and Rear Panels Removed)  
Showing Plug-In Coils

**GENERAL**—The REL Cat. No. 186 set is a complete, comparatively low power short wave radio telephone and telegraph transmitter designed for amateur and experimental purposes. The self-contained power unit makes this set ready for immediate use wherever 110 volts, 50 to 60 cycles, alternating current is available. Operates from any ordinary electric light socket at low cost.

The simplified instructions supplied with each set are easily grasped by the beginner. Details are given on the different types of antennae suitable for the various amateur bands. By means of the new REL vertical type plug-in coils, almost any wave band may be covered, thus making this a very flexible set. It is a simple matter to change from one amateur band to another. Special care has been given to the design of the inductances and the condensers used. These will, in all respects, be found admirably suited to the new narrow amateur wavelength or frequency channels which become effective January, 1929. Precision frequency settings on any of the bands will become a necessity. The amateurs will quickly realize how this is simply and efficiently accomplished with the REL Cat. No. 186 sets.

These sets are ideal for the typical amateurs who enjoy operating an efficient transmitter using straight C.W. telegraph or phone. The compactness and neatness of these sets makes them accessible to any place in the home without creating the usual "hay wire" appearance. They may be classed with the finest broadcast receiver models now securable.

**SPECIFICATIONS**—The complete transmitter and power supply unit are housed in one ruggedly constructed aluminum case, which is reinforced with cast aluminum end frame castings. All sheet aluminum panels are fastened with machine screws to these castings, thus allowing the quick removal of any side, back or top section, thereby giving accessibility to the interior.

The outside is finished in black crystal lacquer while the inside remains dull aluminum. The front panel is neatly engraved so as to designate the various controls. All jacks, switches and connecting posts are nickel plated. All variable condenser and rheostat dials are of polished black Bakelite.

The transmitter unit is located in the upper section and completely shielded from the power supply and filter unit which is in the lower compartment.

Total weight of set, including three plug-in coils, is 34 pounds.

Overall dimensions are 14½" x 13" front x 11½" deep.

**TRANSMITTER DATA**—Two UX-210 type tubes are employed, using the well known and highly efficient "Hartley Heising" circuit which is adaptable to either telephone or telegraph transmission. Jacks are provided for inserting the key and microphone so as to use either straight C.W. or phone operation. The shift from code to voice operation is automatically accomplished by means of the unique C.W. key jack used.

Variable condensers are supplied for tuning the primary and antenna circuits. These are of special design, so as to give vernier frequency adjustments in each amateur band. Three one-piece Bakelite form plug-in coils are furnished with each set. These cover the following ranges:

Coil No. 1—3500 to 4000 kilocycles (85.7 to 75 meters).

Coil No. 2—7000 to 8000 kilocycles (42.8 to 37.5 meters).

Coil No. 3—14000 to 16000 kilocycles (21.4 to 18.7 meters).

Frequency calibration charts are supplied for each coil so as to quickly facilitate accurate tuning.

Additional coils may be secured to cover other bands. These will be found listed on page 48 of the standard REL catalogue.

Various other parts, such as fixed condensers, radio frequency chokes, modulation transformers, filter chokes, etc., are of the finest material and workmanship. All apparatus employed is subjected to rigid tests thus insuring a high factor of safety throughout.

Cat. No. 186 Set, Including Three Plug-In Coils

PRICE \$150.00



**RADIO ENGINEERING LABORATORIES**

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## 10 WATT RADIO TELEPHONE &amp; TELEGRAPH TRANSMITTER

CATALOGUE NO. 186

(Combined Transmitter and A. C. Power Supply Unit)

**INSTALLATION**—The data furnished on this page gives an idea of the simplicity with which the Cat. No. 186 sets may be installed and operated. These instructions, altho not as complete as those furnished with each set, give sufficient information to anyone desiring to place these sets in operation.

**CIRCUIT DATA**—"L1" and "L2"  
—Special REL plug-in inductances of one piece design mounting vertically. Primary and secondary windings on same coil form.

C1—.0003 mfd. antenna series variable condenser.

C2—Special .00005 mfd. variable frequency control condenser. (This condenser works in shunt to a small air spaced tank condenser so as to always obtain some capacity across the coil.)

C3—.002 mfd. plate blocking condenser.

C4—.002 mfd. grid condenser.

C5—2 mfd. 1500 volt filter condensers.

C6—.002 mfd. filament bypass condensers.

R—5000 ohm grid resistance.

R1—20 ohm variable primary input voltage control resistance.

L—Antenna resonance indicator (3 miniature lamps are supplied with each set having the following ratings: One .23 ampere, one .35 ampere and one .8 ampere).

RF—Special slotted type radio frequency choke coil.

AF—Constant current audio frequency choke  $1\frac{1}{2}$  henry 150 mils.

AF2—Plate supply filter choke coil 30 henry 150 mils.

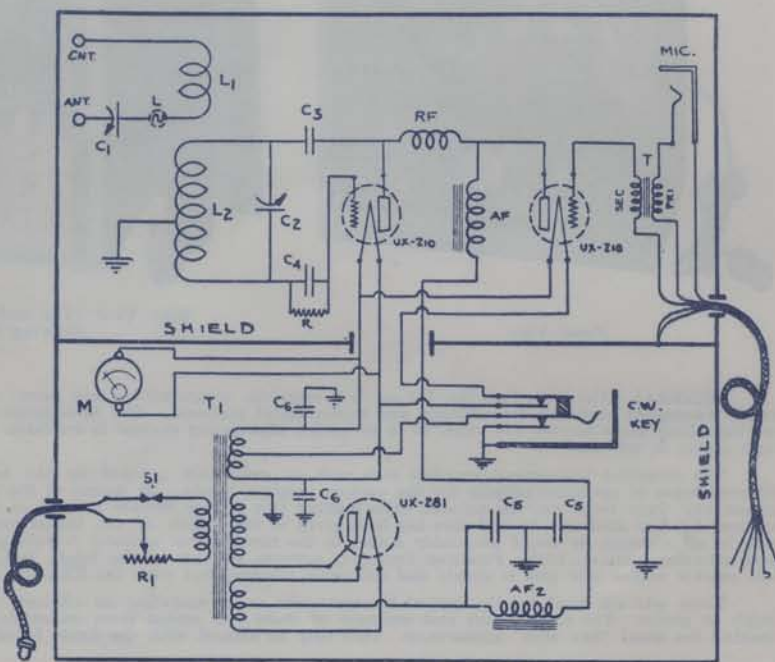
T—Power transformer designed to operate from 110 volt, 50 to 60 cycle power supply.

MIC—Microphone jack.

CW—Automatic jack for CW keying.

SI—Main line switch.

M—Jewell 0-10 AC voltmeter.



Wiring Diagram, Cat. No. 186 Sets

**OPERATING INSTRUCTIONS**—The Cat. No. 186 sets are regularly supplied with suitable coils for operation in the 20, 40 and 80 meter amateur wave bands. A suitable antenna system must be erected so that whichever wave band is employed, there will be some possibility of obtaining resonance. Assuming, therefore, that the correct antenna is ready and that the corresponding plug-in coil has been inserted, the set is now ready for operation.

Plug the connector wire into any ordinary light socket. Turn the primary control resistance "R1" so that all its resistance will be in the circuit. This will then cut down the input to the power transformer so that minimum plate and filament voltages will be applied to the transmitter. Next insert the UX-281 rectifier tube and one UX-210 tube. Place this latter tube in the oscillator socket. It is not necessary to install the modulator tube for preliminary testing. The main line switch is now turned on and if everything is satisfactory, the resistance "R1" is regulated so that the filament voltmeter indicates a reading of 7.5.

The frequency calibration chart which is supplied with each coil may be used in the setting of the wavelength or frequency control variable condenser. This is accurate enough for average uses. However, if a greater accuracy is desired, it will be necessary to tune the transmitter to a precision type of wavemeter.

The smallest antenna lamp is inserted in the antenna indicator socket and the antenna series variable condenser is rotated until a point is reached where the lamp begins glowing. If further adjustment of condenser "C1" very greatly increases the brilliancy of this lamp, it is advisable to replace it with one of the other larger types. The condenser "C1" is finally adjusted so that the antenna indicator lamp gives maximum brilliancy. Care must, however, be taken to check the stability of this adjustment. There may be a possibility that the circuit is tuned too "tightly" to the antenna circuit and if keying would be attempted the antenna lamp would not come up to the same original brilliancy. To further check this adjustment, insert the key plug into the jack marked "CW key" and note whether the antenna lamp always comes back to the same brilliancy when the key is down. If not, decrease the capacity of condenser "C1" slightly and check again with the key. A setting of "C1" will be found which will not be critical and still give maximum output.

The above data gave information for using CW telegraph for transmission. For telephone operation insert the modulator tube (UX-210) in its socket, remove the CW key plug and insert the microphone plug into the jack "MIC." It may here be necessary to slightly decrease the resistance of "R1" so that the filament voltmeter "M" again shows 7½ volts. A small 22½ volt "C" battery is connected to the cable leads. This is used as a negative biasing battery on the modulator tube. It will also be necessary to connect some source of 6 volt supply to the leads marked thus. This is used to energize the carbon microphone employed. This battery may be either a 6 volt storage battery or else four small 1½ volt dry cells connected in series. There is also another wire in the cable lead which connects to a ground. It will be noted that when the microphone is spoken into the antenna lamp will fluctuate with the voice. It should increase in brilliancy.

Due to the complete shielding of this radio equipment it will not be necessary to pay particular attention to its placement or location. It will never be affected by nearby metallic objects. It should, however, always be advantageously located to the antenna and counterpoise leads.

RADIO ENGINEERING LABORATORIES

100 WILBUR AVENUE

LONG ISLAND CITY, N. Y., U. S. A.



## PORTABLE RADIO TELEPHONE &amp; TELEGRAPH UNITS

CATALOGUE NO. 135

(Combined Transmitter and Receiver)



Front View



Rear View (Rear Panel Removed), Showing Plug-In Coils and Battery Cable

**GENERAL**—The REL Cat. No. 135 sets are complete radio telephone and telegraph units, ruggedly and compactly designed for all portable and similar uses. The extreme lightness of these sets makes them adaptable to field work, airplanes, small boats, automobiles and home use.

A minimum number of controls greatly simplifies the operation and adjustments, thereby creating an ideal set for inexperienced persons. Necessary instructions regarding suitable antenna systems are supplied with each set, also full data is given regarding tuning and operating.

These units employ any of the standard UX base tubes. The power supply necessary depends upon the tubes used. It is preferable to employ batteries. This means that these sets may be operated anywhere and are not dependent on a separate form of electric supply.

**SPECIFICATIONS**—The complete transmitter and receiver are housed in one ruggedly constructed aluminum case. This is reinforced throughout by means of aluminum and castings. All sheet aluminum panels are screwed to these castings. These are easily removable thus giving free accessibility to the interior. A strong leather carrying handle is provided.

Inside of case is finished in dull aluminum while the outside is sprayed with black crystal lacquer. The front panel is neatly engraved to designate the various controls.

The transmitter unit is located in the upper section and completely shielded from the receiver, which is in the bottom compartment.

The total weight of the set including one set of coils, tubes and battery cable is 22 pounds. (For data on battery cases and other accessories see other side of this page.)

Overall dimensions are 16" x 12½" front panel x 9" deep.

**TRANSMITTER**—Two tubes are employed, using the efficient "Hartley Heising" circuit which is adaptable to either telephone or telegraph transmission. Jacks are provided for inserting the key and microphone so as to use either straight C.W. or phone operation. A main switch connects either the transmitter or receiver to the antenna and at the same time closes necessary battery contacts. This switch is the main control, because when in the "send" position the transmitter is ready; when in the "receive" position the receiver is ready, and when in the neutral position all circuits are open.

The frequency or wavelength control condenser is located internally. This can be set and locked at some predetermined wavelength. (If desired and so specified this can be done at our Laboratory involving no extra cost.) Special vertical transmitter plug-in coils are used. Each set is supplied with one regular type "G" coil covering a wavelength of 35 to 120 meters. Additional coils to cover other bands may be secured extra. (See reverse side for listings.)

Resonance with the antenna circuit is accomplished with a series variable condenser and indicated with a standard small flashlight lamp.

Using two UX-210 type tubes with about 350 to 410 volts plate supply and 7½ volts filament supply the following transmission ranges may be expected under favorable conditions:

Telephones 5 to 100 miles.

C.W., Telegraph 50 to 1000 miles.

Smaller tubes and lower battery supplies cover proportionally smaller distances.

**RECEIVER**—This employs two 261-A type tubes in a standard circuit. The same batteries used for the transmitter are also employed for the receiver except that the voltages have been reduced to correspond to the tubes used.

One standard vertical plug-in coil is furnished with each set to cover from 23.5 to 94 meters. Additional coils to cover other bands can be purchased extra. These are listed on the reverse page.

Operation of the receiver is simple. There are only two controls. One for varying the wavelength and the other for controlling the amplification. Special vernier dials are furnished for both of these controls.

Due to the complete shielding and other design features, this set will not be sensitive to local electrical circuits such as ignition systems of gasoline motors; electric motors; relays; automatic switches, etc. The reception at all times is clear and undisturbed, with the possible exception of atmospheric disturbances.

The receiving range of the set is almost unlimited, depending upon many varying conditions. It will always greatly exceed the ranges specified for the transmitter.

Cat. No. 135 Set, Including One "G" Coil, One "L" Coil and One Battery Cable

PRICE \$180.00



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LONG ISLAND CITY, N. Y., U. S. A.



## ACCESSORIES FOR CAT. NO. 135 SETS

(Also For Use With Cat. No. 186 Sets)

**FRONT COVER**—Constructed of reinforced sheet aluminum finished in black crystal lacquer.—Slips over front of set, being fastened with four wing nuts.—Fittings provided on inside to hold head phones, telegraph key and microphone. When mounted increases total width of set from 9 inches to 10½ inches.

Item No. 135A Front Cover—Price \$14.00.

**MICROPHONE**—Standard "Federal" hand microphone with cord and plug; of finest construction, having highly nickel plated metal parts; ribbed rubber handle and unique removable rubber mouthpiece. The best unit available at a reasonable price, for all general telephone transmission purposes.

Item No. 135B Microphone—Price \$10.00.

**TELEGRAPH KEY**—Heavily constructed of brass lacquered material. Mounted on insulating base and supplied with cord and plug.

Item No. 135C Key—Price \$5.00.

**HEADPHONES**—Standard set of "Branda" phones with cord and plug. These headsets are ruggedly built and suitable for all general purposes.

Item No. 135D Headphones—Price \$3.50.

### ADDITIONAL PLUG-IN COILS FOR TRANSMITTER—

Item No. 135E Coil 18.7 to 44.8 meters. Price \$3.50.  
Item No. 135F Coil 21.0 to 66.6 meters. Price 3.75.  
Item No. 135G Coil 35 to 120 meters. Price 4.00.  
Item No. 135H Coil 112 to 350 meters. Price 4.25.  
Item No. 135J Coil 320 to 720 meters. Price 9.00.

### ADDITIONAL PLUG-IN COILS FOR RECEIVER—

Item No. 135K Coil 19.5 to 45 meters. Price \$3.25.  
Item No. 135L Coil 33.5 to 94 meters. Price 3.25.  
Item No. 135M Coil 58 to 152 meters. Price 3.50.  
Item No. 135N Coil 147 to 300 meters. Price 3.80.  
Item No. 135P Coil 240 to 525 meters. Price 4.80.  
Item No. 135Q Coil 510 to 900 meters. Price 7.00.

Coils in cover other wavelength ranges can be supplied. Prices upon request.

**BATTERY CASE (LIGHT PORTABLE)**—The REL Catalogue No. 153 Battery Case has been designed for uses requiring an extremely light and compact power supply such as field expeditionary work; airplanes and other similar enterprises. The battery, being extremely light, will not stand up for long periods of operation but will, in most cases, deliver sufficient power to conduct necessary communications.

This case is of strong construction employing ¼" wood veneer paneling. Interior compartments for holding batteries in place. Inside made moisture proof in dull black lacquer. A strong carrying handle is supplied. Hinged cover allowing quick replacement of all batteries. Complete battery wiring diagram supplied.

The following batteries are required to correctly fill this case:

15—2½-Volt Batteries (Equal in size to "Eveready" No. 768 type).  
6—1½-Volt Batteries (Equal in size to "Red Seal" dry cells).

This combination of batteries will deliver to the set about 8 volts "A" filament supply; 325 volts "B" plate supply and 22 volts "C" grid battery. When two UX-210 type tubes are used in the transmitter and two UX-201A type tubes in the receiver, the average life of the "A," "B" and "C" batteries will be approximately 10 hours for transmission and 60 hours for reception.

Overall size—18½" x 11" front x 3½" deep.

Case Weight—9 pounds.

Weight of case fully loaded with batteries—42½ pounds.

Cat. No. 153 Battery Case only—Price \$28.00

**BATTERY CASE (HEAVY PORTABLE)**—The REL Cat. No. 160 Battery Cases are expressly designed for semi-portable purposes, where trucks or boats are available for transportation or for permanent installations where no electric supply or storage battery charging facilities are available.

Constructed of heavy wood with glued and screwed joints.—Hinged cover allows quick accessibility to all batteries. Inside completely waxed insuring moisture proof enclosure of all batteries. Outside finished in dull black lacquer. Skids mounted on bottom. Complete interior battery wiring diagram furnished.

The following batteries are required to correctly fill this case:

9—45-Volt Batteries (Equal in size to "Eveready" No. 770 type).  
1—22½-Volt Battery (Equal in size to "Eveready" No. 768 type).  
10—1½-Volt Batteries (Equal in size to "Red Seal" dry cells).

This combination of batteries will deliver to the set about 7½ watts "A" filament supply; 405 volts "B" plate supply and 22½ volts "C" grid battery.

When two UX-210 type tubes are used in the transmitter and two UX-201A type tubes in the receiver, the average life of the "B" and "C" batteries will be approximately 200 hours for transmission and about 1,050 hours for reception. The "A" batteries will last about 40 hours. It will, therefore, become necessary to change the "A" batteries several times before either the "B" or "C" have been used up.

Overall size—29" x 18½" front x 11" deep.

Case weight—42 pounds.

Weight of case fully loaded with batteries—172 pounds.

Cat. No. 160 Battery Case only—Price \$34.00.

**BATTERY CASE (PERMANENT TYPE)**—The REL Cat. No. 262 battery case has been mainly designed for permanent installations either on land or sea, where weight is not a deciding factor. An external storage battery must be used. Available means for charging this battery must either be on hand or nearby. Under all conditions, whenever charging facilities are available use a storage battery as it is always the "A" supply which lasts longest.

Constructed of heavy wood with glued and screwed joints. Hinged cover allows quick inspection or renewal of batteries. Inside of case made moisture proof thru wax covering. Outside finished dull black lacquer. Skids mounted on bottom may be used for securing to permanent base. Complete interior battery wiring diagram supplied.

The following batteries are required to correctly fill this case:

3—45-Volt Batteries (Equal in size to "Eveready" No. 770 type).  
1—22½-Volt Battery (Equal in size to "Eveready" No. 768 type).

Any 8 or 12 volt storage battery with a 60 to 100 ampere hour capacity may be used. This is located externally. Marked posts mounted on the battery case are provided to which the storage battery connections are made.

When two UX-210 type tubes are used in the transmitter and two UX-201A type tubes in the receiver, the average life of the "B" and "C" batteries will be approximately 200 hours for transmission and about 1,050 hours for reception. The storage battery supplying the filaments lasts about 50 hours. When this runs down it can be readily recharged.

Overall size—29½" x 14¾" top x 8¾" deep.

Case Weight—54 pounds.

Weight of case loaded with "B" and "C" batteries—146 pounds.

Approximate weight of suitable storage battery—68 pounds.

Cat. No. 262 Battery Case Only—Price \$37.00



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REL

RE

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A. A. HUBERT, President  
 R. B. SWANSON, Secretary

## THE AMERICAN RADIO RELAY LEAGUE

MEMBER OF THE NATIONAL ASSOCIATION OF BUSINESS MEN

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 HARTFORD, CONNECTICUT, U. S. A.

CLASS OFFICE  
 OFFICE OF THE SECRETARY  
 OFFICIAL GUEST OMNIBUS  
 HARTFORD, CONNECTICUT, U. S. A.

Dear Fellow Amateur:

Of course you've heard of the American Radio Relay League--but do you realize that it is made up of amateurs just like you and that you are eligible to membership?

It's true--the A.R.R.L. is made up of YOUR KIND of radio amateurs: some of them are "brass-pounders, some experimenters, some students, but all possessed of the keen interest in radio that marks the American and Canadian amateur. Thousands of your fellow "bugs" have combined to form a continent-wide co-operative organization of, by and for the amateur. You can be a member too, as the only requirement for admission is a BONA-FIDE INTEREST in amateur radio.

When you join the League you throw your weight to the side of organized good government in amateur affairs, and you become a member of the only national amateur society that "does things". The A.R.R.L. represents the interests of the amateurs in legislative and regulatory affairs, it conducts a headquarters information service for their benefit, it publishes a magazine that monthly brings the latest and best radio news and developments to the home of each member, and--most interesting and perhaps most important of all--it conducts organized communication between the stations of the members and runs practical operating tests and relays and stunts that are the joy of every radio amateur. It's worth joining the League to get the A.R.R.L. magazine alone. You know it--"QST", the premier amateur magazine, the oldest one in the world, published exclusively by and for the amateur.

We shall gladly send you a little booklet called "The Story of the A.R.R.L." or if you've already seen enough to make you want to be a member, just write a letter of application and enclose \$2.50 to cover one year's dues and we will take care of you. That entitles you to a subscription to "QST" during your membership, too.

Ev, OM?

Sincerely yours,

*R. Swanson*  
 Secretary-Editor.

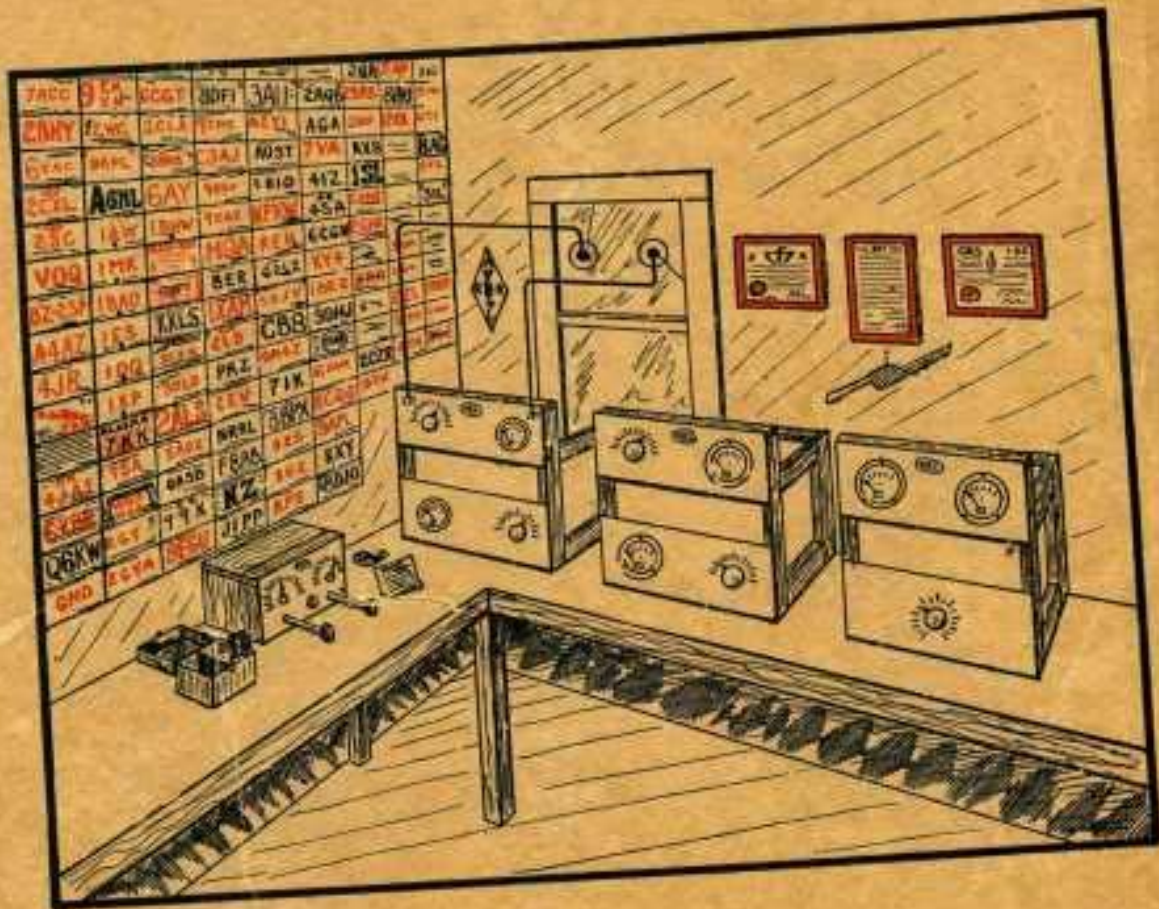
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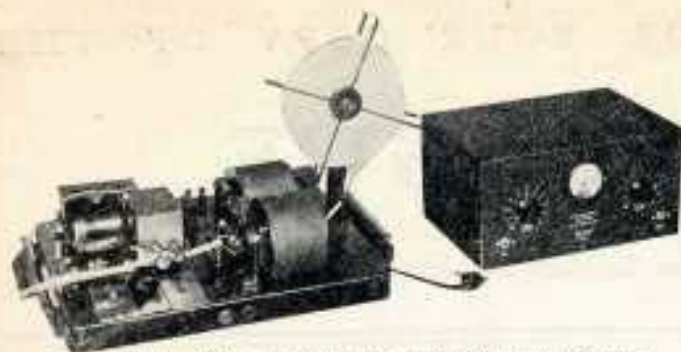
# QUALITY **REL** PRODUCTS



A Typical Amateur Station equipped with REL Short Wave Apparatus. The transmitter illustrated comprises one 7½ watt Crystal Oscillator, one 7½ watt Amplifier and one 50 watt Amplifier. The receiver is made up from the parts supplied with the No. 130 kit. On the extreme left is the REL Type "A" Wavemeter.

## APPARATUS THAT YOU WILL EVENTUALLY USE





Vacuum Tube Relay with Automatic Sight Recording Apparatus. Can be connected after the output of any receiver having one stage of audio frequency amplification. Will faithfully record up to 122 words per minute.



Short Wave Super-Heterodyne Receiver. Wavelength, 12 to 204 meters. REL Plug-in coils. Special variable condensers and verniers, intermediate frequency transformers, tuned filter transformers, etc.



1000 Watt Master Oscillator Power Amplifier C. W. Radio Telephone Transmitter. Wavelength, 250 meters; height, 6 1/2 feet. REL inductances, variable and fixed condensers, R. F. choke coils, tube sockets, aluminum cast frames, etc.

All Metal Enclosed  
**RADIO APPARATUS**

using



QUALITY PARTS

*Ultra-Modern Design*



Portable Short Wave (combined) Transmitter and Receiver for Telephone and Telegraph operation. Employs two tubes for transmission and three tubes for reception. REL plug-in transmitting and receiving inductances, sockets, aluminum cast frames, etc. (Bottom compartment contains all batteries—actual set weighs only 22 pounds).



Broadest station line Amplifier and Control Unit. Completely controls the input to the transmitter. Wire telephone connections with each remote broadcast point. Automatic light signal devices.



250 Watt Master Oscillator Power Amplifier C. W. Telegraph transmitter. Wavelength, 15 to 45 meters. REL equipped throughout.

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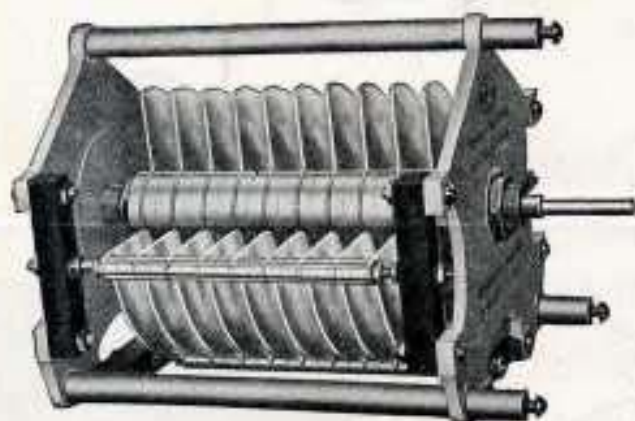




# CATALOGUE

Please Insert Them According To Page Numbers

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## NOTICE!

new

## CONDENSERS

All **REL** transmitting kits, employing power tubes rated at 50 watts or over, are supplied with these new **REL** catalogue No. 149 Variable Condensers.

### NO PRICE INCREASE

All Present Kit Prices Still In Effect

### NOW THE BEST BUY IN RADIO

**REL** Short wave apparatus is standard equipment in most amateur stations throughout the world — Join the majority and build the **REL** way.



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