RADIO

ESTABLISHED 1917

October, 1936

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No. 212

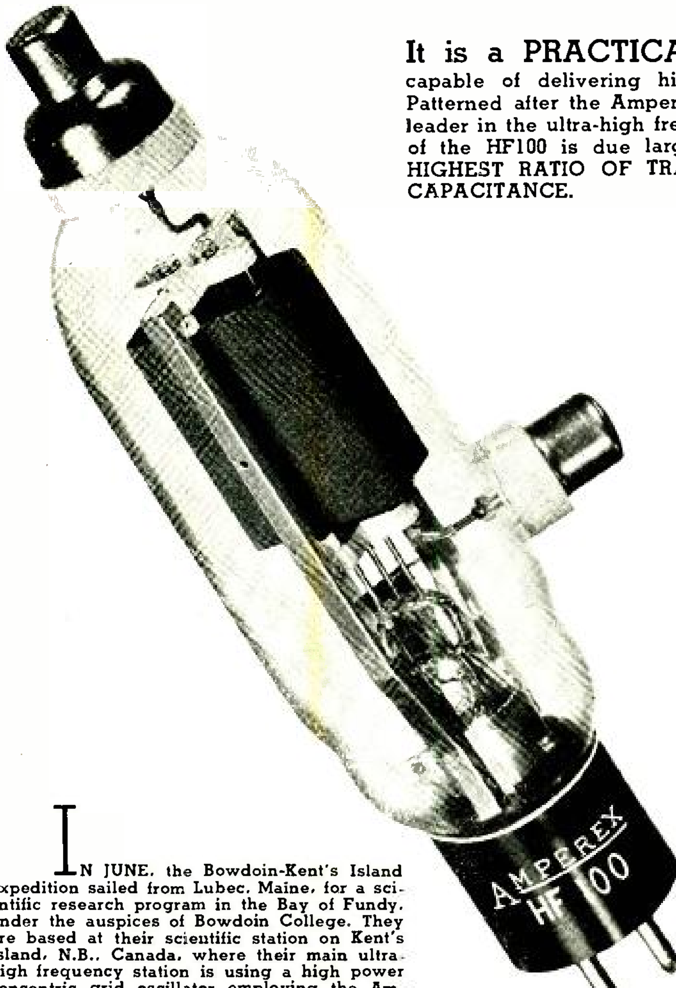
THE WORLDWIDE TECHNICAL AUTHORITY • OF AMATEUR • SHORT WAVE AND EXPERIMENTAL RADIO •

This Month

"G_m 4200 . . . C_{gp} 4.5"

This *New* AMPEREX HF 100

delivers REAL POWER OUTPUT down to 2 meters



It is a PRACTICAL tube . . . Rugged in construction, capable of delivering high power at extremely high frequencies. Patterned after the Amperex HF200 and HF300, it takes its place as a leader in the ultra-high frequency field. The extraordinary performance of the HF100 is due largely to the fact that it also possesses the HIGHEST RATIO OF TRANSCONDUCTANCE TO INTERELECTRODE CAPACITANCE.

$10

CHARACTERISTICS

Filament: Voltage	10 Volts
Current	2 Amps.
Amplification Factor	23
Grid to Plate Transconductance @ 100 ma.	4200
Direct Interelectrode Capacitances:	
Grid to Plate	4.5 $\mu\mu f.$
Grid to Filament	3.5 $\mu\mu f.$
Plate to Filament	1.4 $\mu\mu f.$

MAXIMUM RATINGS

For operation at	30 mc. or lower	60-75 mc.	120 mc.
Plate Dissipation	75 Watts	60 Watts	50 Watts
D.C. Plate Voltage	1500 Volts	1200 Volts	1000 Volts
Modulated D.C. Plate Voltage	1250 Volts	1000 Volts	800 Volts
A.C. Plate Voltage	1500 Volts	1500 Volts	1250 Volts
D.C. Plate Current	150 Ma	130 Ma	120 Ma
D.C. Grid Current	30 Ma	30 Ma	20 Ma
Max. D.C. Grid Bias Voltage for Class C operation	-300 Volts	-225 Volts	-150 Volts
Max. attainable Plate Power out-put	170 Watts	100 Watts	60 Watts

DIMENSIONS

Height overall	7½ inches
Bulb Diameter	2-1/16 inches
Base	Standard UX-4 Prong for filament connections only.
Plate Terminal	Heat Radiating top cap diameter .500 inches.
Grid Terminal	Side cap diameter .500 inches.

IN JUNE, the Bowdoin-Kent's Island Expedition sailed from Lubec, Maine, for a scientific research program in the Bay of Fundy, under the auspices of Bowdoin College. They are based at their scientific station on Kent's Island, N.B., Canada, where their main ultra-high frequency station is using a high power concentric grid oscillator employing the Amperex HF300. Thomas O. A. Gross is chief radio operator.

On July 24th, W2HBO picked up this message from their station, VE1IN:

> *"We have been using Amperex HF300 and 203 H tubes for some time on heavy loads and have had perfect performance. We are particularly impressed with the ease of excitation and ruggedness of these tubes."*

On August 11th, W3BWT, a member of the Army Amateur Radio System, received this:

> *"We are even more enthusiastic about the HF300 than when we spoke on July twenty-four . . ."*

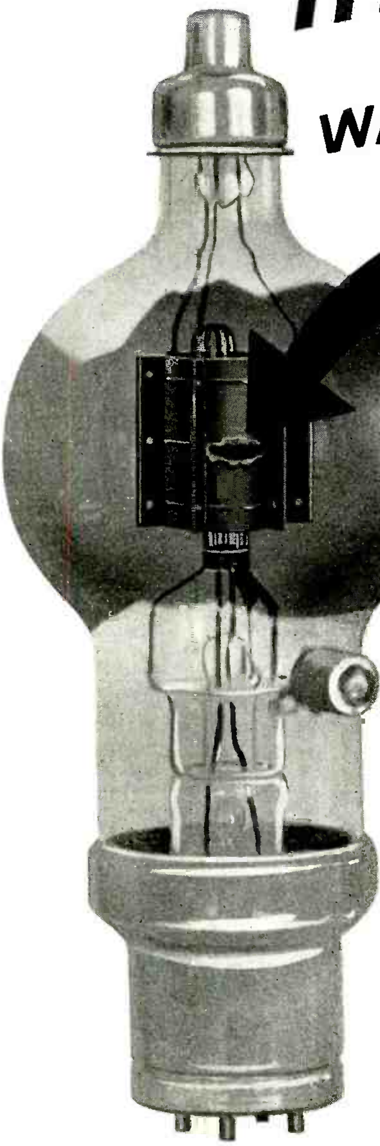
AMPEREX

ELECTRONIC PRODUCTS, Inc.

79 WASHINGTON STREET • BROOKLYN, N. Y.

RADIO, October, 1936, no. 212. Published monthly except August and September by Radio, Ltd., 7460 Beverly Blvd., Los Angeles, Calif. By subscription, $2.50 yearly in U.S.A. Entered as second-class matter February 6, 1936, at the postoffice at Los Angeles, Calif., under the Act of March 3, 1879.

THIS PLATE WAS HOTTER THAN A FILAMENT OF AN INCANDESCENT ELECTRIC LAMP!



3000 watts or 20 times the normal plate dissipation of this EIMAC 150T was necessary to melt this tantalum anode. ● Absolutely no gas was released during this tremendous overload! ● EIMAC exclusive exhausting process permits an unconditional guarantee of complete freedom from gas during tube life.

PLAY SAFE - BUY EIMAC

EITEL-McCULLOUGH, INC.

San Bruno, California, U. S. A.

At Leading Dealers Everywhere

THE WORLDWIDE TECHNICAL AUTHORITY OF AMATEUR, SHORT WAVE, AND EXPERIMENTAL RADIO

RADIO

The publishers assume no responsibility for statements made herein by contributors and correspondents, nor does publication indicate approval thereof.

No. 212 October, 1936

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Contributions to our editorial pages are always welcome; though they will be handled with due care we assume no responsibility for those which are unsolicited; none will be returned unless accompanied by a stamped, addressed envelope. We do not suggest subjects on which to write; cover those you know best; upon request, we will comment on detailed outlines of proposed articles, but without committing ourselves to accept the finished manuscript.

Since we regard current "chiseling" policies as decidedly unfair, a small payment will be made, usually upon publication, for accepted material of a technical or constructional nature. Freehand, pencilled sketches will suffice. Good photographs add greatly to any article; they can easily be taken by the layman under proper instructions. For further details regarding the taking of photographs and the submission of contributions see "Radio" for January, 1936, or send stamp for a reprint.

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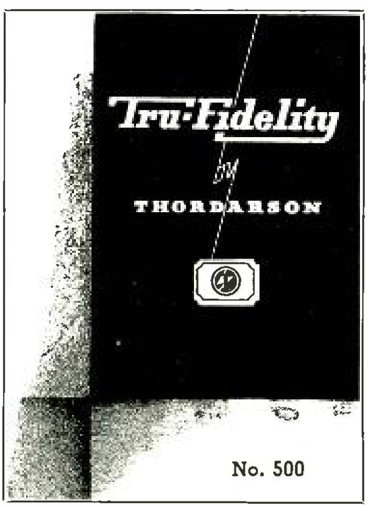

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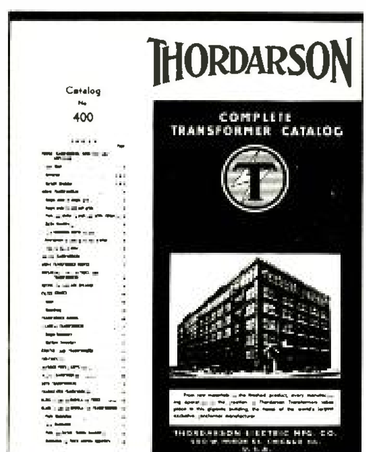

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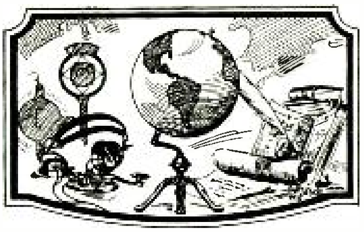


It must be so

. . . because the Secretary says so.

In his editorial in the September number of *QST*, Secretary-General Manager-Editor Warner makes a flat statement: "There is no such thing as 'instructing' a director." He goes on to state that he hears the term mentioned but would like to point out that the thought has no place in "our" scheme of government.

Fortunately the average amateur has both sufficient intelligence and sufficient training in our democratic forms of government in the United States and Canada to realize at once the falsity of any contention that representatives by whatever title they may be known are not supposed to voice the wishes of their constituents.

The idea of definite instructions may well be alarming to the administration which has been in complete power so long, for nearly every convention which has made any real effort to voice the wishes of the membership has turned out to be an "anti-Warner" rally; many of the recommendations proposed in all seriousness by attending amateurs have gone far beyond those proposed from time to time in RADIO.

Once Again

Some of our newer readers who have not been long familiar with our editorial policies have taken us to task for "criticizing *QST*" after perusing remarks such as those above. They err. With *QST* we have no quarrel; it is, to us, a rival publication and, we cheerfully admit, a good one. We assume no right to dictate even in the smallest measure the policies of a rival.

But criticism of the A.R.R.L. is another matter. Not only are some of the members of our staff League members, but, more important, the League pretends to represent all American amateurs and as amateurs it is not only our right but our duty to criticize the actions of officials of the League when we in common with thousands of others believe them not to be for the best interests of amateur radio.

New Tubes

Electronics says "whoa" to the stampede of new tubes. So say we also, and wonder how Europe puts up with its swarm of new bottles with 2 and 3 sets of gadgets in 'em. They have new sorts of bases too, of course. Maybe there ought to be a law.

The Director Controversy

Back in the good old days before 1924, Headquarters never had to worry about what the Board of Directors might do next. The Members of the League didn't *elect* the Directors. They were *invited* to sit on the Board by the "insiders" at Hartford.

But there were murmurings against this system from the "common herd"; and in 1924, the League "went democratic". A new Constitution was adopted, and League members were given the right to elect their Directors. The Directors, in turn, were to choose (not from among their own number, but from the membership at large) a President, a Vice-President, a Secretary, and a Treasurer.

Tradition, and (finally) mere sentiment, kept Mr. Maxim and Mr. Stewart in office as long as they lived, although Mr. Maxim's interests had shifted away from ham radio during the latter years of his life and had drifted into other fields to such an extent that he once published the statement that his three most precious possessions were his movie camera, his books, and his boat.

Disregarding Mr. Hebert's retention of the office of Treasurer for the moment, why is it that Warner has been Secretary-General Manager all these years? That he is cordially disliked by large numbers of "hams" is evident. That the publishing business of the League has prospered, but that the other activities of the organization have suffered under his rule, is fairly plain. And nobody can "laugh off" the fact that only one out of three American hams now belong to our League.

A possible explanation is that for some reason or other the desires of the majority of the amateurs belonging to the League *do not get translated into effective action.*

Why not?

Well, some of the Board members have been "dumb" and inexperienced. For a good many years, now, the Board hasn't *really* directed. It has followed the very human and understandable tendency to let others do the work—particularly where sustained effort and close attention has had to be applied to any given situation. An Executive Committee (illegal under the laws of Connecticut, according to the Majority Report of the late-lamented Investi-

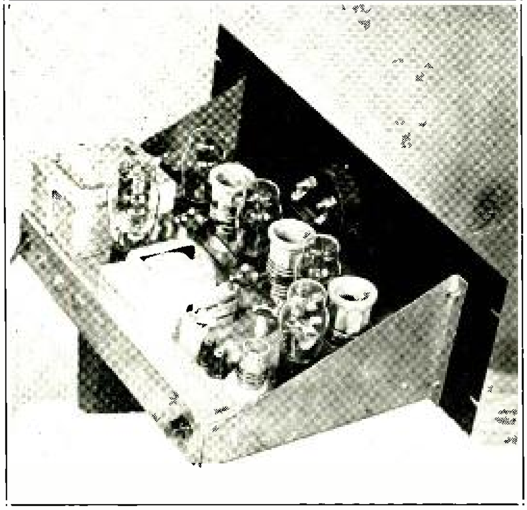
(Continued on Page —)

A "Two in One" Transmitter

By Ted Curnett,* W6BAY

The "midsection" of this transmitter is removable and self-contained, making a compact 200 watt portable. In fact, each unit of the transmitter (exciter, buffer-driver, and final amplifier) is constructed as an independent unit, so that any part of the rig may be changed or worked upon without disturbing the rest of the transmitter.

When designing a new transmitter, the first thing an amateur does is to incorporate as many as possible of the new ideas, circuits, and tubes that have been developed during the few months previous. In addition to these considerations, the writer set up some very rigid requirements for his contemplated transmitter. It was decided that it must be capable of full output on all bands down to and including 10 meters, and work well at reduced input at 5 meters. It should be flexible as to band changing, with a minimum of coil changing. Last, it was imperative that the finished transmitter present as neat an appearance as consistent with high efficiency and ease of construction.



The four-band 53 exciter unit, with its self contained power supply. The power transformer and choke have been "doctored" to provide better ventilation of the windings.

With appearance and flexibility in mind, standard relay rack type construction was decided upon. Besides presenting a pleasing "commercial" appearance, it permits unit type construction, whereby each tray may be taken from the rack and either changed or worked upon without disturbing the rest of the rig.

It immediately becomes apparent that the above-mentioned flexibility will not be obtained unless each unit contains its own power supply for filament, plate, and grid voltages. This was accomplished in the completed transmitter in all but the final amplifier stage, which has its filament transformer on the same chassis but no power supply, as design requirements dictate that it be placed at the bottom of the rack (for obvious reasons).

Looking at the photograph of the complete transmitter, the rectifiers for the high voltage supply are on a shelf behind a screen in the bottom panel. The next panel, containing a voltmeter, covers the high voltage power supply. Next is a vacant panel, included to allow room for possible future expansion. The exciter unit is next in line, then above it the two buffer stages, which may be removed from the rack and used as a complete transmitter. Next above is the push-pull final amplifier, and at the top of the rack a vacant panel for output meters should they be added.

The Exciter Unit

After careful study of the exciter situation, it was decided to use the Jones idea of cascade push-push 53 doublers on as many bands as required, their output fed into a series link circuit. The unit of figure 1 was built up and tested. It worked the first time it was turned on and was not tricky to adjust. To our amazement the output was greater on 10 meters than on 40, and on 5 meters the output was as great as from the 40 meter oscillator.

As may be seen from the diagram (figure 1) a separate link is used for the output of the 5 meter stage, thereby avoiding possible loss in the series link circuit. The small loss incurred by the series links on 40, 20, and 10 meters is not at all objectionable, as excitation to the buffer is more than ample on these bands.

The main precaution in building this unit is to use a plate transformer and filter choke heavy enough for the job. The transformer should be rated at 500 volts and at least 250 ma., this

*1711 26th Ave., San Francisco.

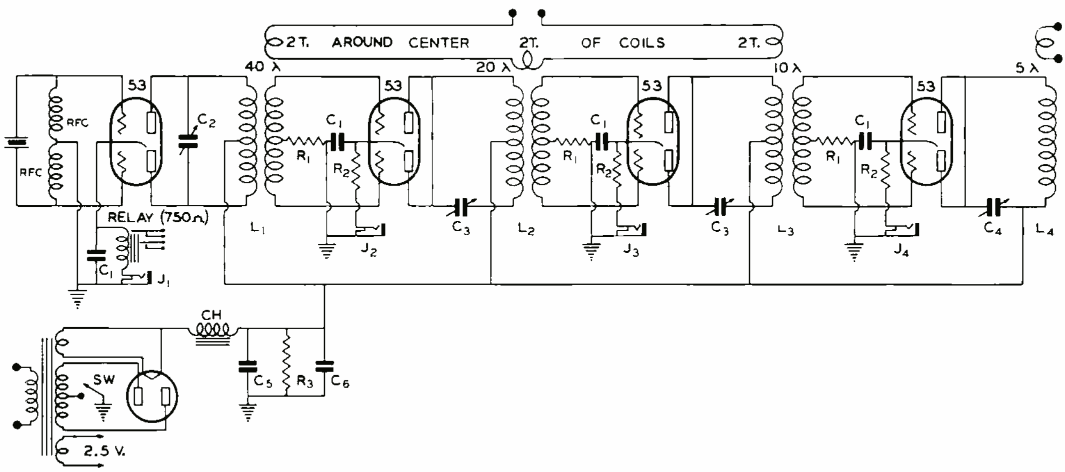


Figure 1. The Exciter Unit

- C_1—0.01 µfd. mica
- C_2—100 µµfd. midget variable
- C_3—50 µµfd. midget variable
- C_4—15 µµfd. midget variable
- C_5—15 µfds. electrolytic
- C_6—0.1 µfd. 1000 v. tubular
- R_1—10,000 ohm, 2 watts
- R_2—350 ohm, 5 watt
- R_3—40,000 ohm, 10 watt
- RFC—2.5 mh. midget chokes
- CH—20 h. 250 ma. choke
- Power trans.—500 v. r.m.s., each side c.t., 250 ma.
- Relay—Single throw, 2 pole relay with 750 ohm winding

current rating also holding for the filter choke. The oscillator draws about 50 ma., and the doublers from 60 to 70 ma. per stage.

The physical layout follows the schematic wiring diagram very closely, as may be seen from the photograph of this unit. This permits very short r.f. leads, which is no doubt largely responsible for the excellent performance at the higher frequencies.

A 750-ohm relay winding was substituted for the usual cathode resistor in the oscillator stage, and the entire transmitter is controlled by this relay. Jacks were brought out to the back of the chassis and connected to husky relay contacts. All primary leads to the speech, modulators, r.f. buffers, and final amplifier are broken by these contacts. Non-oscillating, the crystal stage draws about 15 ma., so the contacts are set to work at about 25 ma. If for any reason the crystal stops oscillating, the other stages (excepting the exciter, which has safety bias) are automatically turned off. This device has been worth its weight in gold on several occasions. This does not, however, eliminate the advisability for an overload relay or fuse in the high voltage lead to the final amplifier, because of the remote possibility that excitation might fail in some place other than the crystal stage.

Keying

Keying for c.w. work is also accomplished by this relay. A key is inserted in the jack J_1. This gives a combination of crystal keying and "primary" keying. This gives as good if not better results than keying the crystal stage only, with fixed bias on the rest of the transmitter (a common practice), and still allows one to use grid leak bias on the intermediate and high power stages. The note is clean cut, with no tails or chirps. If a good relay is used, it will follow a bug nicely.

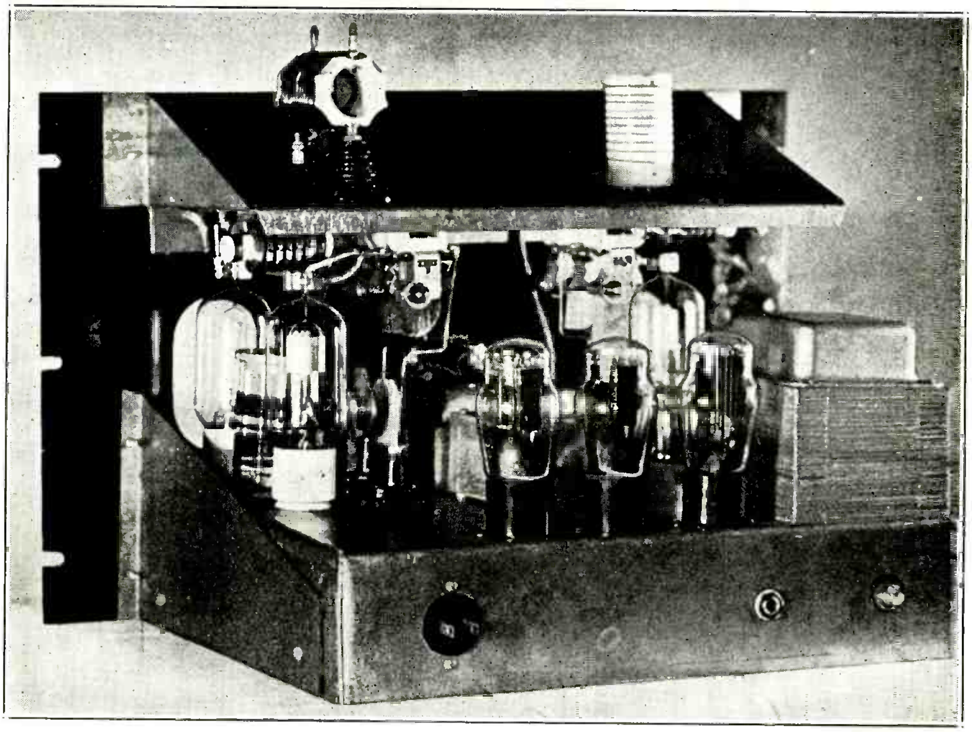
The Versatile Buffer Stages

The combination shown in figure 2 and in the photographs acts as two buffer stages, as one buffer and a push-pull final amplifier, or as a complete portable station, self contained, having an output of 200 watts. The whole unit weighs but 60 lbs., representing quite a few

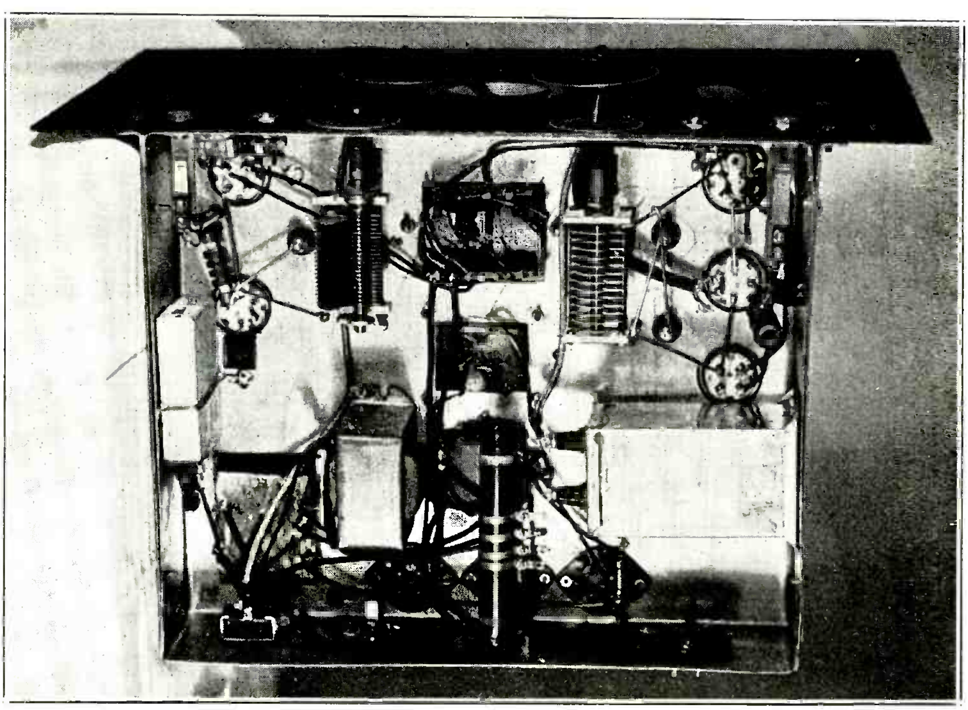
Exciter Coil Table

L_1	Plate,	12 turns no. 16 enameled.
	Grid,	8 turns no. 20 cotton covered.
L_2	Plate,	8 turns no. 16 enameled.
	Grid,	8 turns no. 20 cotton covered.
L_3	Plate,	4 turns no. 16 enameled.
	Grid,	4 turns no. 20 cotton covered.
L_4	Plate,	3 turns no. 16 enameled.

Grid and plate windings are interwound on same coil form 1½" in diameter.



Back View of the Combined Buffer and Portable Transmitter Unit



Bottom View of the Combination Unit, Showing Layout of Parts

C_1—0.004 μfd., mica
C_2—200 μμfd., variable
C_3—5 μμfd. neutralizing
C_4—50 μμfd. per section
C_5—50 μμfd. variable
C_6—5 μμfd. neutralizing
C_7—50 μμfd. per section
C_8—2 μfd. 2000 volt filter
C_9—2—8 μfd. electrolytics in series
R_1—10,000 ohm, 5 watt
R_2—3,000 ohm, 10 watt
R_3—Wire wound, 20 ohms, center-tapped
R_4—50,000 ohm, 100 watt
R_5—Each 100,000 ohm, 2 watt
RFC—2.5 mh. pie wound
CH_1—20 henry, 250 ma.
CH_2—30 henry, 100 ma.
T_1—Fil. trans., one sec. 5 v. 4 a. to X Other sec. 5 v. 8 a. to Y
T_2—Plate trans. 750 v. each side c.t., 300 watt.
T_3—Fil. trans., three 5 volt 3 a. secondaries, 3500 v. insulation.

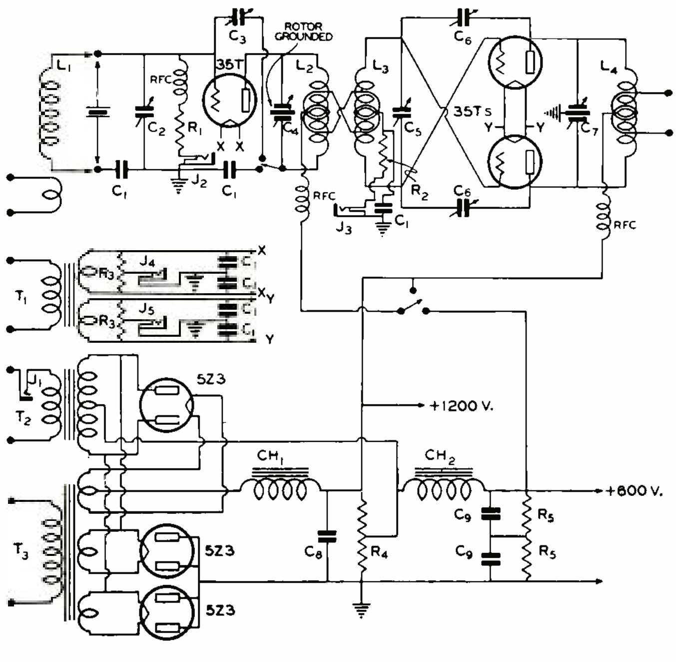


Figure 2. The Combination Transmitter-Buffer

output watts per pound, an important item where portable work is to be considered.

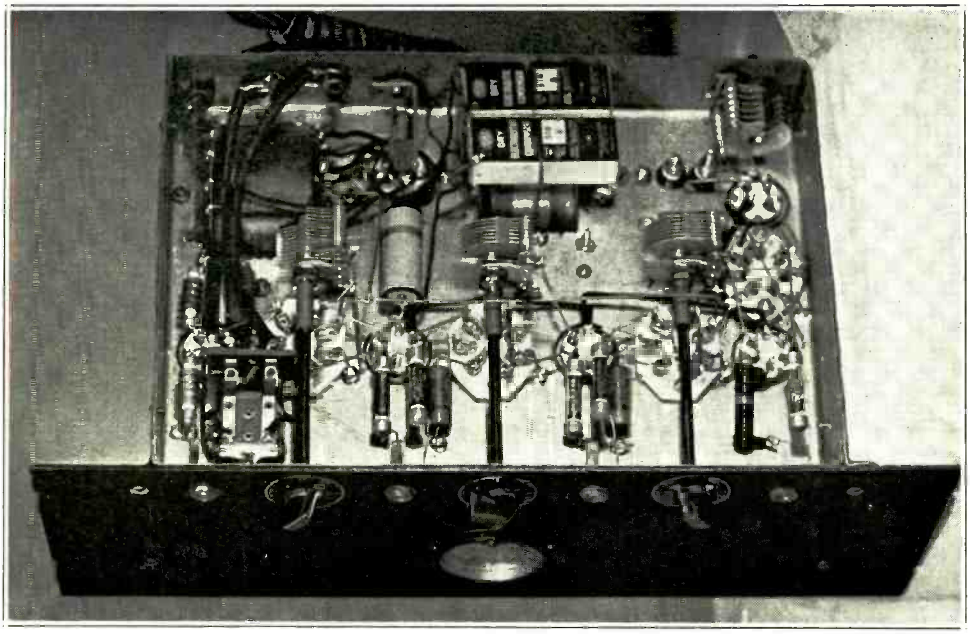
With the circuit of figure 2 and the power supply switch for the oscillator on the 600 volt tap, the crystal current with a 40 meter "A" cut crystal is well within safe limits and the excitation to the push-pull 35-T's is adequate. However, by changing the circuit for the first 35-T to that of figure 4, approximately 1000 volts may be applied to the circuit when used as an oscillator, and the crystal current still will not be excessive. The measured output of the crystal oscillator at this voltage was 60 watts, and the crystal current 112 r.f. ma. (a safe figure for a 40 meter "A" cut crystal).

The variable resistor R_1 in figure 4 (optional circuit) is shorted out when the stage is used as a crystal oscillator. It is adjusted to about 3000 ohms when used as a straight neutralized amplifier, and adjusted to 50,000 ohms (wide open) when used as a doubler. When using this circuit (figure 4) it is imperative that separate filament windings be used for the two 35-T stages.

The low crystal current in this circuit is due to elimination of grid leak bias, to the high μ of the 35-T, and to the very low plate-to-grid capacitance of the tube. In fact, this capacitance is so low that at 160 meters it is sometimes necessary to add external capacity to provide sufficient feedback to sustain oscillation.

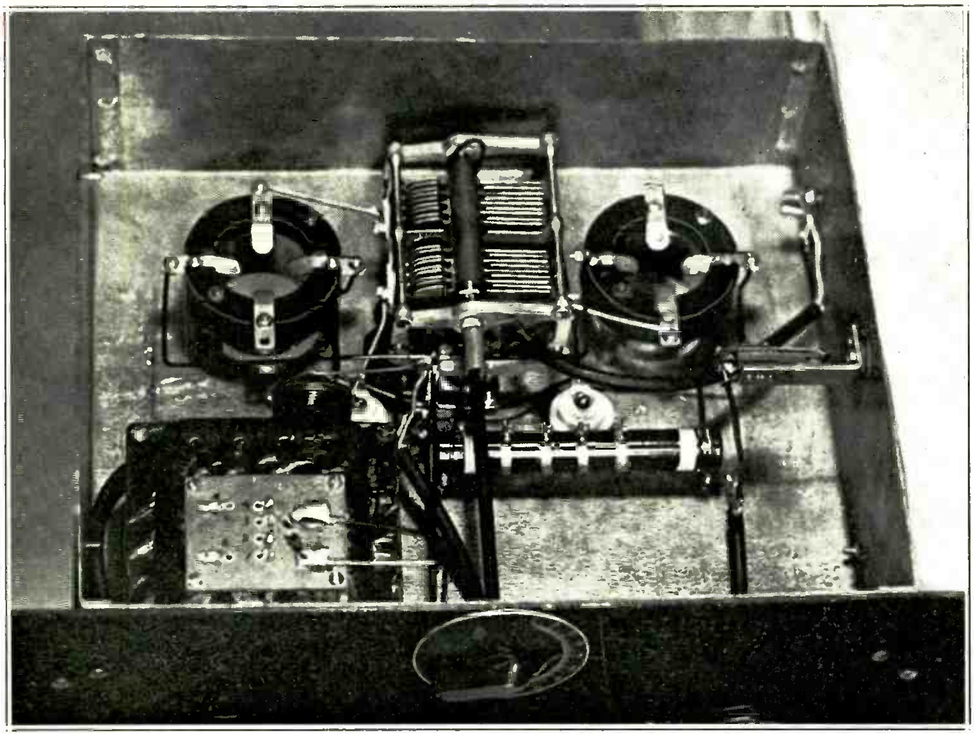
Either oscillator circuit at 600 volts will excite the push-pull 35-T's to 200 watts output, quite a mean sock for a portable and more than sufficient for driving the 150-T's to very high efficiency.

This unit is built on a chassis measuring 14" x 12" x 3" and mounted on a panel 12" high and 19" wide. All filament and plate supplies are mounted on the chassis, and no jamming was required to get everything to fit. A bridge type rectifier system is employed, permitting small receiving tubes to be used as rectifiers, besides providing a handy method of supplying half voltage without resorting to a heavy bleeder. A single-pole double-throw switch is arranged so that ½ the total voltage may be applied to the first 35-T when used as an oscillator or on 5 meters as an amplifier, and the full 1200 volts as an amplifier on lower frequencies, either working straight or doubling.



ABOVE: Under-Chassis View of the 53 Exciter Unit

BELOW: Bottom View of the 150-T Amplifier Stage



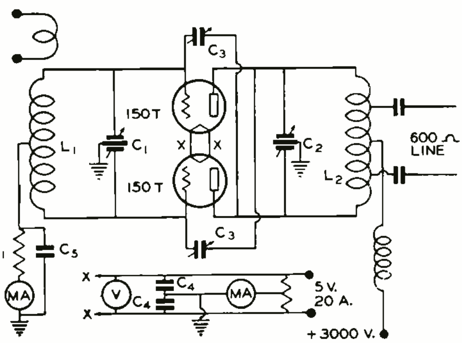


Figure 3. The Kilowatt Amplifier

C_1—50 μμfd. per section, 3000 volt spacing
C_2—50 μμfd. per section (bomemade, described in text)
C_3—Neutralizing, 8 μμfd.
C_4—0.002 μfd., mica, 1000 v.
C_5—0.002 μfd., mica, 5000 v.
R_1—5,000 ohm, 20 watt

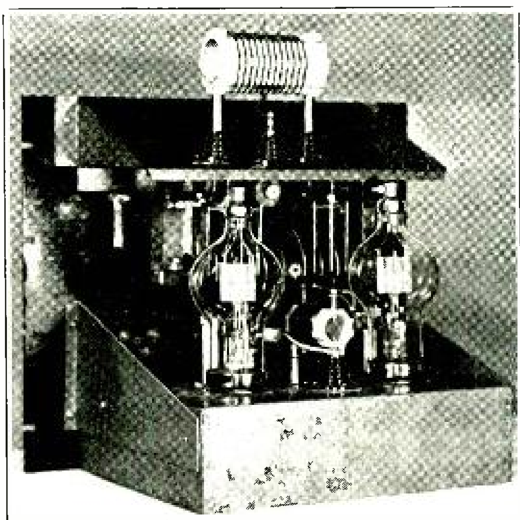
The grid circuits of both stages are mounted under the sub-panel. The coils are plug-in and are mounted so that all leads are very short. Closed circuit jacks are used in both grid and cathode circuits for measuring grid and plate current. To get the true value of plate current, be sure to subtract the grid current reading from the cathode current. A double-pole double-throw switch on the meter cord permits all the meter jacks to be grounded directly to the panel, as the meter connections may thus be reversed when the meter reads in the wrong direction.

"Upstairs" type construction was used in both the plate circuits. This type of construction is very adaptable to all tubes having the plate lead out the top and makes for very efficient plate circuits. It puts the plate circuit at the plate of the tube and provides an easy and efficient means of shielding between the plate and grid tuning circuits. Neutralization is complete in both stages, probably due to the type of construction used. A single-pole double-throw switch was arranged so that when the first 35-T is used as a buffer stage, the neutralizing condenser is connected to the end of the coil opposite the plate, but when used as an oscillator the neutralizing condenser is disconnected and the coil is grounded through a .002 μfd. condenser.

Some very extensive tests were run with this unit. On one test, it was left running steadily for over an hour while delivering 200 watts to a dummy antenna. The oscillator tube drew 50 ma., pushing 40 grid ma. into the push-pull 35-T's. The latter tubes pulled slightly over 200 ma. to deliver the 200 watts output. The oscillator tubes showed no color, but the amplifier tubes ran cherry red, denoting about 35 watts plate loss per tube (the maximum rated plate loss for the tubes). Amateurs using these tubes should not be alarmed at the color of the plates, as they run cherry red in *normal operation*; in fact, the ones in this amplifier have been run white hot with no apparent harm, though of course this cannot be recommended.

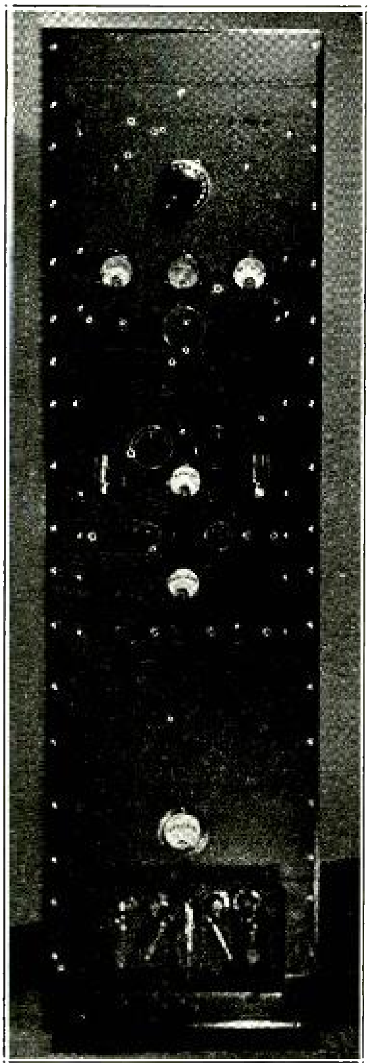
After running for over an hour as stated above, the unit was shut off and an examination made to determine if any component showed signs of stress or overheating. The only part showing any appreciable heat was the grid coil in the push-pull stage, and this may have been induced heat from the tubes, as the coil is mounted right between them. A very good grade coil form is recommended in all stages of the transmitter, particularly on the higher frequencies.

After the tests were concluded on this unit as a self-contained transmitter, the first 35-T was neutralized and the unit used as a two-stage radio frequency amplifier, the first stage being excited by the exciter unit already described. Using this arrangement, more than 200



Back View of the Kilowatt Amplifier

watts output was easily obtained on 40, 20, and 10 meters, the output being apparently the same on all these bands. The unit was then tried on 5 meters. It was immediately apparent that the excitation was not sufficient to allow running the full plate voltage (1200) on the plate of the first 35-T. With the switch thrown to half voltage on this tube, it cooled off and the plate dissipation was within the rated allow-



Front View of the Complete Transmitter

able limit of 35 watts. The output was sufficient to drive the amplifier to class C operation, and an output of about 135 watts was obtained on 5 meters without exceeding any tube ratings.

The aforementioned combination, with or without the exciter unit, makes a splendid transmitter for the amateur who does not want to run (or cannot afford) a following high power output stage. Or, it may be used as above and the kilowatt stage added at a later date when finances permit.

The Kilowatt Amplifier

The high power output stage does not deviate from general practice as far as the wiring diagram goes, but mechanically it is what a $300 a week ad man would call "a symphony in symmetry". Like the push-pull buffer stage the grid tuning condenser and everything but the grid coil itself are mounted under the subpanel. This leaves the grid coil, the neutralizing condensers, and the tubes above. As may be seen in the photograph of this stage, the grid coil is mounted on standoff insulators and equipped with G.R. plugs and jacks. It is mounted between the tubes so that each grid lead is the same length to each tube. The grid condenser is directly below the coil, allowing equal-length leads from the coil to the condenser. The plate coil sits above a shelf just over the tubes, as may be seen in the photo. This provides shielding between the plate and grid coils.

The home made final tank condenser (partly visable in the illustration) is suspended on standoff insulators from the top deck and is varied from the front panel by a dial cable made of silk fish line. The plate-to-plate spacing used in the condenser was ¾", which is ample for plate modulation of a kilowatt at 3000 volts if the rotor is grounded through a 5000 volt mica condenser instead of directly as in the diagram. The direct connection is permissible for c.w., but not phone.

All variable condensers in the transmitter were given a coat of clear lacquer before they were installed. The small ones first had their bearings smeared with vaseline to prevent their gumming up, and then were dipped one at a time in a quart can of clear lacquer. The large condensers were treated the same except that they were sprayed. This process greatly in-

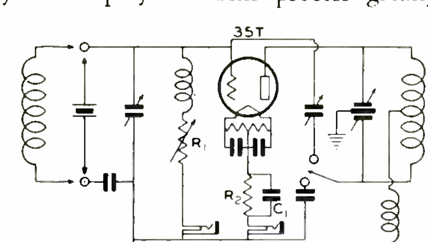


Figure 4. Optional Oscillator-Buffer Circuit

C_1—0.01 µµfd., mica
R_1—0 to 50,000 ohm, variable
R_2—500 ohm, 10 watt
Other constants same as in figure 2.

creases the breakdown voltage, though the lacquer does no good after the condenser has once flashed across. However, if the lacquer treatment is given, the chances are none will ever flash across in the first place.

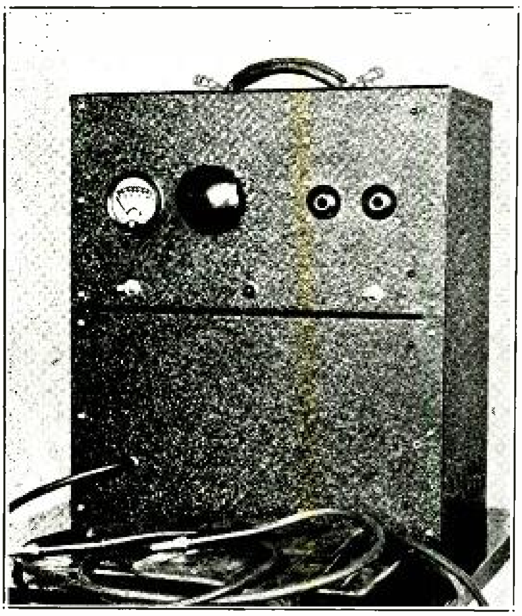
[*Continued on Page 66*]

High Frequency Radio Therapy Equipment

By J. N. A. Hawkins

Some notes on the design of radio frequency oscillators operating as a.c. generators for high-frequency diathermy or radio therapy use in the range from 20 to 50 megacycles. Design for a portable 125 watt short-wave diathermy incorporating the newest in interference minimizing and other circuit improvements.

It has been found that internal heat in living body tissue can be produced by placing the tissues in the alternating electromagnetic field of a high frequency oscillator. Just how the internal heating of the tissue is produced is not perfectly known, but it is probably a combination of eddy current loss, circulating current loss, and dielectric loss. The medical properties of this internal heat are the subject of quite a bit of controversy in the medical field, and about the only agreement among authorities is that radio therapy can be used under certain conditions to relieve pain and stimulate circulation in much the same way that



Well-designed, portable short wave diathermy machine capable of 100-125 watts output at 16 meters. It has a line filter, power supply filter, and a shielded cabinet (metal).

a hot water bottle is used. It may be that radio therapy will be used to kill certain bacteria in the body much as typhoid heat is used now, but it must be emphasized that the ramifications of radio therapy are still highly problematical. The whole subject of radio therapy must be handled with much discretion, as careless use of radio therapy can and has caused damage.

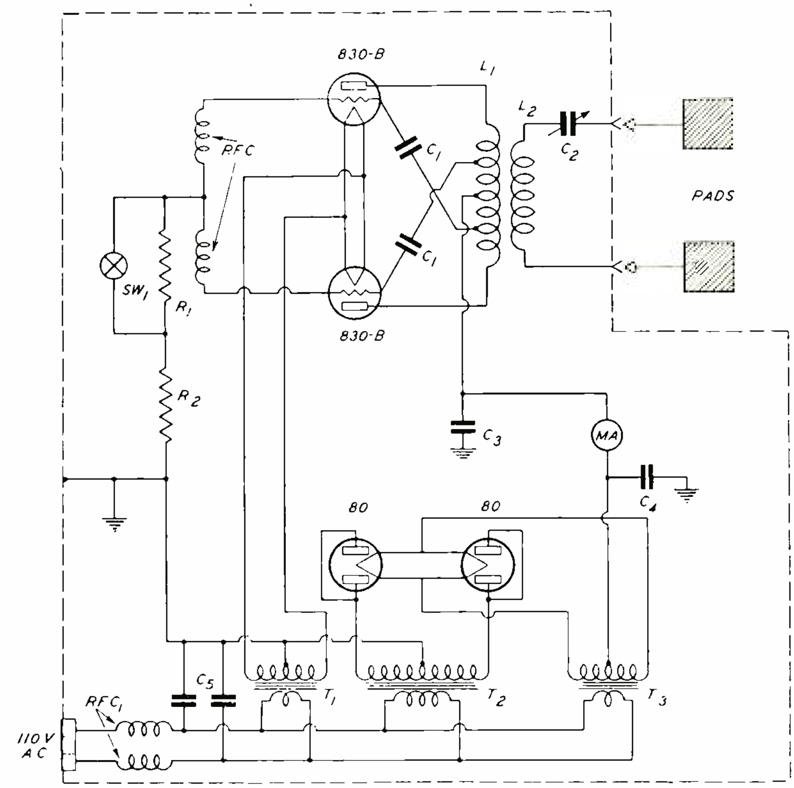
One of the newest ideas concerning the damage to tissue concerns the cell rupturing effect of high *peak* radio frequency voltages. Some of the cheaper radio therapy high frequency generators use half-wave self-rectified oscillator circuits. In this type of circuit the oscillator tubes operate with raw a.c. on their plates. The oscillating r.f. power output is therefore highly modulated with the frequency of the a.c. supply line, and the waveform is somewhat similar to that from a damped wave spark transmitter. As it has been found highly desirable to keep the ratio of peak to average r.f. voltage as low as possible it is evident that a pure, unmodulated r.f. waveform is the most desirable for radio therapy use. Thus full-wave power supply rectification, plus some ripple filter, is desirable in order to keep the effective power output as high as possible without reaching high values of peak voltage and current in the load. The peak power is not useful power as the heating effect is proportional only to the effective power.

The use of full-wave rectification plus some ripple filter also tremendously reduces the radio interference caused by the present type of radio therapy oscillator. A 200 watt oscillator in a hospital at Norfolk, Virginia, recently blocked out over 80 k.c. of the ship-to-shore telephony band over the whole of the north Atlantic ocean. Another similar oscillator located in Boston was putting a husky signal into Seattle, Washington. In both of these cases the oscillators were keyed by investigators trying to locate the source of interference, and two-way communication was held by means of the radio therapy oscillator at one end and a conventional radio transmitter at the other.

As these oscillators are being made and sold by the thousands there can be no doubt but that steps will have to be taken to prevent the tremendously broad radio interference from becoming worse than it now is.

There are four steps that must be taken to

R_1—2000 ohms, 25 watts
R_2—7500 ohms, 25 watts
C_1—100 µµfd., 5000 volt mica
C_2—150 µµfd., 3000 volt spacing
C_3—.002 µfd. mica, 5000 volt test
C_4—4 µfd. 1500 working volts
C_5—.006 µfd. mica, 1000 volt test
RFC—2.5 mh. pie wound chokes
RFC_1—Short-wave line chokes, 4 amp. rating
T_1—10 volt 4 amp. filament transformer
T_2—800 volts each side c.t., 300 watts
T_3—5 volts, 4 amp., 2500 volt insulation
MA—0-300 ma. d.c.
L_1—10 turns space-wound no. 10 enamelled, 2½" diameter, tapped approximately 1¾ turns each side of center tap
L_2—7 turns 1¼" diameter, inside L_1



Wiring diagram of the diathermy shown in the photographs. A pair of the new HF-100's could be substituted to advantage for the 830-B's. If HF-100's are used, the values of R_1 and R_2 should be increased by 50%. The metal cabinet should be grounded with as short a lead as is possible. C_1 should be at least as large as specified or the plate voltage will drop considerably under full load.

remedy most of the unnecessary interference from conventional radio therapy oscillators:

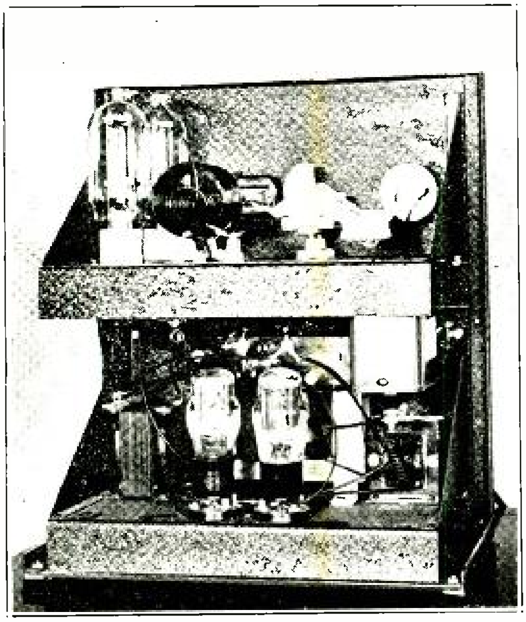
First, full-wave power supply rectification is essential. The self-rectified oscillator's only virtue is cheapness.

Second, a small amount of filter capacitance is essential across the output of the rectified plate supply to prevent the oscillator from dropping out of oscillation over part of each cycle when heavily loaded, which sets up high-amplitude extraneous frequencies which cause bad QRM and contribute nothing to the output of the set.

Third, the cabinet in which the oscillator is mounted (unless of metal) should be shielded with copper screen to minimize direct radiation into local wiring, piping and structural metals.

Fourth, the a.c. line which feeds the oscillator should be filtered with an effective network of r.f. chokes and bypass condensers. This filtering should preferably occur at two separate points. One filter should be located in the cabinet of the oscillator close to the primary of the plate transformer. The other filter should be located at the meter box of the power line feeding that particular power outlet. The effectiveness of these filters will be dependant on the quality of the ground connection used with them so that the standard separate Underwriters-approved ground connection should be used. This ground connection should be insulated copper wire down to within three feet of the actual ground level, where it may connect to a water pipe or a similar effective ground.

The cost of these four measures to eliminate radio interference will never exceed ten dollars when done on a production basis. The cost of a complete radio therapy set now ranges from about $275.00 to $450.00 In view of the many dollars damage already done to the communications industry in the form of delay and idle equipment, there can be no doubt but that the manufacturers of radio therapy equipment can fairly be expected to clean up this situation. If the radio therapy industry does not see fit to take steps to eliminate this form of radio in-



Back view of the portable diathermy. The 830-B's run at approximately 950 volts filtered direct current.

terference then the communications interests will have to do something about it.

While the F.C.C. has not made a public ruling on the interference caused by diathermy and radio therapy apparatus, a very authoritative source indicates that it should not be difficult to obtain a court decision ruling radio therapy interference as a definite violation of the unnecessary signal provision of the communications act. Naturally it would be expensive and difficult to run down all the radio therapy equipment in operation, but several good stiff fines judiciously advertised around the medical profession would make most medical men very poor prospects for the purchase of poorly designed and/or improperly installed radio therapy equipment.

Three cities are now contemplating local ordinances making it illegal to own and operate radio therapy equipment not approved by the local interference commission. This new ordinance specifically names and defines radio therapy equipment and is separate from the many general interference ordinances in force in many cities. The use of a separate ordinance is desirable to combat this type of interference because most of the general interference ordinances are uninforceable due to political pressure. However, there can be no doubt but that a specific ordinance could be enforced against the users of unapproved radio therapy equipment, as the balance of political power in such a contest would almost always be with the communications interests, which, of course, include the amateurs.

Many sources of radio frequency interference cannot be properly and easily filtered at a cost justified by the value of the device causing the interference. Thus the general interference ordinances fall down against such equipment because no ordinance can be practically enforced which is confiscatory in its effect without equitably distributing the burden fairly over everyone concerned. Therefore, a general ordinance cannot readily be enforced against radio therapy users when other noise and interference sources operate without practical restriction.

However, as the major cost of improving radio therapy oscillators lies in rectifying and filtering the plate power supply, it is possible that the industry will make the necessary steps voluntarily, as the use of rectified and filtered plate voltage has definite operating advantages in raising the effective power output in proportion to the peak output. Also the reduction of the current peaks through the oscillator tubes, for a given effective heating power output, materially increases the life of the oscillator tubes.

◆

"Polaroid"

Since two readers asked, maybe four wish to know. The new light-polarizing glass is available from Land-Wheelwright laboratories, Boston, Mass. It is called "Polaroid" and is a special sort of safety-glass in which the central shatter-proofing layer is replaced by a special layer containing a vast number of crystals. It is seriously being considered as a means of cutting down headlight glare (polarize lamps one way and windshields another). Cute? Yeah— and costly. Maybe less costly when we all wear them—on our cars, not in our eyeglasses.

◆

To Swing or Not to Swing

For years we have been after the "Lake Erie roll" exponents in an endeavor to make them ashamed of their too-distinctive fists instead of proud of them. And just when our efforts are beginning to bear fruit (one hears comparatively few nowadays) along comes the present craze for "swing" music. Now that it is "smart to 'swing' it", we are afraid to reproach any of the personality-fist boys for fear they will come back with "It Don't Mean a Thing If It Ain't Got That Swing".

"Revamping" All-Wave Broadcast Receivers

By Robert S. Kruse

A very excellent amateur receiver can be made from a good b.c.l. "all wave" receiver, either of current or recent vintage. The conversion is not particularly difficult, and if sufficient care is taken, the resulting receiver will compare favorably with the better amateur-type receivers of commercial manufacture.

We all know that an all-wave broadcast receiver can be satisfactorily adapted to amateur use; in fact some of the amateur receivers sold today are factory-converted broadcast receivers. The large production of broadcast receivers makes their cost relatively modest.

The factory-converted receiver can, and usually does, have some features not easily applied by the individual amateur, but on the other hand the amateur does not have to charge himself for the time spent on the job, so that it is of interest to consider what one can do when the price isn't at hand for such purposes but the time is. I believe it will be found that it is considerably less costly to convert an all-wave b.c.l. receiver than to build from loose parts a receiver with something like the same performance.

Choosing a Chassis

The first move is to pick a chassis to start from. Sometimes this is best done by picking up a receiver of 1932-34 vintage, taking due account of the fact that electrolytic condensers probably need replacing by now, that several tubes may not be very good, and some of the controls perhaps noisy. Unless such a receiver can be picked up very cheaply, it is really cheaper to buy a receiver which has only just gone out of production, or perhaps even a current-production chassis. Still, some of the older sets do have their points. For instance there was the General Electric-and-R.C.A. receiver of several years ago which had a 4-gang condenser and a 55/1 velvet-smooth condenser drive, and even today it gives 20 meter performance that makes some of the current season's "great name" receivers grunt pretty hard. That receiver is mechanically something of a headache because of a too-small chassis which makes repairs difficult, but its signal-to-noise ratio is excellent and even in very bad locations the long-wave commercial interference does not bother it at all. If you can find one of those, consider it, for it was not a very costly set to start with and ought to be available very reasonably now. I do not remember the R.C.A. number, but the 4-gang condenser identified it. The General Electric designation was K-80, in the table-top model.

The signal-to-noise ratio should be one of the main points to consider. After listening to nearly every sort of receiver on the market, and making many side-by-side comparisons I feel certain that it is very misleading to gauge a receiver by measured selectivity and sensitivity without letting noise into the consideration. Some receivers that "sound dead" will produce more signals that are useful than do some receivers that sound "hot" but are noisy, either at all times or under some conditions. The only satisfactory test I know of is to tune in one station after another on *both* receivers tied to identical antennas, and to note which one produces the more intelligible signal—and that test includes both noise of the set-generated type and reproduction of noise from other sources.

Standard-rack mounting of a receiver has its points, as such standard-panel mountings will

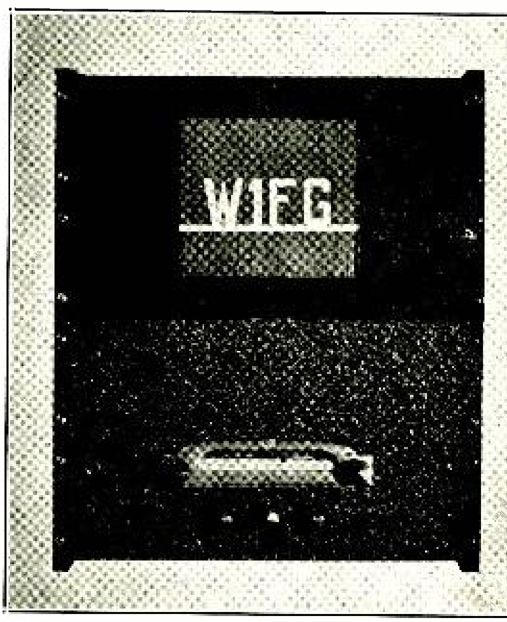


Figure 1
A Rack-Mounted Converted Receiver, with A.V.C. and Beatnote Switches

always fit into another station's rack or into the standard-panel cabinets.

The clearance between the uprights of a rack is 17½", and a receiver, because of its weight, must be supported by brackets at either end, the proper sort being those intended for an 11" base. A moderately priced bracket which serves the purpose is the Wholesale Radio Co. type YP-15272. The photographs show a 15" chassis mounted between two of these on a 19" by 10½" (standard size) aluminum panel. Aluminum was used because the dial of this particular receiver required an oblong hole, which is hard to work out of ⅛" steel unless one is equipped with a drill-press or a so-called "nibbling machine". It was done in short order in the aluminum with nothing but a hand-drill, a hacksaw blade with 24 teeth to the inch, and a couple of files, which were used very little. Note that a chassis much longer than 15" would not go into the space.

Dials

It may seem picayune to mention dials as being important in choosing a receiver. It might be picayune if one intended to tune in a b.c. station and let it run for hours, but with the constant tuning-around done in amateur work it is sometimes better to have a good dial with a not-so-good receiver than vice versa. Most broadcast receivers have poor dials or poor dial drive. Too much lettering is crowded into the space, and sometimes made worse by a "fancy" type of lettering or dial-shape, or a "trick" pointer. The dial-drive is often stiff, or irregular in action, and seldom has a sufficient gear-ratio (which we sometimes call "mechanical reduction"). In addition the scale is usually crowded.

Last year a study was made to find out which of these is the worst drawback—for it seems that we have no broadcast receivers which are free of all three failings. Rather to the surprise of everyone it was decided by three observers that if the dial was readable and the mechanical drive smooth and slow, one could stand a cramped scale very nicely! However, you are welcome to another opinion.

Test Racks

The simple rack shown in the photographs (note especially the rear view) is made by screwing a length of white-pine 1" x 3" to each of two pressed-steel shelf-brackets of the so-called "9 inch by 10 inch" size. The whole is painted with black 4-hour enamel. There are no crossbars, as the panels themselves give ample rigidity for a rack 3 feet high, the whole thing standing firmly where set, though it can be screwed down. The panels are secured to the uprights with 1½" number 14 blued round-head woodscrews. To avoid splitting the uprights, hold a panel in place temporarily, mark very carefully, drill each screw hole 1½" deep with a number 17 drill (or ⅛") followed by a ¼" drill sent in about 5/16". The screw-heads are practically identical with those of the machine screws used on metal racks, and the appearance is satisfactory for test use, or permanent use.

Figure 2
Rear view of the converted receiver, showing beatnote oscillator on panel; also separate beatnote oscillator, and type of dials used where additional reduction is needed.

Another economy dodge is shown in the upper panel, which is of "masonite", likewise painted with 4-hour black enamel. The surface resembles a steel panel more in fact than in a photograph. Such a panel is not stout enough to support the chassis, and may show some sagging under even the weight of a speaker of large size. This is taken care of by a metal clip which may be seen in the rear view. It is secured by the bottom speaker-mounting screw and grips the upper edge of the lower (metallic) panel. This takes out the warp completely for the 7 pound speaker shown. Metal speaker-panels are of course available with ready-cut openings, but that adds several dollars to the cost.

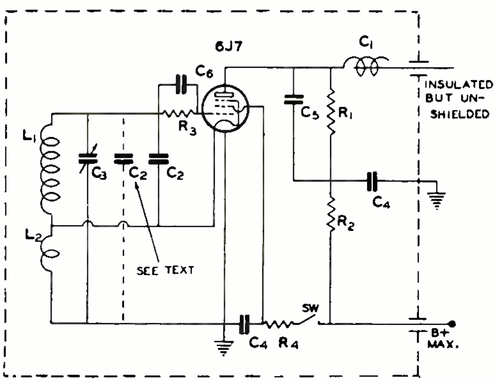


Figure 3

R_1—25,000 ohm, 1 watt
R_2—100,000 ohm, 1 watt

C_1—5 µµfd.
C_2—See text
C_4—0.01 µfd.
C_5—0.0005 µfd.

The Actual Adaption

Having chosen a chassis, one generally finds it necessary to increase the selectivity, to add a beatnote-oscillator, and to make some changes in the dial-drive. To show how we go at this an example will be "run through", with side comments on other sets.

A General Electric A-82 receiver was used in making the particular adaption shown in the photographs. This receiver has a type of dial which is at once excellent and bad—from an amateur viewpoint. The excellence comes from the fact that the tuning-scales are extremely easy to read because they are in sight *one* at a time, and are straight, being printed on a translucent drum which rotates with the wave-band switch. The badness comes from the fact that the drive of the scale-pointer is of a two-speed type which automatically goes into high-speed after the control-knob is turned about one revolution, the pointer thereafter traveling about 7 times as fast, which is much too fast for amateur-band work. This was very easily cured, by merely clipping ¼" from the length of the 3/32" pin screwed into the end of the tuning-knob shaft. Thereafter this pin missed the pickup device and the dial stayed in low gear, where its action was found satisfactory. A further reduction would be useful even if not necessary, and has in fact been introduced in the G.E. line this year—showing that this is not an individual opinion. However, the smooth action of the A-82 dial makes tuning quite a pleasant job, even for c.w.

In some receivers it is both necessary and possible to apply additional mechanical reduction to the tuning device. About the simplest way to do this is to saw off a portion of the tuning-knob shaft and then to drive it by means of a small reduction gear upon which the tuning knob is then mounted. The most suitable gear which has been found for this purpose is one made by Crowe (Chicago) and shown in the rear-view photo in both its assembled form and with the dial removed, leaving the pinch-drive gear ready for a tuning-shaft. The Crowe number is not known but this dial appears in Wholesale Radio, Sears Roebuck, and other catalogues. For this purpose choose a "pinch drive" or "wedge drive" dial of a moderate ratio, remembering that its ratio will be multiplied by that already present in the b.c. receiver. One caution: When sawing off the original tuning-knob-shaft give it good mechanical support, and saw cautiously with a fine-tooth hacksaw—24 teeth—until almost through, then break cautiously and finish with a fine file. Silly caution? Not at all; several controls are known to have been spoiled during such operations.

One converted amateur receiver seen recently had the original drive removed altogether, and mounted on the condenser shaft a 7 inch grooved wheel worked by a "fishline" drive with a 14/1 ratio, which is enough if the drive is smooth and a large tuning knob is used.

Beatnote Oscillator and A.V.C. Control

In the front view of the panel-mounted receiver may be seen two snap switches at the upper right and upper left of the lower panel. One of these cuts off the automatic volume control, while the other cuts off a beatnote oscillator. The purpose of cutting off the a.v.c. is the usual one of preventing an interfering station from pushing down the sensitivity, or for c.w. reception.

In some receivers it is quite a trick to find a satisfactory way of killing the a.v.c. without running into bad feedbacks when the a.v.c. is on. One begins by looking over the circuit to find out how the a.v.c. action is secured. In every circuit there can be found a resistor from which the a.v.c. voltage is taken to be fed to the r.f. and i.f. tubes which it controls. The varying d.c. voltage across this resistor is generated by passing through it the rectified output of the second detector (or the plate current of a separate a.v.c. tube), which of course varies with the incoming signal. Short-circuiting this resistor will therefore kill the a.v.c. action, and if the rest of the circuit is not disturbed in its action by such a short-circuit, this is a satisfactory scheme, and is used in some commercial

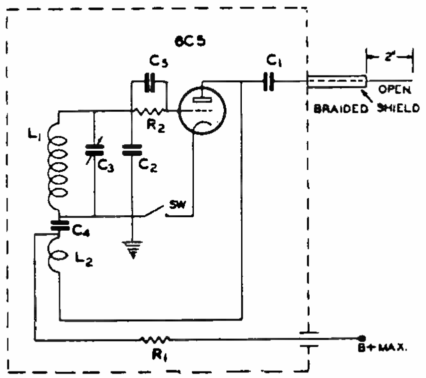


Figure 4

R_1, R_2—10,000 ohm, 1 watt
R_3—0.1 megohm, 1 watt
R_4—50,000 ohm, 1 watt
C_2—See text.
C_4—0.01 µfd.

"ham" receivers. First try short circuiting right at the resistor with a short wire (do not hold onto the wire). If the action is satisfactory, next try connecting on a pair of leads which will extend to the desired switch position. If hum or motorboating result, slide a braided metal shield over the leads, which should be rubber-insulated, as even a high-resistance leak in moist weather will result in uneven a.v.c. action or noise. In some receivers it is not permissible to short-circuit the a.v.c.-drop resistor; therefore this resistor is left alone and the lead from the 2d detector is switched to another resistor of the same value but not connected to anything else but chassis. This resistor should be located near the a.v.c.-drop resistor and the arrangement requires 3 wires to a switch of the single-blade-double-throw sort, though actually it is still one of the small, tumbler snap-switches shown in the panel-view.

Beat Oscillators

Usually it is not very practical to mount the beatnote oscillator on the chassis, for lack of room. Accordingly this oscillator is mounted on the panel, which also facilitates control. In the rear view two oscillators are shown. They are of different types.

The one on the table at front center is a triode oscillator constructed by an engineer at the Bridgeport plant of General Electric. It uses a 6C5 metal-shell triode as a straightforward tuned-grid oscillator with the frequency stabilized by a plate resistor and by the choice of constants. The oscillator coil used is somewhat important, and while this is no G.E. advertisement, it is recommended that the oscillator-coil be bought outright under its General Electric stock number, RL-207. You will waste much more than 80c worth of time in working up such a coil. Used with a 6C5 tube and shielded by an aluminum can about 1⅞" in diameter, this coil "tunes across" the usual 465 kc. amplifier when the grid coil L_1 (larger resistance of the two coils) is shunted by a fixed condenser C_2 of .0001 µfd. and trimmed by a condenser C_3 having a maximum of about 35 µµfd. A suitable trimmer is the Micamold ceramic-base A-54. The G.E. oscillator was intended to be plugged into an unchanged b.c. receiver; therefore the filament and plate voltages are supplied by a 4-wire cable and an adapter fitting under one of the 6F6 output pentodes. The adapter is Na-ald type 977MML. By the way, do not take your plate supply from the plate prong of an output tube as this introduces audio. It must come from the screen prong or direct from the filter. The G.E. wood-cabinet mounting method mentioned also required a lead to chassis, and a shielded output cable as shown in the diagram B. The chassis of the oscillator also had to be rather thoroughly shielded and was of 1/16" brass with a floor-plate, the whole measuring about 3"x4½"x1".

A simpler oscillator is shown on the panel of the receiver. It uses the same G.E. coil but the chassis is lighter (thin aluminum), larger (for convenience of construction) and has no basement floor because it rests against the metal panel instead. The chassis was made 1½" deep to allow a from-the-panel air trimmer to be installed, but this was abandoned in the bread-board stage as the stability was such as not to require tinkering with the frequency. Accordingly the trimmer is a Micamold A-54 reached by a screwdriver through a ¼" panel hole. The power supply is via a short home-made cable coming through the chassis via the hole provided for the speaker-cable. Cross-talk was expected, but was mild, and stopped when R_1 and R_2 were moved up into the oscillator chassis. The circuits of both figure 3 and figure 4 have been used, and very little advantage in stability resulted from the use of figure 3, because the loading is light and fixed. I am not sure that there is any advantage at all, and circuit 4 is certainly simpler and cheaper, and better shielded for the same effort.

If circuit 3 does not oscillate strongly enough, move C_2 to the dotted position and use .0001 µfd.; otherwise leave in solid-line position and

[*Continued on Page 70*]

A Three Tube, All Band, Kilowatt Transmitter

By Melvin O. Kappler, W6LDB

One can get on the air by building the exciter to this rig, then increase power by adding the RK-20, again by adding the 354. One need not worry about the finished product being shy on excitation, because the original shown here was built "backwards" (last stage first) to guard against just such a thing. It is just about the simplest and most economical kilowatt rig one can build.

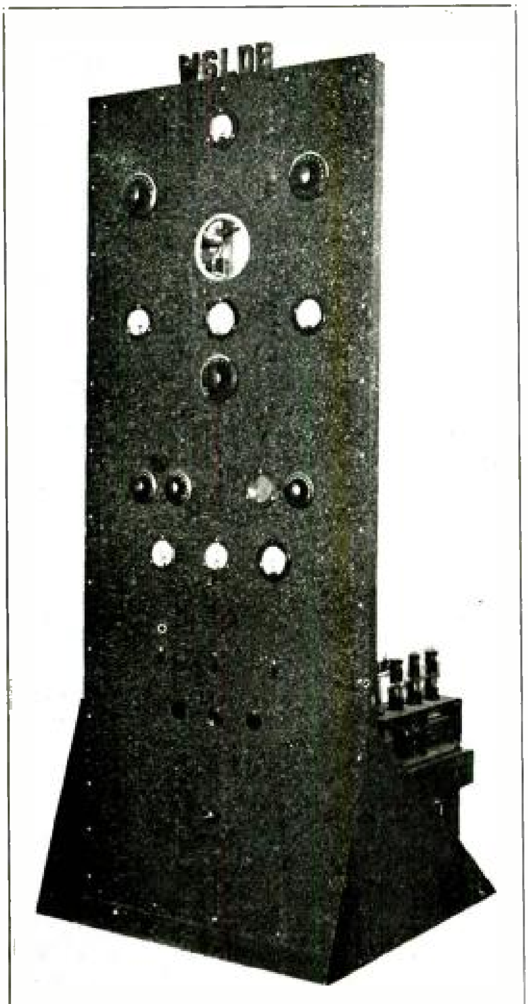
The modern amateur transmitter must meet very definite requirements. Some of these are low cost, compactness, efficiency, ease of band changing, and simplicity of control. With this in mind, anyone beginning the construction of a new transmitter looks for a small group of tubes which will take inputs of 1 kw. and give outputs as near as possible to the 1 kw. mark. The logical way to choose these tubes is to start with the last stage, working back toward the crystal. This is the reverse of the usual procedure, as most amateurs start out with a small transmitter and add stages as they feel more ambitious. However, this usually results in a woefully under-excited transmitter, with an appalling number of stages and controls.

The second decision to be made before construction work started was the choice of high voltage and low current, in spite of the extra insulation and filter problem, due to the fact that there is no single inexpensive tube on the market which will pull current for a kilowatt at low voltage. The next decision was that of the antenna coupling system. Although field tests showed a slight loss in the "simplified Collins", it was selected over the others due to its extreme smoothness of loading and ease of band changing. The last remaining point to be settled was whether or not to use band switching. After seeing several good men and true worry over taps falling off coils, insulation burning off, and all that goes with it, it was decided for the present at least, to continue to use plug-in coils, especially since it takes no longer to change plug-in coils in a transmitter than it does to change the receiver, if the transmitter does not have too many tank circuits.

With these matters disposed of, it was necessary to choose a final amplifier tube which satisfied the requirements outlined above. The HK354 and 150T type fill the bill nicely, the manufacturer's rating being 4000 volts.

After the final stage tube was decided on, the next decision was a choice between a high-gain buffer and low-powered crystal arrangement, and a relatively high-powered crystal working into a medium power-buffer. After flattening an RK-20 in an oscillator and putting blemishes on several perfectly good crystals, it was decided that the first mentioned arrangement would be superior. Therefore a high-gain buffer with sufficient output to excite the final was considered. Another RK20 (which we already had) looked like a logical choice, as this tube had the additional advantage of being self-neutralized. A crystal stage to excite this was very easy, inasmuch as only one watt is required. At this point the question of 10 and 20 meter operation from 40 meter crystals arose, and the Jones exciter unit was selected, since it gave the same output on 20 that it did on the fundamental. When the transmitter was completed, it was found that the combination of the two, 53 and RK20, gave stable operation on 40, 20, and 10 meters.

With the tube selection made, an experimental model was built and many things were learned before the finished product was started. The layout for the transmitter was made by placing a life-size paper template of the front panel on the floor and placing the parts on it in their correct relative position, with due consideration to the length of r.f. leads, as well as location of cold leads and circuits out of the r.f. fields. It was decided to locate the power supplies at the bottom, thus keeping these parts as far as possible from the final tank and steadying the rack. The other stages were spaced in such a manner as to afford the best possible isolation of the crystal from the final. The exciter itself was built in a completely shielded box and the grid circuit of the RK20 was located below the metal shelf, which also separated it from its own plate circuit, preventing any chance of oscillation at that point. The cold leads from the final were run down the outside edges of the rack, staying as near ground as possible in order not to pick up stray r.f. currents. The long leads were allowable since the only wires which were carrying any appreciable amount of current were those for the filament of the 354, and the loss in these was compensated for by an over-voltage filament

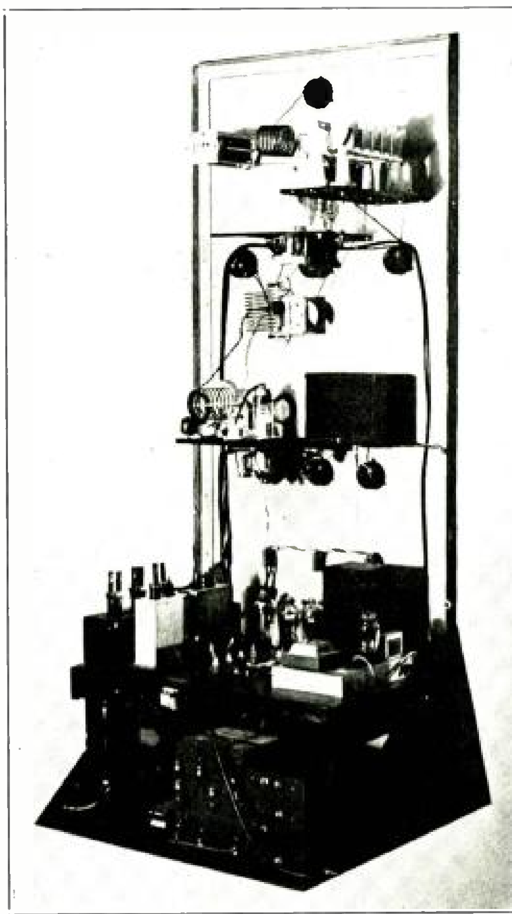


The 3 Tube 1 Kw. Transmitter

transformer and a variable primary resistor. The leads to the voltmeter, of course, were connected at the socket of the tube. The locating of the final stage at a distance from the crystal and well shielded from it was an outgrowth of trouble experienced in the earlier transmitter.

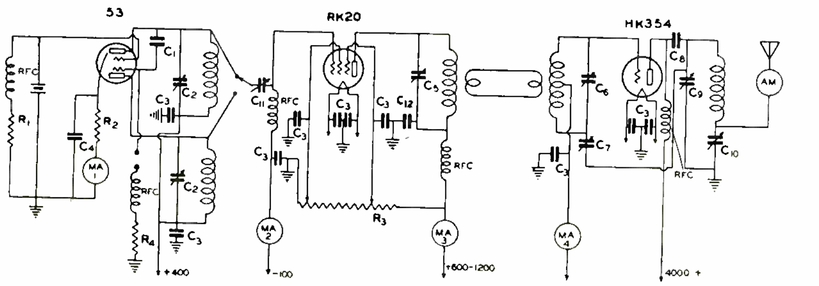
The following circuit arrangements were made especially to provide adequate insulation between meter frames and ground. The final plate milliammeter was located in the negative of the high voltage power supply and the filter condensers were so connected that a dead short through the meter would not result in case of condenser failure. One caution to be observed in connection with this circuit is not to discharge the filter condensers to ground, as the meter would be called upon to carry the full instantaneous current. The grid milliammeter to the final stage was provided with a bakelite case, as was the plate milliammeter for the buffer. The milliammeter for the crystal was located at ground potential in the cathode lead.

The use of simplified antenna coupling permitted the antenna condenser and the final tank tuning to be at ground potential, taking care of any question of insulation at this point. The grid condenser of the 354 and the plate of the buffer stage were mounted on stand-off insula-



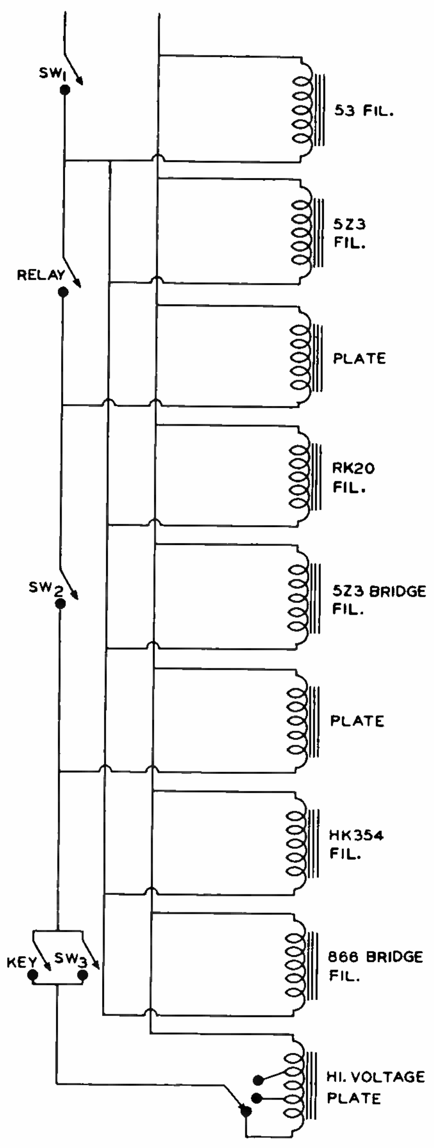
Back View. Showing Construction

tors with shafts protruding through large holes in the front panel. The condensers in the exciter were simply insulated with bakelite. The use of simplified coupling in the final tank brought up a lot of questions, some of which have already been mentioned, which did not involve output to the antenna. One of these



Wiring Diagram of the R.F. Section

R_1—20,000 ohms, 2 watt carbon
R_2—500 ohms, 10 watt wire-wound
R_3—50,000 ohms, (2 25,000 ohms, 50 watt)
R_4—15,000 ohms, 1 watt
C_1—.00005 mica
C_2—100 μμfd. midget variables
C_3—0.002 mica, 1000 volt
C_4—0.01 non-inductive
C_5—50 μμfd. variable, 0.070 spacing
C_6—50 μμfd. variable, 0.070 spacing
C_7—5 μμfd. neutralizing, ¾" spacing
C_8—0.001 μfd., 7500 volt mica
C_9—80 μμfd., variable, ¾" spacing
C_{10}—350 μμfd. variable, 3500 volt
C_{11}—35 μμfd. variable
C_{12}—.002 mica, 2500 volt
RFC—2½ mh. 125 mil. except 354 plate which is 4 mh. 500 mils.
Ma. 1—0-150 ma.
Ma. 2—0-25 ma.
Ma. 3—0-150 ma.
Ma. 4—0-100 ma.
Am.—0-1½ r.f. ammeter



was the question of how to neutralize. Obviously, this would have to be done in the grid circuit. Therefore a balanced grid circuit was decided upon, and the location of the grid tuning condenser and the neutralizing leads was such as to give a fair imitation of the grid to filament capacities of the tube. This permitted the stage to stay neutralized permanently. Another advantage of this circuit was the removal of the d.c. plate voltage from the neutralizing condenser by connecting it outside the plate-blocking condenser. Furthermore the danger to the operator was materially reduced by having tank coils and condensers at ground d.c. potential. One thing should be mentioned about the plate choke and plate-blocking condenser. The latter must be not only of high voltage rating but high current, and the choke should be a *good* one, else it will be necessary to use two or three in series. The spacing of the antenna condenser does not need to be greater than 3000 volts, since the voltage across it is considerably lower than across the other condenser. The shelf in the final stage is more than a shelf; it is also a shield, and should come up close to the metal sleeve at the base of the tube. It should be connected to the mid point of the filament bypass condensers, as should the base sleeve and the metal ring on the socket.

The power supplies at the bottom of the rack were constructed on individual chassis,

LEFT: Line connections for the various transformers in the power supplies. The power supplies are not shown because they are conventional and may be found in the "Radio Handbook".

COIL TABLE

	10 METERS	20 METERS	40 METERS	75 METERS
Oscillator	11 turns no. 16 spaced, on 1½" form. 40 m. xtal	11 turns no. 16 spaced, on 1½" form. 40 m. xtal	11 turns no. 16 spaced, on 1½" form. 40 m. xtal	15 turns no. 16 close-wound on 1½" form. 75 m. xtal
Doubler	5 turns no. 16 spaced, on 1½" form.	5 turns no. 16 spaced, on 1½" form.	11 turns no. 16 spaced, on 1½" form.	
RK20 Buffer	4 turns no. 14 spaced ⅞" "air-wound" 2½" dia.	7 turns no. 14 spaced ½" "air-wound" 2½" dia.	21 turns no. 12 spaced to 5" "air-wound"	26 turns no. 14 spaced to 3½" "air-wound" 2½" dia.
Final Grid	5 turns no. 14 spaced ⅞" "air-wound" 2½" dia.	10 turns no. 14 spaced 7/16" "air-wound" 2½" dia.	24 turns no. 12 spaced to 5" "air-wound"	29 turns no. 12 spaced to 5" "air-wound" 2½" dia.
Final Plate	5 turns no. 12 spaced ⅞" "air-wound" 2½" dia.	10 turns no. 12 spaced to 5" "air-wound" 2½" dia.	23 turns no. 12 spaced to 5" "air-wound" 3" dia.	22 turns no. 12 spaced to 5" "air-wound" 4" dia.
	All "air-wound coils are 5" between plugs except the final plate coils, which are 8" between plugs.			

with all leads on plugs in order that any unit might be quickly removed to be worked on. The final power supply has no chassis but its parts are mounted on a wooden shelf whose height was so arranged as to make it flush with the top of the pole transformer, which furnished the high voltage. The terminals of this transformer stick through the Masonite for convenience in changing the voltage. The rectifiers are located immediately in front of it opposite the windows in the panel. The rest of the high voltage parts are suspended below the shelf, lessening the danger to the operator. There is still room below the shelf for the bias batteries. The shelf itself may be removed by disconnecting plugs. The power supply plugs and switches are arranged as shown in the power supply diagram in such a manner that everything is interlocked to prevent plate voltage from being applied to any tubes, including rectifiers, without the filament being on, or without excitation. The switches are also so arranged that the relay may be made to turn on plate supply for one, two or three stages at will. This is especially valuable for tuning up. For keying, the last switch is left off and the key plugged in in parallel, thus keying the primary. Due to the interlock the key does not put the plate voltage on unless the send-receive switch is thrown, closing the relay.

The rack was constructed at home and made of no. 16 gauge annealed iron. The frame work was 1½" x 1½" x 5/16" angle iron and the panel was screwed on with 10-32 screws tapped into the angle iron. The base was made of the same metal and was cut and bent by a neighboring tinsmith. The cost of the whole rack, including base, angle iron, and panel was only about $7.00.

Capacity coupling is used between the RK20 and the exciter, consisting of a 35 μμfd. variable condenser. Admittedly this is a poor system of coupling; however, the exciter furnishes more than enough excitation, and since over-excitation is hard on a pentode, it was decided that a little loss of efficiency here would be acceptable in the interest of ease of adjustment. A small fixed capacity would not help the situation much, since the output of the exciter unit varies with the frequency. The RK20 grid circuit is carefully shielded from its plate as mentioned before, and the screen and suppressor chokes and by-passes are located right at the socket, along with the filament by-pass condensers. It might be mentioned that both the buffer and the final stage are completely enough neutralized that without excitation no oscillation takes place with the bias set at cut-off, or even below. The power supply for the RK20 stage consists of three 5Z3's in a bridge circuit, with the plate supply transformer so arranged that 600 volts might be used for lining up, or when less excitation is required for the final. If trouble should be encountered in making the neutralization of the final hold when bands are changed, the tap may be adjusted to include more or less turns in the neutralizing part of the

[*Continued on Page 73*]

Audio Selectivity with the "Selectosphere"

By F. Malcolm Gager*

A New Code Loudspeaker

The "Selectosphere", a highly selective loudspeaker, gives the selectivity of a crystal filter without the oftentimes annoying crystal "ping" that results from keying, static, ignition noise, etc. In addition, it gives signal limiting that serves both as a noise reducer and a.v.c. on code signals. This response limiting occurs at a comfortable room level, therefore making it of practical utility.

The "Selectosphere" combines electrical, mechanical, and acoustical resonance, yet is astoundingly simple. In fact, were it not that the sphere part is a spot-welded job of about .015" metal, heat treated at a high temperature in hydrogen with a definite cooling cycle, the device could be readily duplicated by any amateur handy with tools. Except for this spherical shell, construction is a simple matter.

It is highly probable that someone with the facilities will see the merits of the device, its potential wide adoption, and manufacture the spherical shell for sale. As the author refuses to exploit the instrument, we will have to wait patiently until someone drops the manufactured shell in our laps. At this time. Professor Gager promises us a practical construction article. In the meantime. the following article gives a clue to what the new appliance is, what it will do. and how it accomplishes what it does.

Noise vs. Signal

The acoustical output of any radio receiver always contains, in addition to what the French call "sounds from the depths", the customary components of noise arising from natural or man-made causes. The elimination of man-made interference outside the receiver is a problem in itself; the directional properties of static and the seats of such disturbances are a rather well-accomplished separate study.

Even with an excellent antenna system, the noise voltage traceable to internal receiver elements (and sometimes improper construction and disposition of components) is never a negligible factor. More to the point, our experience indicates that tube plate-current fluctuations caused by static, secondary emission, gas ionization, the shot effect, and thermal agitation are inherently augmented by an otherwise indispensable heterodyne principle. These factors, separately or collectively, dictate the limits of successful reception as a function of the signal-to-noise ratio, and not the absolute value of the signal level itself. Practically speaking, the useful sensitivity of radio receivers is determined by these noise and interference level conditions. Inasmuch as the noise level is, in part, proportional to the required frequency band width set by the demands of the various types of transmission, it is evident why continuous wave transmission, utilizing as it does a very moderate band width (which is a function of keying speed) has been materially assisted by the many angles of approach to the general problem of its reception.

Historically, the code reception art has seen regeneration applied to both the radio and audio frequency portions of the receiver in order to reduce the overall band width response and bring about improved signal-noise conditions. Of course, intimately associated with the latter trend are the increasingly congested transmission bands, where it is possible to hear a bedlam of different beat signal frequencies at any one dial setting. Where but one signal is desired, the effective background noise level is increased, due to the presence of the unwanted emissions. The noise level and the growth of this effective background interference has stimulated a demand for the so-called "de luxe" receiver wherein practical single-signal reception is accomplished with intermediate-frequency amplifier filters[1] employing regeneration or mechanical resonators operating on electric striction principles. Added to the general march of progress must also be mentioned the noise suppression systems[2], and here and there specific circuit improvements. All of these attempts represent progressive steps toward the solution of the problem. However, they all have inherent faults which detract from their complete effectiveness. Citations are not necessary for the informed, but it is sufficient to relate that the characteristic "ping" of the quartz filter is most annoying when agitated by man-made or natural phenomena (static, key thumps, ignition noise, etc.) and there is little consolation in the fact that some amplitude-limiting cir-

*Dept. of Physics, Boston College, Chestnut Hill, Massachusetts.

[1]See *QST*, June, Aug., Sept., '32; Mar. and Apr., '33.
[2]See *QST*, Feb., '36 and subsequent articles.

cuits perform best when the selectivity of the receiving system is poor.

It has been charged that some frequency bands are not used to their fullest efficiency, yet the investigator interested in code reception has been somewhat disinclined to realize the full possibilities in audio frequency selectivity, even though displayed before him from time to time.

This reluctance toward the use of extreme selectivity is not confined alone to the audio-frequency portion of the receiver. Human nature's aversion to stop the leak in the dyke is readily charged off because of the apparent ease with which one can often shift his rocking chair to higher ground. But where one is confronted with a troublesome background noise and a congested frequency spectrum, such simple action is useless. One is very cautious to condemn, however, because the cost of installing the present-day high selectivity and amplitude-limiting devices or attachments is not within the financial realm of all amateurs. Furthermore, their adoption involves the performance of a major operation on the existing receiver. Assuming, but not admitting, the competence

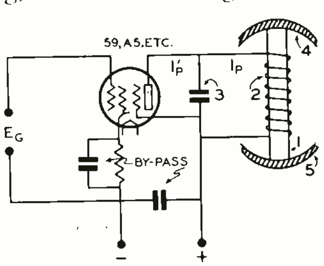


Figure 1
Schematic Diagram of the "Selectosphere" Circuit

of all amateurs in circuit surgery, such permanent alterations do not always facilitate a return to the *status quo* when desired.

A New Transducer

This paper deals with another approach to the time-honored problem: the physical entity, figure 3, which for want of a better name is called a *selectosphere.* This device, when used with a superheterodyne or advanced-design t.r.f. receiver, rivals crystal filter performance in selectivity and acoustical tone quality, embodying as it does the potentialities of simultaneous electrical, mechanical, and acoustical resonance in a single unit, where sharpness of resonance is indicative of a preponderance of stored energy over energy loss per cycle. The device is in fact an audio frequency filter-speaker which differs from the ordinary speaker in several as-

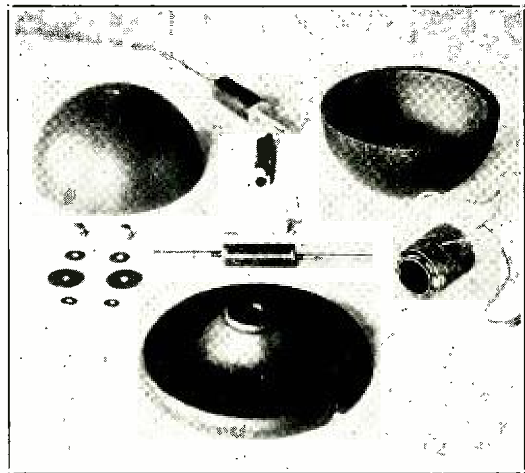


Figure 2
The Essential Parts of the Selectosphere

pects. In one respect it demonstrates, practically, the single audio frequency response of the high selectivity mechanical resonance system. In addition, it embodies the ideal characteristic of acoustical output-limiting or amplitude saturation as a function of the driving force. These, in conjunction with the fact that it is readily plugged into the output of the receiver audio power tube, make the "selectosphere" a very useful unit. As a tri-resonant contrivance it employs electrical resonance to limit the exciting frequency components to the mechanical circuit and to control the input impedance. Mechanical resonance of crystal filter character is obtained by magnetostriction, and the amplitude limiting characteristic is produced by the inevitable magneto-strictive deformation saturation. Cavity resonance in conjunction with a circumferential orifice is a Helmholtzian acoustical feature which can either be made to correspond with the mechanical resonance or shifted outside the frequency band of mechanical response.

Selectosphere Details

The diagram, figure 1, shows the electrical connections to an audio power tube and shows, in addition, the mechanical system in skeleton form. The exciting coil "2" associated with the condenser "3" forms the electrical resonant system, linked with the mechanical system by magnetic flux through element "1". Coil "2" is arranged to carry the direct current component of plate current in order that the equivalent spring parameter "1" of the mechanical resonant circuit be immersed in a polarizing magnetic flux bath so as to exhibit a sense of

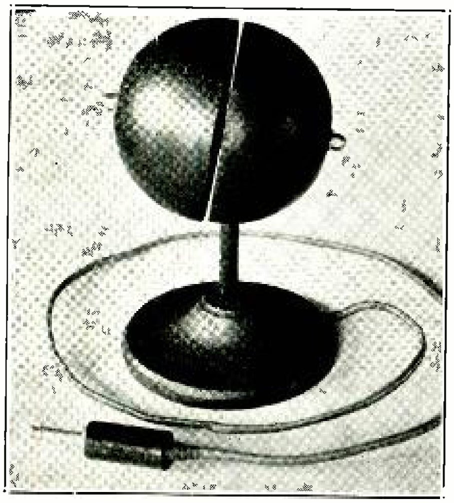


Figure 3
The Assembled Selectosphere

mechanical deformation, the frequency of which will conform with that of the driving voltage.

The effective spring parameter "1", radially formed for adequate flux penetration, is loaded by the masses "4" and "5". Due to the disposition, material, and the shape of these masses (see figures 2 and 3) they act to complete the magnetic flux path, and provide a circumferential gap which is a magnetic air gap as well as the internal volume orifice. The masses also provide a quasi-spherical piston[3] to do the work against the air medium, whether it is used with or without a rubber membrane covering the cavity orifice.

Figure 2 is a display of the essential parts of the selectosphere. Above the mounting base may be seen in order the equivalent spring, condenser, supporting stem, and connection plug. To the right of the equivalent spring is the exciting coil and above the coil a semi-internal view of one of the loading masses. The other mass is clearly evident, as is the small amount of necessary hardware. The two cap nuts are the simple means of assembling these parts into the finished article (figure 3), since the hollow support stem, base, and one hemisphere are threaded. The coil and condenser are internal to the sphere and the connection leads are brought down through the support stem and out at the base.

Electrical Operation

Referring to figure 1, the frequency of the voltage e_g must fall within the very selective mechanical resonance curve of the device or else the acoustical output of the spherical member will be negligible. Therefore, in one of its uses, if e_g were to contain several audio frequency components corresponding, let us say, to beat notes of continuous wave signals, the act of tuning the receiver in the regular manner would allow one to scan the radio frequency spectrum and reproduce only those audio frequencies corresponding to the overall resonance curve of the device as depicted in figure 4. This resonance curve indicates the ability of the device to select the desired signal (a selectivity measured in cycles and not hundreds or thousands of cycles).[4]

The Elastic Member

The "equivalent spring" of the mechanical resonant system is a ferromagnetic member, which means, among other things, that a change in magnetism of this element is possible, due to an orientation of uncompensated spins of certain orbital electrons, each of which possesses a magnetic moment and angular momentum consequent of a known moving charge and mass. To the latter must be added that adjacent atoms of any domain must have spins in parallel magnetic saturation, due to a high "exchange" force. Experimental evidence of the former (gyroscopic action of electrons) is found in the work of Barnett, whereas domains are drawn into being from the minute step-by-step "B-H curve" effect of Barkhausen. Ferromagnetism thus recalls the orientation of certain atomic electron spins rather than orbital plane shifts.

Materials which exhibit the above atomic properties exhibit a change in length brought about by the material seeking an equilibrium between the elastic and magnetic forces existing between adjacent atoms of the substance when it is subjected to a magnetic flux or change in magnetization under the influence of mechanical deformation. The direct effect of magnetization on the length of a specimen has, in reciprocity, the reverse effect of strain on magnetization. Experimentally, these calculated effects are more than verified, because the atomic problem, mathematically speaking, has yet to satisfy the experimental evidence for all ferromagnetic substances. Nevertheless, most of

[3]The mode of the sphere is intimately related with the supported mass and the supporting stem length.

[4]This signal selection and background noise rejection quality is largely the role of the masses and equivalent spring. With this qualitative explanation the magnetic phenomena associated with the all-important equivalent spring or elastic member is considered in the same manner.

what has mathematically emerged apparently agrees both in sign and magnitude with experimental evidence. This same evidence shows that ferromagnetic rod members when actuated at a resonant frequency exhibit a change in length which is much more than that produced by taking a static characteristic of the member. Such resonant changes are limited by the tangential viscous forces of the material, and it is recalled that the viscous resistance set up is the time derivative of the distortion and is independent of the amount. Ferromagnetic members displaying the direct and reverse effects, whether in static or dynamic deformation, can (approximately) make constant volume alterations in agreement with Poisson. For the time being it is the direct and reverse effect of the elastic member in which interest is centered, in order to determine the dynamic properties of the selectosphere.[5]

Selectivity and Saturation Traits

The overall selectivity of the selectosphere is presented in figure 4; the system demonstrates a high degree of audio frequency selectivity measured in cycles. This curve, taken at a

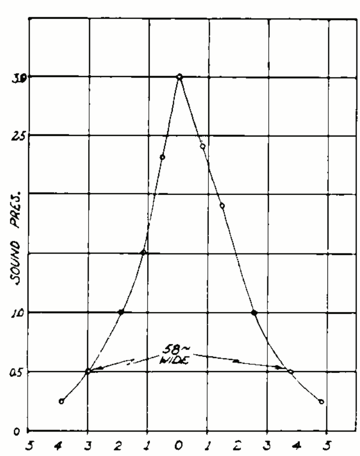


Figure 4
Overall Selectivity of the Selectosphere

constant applied voltage and a resonant frequency of eight hundred and fifty cycles, indicates acoustical pressure in arbitrary units plotted as a function of frequency. The reader can readily fashion a more impressive curve in other units if it suits his fancy, but in any event its narrow response breadth emphasizes its ability

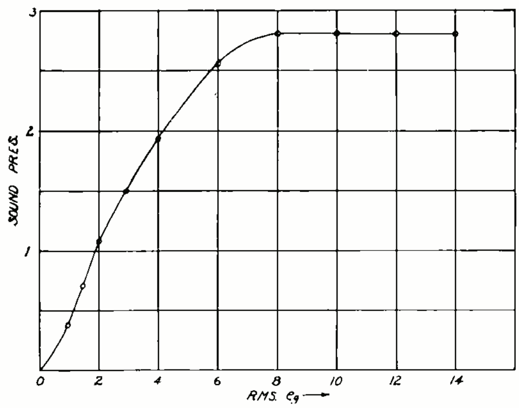


Figure 5
Acoustical Output Limiting Characteristic

to respond vigorously at the peak frequency to the exclusion of excitation at other frequencies. Hence it is not a loudspeaker in the ordinary sense of the term. Its acoustical output at resonance is more than sufficient for the purpose of "loud speaker" reception of code signals, however.

The curve of figure 5 demonstrates the acoustical output-limiting characteristic, acoustical pressure in arbitrary units plotted against driving force. Here again this desired characteristic is not to be construed as that of the ordinary loud-speaker, because the acoustical output saturation, caused by magnetostrictive deformation saturation of the elastic member, occurs at what might be termed a *comfortable volume level.* Thus inequalities in amplitude of component driving forces of different frequencies (and of the same frequency) tend to be ironed out; further, such a characteristic will suppress interference characterized as other than signal. Together, figures 4 and 5 portray a device which acts as a narrow-frequency band-pass filter capable of acoustical output limiting at a comfortable level, something which is readily adaptable to existing receiving equipment.

Reception Tests

The selectosphere, in actual reception tests, demonstrates the effectiveness of the characteristic curves of figures 4 and 5. Its high audio-frequency selectivity requires a reasonable degree of band-spread tuning,[6] such as is necessary with a quartz crystal intermediate frequency filter. Its use on continuous wave reception affords a very sharp response peak on both sides of zero beat when not used with a receiver embodying the single signal feature. Quite natu-

[*Continued on Page 74*]

[5]There follows in Professor Gager's original paper a detailed mathematical discussion of the dynamic relations of the selectosphere, omitted in this article for the sake of brevity.—EDITOR.

[6]Mechanical, electrical, or a combination of both.

Dressing Up the Station for 1937

By W. E. McNatt, Jr.,* W6FEW

One cannot deny that it costs a few extra dollars to "doll up" a transmitter so that it is ornamental as well as useful. But even so, it seldom represents more than but a few per cent of the total cost of the transmitter. And unless there is something radically wrong with you, a neat appearing rack-and-panel job should be a source of as much satisfaction as comes from working your 94th country. Here is the way to do it inexpensively.

Fall is here. Election time is here. *Rebuilding* time is here. No matter what John Q. Ham is doing when this time of year rolls around, ideas for rebuilding last year's rig are always in the back of his mind.

Every amateur should take sufficient pride in his station, no matter what the time of year may be, to have its *appearance* 100% equal to its operating performance. In spite of the many articles telling and showing how to improve the appearance of a station, there are yet hundreds of hams who have a nice looking receiver and monitor, but a transmitter that is strung about the room on breadboards lying on or under tables.

Two principal arguments have persisted for years against rack and panel transmitters. Of the two, cost seems to be the principal one. The other is, in so many words, "A guy goes to all the trouble of building up a nice rack-panel rig, and then it is full of bugs when it's finished!"

Radio has run several articles showing that racks are *not* expensive when home made. For example, see "A Relay Rack at Low Cost", Radio, April, 1936. The cost of the rack described therein is about the highest one ever need pay for a homebuilt job. The writer has a rack and panel which cost him $5.00, including every part. The uprights are of wood, the panels are of tempered "Masonite", and the base is a piece of sheet iron bent into a "U". The whole rack was painted black, and the panels were given two coats of crackle-finish over two coats of "primer". Nickel-plated grommets are used with the screws for the panels, which adds greatly to the appearance of the layout. It's attractive *and* its cheap.

The complaint against the operation of a rack-and-panel transmitter has little foundation to it. Most of the transmitting units recently shown in these pages are rack-panel jobs. It is likely that the ham who builds a rack-and-panel transmitter after having used "haywire" layouts for several years uses haywire methods for his rack and panel rig instead of forgetting all about such methods and changing to neat, well-designed construction.

Let us imagine ourselves descending "en masse" on a ham who has parts of good quality, who is able to spend moderate sums on his station at not too infrequent intervals, but who is guilty of "haywiring" his transmitter.

"Lissen you!" say we, by way of a gentle opening.

Not equally gently, he replies, "Whoinxx are you?"

We spend the next five minutes informing him that he is guilty of atrocious "haywiring". He gives us our opportunity by asking, "So what?"

Whereupon we launch ourselves well on our way.

"Look here, you have a lot of nice stuff. Some of it's not so good, but, generally, it's ok.

"F'rinstance, the transmitter. You have a '59 oscillator, 802 buffer, 35-T second buffer and a 150-T in the final. You will notice that we have walked nearly five feet in order to gather this much information."

Being consistent, he again answers, "So what?"

"Look;" say we, as we pull out the design shown here as figure 1, "this set-up will just take care of your transmitter . . ."

"And won't work as well as a breadboard rig," he interrupts.

"Tsk, tsk!" we chide him. "Not if you use your head while building it!

"You can put your high-voltage power supplies at the bottom. The bottom panels will give you plenty of room for your power transformers, filament transformers, filter, keying relay, and bias supply. The control panel should be included so as to avoid running back and forth from the transmitter to the operating position when tuning up or shifting bands; for regular operation, just have duplicate controls at the desk."

*1613 7th Ave., Lewiston, Idaho (BT7).

"Wait a minute; you're getting 'way ahead of me. How about the chassis for the power supplies; they're pretty expensive when you buy a whole flock of them."

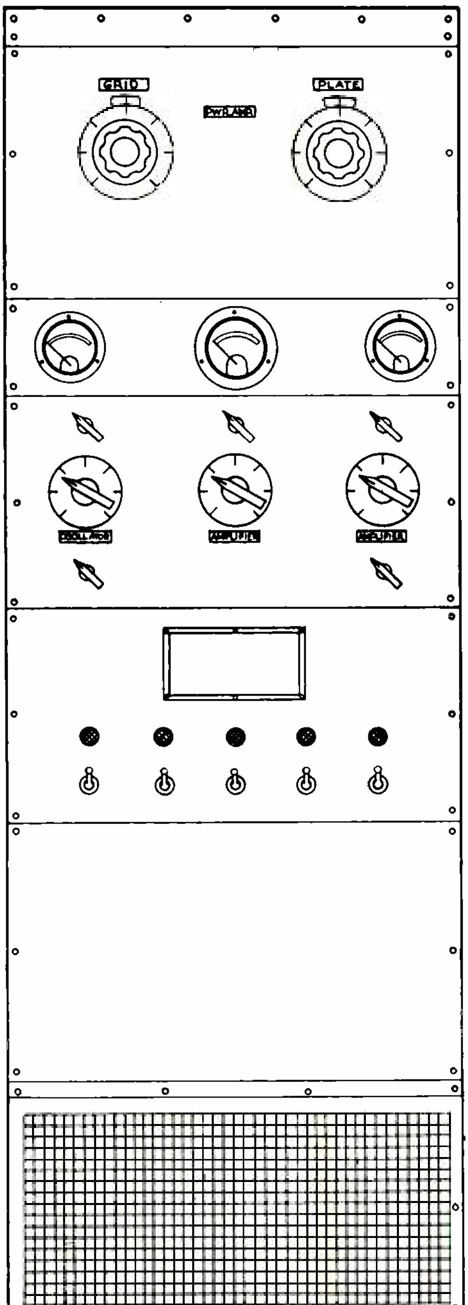


Figure 1
Balanced, well-designed transmitter layout suitable for many different tube lineups, a typical one being mentioned in the text. Size 55"x19"x18".

Success! We have aroused his interest!

"Well, it's like this. Some fellows prefer metal chassis; others don't. If you're the type of ham who likes to try out new circuits every once in a while, it would be too expensive to use metal chassis," we offered.

"As far as the rig is concerned, I usually don't tear it up or try any major changes for sometimes a whole month," he explained.

"In that case, metal chassis wouldn't do. Too expensive to buy or make a whole new set of them every time you wanted to try out something. When you change a circuit, the old holes in the chassis usually don't fit for the new circuit.

"Well, there's nothing wrong with tempered Masonite. You can build up a chassis very cheaply, and when you make changes, the cost for a new top for it wouldn't be more than 15 cents."

I pulled out the December, 1935, *R/9* and turned to Fay Harwood's "The 'Common Sense' Exciter".

"See this, for example. Notice how simply constructed that chassis is? Wouldn't cost more than two-bits to build one to fit this rack." (Figure 1.)

"Hmmmm! Could leave off that strip in front and put my panel there instead. And a few dime-store right-angle braces would fix up the chassis for the power supplies so that it'd be strong enough.

"But," he challenged, "how about that grill you show on the front for the rectifiers!"

"Simple," says we. "It's made of ¾" angle iron, some strap-iron, and ½" wire mesh. The whole works didn't cost more than a dollar and a half. The welding was done by a friend who works in a garage. We did our own painting and drilling. It's worth having, too. We lost one cat and got a couple of hefty shocks off the rectifiers before I covered them. A fellow can't be too careful with high-voltage."

"Besides, a fellow might kick out a couple of tubes if they weren't protected," he added.

"Check," said we.

He frowned again as he looked at the drawing. "How about the bux for all these nice dials, and the toggle-switches and pilot-lights on the control panel?"

"Well, the dials are direct-drive, not vernier, and direct-drive dials aren't at all expensive, comparatively speaking.

"The pilot lights aren't absolutely necessary, but they're certainly useful to show when the right things are 'on' or 'off'. Toggle-switches

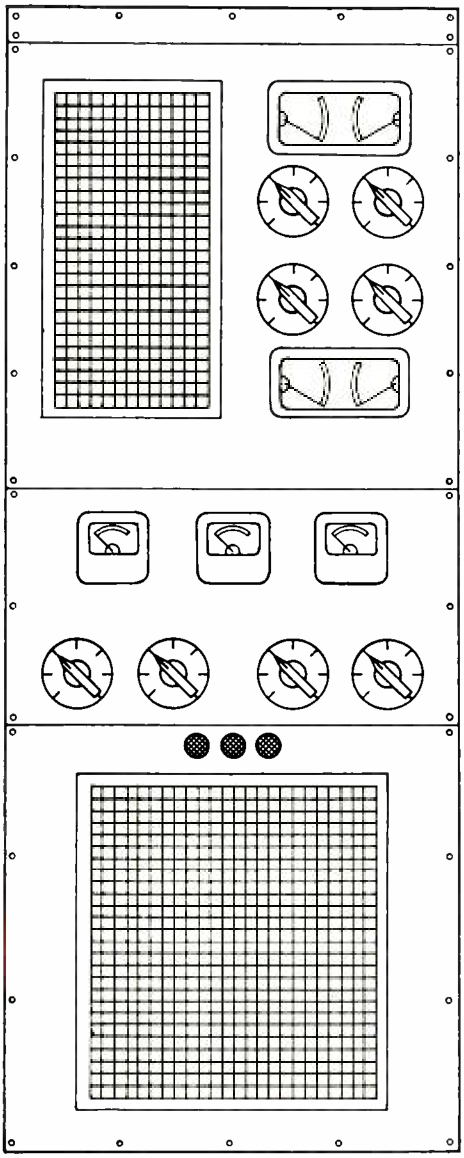


Figure 2
A somewhat fancier layout than figure 1, for those who desire something more "flashy". The wire mesh used for the grills is obtainable at larger stores in several mesh designs. The rack measures 48" x 19" x 20".

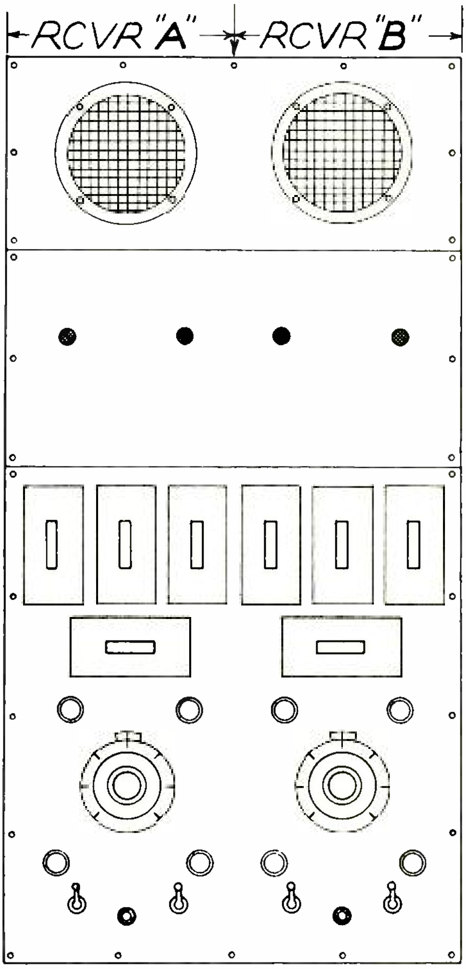


Figure 3
Here we have the "Communications Twin", a dual receiver of many uses as described in the text. Size 38" x 19" x 10".

aren't expensive; they're about the only nice looking, cheap switch a fellow can get; yet they handle their work ok."

"By the way," he asked, "what do the small knobs on the exciter panel control?"

"They're for band-switching. Each knob operates a switch. One selects the desired crystal; it's at the lower right. And the others tap down the coils in the crystal oscillator and the two buffers. The lower left-hand switch taps the grid-coil of the second buffer stage for link coupling.

"Considering everything, band-switching in a low-power stage isn't so objectionable; and it's sure the berries for QSYing in a hurry.

"The final uses only plug-in coils of the 'air-wound' type, which are by far the most efficient."

"But how about the rack?" he heckles.

Whereupon we rush to tell him all about our own rack, W6ITH's rack, and of many other ways to get a nice looking job without jeopardizing the bank-roll.

We must have convinced him, as he was looking over his file of RADIO's and catalogues when we left.

Other Refinements

For the amateur who wants to go "fancy" with a few added touches to his transmitter rack, figure 2 shows a design which may give him a few ideas. While not shown, this setup is covered with a cabinet which has a full-size door in its back. All the doors are simply and inexpensively made of strap iron and ½" wire mesh, providing ventilation and acting as windows besides.

Several ways of locking the doors can be devised, none of them complicated, yet effective. All the doors should be fitted with a power interlock switch so that the high voltage, including the bias voltage, is "off" when any door is open. Remember that high voltage simply will not stand familiarity.

A little serious thought and planning in laying out the doors will bring better results than might be had by just "throwing" them together. It is suggested that the large door for the rear of the cabinet be braced at the corners and at the "horizontal middle" in order to keep it from twisting when it's swung open and shut.

Doors, at such low cost, are desirable. They add to the "commercial" and business-like appearance of the transmitter. Too, the glow of filaments is always more impressive when visible than when hidden behind a panel. Also, one can keep a watchful eye on that "66 with a bright spot on the filament."

The cabinet proper is made of tempered Masonite (again!) which, when sprayed with a priming coat of black paint and given a coat of crackle finish, has a very "metallish" appearance.

Other added touches in this case are the square type instruments; singles and twins. The meters on the exciter panels are for the plate current to the oscillator, grid current to the buffer stage, and plate current to the buffer stage.

There are several good circuits which could nicely fill this design. For instance, we like this one: that extraordinarily simple but powerful 6L6 crystal oscillator circuit ("glass" 6L6) to drive the "socks" out of an RK-20 or 804 in the buffer stage which, in turn, would drive a pair of 150-T's or 354's in push-pull to "ye olde kilowatte inputte". Similarily, there are many combinations, not necessarily high-powered, which will fit nicely into such a dressy "home".

Rack-Mounted Receivers

Receivers, too, can be dressed up and put into a new home to advantage. Dx men, traffic men, and just plain hams all have use for two receivers, whether they have them or not. The dx man likes to keep an "ear" on both 20 and 40 meters; the traffic man may have schedules on two different bands, in which case there'd be nothing like having two receivers: one to tune to the frequency of the "next sked" while working another station with the other receiver.

About the simplest and nicest circuit we can think of for such work, considering cost, performance and *appearance,* is the RADIO "Super-Gainer" of Frank Jones, which has found deserved popularity with countless amateurs.

No matter what his interest may be, the ham —Dxer, trafficker or just "plain hammer"— likes to keep that tuning dial reasonably close to the surface of the operating desk. Conventional rack-panel receivers always mount one receiver above the other. Keeping the idea of "tuning dials close down" in mind, we scrawled, scratched and scribbled. Out of the mess came the design shown in figure 3. Some fool notion in the back of our head makes us want to call it (or "them") the "Communications Twin", or should we say, "Twins"?

It will be noticed that the design of this "twin" differs from the conventional in that the receivers proper are not mounted one above the other, but are mounted *side by side* in the relay-rack.

Starting at the bottom, first are the filament-plate toggle-switches and phone jacks for each receiver. Each pair of toggle-switches, respectively, control the filament and plate voltages to each receiver. At times it might be that the operator would want to cut off the plate voltage to one of the two receivers; hence the inclusion of a plate-voltage switch. The phone jacks directly below the tuning dial for each receiver may be so connected that the speaker for that particular receiver is disconnected when the 'phone plug is inserted into the jack. Or, the audio circuit can be so arranged that the speaker remains connected whether the phones are plugged in or not.

The rest of the collection of knobs are the controls for each receiver, the circuit of which has been described several times in earlier issues of RADIO.

We thought it would be kinda nice to fix up the two coils for each receiver so that they could be handled as one unit when plugging them in. Consequently, the bottom-most pair

[*Continued on Page 68*]

Magnetrons for the Ultra-High Frequencies

By S. G. Lutz*, W9TJB

The trend is ever upward; interest in the "ultra highs" points towards the frequencies above 300 mc. But to date amateurs have, on the whole, done little about the "ultra ultras". If we want to retain our reputation as pioneers of the higher frequencies, we had better start investigating them right now; as it is, the "frontier" has almost caught up with us. The operation of magnetrons on wavelengths below 1 meter offers a fertile and fascinating field for experimentation, requires no expensive gear.

Most amateur ultra-high frequency activity has involved the use of triodes in conventional feed-back oscillator circuits. The upper limit of frequency obtainable with such circuits is determined by tube capacities and the transit time of the electrons. Such circuits, with commercial tubes, will give satisfactory output at wavelengths as short as two meters. Special miniature tubes will oscillate at wavelengths as short as a half meter, but with very low output and efficiency.

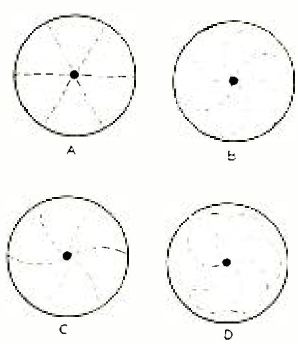


Figure 1
Effect of Magnetic Field on Electron Paths in Magnetron Tube. A) No magnetic field, electrons travel straight to plate. B) Critical field; electrons just graze the plate. C) Less than critical field; all electrons reach the plate. D) Greater than critical field; no electrons reach the plate.

Below fifty centimeters it is necessary to use some form of electronic oscillator, such as the positive grid triode (Barkhausen-Kurtz), or the split anode magnetron. Some amateurs have tried the positive grid circuits, since it is possible to use commercial tubes having cylindrical electrodes. However, low output and short tube life have been rather discouraging. Most amateurs, after having the grid melt out of a pet 852, decide that a tenth of a watt on 75 centimeters is too expensive! With specially constructed tubes and intelligent operation, it is possible to operate positive grid triode oscillators successfully on wavelengths as short as ten centimeters. However, if special tubes are to be used, why not try magnetrons?

The magnetron tube, in its simplest form, is a diode consisting of a cylindrical plate and an axial filament. The tube is operated in a magnetic field parallel to the axis of the plate and filament. With no magnetic field, electrons from the filament are attracted directly to the positive plate, as shown in figure 1a. When the magnetic field is applied, the electrons will be deflected in a curved path. At a certain critical value of magnetic field the majority of the electrons will just graze the plates (1b). Below this value all electrons will reach the plate, while at greater fields practically none of the electrons will reach the plate (see figures 1c and 1d). It is obvious that if this cut-off action is sharp, a very slight change in the magnetic field can be used to produce a large change in the plate current. By taking advantage of this effect, the magnetron may be used as a rectifier, amplifier, or oscillator at low frequencies. This type of operation is limited to the low frequencies because of the large inductance of the magnet windings. However, the ultra-high frequency operation of magnetrons depends upon entirely different phenomena and does not require fluctuating currents in the magnet windings. The actual phe-

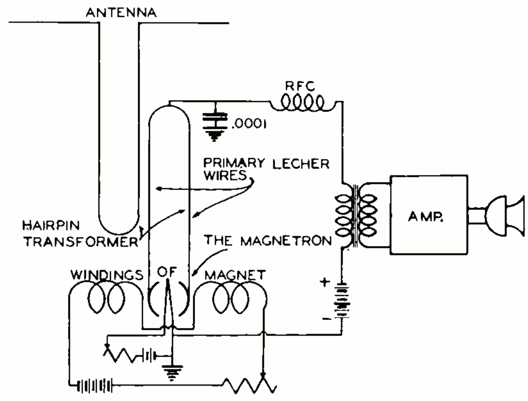


Figure 2
Split-Anode Magnetron Transmitter

*218 Sheetz St., West Lafayette, Ind.

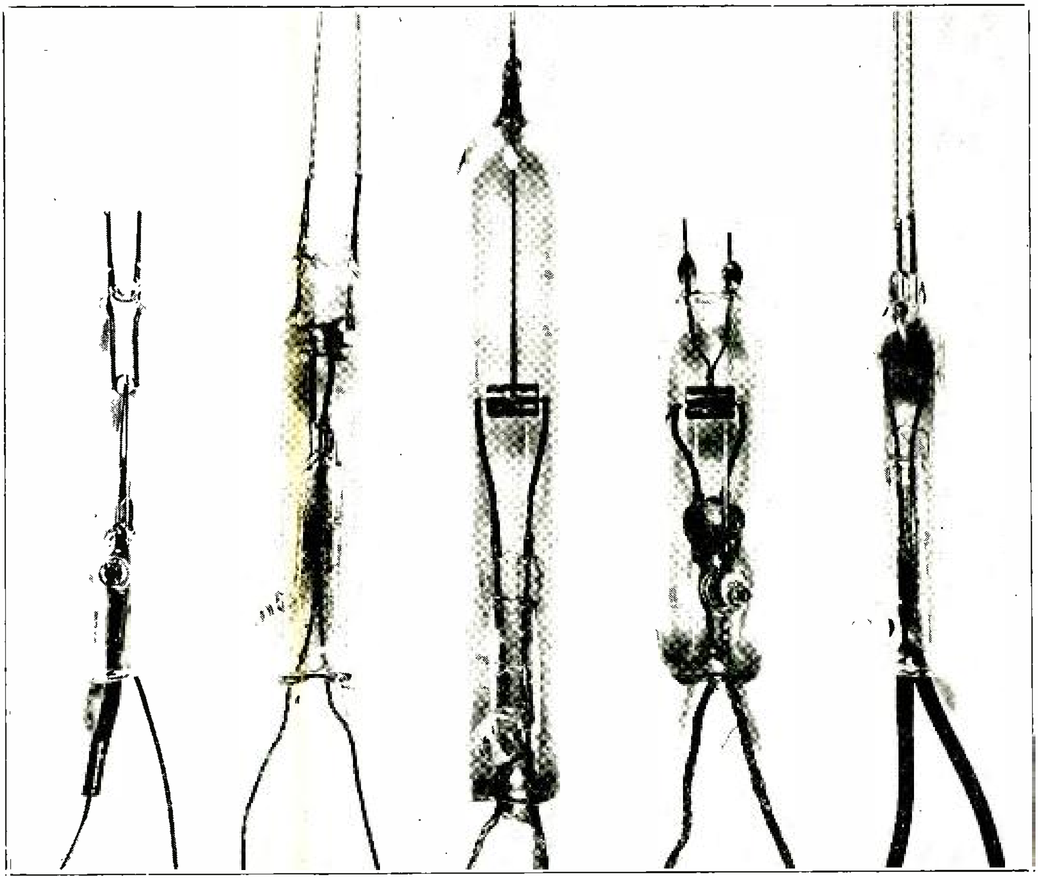


Figure 3

Typical, Home-Made Split-Anode Magnetrons (The Small Tubes Will Operate on 9 Centimeters)

nomena of oscillation in magnetrons will be explained later.

The first magnetrons had the oscillatory circuit connected between the anode and filament. However, most modern tubes have the anode split axially into halves and use the oscillatory circuit connected between these split anodes as shown in figure 2. The split anode feature provides a push-pull action, greatly increasing the efficiency and the power output.

Dynatron Oscillations

There are two principal modes of oscillation obtainable from a magnetron: namely, dynatron oscillations and pure electronic oscillations. The dynatron oscillations from a magnetron should not be confused with those resulting from secondary emission in a screen grid tube. The term "dynatron" is often applied to any type of oscillator not requiring feed-back circuits and in which oscillations result from a negative resistance appearing between two terminals. In the screen grid dynatron the negative resistance is the result of secondary emission, but negative resistances may be obtained in many other ways. By proper adjustment of the magnetic field, a negative resistance may be obtained between the two plates of a split anode magnetron. If a tuned circuit is connected to the plates, dynatron oscillations will be produced. The frequency of these oscillations will be determined by the constants of the tuned circuit and may be varied over wide limits. At moderate wavelengths, say two or three meters, the efficiency may be as high as 50% and it is possible to obtain an output of five or ten watts from small tubes. Outputs of several hundred watts have been obtained from larger tubes with adequate cooling area. These dynatron oscillations are similar to common feed-back oscillations in that their upper fre-

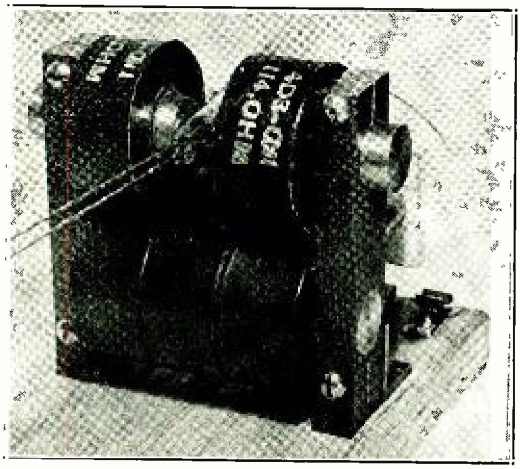


Figure 4
Field Magnets for the Magnetron Oscillator

quency is limited by electron transit time. As the frequency is raised the efficiency and power output fall off. Fifty centimeters is about the shortest wavelength obtainable from magnetrons operating as dynatron oscillators. For shorter wavelengths we must use the electronic oscillations.

Pure Electronic Oscillations

Unlike the dynatron oscillations, the wavelength of the electronic oscillations is determined entirely by the plate voltage and the magnetic field, not by the external tuned circuit. The wavelength is given approximately by the equation $\lambda = \frac{12300}{H}$, but the plate voltage must also be adjusted for each value, H, of the magnetic field. Another peculiarity of the electronic oscillations is, that unless the tube has a heater type cathode, maximum output will occur when the axis of the plates is tilted at a slight angle (5 to 10 degrees) with respect to the magnetic field. Maximum output from dynatron oscillations always occurs with zero tilt. It is quite easy to obtain electronic oscillations of twenty centimeters wavelength, and wavelengths as short as 1.1 centimeters have been obtained in this manner.

Electronic oscillations are apparently produced by the spiral oscillatory motion of the electrons within the tube, and the frequency is determined by the period of oscillation of the electrons. The principle of securing these electronic oscillations is somewhat similar to that involved in the positive grid (B-K) circuits. In the positive grid oscillator, electrons are attracted to the grid at a high velocity. Some of the electrons pass on through the grid and are repelled by the negative plate. Some of the electrons repelled by the plate pass back through the grid and are repelled by the filament. In this manner, some electrons may oscillate about the grid for several cycles. In the magnetron, since electrons leave the filament with slightly different velocities, some of the electrons may fail to reach the plates on their outward journey and may spiral around inside of the tube for several cycles before finally landing upon one of the two plates.

One of the most attractive features offered the amateur by the magnetron is its relatively high power. With positive grid oscillators the output may only be a few milliwatts, and it is necessary to make all measurements with sensitive thermocouples. The output from a magnetron may easily be a half watt at ten centimeters and the usual amateur flashlight bulb technique works very well.

Construction of Magnetron Tubes

Unfortunately magnetron tubes are not yet available on the amateur market, though they probably will be within the next few months. However, magnetrons are very easy to build, as the electrode structure is very simple, and

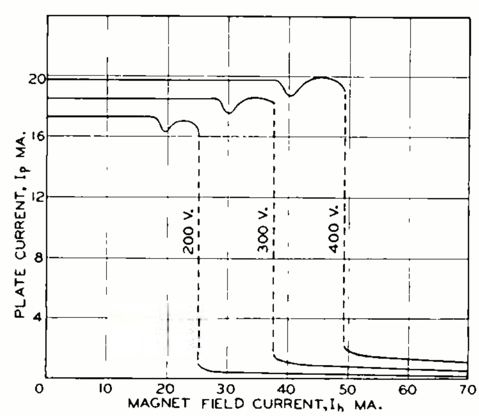


Figure 5
I_p-I_h Curves for Split-Anode Magnetron at Zero Angle of Tilt

the glass work is not difficult. Any amateur having the use of a small spot-welder and a good oxygen blast lamp can readily learn to make his own tubes. If pumping equipment is not available, he can probably have the tubes pumped and bombarded at a nominal charge, as it is a very short and simple process with proper equipment.

It is good economy to build experimental

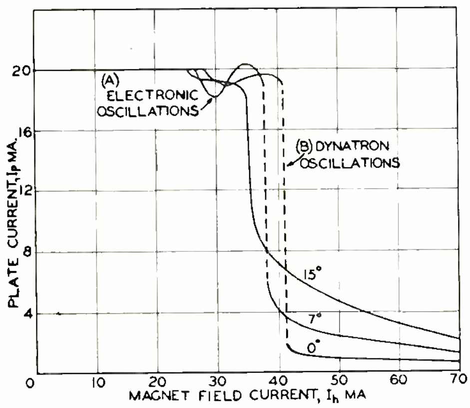


Figure 6
Effect of Tilting Tube upon the I_p-I_h Characteristics

tubes from the very best materials, as the cost of materials will be negligible in comparison with the labor involved. The plates of a magnetron often get extremely hot in operation; so every precaution must be taken against tubes becoming gassy. Tantalum is perhaps the best possible material for the plates as it may be operated at a bright red heat without danger of gas. Tantalum is a very expensive material, but so little of it is required that its use will add but a few cents to the cost of a tube. Carbon plates may be used in larger tubes where tantalum would be too expensive, but the assembly and exhausting of tubes with carbon plates is rather difficult. Nickel and even copper have been used, but are not to be recommended for homemade tubes. Tungsten should be used for the seals, leads and filaments. Nonex is the best glass to use as it seals very easily to tungsten. Pyrex may be used, but care must be taken to avoid "pin holes". Nonex must be worked in a strong oxidizing flame to avoid darkening it.

The present methods of designing magnetron tubes are largely empirical. Almost any design will work reasonably well. Figure 3 shows a few typical homemade tubes incorporating different features of construction.

The diameter of the plates may be approximately determined from the desired minimum wavelength and the maximum available voltage by the use of the formula:[1]

$$d_a = \frac{\sqrt{181\ E_a\ (\text{volts})}}{H\ (\text{gauss})}\ \text{cms.}$$

[1] "An Investigation of the Magnetron Short-Wave Oscillator" by E.C.S. Megaw, *Journal of the Institution of Electrical Engineers* (London) Vol. 72 (1933) pages 326-352.

A quarter of an inch is a convenient diameter for most purposes. Larger diameters require excessive voltages at short wavelengths, while smaller diameters often lead to constructional difficulties. The length of the plates should be about one and one-half times the diameter, though this distance is not critical. The distance from the plates to the seal at the end of the tube should be about a quarter of the shortest wavelength: for example, one inch if you wish to reach ten centimeters. This reduces the glass losses and the danger of cracking the seals, by putting the seals at a voltage node. The gap between the two plates should be about 20°.

Amateur tubes should have husky filaments. The only disadvantage to too large a filament is the power required to heat it and the fact that it cuts down permissible plate dissipation. Pure tungsten filaments are preferable to the thoriated type, as they do not have to be activated, and they are not damaged so easily in use. A tube with plates of one centimeter

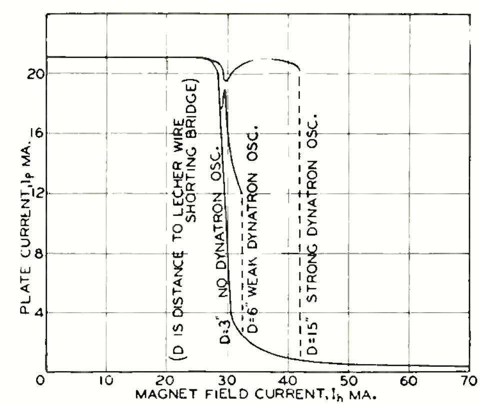


Figure 7
Effect of Lecher Wire Length upon the I_p-I_h Characteristic

diameter should have a tungsten filament of about .01 inch (10 mil) diameter. Such a filament will probably draw about seven or eight amperes at one or two volts. The filament support leads should be of very heavy tungsten, about five times the diameter of the filament. If they are not sufficiently heavy the filament current may heat them enough to crack the seals. It is almost impossible to spotweld tungsten to tungsten; so it is a good idea to spot a tiny scrap of tantalum to the filament support and then spot the filament to the tantalum.

It is quite important that the filament be very accurately centered between the two anodes. Failure to secure good alignment will

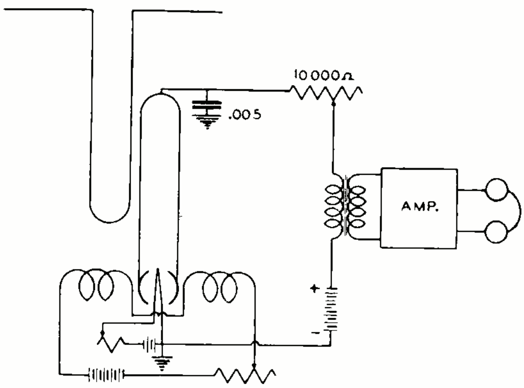


Figure 8
A Super-Regenerative Magnetron Receiver

reduce the sharpness of cut-off of the plate current.

Do not make the tube too large in diameter. The smaller the outside diameter can be made, the easier it will be to secure a strong enough magnetic field.

Design of the Field Magnet

In designing the field magnet, we can safely neglect the reluctance of the iron in comparison with that of the air gap. As previously mentioned, the field required for any given wavelength is given by the formula:

$$H = \frac{12300}{(\text{cms})} \text{ gauss}$$

Suppose we wished to reach 20 centimeters; we would need a field of 615 gauss. Actually, it will be wise to design the magnet for 1200 gauss, to allow for adjustment.

Dynatron oscillations require stronger fields than electronic oscillations and also, unless the magnet pole faces are very large, the field between them will probably not be as large as we would expect. The magnetic flux tends to "fringe" or "barrel" out instead of passing directly between the pole faces. As it is quite important that the tube operate in a uniform field, the diameter of the pole faces should be at least equal to the air gap between them. If the air gap is one inch (2.54 cms.) we will need

$$\frac{H\,L}{0.4} = \frac{1200 \times 2.54}{0.4 \times 3.14} = 2420 \text{ ampere turns.}$$

The actual method of supplying this number of ampere turns will depend upon the d.c. supply available. 110 volts d.c. or even a storage battery may be used. However, an ordinary a.c. power supply will usually be the most convenient. Field coils for midget dynamic speakers may be used very conveniently for the magnet winding, or special coils may be wound for the purpose. Figure 4 shows a typical magnet using dynamic speaker field coils. This type of construction is quite flexible, allowing the air gap to be adjusted to fit different tubes. Extra coils may easily be added if a stronger field is desired.

Operation of Magnetrons

When testing a new tube, the first step is to determine the correct filament current. This is done with the circuit shown in figure 2, omitting the secondary or antenna circuit for the time being and using only the "primary Lecher wires", which should have a movable short-circuiting cross-wire or "bridge". Use about 300 volts on the plate with no magnetic field. Gradually increase the filament current until enough plate current is being drawn to heat the tantalum plates to a dull red color. This will give a good idea of the correct filament current and the maximum safe plate dissipation. Less filament current will be required at higher plate voltage to maintain this same plate power.

Next, be certain that the axis of the plates is parallel to the magnetic field and that the short on the Lecher wire system is a foot or more from the tube. Then run a family of plate current vs. magnetic field current curves for several values of plate voltage. These curves should resemble those of figure 5. At some point on the curve the plate current should jump abruptly from one value to another. In the vicinity of this "break" a flashlight bulb or neon tube will show the presence of dynatron oscillations (point "B" in figure 6).

The effect of tilting the tube in the magnetic field is shown in figure 6. Also, the effect of reducing the length of the Lecher wires is shown in figure 7. Either of these changes tends to reduce the "break".

Dynatron oscillations always have maximum amplitude with zero angle of tilt. This constitutes one method of distinguishing dynatron oscillations from the electronic oscillations. Also, with the dynatron oscillations, the flashlight bulb will continue to light as it is moved along the primary Lecher wires, gradually dimming and going out as it approaches the tube. Since the frequency cannot be measured directly on the primary Lecher wires attached to the tube, it is necessary to measure the frequency on a second Lecher wire coupled to the tube with a "hairpin" transformer. At longer wave-

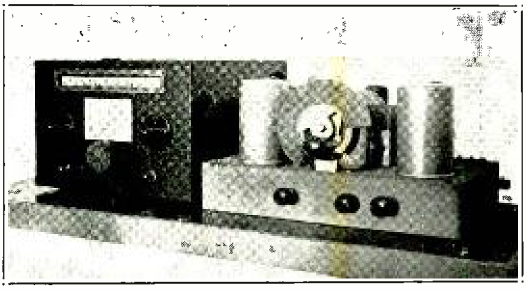
[*Continued on Page 75*]

Preselection from a Rebuilt S.W. Converter

By H. Frank Jordan,* W5EDX

No one can deny that a short wave superheterodyne without pre-selection is sadly lacking in all-around performance when compared with a receiver having a stage or two of amplifying preselection. If your superhet lacks preselection, here is an inexpensive yet easily made preselector, consisting of a rebuilt short wave converter. The changes are few and simple.

A two-stage, all-wave, regenerative preselector with single - control, front-panel band change, built-in power supply, and calibrated in megacycles, all for $12.00, is a large order. It sounds like a fish story, but it's true, nevertheless, *and* it really works.



The converted preselector, without cabinet, being used with the author's FB-7 superheterodyne.

There is no use taking up space here telling you the benefits derived from the use of a preselector, as everyone knows what they are.

This preselector has as its foundation the old Philco model 4C superheterodyne short-wave converter which became famous for its sensitivity and its remarkable performance, many of which are still in use. Some folks, not wishing the separate cabinet housing the unit on top of their radios, traded them in to the radio dealers on all-wave sets. Therefore the loose Philco 4C units; many of them, in fact, now resting on dealers' shelves are purchasable very cheaply. This one cost me $9.00, and I found later I could have purchased it for less.

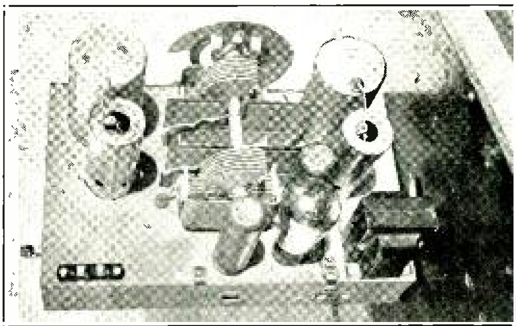
The parts necessary in addition to the unit are few and inexpensive, costing about $3.00 if you use Philco parts, which match up nicely with the parts on the converter.

The original wiring diagram is shown as figure 1, the revamped circuit as figure 2.

The changeover is very easy, and the writer's was finished in one day. It is well worth the little time and small expense required.

Among the parts not needed that can be removed from the chassis is the connecting cable, the large affair about 18 inches long. This can be removed by unsoldering the two wires protruding from the cable where the cable enters the chassis, and then it can be drawn through the large hole. The antenna choke and fixed condenser connected from large cable to antenna change switch are no longer needed and can be discarded. The small coil and fixed condenser and mica balancing condenser formerly used for a wave trap at 1000 kc. are removed. The bakelite case oval-shaped condenser (.05 µfd. capacity) and brown resistor near the first detector coil should be removed, or can be left and used in place of one of the cathode bypass condensers on the list of parts needed. Two fixed resistors: the white one, 99,000 ohms, and the red and yellow, 240,000 ohms, are both removed.

The aerial binding-post strip can be made from a small strip of bakelite and the strip mounted on the top of chassis as shown, making sure that the posts, which most likely you have in the junk box, are not touching the metal chassis. Provision is made for a doublet, or an aerial and ground can be used by shorting two



Looking Down on the Revamped Converter

posts as shown in figure 2. An insulated binding post is located on the left of the chassis looking down on top from the front, and should be placed in the nearest position to the antenna post on the receiver itself. Right next to it can be mounted a binding post connected direct to the chassis, which of course joins the "Gnd."

*831 West Lullwood, San Antonio, Texas.

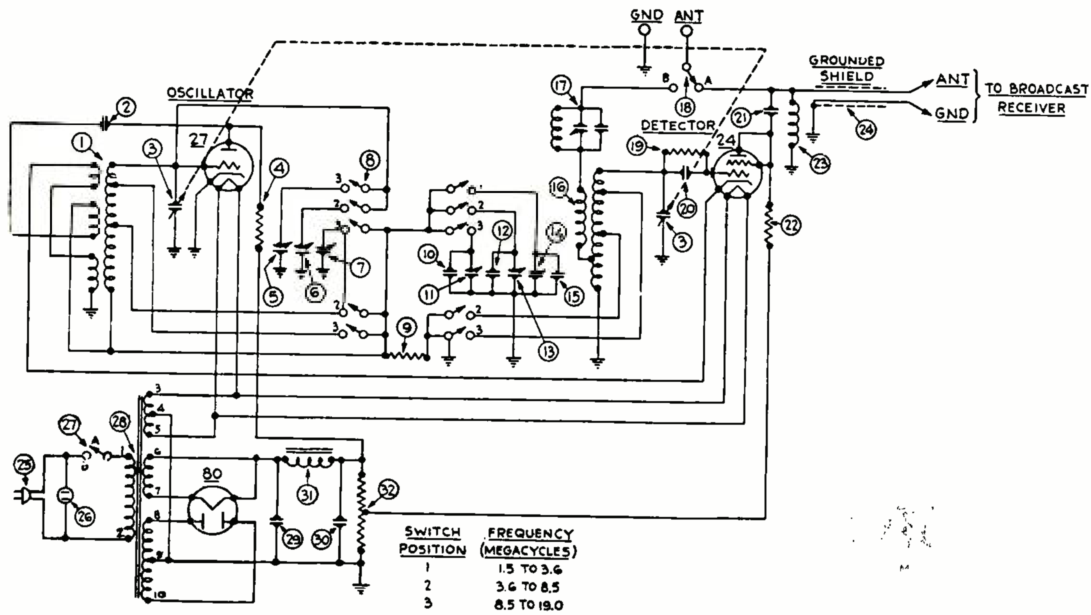


Figure 1

Original Circuit of the Philco Type 4-C Converter

post of the receiver. The leads between the preselector and receiver should be as short as possible for ordinary operation, but can be left about 10 inches long while aligning and trying out the preselector, which can be placed on its side while still connected to the receiver.

Now for the wiring: Unsolder the leads at each soldering lug at the bottom of each of the coils located in the two large shield cans, and unscrew the self-tapped screws from the bracket holding each coil to the chassis, and pull out the coils. The two coils are different, but fortunately are threaded and it is not hard to make both coils identical in secondary turns and taps, by removing turns of wire from the coil which has the longest form (about an inch longer, the old first detector coil) until they match and therefore will track properly, being single control. The midget coil about ¾ inch in diameter should be removed from the larger coil while this rewinding is being done, by unsoldering its leads and prying out the thin black cardboard spider frame from the three slots in the end of the coil. Then when the long r.f. coil is finished this midget coil can be put back in place easily, and serves admirably as a primary winding on all bands. The bottom of the grid coil of each stage should be soldered directly to the bracket which holds the coil to the chassis. Remove the old grid leak and condenser from its soldering lug, and in its place solder about a ten-inch piece of wire for the control grid lead. Possibly this all sounds difficult in print, but you will not have any trouble with it. See figure 3 for winding connections.

The shorter coil (the old oscillator coil) is now changed. The secondary, or grid winding, is left as it is. The windings of smaller wire between the sections of secondary turns, at the taps, will have to be changed slightly, and are used for regeneration. It was originally 3 windings with one reversed. The first one is at the top of control grid end (smallest wire, remember) and consists of about ¾ of a turn, which is removed. The next two, of 3 and 5½ turns, are left as they are and the connections to the soldering lugs are ok. A 3/16 inch hole is drilled in top of this form in the same position the grid lead attaches to the long coil. A small soldering lug is attached by means of a short 6/32 nut and bolt, then a piece of wire about ten inches long, suitable for a control grid lead, is soldered on the lug as well as the wire which goes down through the coil and connects with the proper lug at the bottom of coil. A hole must be drilled in the top of the coil shield can to match the hole in the other can and a small rubber grommet inserted. If you do not have one, merely wrapping the wire with tape where it will touch the hole edge will be

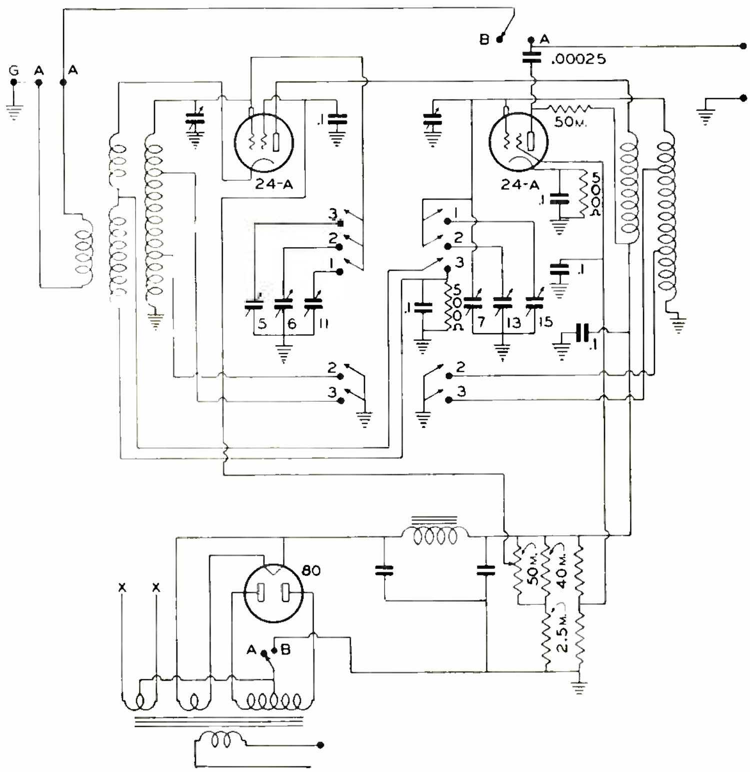


Figure 2

The "Converted Converter", the 4-C Revamped to Make a Regenerative Two-Stage Preselector

sufficient. The antenna primary, for all-band operation, was quite a perplexing problem, as the band change switch did not have any more contacts available. This arrangement was found to work f.b. on all bands, and different type aerials had little or no effect on regeneration. Wind some one-sixteenth inch composition paper or cardboard around the center of the coil and hold in place by a twisted rubber band. This strip should be about 8 inches long and about an inch wide. Now about 3 feet of single-strand push-back no. 20 hookup wire is cut and the center of it is wrapped 3 turns close-wound around the entire coil. Place a small piece of spaghetti tubing about an inch long under the three turns to push the last of the 3 turns through. Bring both leads up through one of the convenient slots in the top of coil and loop them through about twice and then twist the leads in the direction of your doublet lead-in (if you are using one). After the three turns are made secure, place several drops of sealing wax around the edges of hookup wire and touching the cardboard; then the rubber band can be removed. No wax is put on edges of the cardboard until you are sure that you have the antenna coil in the proper position on the form. Too near the top will prevent regeneration on higher frequencies, and too near bottom (bracket end) will reduce sensitivity on higher frequencies. This can be best ascertained after the unit is placed in operation. It can be slid up or down on the coil for best results, then anchored there by some more good old wax.

A shield can and base for it are obtained for the 24A tube which is used instead of the 27, and you can get an exact duplicate of the one already in the converter from any Philco parts dealer. The rivets are removed from the wafer socket, then remounted with the tube shield base using 6/32 nuts and bolts, placing a soldering lug underneath one of the sides of the wafer socket for a convenient ground to chassis.

The regeneration control potentiometer is mounted on the front panel of the chassis midway between the band change switch and the regenerative first stage, about two inches to the right of the band-change switch shaft.

The next part to be changed is the band-

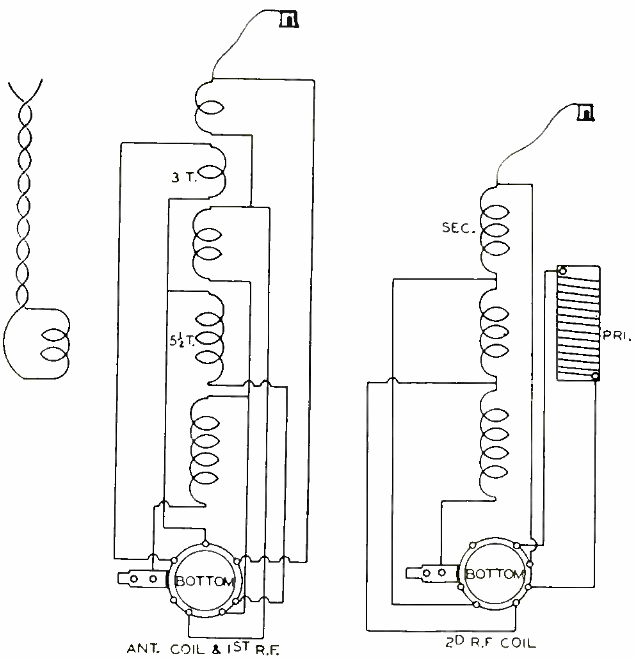


Figure 3

Key to Revised Coil Windings; Coils Should Be Altered As Shown Above.

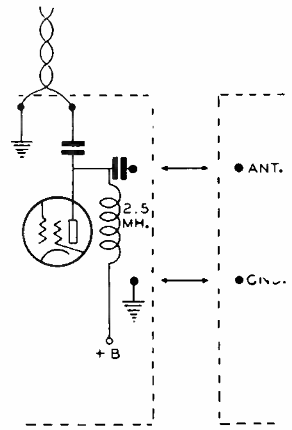
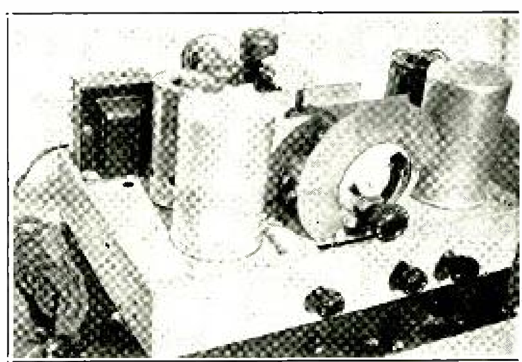


Figure 4

Optional method of coupling, using an r.f. choke instead of a plate coupling resistor, permitting full voltage to be applied to the plate of the tube. Another method is to feed the plate voltage through the antenna coil in the receiver, dispensing with the need for either a resistor or coupling choke. This is probably the best method, but requires some doctoring on the receiver, as the antenna coil (or coils) is usually grounded directly to the receiver chassis.

change switch, and only a minor change is necessary. In position 1, it is necessary to have more than one switch position as used in the old converter, and as there were more than the necessary positions of no. 3, it was decided to change one of the cams to close at no. 1 instead of no. 3. The fiber cam which is number 5 from the front of the switch is the one to reverse. Drill a small hole down into it right next to the small steel shaft (which looks like a small drop of solder) and on the far side of the fiber cam from the front of the panel. The egg-shaped cam, now weakened, can be pushed toward the front panel away from the small rivet with a screw driver and a pair of small pliers, and reversed. Obtain some good glue or cement (I used Dupont waterproof) and place some of it on the sides of both the reversed cam and the one next to it, no. 6 from the front, and squeeze them together and allow to dry. They should be held together by a piece of bent tin or brass so that the glue can do its work. Both the no. 5 and 6 cams are now turned in the same direction.

The next step is to change the positions of no. 7 and no. 11 balancing condensers. Place no. 7 in no. 11 position and vice versa. The small fixed condensers, shunting most of the



Closeup of the "Converted Converter"

balancing condensers, should be removed by unsoldering or cutting their leads.

The rewiring under the chassis is very simple, as there are but few connections to make. Follow the diagram carefully and run all leads as short and direct as possible, and solder them all well.

Each amateur band can be peaked while the unit is connected to your receiver, using the crystal stage of your transmitter, or some fairly steady ham signal on each band. You will find the calibration very close, as the old unit was

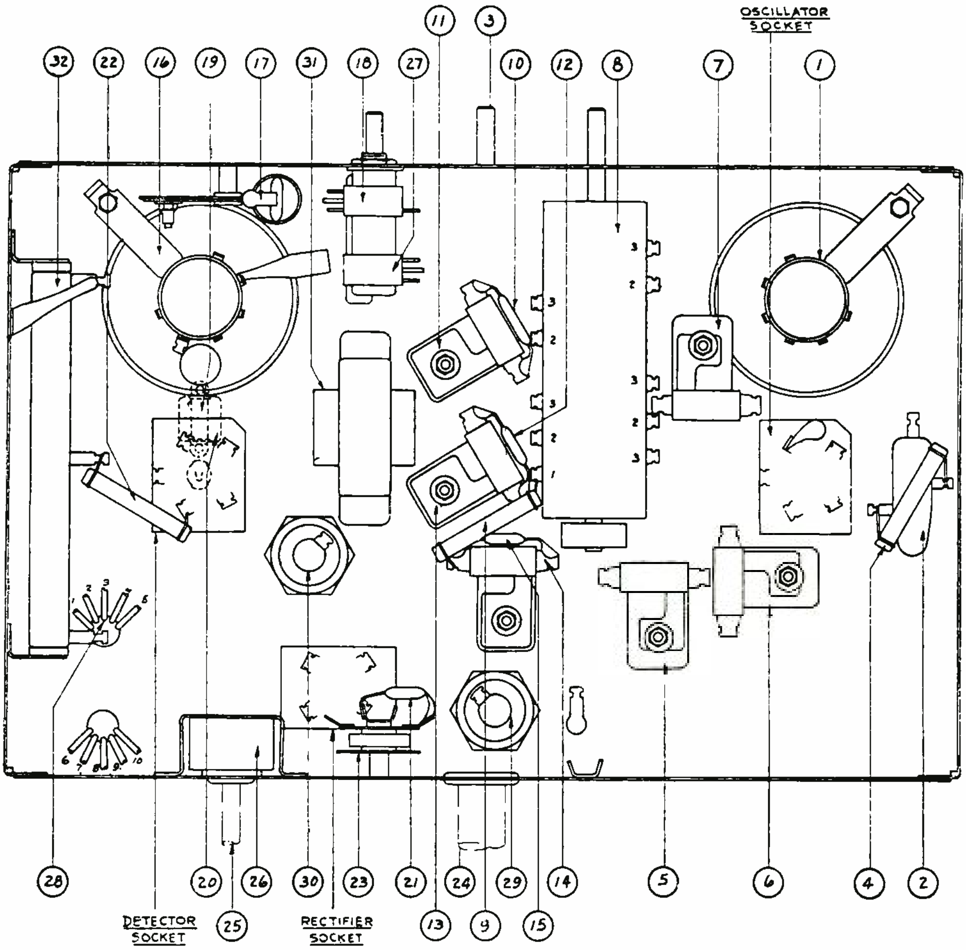


Figure 5

Schematic Layout of the Original Converter. Key Numbers Refer to Figure 1.

the steadiest of any I have ever seen, and I have never found one that drifted a particle while heating up. Use the Philco wrench of one of the smaller size or type, as the balancing condensers cannot be adjusted with a metal wrench.

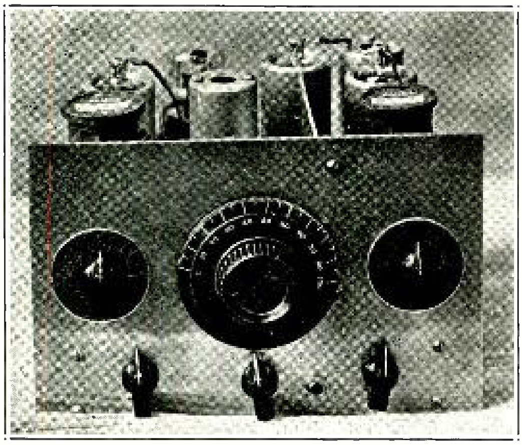
When the switch of the preselector is in the "off" position, the tubes are left lighted and the B positive is off and the aerial is connected to the receiver alone. In the "on" position, the aerial is shifted back to the preselector and the power is on. The band change switch covers 1.5 to 3.6 mc. in position "1", 3.6 to 8.5 mc. in position "2", and 8.5 to 19.0 mc. in position "3", and therefore covers all ham bands except the very high frequencies. The preselector is really "all wave" except for the broadcast band. The regeneration control works nicely and in use the regeneration is pushed to the point just before it spills over, where you will find the preselector the most sensitive and the most selective.

As to performance, it exceeded expectations, and I can receive the other fellow much better than I did before. It is very sensitive, and any signal that you can bring in on the receiver can be brought up to R9 using the preselector. The local conditions here are very bad for dx, especially on 20 meter phone, but the second morning I tuned across that band I heard PK1MX in Java calling CQ, after hooking in the revamped 4C, and called him and got him. The next night I worked a VK phone and the next morning I heard a KA in the Philippines coming through R7, and a great deal of dx that I have never heard before and never worked simply because I had never been able to hear it.

[*Continued on Page 66*]

The "Transuper", an 80 Meter Transceiver

By GUS TREUKE,* W6DSR



The "Transuper" Described in the Text

Years ago, when the two-tube "blooper" was king, some very satisfactory QSO's were carried on by merely keying the receiver. Because of the low value of plate voltage used, and the high value of grid leak for optimum reception, the radiation from one of these oscillating receivers seldom exceeded a small fraction of a watt. But everybody had a lot of fun, and some noteworthy emergency-disaster work was carried on in this manner. One amateur we knew carted his blooper with him when on out-of-town trips. Landing in a strange town, he would QSO several locals with his keyed blooper and within a few hours have a half-dozen invitations to dinner. He even talked home once, over a distance of some 100 miles.

Elaborating upon this idea, and applying it to the present-day superhet, with its pentode output tube and dynamic speaker, we can put approximately 5 watts of crystal controlled signal into an 80 meter antenna by merely adding a few inexpensive bypass condensers, chokes, a coil, and a crystal. The diagram shows the idea as applied to a modified "Super Gainer" superhet. However, the idea may be incorporated in or added to any standard receiver utilizing either a 47, 2A5, 6F6 or other similar pentode with from 250 to 350 plate volts.

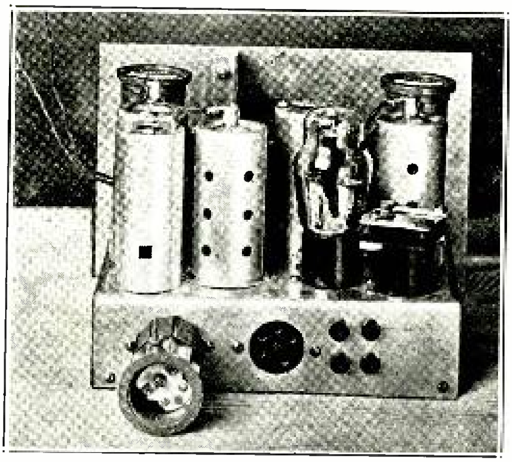
The receiver shown, because of its compactness and performance, makes an ideal "vehicle" for the transceiver scheme, as it makes a nifty portable. It will fit nicely, along with a power supply and 5″ dynamic speaker, in a small carrying case.

*2544 East 16th St., Oakland, Calif.

The i.f. transformers of this receiver can be aligned by tuning in a phone signal (that isn't fading) and adjusting the trimmers by ear. Aligning equipment would be better, but as there are only two i.f. transformers in this receiver, a fair job can be accomplished as described above.

The tuning of the receiver is similar to the "Super Gainer", and therefore does not require explanation.

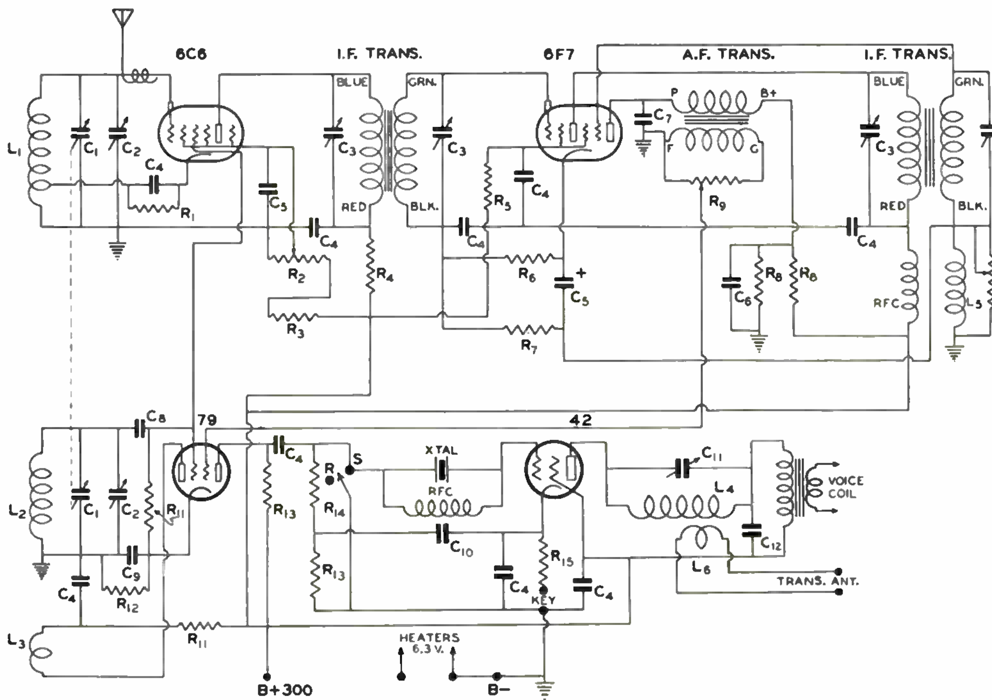
The crystal oscillator tank circuit consists of the coil seen sticking out the back of the receiver, and a small mica trimmer mounted inside the coil form for tuning. For an 80 meter crystal, the coil should consist of about 40 turns of no. 22 d.c.c. on a 1½ inch form. The crystal oscillator may be used on 160 meters instead of 80 by substituting a suitable tank coil.



Back view of the transmitter-receiver. The 80-meter tank coil and trimmer condenser are seen projecting out the back. The home-made crystal holder may be seen to the right of the output pentode.

Most output will be obtained if this tank circuit is very low "C", and the stability will be just as great as with a high "C" tank.

To receive, throw the send-receive switch to "R" and close the shorting switch on the transmitting key (most of them have such a switch; if yours hasn't, just put a brick on the key).



General Wiring Diagram of the "Transuper"

C_1—10 μμfd. variable
C_2—100 μμfd. variable
C_3—I.f.t. tuning condensers
C_4—0.01 μfd. mica
C_5—0.1 μfd. tubular paper
C_5—(Cathode 6F7) 25 μfd. electro.
C_6—1 μfd. paper
C_7—0.001 μfd. mica
C_8—0.00025 μfd. mica
C_9—5 μfd. electro
C_{10}—0.5 μfd. paper
C_{11}—Osc. tuning, mica or air trimmer inside tank coil form.
C_{12}—0.004 μfd. mica
R_1—1500 ohm, 1 watt
R_2—50,000 ohm potentiometer
R_3—25,000 ohm, 1 watt
R_4—2000 ohm, 1 watt
R_5—100,000 ohm, 1 watt
R_6—400 ohm, 1 watt
R_7—1200 ohm, 1 watt
R_8—25,000 ohm each, 5 watt
R_9—500,000 ohm potentiometer
R_{10}—10,000 ohm variable.
R_{11}—50,000 ohm, 1 watt
R_{12}—1,000 ohm, 1 watt
R_{13}—50,000 ohm, 1 watt
R_{14}—10,000 ohm, 1 watt
R_{15}—600 ohm, 5 watt
L_4—See text
L_6—See text
RFC—2.5 mh., receiving type
R-S—S.p.s.t. switch

To send, throw the switch on the receiver to "S", open the key circuit, and pound away.

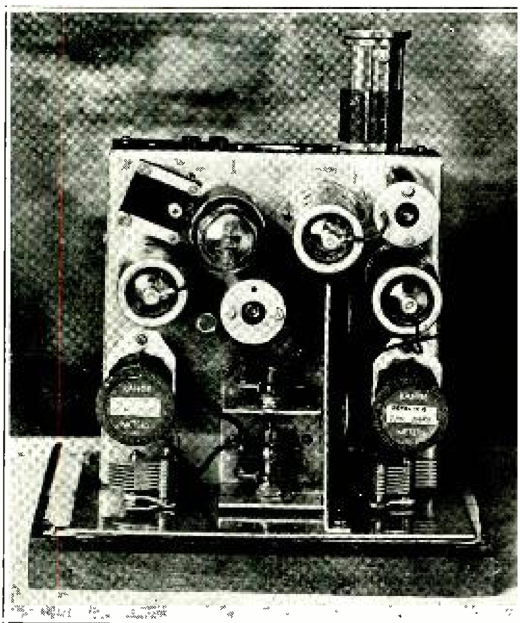
Though most any common type antenna and coupling method may be used with the transmitter-oscillator, best results will be obtained with inductive coupling to the antenna. A 3 to 5 turn pick-up loop may feed either a grounded Marconi or twisted pair doublet. Loading may be adjusted by sliding the loop up and down the coil. Gradually increase the coupling until finally the oscillator will not oscillate regardless of the setting of the tank trimmer condenser. Then back off the coupling until it oscillates stably and follows keying satisfactorily when the trimmer is adjusted to the proper value. No meters are needed for this tuning-up procedure. Another tuning method is to put a flashlight bulb in one feeder of a twisted pair doublet or the ground lead of a Marconi and adjust the coupling and trimmer condenser for the greatest brilliancy concomitant with clean keying. When finished tuning up, short out the flashlight bulb, as a watt of power is of considerable value when one has few to begin with.

When "transceiving", 10 or 15 feet of bell wire will suffice for the receiving antenna, as it is doubtful if you will be working any VK's or PY's with the rig anyhow. Nevertheless, with a good 80 meter transmitting antenna in a good location, average reports of R6 to R7 will be received at night up to 200 or 300 miles.

As the writer is a lazy sort of a cuss, he finds much pleasure in this rig as a bedside layout. Many a pleasant hour is spent in bed working the gang. If your YF objects to a full-sized transmitter in the bedroom, perhaps you will be able to persuade her to let you install this layout. It can be squeezed into a surprisingly small space.

RECEIVER COIL DATA

Band	L_1	L_2	L_3
160 METERS	1¾" winding space of No. 24 E. tapped at 1½ turns. Close wound.	1¼" winding space of No. 24 E. Close wound. Grid on top end.	12 turns No. 24 E. Close wound ⅛" from L_2. Wind in same direction as L_2 with plate on far-end.
80 METERS	40 turns No. 20 d.s.c. spaced to cover 1¾". Tap at ¾ turn.	33 turns No. 20 d.s.c spaced to cover 1¾".	8 turns No. 24 E. Close wound 1/16" from L_2.
40 METERS	12 turns No. 20 d.s.c. spaced to cover 1½". Tap at ½ turn.	11 turns No. 20 d.s.c spaced to cover 1¼".	5 turns No. 24 E. Close wound. Spaced ¼" from L_2.
20 METERS	5 turns No. 20 d.s.c. spaced to cover ⅞". Tap at ⅓ turn.	5 turns No. 20 d.s.c spaced to cover ⅞".	3 turns No. 20 d.s.c. spaced ¼" from L_2.
10 METERS	3½ turns No. 20 d.s.c spaced to cover 1 inch. Tap at ⅓ turn.	3½ turns No. 20 d.s.c spaced to cover 1".	2½ turns No. 20 d.s.c. ¼" from L_2 and 1/16" between turns.



Top View of the "Transuper"

Although liberties may be taken with the receiver part of the circuit (front end), do not attempt to make any extensive changes in the pentode output stage circuit in designing a transceiver such as this one. For instance: substituting a 25 μfd. electrolytic cathode bypass for the decoupling network will work fine on audio, but the electrolytic condenser will get very unhappy when the 42 starts grinding out r.f.

Under certain conditions of wiring and stray circuit capacitance, it may be that the crystal will try to oscillate even with the switch on the "receive" position. If this trouble is encountered, it can easily be remedied by connecting the junction of R_{14} and C_4 to the point "S" through a 2.5 mh. radio frequency choke instead of directly.

◆

Uni-control U.H.F. Receiver

The Dunmore uni-control u.h.f. receiver is well described in an article by F. W. Dunmore, appearing in the December, 1935, issue of the *Journal of Research* of the Bureau of Standards as research paper no. 856. A reprint is available at 5c from the Superintendent of Documents, Government Printing Office, Washington, D. C. They will not take stamps but want a postal money order—for a nickle! The receiver is something; it produces per-stage gains as high as 16 at 100 mc., although it has a 2-to-1 tuning range.

◆

The Eight Ball

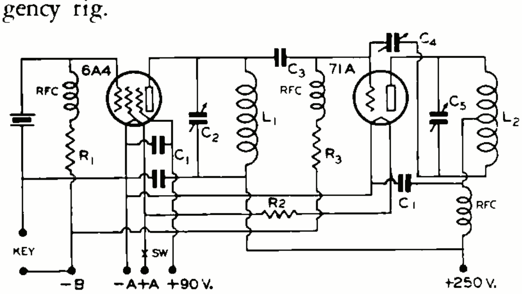
This is certainly an upright and virtuous crowd. Exactly seven readers have asked why a microphone should be called "eight ball", just because it is black and ball-shaped. Are we editors the only ones so low as to know what the eight ball on a pool table looks like?

◆

We hear from "Pye" Reid, ZS2A, that he not only hears many 9 meter police stations down there, but that he occasionally hears the *cars*.

A Battery-Operated Emergency Portable

A great deal of interest has been shown in the construction of a simple, rugged, and dependable battery-operated transmitter, particularly by members of the A.A.R.S., amateurs in remote locations, and those wanting an emergency rig.



The Battery-Operated Emergency Portable

R_1—10,000 ohms, 2 watts, carbon
R_2—4 ohms, 1 watt or greater, wire wound
R_3—35,000 ohms, 2 w.
C_1—.004 μfd., mica, 500 v.
C_2—100 μμfd. midget variable
C_3—100 μμfd., 500 v. mica
C_4—15 μμfd. midget variable
C_5—100 μμfd. midget variable
L_1, L_2—35 turns no. 20 d.c.c. on 1½" form, L_2 tapped at center turn.
RFC—2.5 mh. r.f. chokes

Most of the portables that have been written up lately have been of the small a.c.-operated type, which can be operated from a storage battery by means of a converter, but only at a rather heavy drain. For use where it is inconvenient or impossible to get recharges or replacements, the problem of battery drain is of considerable importance. The trouble is mostly with the filament current, as the B drain isn't so much of a problem, particularly with a c.w. rig, which is unquestionably the most practical for the above-mentioned uses. The other factors entering into the picture are: frequency to be used, desired power input, portability, ruggedness, simplicity, antenna adaptability, and in most cases, cheapness and availability of tube replacements.

The transmitter should of course be crystal-controlled, eliminating the absolute need of a monitor and assuring that one's frequency is right where the other fellow is looking for it. As most portable work is done on the 80 meter band, with perhaps some on the 40 meter band, "straight-through" operation eliminates the need of a doubler stage. In fact, the whole transmitter could be a single tube affair consisting of only the crystal stage. However, in practical operation it was found much better to make the rig an oscillator-amplifier, as the additional stability and cleaner keying is worth the slightly greater current drain per antenna watt.

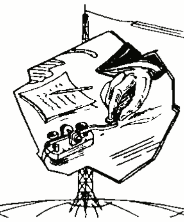
Inputs of ten to twelve watts to the 71-A were found to provide ample signal strength (with a good antenna) to work through all except the worst QRM with good reliability, and still not impose too much of a load on the B batteries. The larger sizes of B batteries should preferably be used, although for very temporary emergency use, the small ones would be all right. This rig is out of the "under your arm" class but a portable of that type is altogether another story. For greatest antenna adaptability the amplifier is of the "single ended" type.

The choice of the tubes to be used in the transmitter quickly centered on those of the directly-heated cathode type, as the minimum of battery filament current consumption can be achieved by turning off the filaments between transmissions during a QSO and leaving them off while "looking over the band". The heating time is negligible with the tubes shown; so this is no trouble at all when desiring to break-in or answer a call.

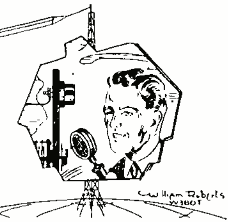
The most practical circuit layout was found to be standard in every respect: a pentode crystal oscillator, capacitively coupled to the grid of a 71-A, plate neutralized. With 250 volts on the plates of both the crystal oscillator and the amplifier, and a plate current of 40 or 50 ma. to the amplifier, the output and stability is all that could be desired.

The 71-A is used because of the better efficiency that can be secured as an r.f. amplifier than higher μ tubes at low plate voltage and high plate current. It meant the difference between a single tube in the amplifier and a pair of perhaps 01-A's, which would double the filament current in the amplifier. There also is a better transfer of exciting energy from the high impedance plate circuit of the oscillator tube to the high impedance grid circuit of a tube of the 71-A type. The grid leak is of a slightly lower value than usual with tubes of the 71-A, 45, 2A3 type, giving better output at the low plate voltage, though the efficiency is slightly lower than with a 50,000 or 75,000 ohm grid leak.

[Continued on Page 75]



CALLS HEARD AND DX DEPARTMENTS



Numeral suffix indicates "R" strength. Send Calls Heard to Calls Heard Editor, not to Los Angeles.

Edgar A. Sebire, Receiving Station VK3ERS, Victoria Road, Wandin North, Victoria, Australia
To April 14, 1936
(14 Mc. phone)

W 2FHI; 2UK; 4CDY; 4DBC; 4YF; 8HAF. — F8MH; FB8AB; G2NI; K6IJB; KA1AN; KA1NA; PK1MX; PK4AU; TI2RC; VS6AF; VS7RA; VU2BG; VU2CQ; X1G.

(14 Mc. c.w.)

W 1CDX; 1CJC; 1DHE; 1FSN; 1GF; 1IRB; 1LZ; 2ARB; 2CTC; 2DSB; 2EYY; 2FVT; 2GRA; 2GTZ; 2HHF; 20A; 3BXJ; 3DDL; 3EED; 3EJM; 3EYS; 3FAL; 3GAP; 4BZA; 4CDY; 4CEN; 4COT; 4CS; 4DEC; 4TR; 5COU; 5FUJ; 6AHZ; 6BBY; 6CBE; 6FMY; 6GRL; 6IDW; 6QD; 6RR; 6VB; 7IF; 8AAX; 8CET; 8CTL; 8EQ; 8ERZ; BFJL; 8GRX; 8JAN; 8KK; 8JLW; 8JRW: 8JTW; 8KMO; 8WWI; 9ADF; 9CRP; 9DIB; 9ENR; 9JEO; 9TEX. — CM2DO; D4ARR; D4JKB; D4KCG; D4MCN; D4WYG; D4XCL; D4YLI; EA1AZ; F8BS; F8DC; F8FK; F8LU; F8RR; F8WB; FB8AB; FR8VX. — **G** 2NF; 2PL; 2YB; 5CH; 5JO; 5KG; 5QA; 5YH; 6BQ; 6CL; 6GT; 6HM; 6KT; 6QZ; 6VX; 6WU. — GI2KR; HB9B; J2CL; J2HQ; J2KJ; J8CA; J8CD; K5AC; K6AIU; K6JPD; KA1AP; KA1ER; KA1LB; OA4J; OH3NA; OH3NP; OH5OA; OK2AK; OK2HL; ON4AS; ON4PA; ON4UU; PAOFF; PAOIDW; PAONP; PAOTSK; PK1BO; PK3BX; PK6AJ; U2NE; UK3DT; VEIBT; VE2EE; VE2JO; VE3DD; VE3JZ; VE3KF. — **VS** 1IJ; 2AG; 6AF; 6AG; 6AK; 6AO; 6AQ; 6AZ; 6BD; 6RA. — VU2BY; VU2CQ; VU2EB; VU2EQ; VU7FY; XE1AM; XE2C; XU8AL; XU8MT; YM4AA; YT7VN; ZE1JN. — **ZL** 1CD; 1CK; 1CV; 1DV; 1JZ; 2BD; 20Q; 2QM; 3JR; 3JX. — ZS6AL; ZT6AK; ZT6Q.

K. Yuasa, J3FJ, 3-Chome Kamomecho, Naniwauku, Osaka, Japan
(28 Mc. c.w.)

W 2NDG; 6AC; 6BAY; 6DQD; 6DTB; 6EML; 6FMY; 6GRL; 6JN; 6KB; 6MDN; 6PR; 6QG; 6RH; 6WI; V(VV; 7DOX; 9GHY. — D4CRR; D4GWF; FGVS; HB9AO; HJ3AJH; K6CRU; K6KSI; KA1SI; KA4J; OH7ND; OH7NF; U3AG; VE5BI; VE5MZ. — **VK** 2NY; 3BD; 3BW; 3CP; 3CZ; 3HL; 3KR; 3MR; 3YP; 4BB; 4EI; 5IH; 5JC; 5KD; 5MP; 5WG; 5ZC; 6AA 6SA; 6MW. — VS6AH; VS6AS.

T. V. Magunsson, SM7YG, Skogstropsgatan 14, Helsingborg, Sweden
April 1 to May 1
(14 Mc. c.w.)

W 1ADO-5; 1BXC-6; 1GNE-7; 1IBD-6; 1IIU-7; 1IKT-7; 1IYL-7; 1JOO-7; 1WE-8; 2AIW-6; 2BDZ-6; 2CJJ-6; 2CYN-4; 2EWH-6 2FBS-7; 2FXE-8; 2GIZ-6; 2IFZ-7; 3BES-6; 3BWU-7; 3CHG-5; 3CLT-6; 3DBD-6; 3FGG-5; 4AH-5; 4CUO-5; 4DQV-7; 4MY-6; 4ZH-6; 4ZZ-6; 5BMM-4; 5DRR-4; 5FE-5; 6AHZ-6; 6CNX-6; 6HX-6; 6INP-6; 6-JUL-5; 6KRI-7; 6RH-6; 7APG-6; 7QC-; 8CGK-7; 8FDA-; 8GC-6; 8MPD-6; 8ONR-6; 9PWZ-5; 9USL-6; 9VDY-6. — CE4AD-6; CP1AC-7; CR4AR-6; EA3AG-5; EA7AI-7; EA7AV-6; EA7CL-6; LU4DQ-5; LU5BZ-5; LU*DJK-6; VE1AE-7; VE2IL-5; VE3LU-6; VE4BF-6; VE4BG-6; VK3NW-3; VK3ZB-4; Z13GR-6; Z13JR-5.

March 1 to April 1
(14 Mc. c.w.)

W 1AXA-8; 1BHQ-7; 1CGM-8; 1CHR-9; 1CMX-7; 1DDM-8; 1DHE-6; 1EZ-7; 1FUO-6; 1GCX-7; 1GUX-8; 1HM-6; 1HPI-8; 1HUG-6; 1IEI-9; 1IGU-8; 1IOE-8; 1IXP-6; 1JCE-8; 1LZ-5; 1....1-7; 1QV-9; 1RY-8; 1ZB-8; 1ZI-6; 2AAL-9; 2AMP-8; 2APZ-8; 2BYP-7; 2CWE-9; 2DCg-6; 2DFN-7; 2EOA-9; 2EVI-6; 2GFX-8; 2GIZ-8; 2GJK-7; 2GKR-8; 2GLD-9; 2GYM-8; 2MJ-8; 2KU-8; 2UK-8; 2ZA-5; 3BBL-4; 3CHH-8; 3EE-8; 3EKL-8; 3EMF-8; 3EVT-8; 3EYP-6; 3FGO-8; 3FKK-7; 3KF-9; 3QM-8; 4CCH-6; 4DRD-6; 4ZH-8; 6HEW-8; 7EK-6; 8AHK-9; 8BAI-9; 8BTK-6; 9GIZ-7. — K5AC-9; NY2AD-7. — **VE** 1ET-7; 2CR-7; 2ET-7; 2HF-7; 2JQ-4; 4BQ-5; 4MY-5; 4TJ-4;. — VK2BQ-4; VK7JB-5; VQ3FAA-5; ZC6JM-8; ZL2QM-4; Z13DJ-7.

P. Jastrzembskas, LY1J, Hipodromo 14, Kaunas 1, Lithuania
To May 10
(7 Mc. c.w.)

W 1TS-4; 2HFP-5; 2FFN-4; 2IPI-4; 6NEX-4; 7JZ-3; 8HWE-6; 9DBJ-6; CN8MT-4; CR7AC-4; CT1KH-5; CT1OR-6; CT3AN-5; EA5BL-5; EA7BG-5; EA8AU-4; FB8AA-4; HAF5C-5; HJ6DS-6; J2LU-4; J5CC-4; OM1TB-5; ON4CJ-6; PK1MO-3; SU1FS-5; U9AV-5; U9AZ-5; U9BH-4; VE1EY-4; VE2LH-4; VK2KS-4; VK2OC-4; VK2PX-4; VK2QP-3; VK2RF-4; VK3DM-5; VK3FB-4; VK3VW-4; VK5RE-3; ZE1JK-5; ZL4CK-4; ZT5Z-4; ZU1X-$.

(14 Mc. c.w.)

W 1AEP-4; 1CSC-5; 1DEO-6; 1DHI-3; 1DOE-4; 1EZ-4; 1FFA-4; 1FUC-6; 1GPE-4; 1GXW-4; 7LQ-6; 1LZ-5; 2AIW-6; 2BYP-4; 2CBO-4; 2CTC-5; 2CZV-4; 2DC-4; 2EVI-6; 2GJK-4; 2KL-6; 2UK-5; 3APJ-4; 3DBD-4; 3EE-3; 4AMC-5; 4DRD-4; 6GAL-5; 6MDP-3; 8ADG-4; 8CYT-6; 8EMW-5; 8EWC-3; 8FDA-4; 8IXS-4; 8JJW-5; 8KPB-5; 8MPB-4. — CN8MMA-4; FB8AB-6; FB8AG-5; GI5JN-3; I1KN-5; K4DR-4; ON4FLO-6; PK3BX-4; U8EC-5; U9ML-5; VE1BK-4; VE1DT-4; VE1EA-5; VE2EB-4; VE2HF-5; VE4EA-4; VE5GI-5; — **VK** 2AH-4; 2BQ-4; 2SK-4; 2TH-4; 2ZT-5; 3ES-4; 3FC-4; 3XF-4; 3YO-4; 4US-3; 5QR-4; VS6AF-5; VS6AX-5; VS6BD-3; VU2CQ-4; XU1B-5; ZL2BP-4; ZL2BU-3; ZS1B-4; ZS1C-4; ZT6M-6; ZU6B-4.

Eric W. Trebilcock, BERS-195, Telegraph Station, Tennant Creek, North Australia
May 1 to June 1
(7 Mc. c.w.)

J9CA-5; KA9SK-7; VR4JD-6; XU8KW-4.

(14 Mc. phone)

1UH-8; 2AKK-7; 2BYM-6; 2EWRVBGKVBGKVBGKQJVBGKQ
W 1AXA-6; 1CND-5; 1DAH-6; 1FVO-5; 1GBE-5; 1GPE-5; 1UH-8; 2AKK-7; 2BYM-6; 2EDW-6; 2EUG-7; 2FHI-6; 2FLG-5; 2HNA-6; 2HUQ-5; 3BEK-5; 3BRZ-6; 3CC-7; 3DMR-6; 3LP-5; 3SI-5; 3ZX-7; 4BAZ-5; 4BYY-5; 4CFD-5; 4CWX-5; 4DBC-7; 4DGR-6; 4DGS-5; 4KR-5; 4NN-6; 5AHK-6; 5BDB-6; 5BEE-6; 5BMM-5; 5DNV-5; 5DSV-5; 5DUK-6; 5JC-7; 6AH-6; 6AM-5; 6AVU-6; 6BGH-6; 6BKY-7; 6BUQ-6; 6CNE-5; 6CWH-6; 6DTE-6; 6FQY-7; 6GAL-7; 6GNP-6; 6ISH-6; 6ITH-8; 6KSD-6; 6LLQ-8; 6LY-5; 6MIM-6; 7ALZ-6; 7AQO-5; 7QC-5; 8ANO-8; 8CYT-5; 8DNY-7; 8HAF-6; 8IMF-6; 8JK-6; 8JNU-6; 8JYU-5; 8LQI-5; 9ARL-5; 9AYQ-4; 9BHT-5; 9CLH-6; 9OEF-8; 9DGY-5; 9DGZ-6; 9GIC-6; 9NGZ-6; 9PBA-6; 9QI-6; 9RUK-7; 9ZD-6. — CO7CX-5; HI5X-6; HI7G-6; K6CMC-6; K6FKN-6; K6JLV-6; K6MHY-7; KA1AK-8; KA1AN-7; KA1ME-5; OM2BC-6; OM2RX-5; PK1MX-8; SU1CH-5; TI2RC-8; VE4LX-6; VE5OT-6; VU2BG-5; VU2CQ-6; XE2AH-6.

(14 Mc. c.w.)

CM2EA-5; CM7AB-5; CP1AC-5; EA1AZ-5; EA3CZ-6; F8BS-3; F8EB-6; F8GV-6; F8QT-3; F8UK-4; F8WK-5; FM8AD-5; G2UL-4; G5YG-5; G6HB-5; HAF3B-5; HAF8C-6; HH3L-4; HS1PJ-4; J2LL-5; J3BP-4; J3FI-6; J3FJ-5; K5AH-5; K6BJJ-6; K6KSI-6; OA4AT-6; OK1FD-5; ON4LZ-4; ON4OU-5; PA0QL-4; PK1JR-6; PK1PK-6; PK6HA-7; PY2QD-6; TI2DB-5; U5AE-5; VE3XQ-5; VE4IG-4; VP1WB-5; VP2DF-6; VQ8AA-5; VR4BA-5; VS2AG-7; VS7GT-4; XE2V-5; XU3DF-5; XU8SM-6; ZB1H-4.

James Alexander, 2AXX, 63 Tennyson Road, Birmingham 10, England
(14 Mc. phone)

W 1IFD-7; 2EUG-9; 2ZC-9; 3ABM-8; 3BSY-7; 3EKU-7; 3EXC-8; 4AUP-8; 4DZ-8; 6AM-6; 8CKC-7; 9FJ-6; 9LOY-7. — CT1AY-9; CT1DV-9; EA3EG-9; EA3EU-8; EA7BB-7; EA7BA-9; EA7DA-8; EA8AT-8; HI6A-8; LY1J-9; PY2CK-7; SM5SX-9; SU1RO-9; SU1SG-9; VE1AQ-8; VE1AW-9; VE1CN-7; VE1CR-9; VO1I-8; VP2CD-7; VP3BG-8.

(14 Mc. c.w.)

W 1AUR; 1DZE; 1EAQ; 1ELR; 1FUY; 1GBO; 1ILY; 1LH; 1LZ; 2ABH; 2AFU; 2BHW; 2CJX; 2DYT; 2FZY; 2GKE; 2GTP; 2GTZ; 2GXB; 2HEA; 2HNG; 2HSD; 2HYA; 2IRV; 2JDF; 2KU; 2MJ; 3ANH; 3BQJ; 3EMF; 3FGB; 3GCX; 3GHD; 3JM; 3KU; 3QM; 4BMR; 4BNR; 4DRO; 4UP; 5FMO; 5FSK; 6CXW; 6DAP; 6HFB; 6JWL; 6LYM; 6MTC; 7BPJ; 7BYW; 8AOR; 8AU; 8BJG; 8CRA; 8DPS; 8IJK; 8JAK; 8LEC; 8LUQ; 8MXC; 9CGV; 9DHT; 9FLH; 9NDE; 9PVB; 9SPB; 9SPV; 9ZT. — CM2AI; CM2DO; FB8AB; FB8AD; FB8AG; K6KVX; LU4BH; LU5BZ; LU8BJ; LU8EN; OA4AA; PY2AE; PY2BX; PY2CN; PY2CW; PY2IQ; PY2QB; PY5AG. — **VE** 1BK; 1DT; 1EA; 1EF; 1EK; 1EX; 1GL; 1IS; 2DM; 2GA; 2IJ; 2KY; 3AIV; 3TA; 3UF; 3XQ; 4RO; 4UF. — **VK** 2AS; 2BP; 2KS; 2PX; 2ZC; 2ZR; 3EO; 3GV; 5GW; 5RD; 5ZC; 7CL. — VP2AT; VP5AD; VQ3FAR; VQ3MSN; VQ4KSL; VS1AB; VS6BD; VS7GJ; VS7RF; XE2C; XE2N; YN1AA; ZD8A; ZE1JS; ZZ2A.

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*George Walker, Assistant Editor of RADIO, Box 355, Winston-Salem, N.C., U.S.A.

(28 Mc. c.w.)
W 1GLX-5; 1HJA-7; 1HNX-7; 1HSX-6; 1HWY-6; 2JBN-7; 8ADX-6. — U2AG-7; YR5TQ-8.

E. L. Walker, W8DFH, 2717 Connecticut Ave., Pittsburg, Pa.
May 1 to June 7

(14 Mc. phone)
CE1AR-6; CE1BC-7; EA2BA-6; EA2BT-7; EA7AI-7; EA7BA-7; EA8AO-6; EI6F-6; G5BJ-6; G5ML-7; G5NI-8; HC1RF-9; HI2K-7; HI5X-8; HI7G-8; HK1ABM-7; K6JNW-7; NY2AE-8; ON4VK-7; PA0IDW-6; SM5SX-7; TI1AF-7; TI2RC-8; TI5JJ-7; VK2AZ-8; VK2BW-7; VK3DP-7; VK3GM-7; VK3MR-8; VK4JX-7; VK5KG-6; VK6FW-6; VO1I-8; VO1J-7. VO1P-8; VP3BG-7; VP4TH-7; VP6YB-7; VP9R-7; YN1HS-7; YV4AC-7; ZE1JM-4.

(14 Mc. c.w.)
CE3EN-6; CN8MI-7; CP1AA-7; CP1AC-8; CT1JU-7; CT1KR-7; CX1BG-7; CX1CG-7; CX2AK-7; CX2B-7; CZ2G-7; D4XCG-7; EI5F-7; EI6G-6; EI8B-7; EI9F-6; ES2D-7; FA8BG-6, FA8SR-6; FB8AB-7; FB8AD-6; FB8AG-6; FK8AA-7; FM8AD-7; FT4AG-6; HAF2I-6; HAF2N-6; HAF3D-6; HAF4H17; HAF5C-7; HAF8I-7; HH2A-7; HH3I-7; HH5PA-7; HJ3AJH-6; HP1A-7; I1IY-7; I1II17; I1RRA-7. — J 2CB-7; 2CL-6; 2HQ-6; 2KJ-7; 2LL-7; 2LU-8; 2ME-5; 2MI-4; 2ML-6; 3CK-5; 3DP-6; 3FI-6; 3FJ-6; 4CT-6; 5CE-6. — K4DRN-7;K5AF-6; K6KLL-7; K6KSI-8; K7ENA-7; KA1LB-7; LA1M-6; LY1J-7; MX2B-7; NY1AA-7; CA4AE-6, OA4AQ-7; OA4AT-6; OA4M-7; OA4J-6; OH2NR-5; OH3NP-6; OH3OI-6; OH5NF-6; OK1BC-6; OK1FD-5; OK1LM-6; OK1RO-6; OK2AK-8; OK2DF-6; OK2HX-6; OK2ZD-6; ON4CJJ-8; OZ1I-5; OZ4H-7; OX7CC-7; OZ7CK-6; OZ7KB-6; OZ7SS-7; OZ7JB-6; OZ9A-7; PA0FLX-6; PA0JMW; PA0QF-6; PA0RN-6; PA0VB-5; PA0XF-6; PK1MO-6; PK1PK-6; PK6AJ-8. — PY 1AJ-6; 1AW-6; 1DW-6; 2AE-7; 2AP-7; ABB-6; 2BX-6; 2CN-5; 2EA-5; 2IG-6; 2JO-6; 2QD-6; 3CJ-6; 7AA-9; 7BB-7. — SM5UU-6; SM5YB-5; SM5YS-6; SM6WL-6; SM7YG-7; SP1AO-5; SP1CM-6; SP1DT-5; SP1GZ-6; SP1PJ-6; SX3A-9. — U 1AB-6; 1AD-6; 1AP-9; 1CN-7; 1CE-7; 2NE-8; 3AG-6; 3QE-7; 3QT-6; 3VB-5; 6SE-6; 9AC-7; 9MF-7; 9MI-7. — UK5AA-5; VI1L-7; VO1N-7. — VP 1DM-6; 1JR-7; 1WB-7; 2AT-6; 2CZ-7; 2DF-6; 2TG-6; 4TA-7; 4TJ-7; 5AA-6; 5AD-5; 5AE-6; 5PZ-8; 7AA-7. — VQ4CRT-7; VQ5NB-6; VQ5NB-6; VQ8AA-7; VQ8AB-6; XU8AG-7; XZN3D-7; YL2BB-7; YM4AF-6; YN1AA-7; YR5OR-7; YR5RR-7; YT7VN-6; YU7GL-6; ZB1H-7; ZE-JM-6; ZN2M-7; ZS1AL-6; ZS1AX-5; ZS2X-6, ZS6T-6; ZT6Q-6; ZT6S-5; ZU1T-6; ZU6M-6.

Donald Morgan, BRS-1338, 15 Grange Road, Kenton, England
May 5 to June 5

(14 Mc. phone)
W 1AF-7; 1AJA-7; 1AJZ-8; 1ARC-7; 1CGH-6; 1CRW-7; 1DNL-7; 1DRL-7; 1EAQ-7; 1ESU-7; 1FLH-7; 1GED-8; 1GFX-7; 1GPE-7; 1IAS-7; 1SZ-8; 2AKK-8; 2AYE-6; 2BSD-8; 2BYP-7; 2CEZ-8; 2CLS-7; 2CWC-7; 2DNZ-7; 2EDW-7; 2EO-8; 2EOO-7; 2EVI-7; 2FWK-8; 2GKA-7; 2GKO-7; 2HCQ-7; 2HUQ-7; 2MJ-7; 2NW-7; 2ZC-8; 2ZT-7; 3CRG-7; 3CUB-7; 3CZE-7; 3DNZ-7; 3DPC-7; 3DPT-6; 3DRA-7; 3EFS-7; 3LM-7; 3PC-8; 3OX-7; 4AKY-6; 4AQN-7; 4BN-6; 4BYP-7; 4BZ-7; 4CJ-6; 4CWG-6; 4DAY-7; 4DYT-6; 4FQ-7; 4OC-7; 4UP-7; 5BLT-6; 5CXQ-6; 5EWD-5; 5LD-6; 8DIA-7; 8HEQ-7; 8JNC-6; 8LQI-7; 8MQX-7; 9ARK-7; 9CLH-6; 9ETR-6; 9FJ-6; 9GHY-5; 9KGS-7; 9HRL-7. — CO 2AA-8; 2AN-7; 2AU-7; 2HY-7; 2SV-7; 2WZ-6; 6OM-7; 8YB-7. — CT 1AB-7; 1AH-7; 1AY-8; 1BG-7; 1BY-8; 1DA-7; 1DV-7; 2AB-7; 2AV-8. — CX1AA-7; CX2AK-6. EA 1BH-6; 2BA-7; 3AA-7; 3AQ-7; 3BA-7; 3CY-7; 3CZ-7; 3DY-7; 7AI-8; 7BA-7 7BB-7; 8AF-8; 8AL-7; 8AO-7; 8LW-7. — EI3J-7; F3GR-6; F8II-8; F8WK-7; FT4AA-7; FT4AH-7; FT4CC-7; HH5PA-7; HI1C-7; HI5X-7; HI6O-7; HI7G-7; I1CKM-7; K4DDH-6 LA1G-8; LA3B-6; LA4N-8; LU1EX-7; LU6AP-7; LU8AB-6; LY1AK-6; LY1J-8; OE6MP-8; ON4DM-7; ON4EW-6; OZ1D-7; PY1CQ-6; PY2CK-7; PY2ET-7; SM5SI-7; SM5SX-9; SP1LM-6; SU1CH-7; SU1RO-7; SU1SG-8; TI2AV-6; TI2RC-6. — VE 1AQ-8; 1AW-7; 1BY-6; 1CF-7; 1CR-7; 1DR-7; 1ET-7; 1GH-6; 2BG-7; 2EE-7; 2VF-6; 3AB-7; 3AFD-7; 3BK-7; 3JV-7; 4TJ-6; 9AL-7. — VK2BQ-6; VK4WX-6; VO1I-7; VP2CD-7; VP3BG-7; VP6YB-7; YV4AC-7.

Yoshiharu Mita, J2IS, 40 Meguro Mita, Tokio, Japan
April 1 to May 1

(28 Mc. c.w.)
W 6AC; 6BAM; 6DZH; 6EWE; 6KB; 6KEV; 6KDO; 6LVX; 6QG. — D4JMK; F8VS; K6KSI; K6MVV; KA1EL; LU1EP; OA4J. OH7ND; OH7NF; OM2RX; OM2RX; PK3ST; VE5IQ. — VK 2LZ; 3BD; 3BO; 3CP; 3CZ; 3KR; 3KX; 3YP; 4EI; 5ZC; 6SA. — VS6AH; VS6AS; VU2LJ; ZL1CD; ZL1DV; ZL2BP; ZL2CD; ZS1H.

Robert Douglas Everard, Westgate House, Great Grandsden, Sandy Beds, England
To May 1

(14 Mc. phone)
W 1ACQ; 1ADE; 1AF; 1AGW; 1AHI; 1AJA; 1AJZ; 1AKR; 1AQM; 1AR; 1ARC; 1AUC; 1AWD; 1AXA; 1AYX; 1BDN; 1BIC; 1BLO; 1BLU; 1BR; 1BSN; 1BPH; 1CAA; 1CAV; 1CFI; 1CJC; 1CND; 1COJ; 1CRW; 1CZC; 1DFI; 1DNL; 1DSK; 1DTJ; 1EBO; 1FVD; 1GJX; 1GPE; 1HCM; 1HNW; 1HVJ; 1HZU; 1IAS; 1IFD; 1IGE; 1IGX; 1IHE; 1ILQ; 1ING; 1IPC; 1IQY; 1IYI; 1KJ; 1KW; 1KZ; 1MX; 1NW; 1QM; 1QV; 1UH; 1UP; 1VA; 1VH; 1WH; 1WJ; 1WK; 1ZD; 2AGA; 2AGZ; 2AHP; 2AIO; 2AIT; 2ALE; 2AN; 2APV; 2AYV; 2BAJ; 2BBI; 2BFB; 2BG; 2BSD; 2BYP; 2BZR; 2CBT; 2CFU; 2CLA; 2CLH; 2CLS; 2CMT; 2CMU; 2CSY; 2CTS; 2CZO; 2DC; 2DNG; 2BOZ; 2DPA; 2DTE; 2DX; 2DZJ; 2EDT; 2EDW; 2EGN; 2ELO; 2EOY; 2EUG; 2EWA; 2EWG; 2EXN; 2EYY; 2FAR; 2FDA; 2FF; 2FLG; 2FLO; 2FBP; 2FUP; 2FWK; 2FYD; 2GDU; 2GFH; 2GG; 2GLS; 2GNT; 2GVN; 2HAV; 2HBJ; 2HFS; 2HMD; 2HQY; 2HVI; 2IXY; 2KR; 2OA; 2OJ; 2QZ; 2UZ; 2ZB; 3ABN; 3ACX; 3ADM; 3AER; 3AHS; 3AHR; 3AIB; 3AIF; 3AN; 3APO; 3AXT; 3AZN; 3AZT; 3BBU; 3BFH; 3BHJ; 3BIA; 3BIN; 3BLQ; 3BMA; 3BNC; 3BOF; 3BRX; 3BUH; 3BVU; 3CC; 3CDU; 3CEI; 3CEC; 3CKT; 3CM; 3CNY; 3COP; 3CRG; 3CUB; 3CZE; 3DBX; 3DDO; 3DEK; 3DHK; 3DLL; DMR; 3DNZ; 3DPC; 3DPN; 3DTX; 3EGU; 3EHS; 3EHY; 3EOZ; 3ERK; 3EWN; 3EXC; 3FAL; 3FCB; 3FEU; 3FWN; 3HS; 3IX; 3LN; 3LP; 3LT; 3MD; 3NK; 3OX; 3PC; 3RA; 3SI; 3ZK; 3ZX; 4AFC; 4AGB; 4AGR; 4AH; 4AHH; 4AI; 4ASR; 4AXO; 4BAZ; 4BM; 4BMR; 4BPF; 4BQC; 4BZA; 4BYY; 4CDG; 4CDY; 4CFC; 4CFO; 4CJ; 4COT; 4CPG; 4CRE; 4CVG; 4CVN; 4CYB; 4DAA; 4DAY; 4DBC; 4DCK; 4DFU; 4DGO; 4DGS; 4DLH; 4DOY; 4DQD; 4EC; 4FK; 4KR; 4OC; 4PW; 4TO; 4UP; 4YC; 4ZF; 5ACF; 5AHK; 5ASG; 5ATB; 5AXA; 5BDB; 5BEE; 5BGT; 5BGW; 5BMM; 5CCB; 5DCQ; 5DVK; 5EBP; 5EEH; 5EGF; 5EUB; 5EUC; 5EXL; 5FEI; 5ML; 5NT; 5SF; 5ZA; 5ZS; 6AH; 6BAY; 6BKY; 6BUY; 6BYW; 6CFJ; 6CLS; 6CQG; 6CZ; 6FFN; 6FQY; 6FTU; 6FZR; 6GAL; 6HEW; 6IRX; 6ITH; 6JZE; 6KSO; 6LLQ; 6LLU; 6MXW; 6SJ; 7APD; 7AO; 7DNB. 7IF; 7MD; 7QC; 7VS; 7WL; 8AFC; AAKW; 8ANN; 8ANO; 8AOC; 8AOU; 8AW; 8BGF; 8BK; 8BOT; 8BWH; 8CGX; 8CDW; 8CHT; 8CKY; 8CNA; 8CPC; 8CPF; 8CTY; 8CVJ; 8CYT; 8DBC; 8DCE; 8DHD; 8DI; 8DLD; 8DTJ; 8DW; 8DWU; 8EBN; 8EDR; 8EGQ; 8EPC; 8EVE; 8FC; 8FEQ; 8FMH; 8FNN; 8GGS; 8GLA; 8GPE; 8GWZ; 8HAF; 8HCR; 8HEQ; 8HFE; 8HFV; 8HFY; 8HTX; 8HVE; 8HYZ; 8IBU; 8IEG; 8IGL; 8IHJ; 8IMF; 8IMU; 8IRK; 8IT; 8IV; 8IZN; 8JK; 8JOC; 8JOE; 8JV; 8JVF; 8JYU; 8KQ; 8KQQ; 8KML; 8LAC; 8LEI; 8LFE; 8LFQ; 8LPI; 8LQI; 8LTI; 8LTR; 8MDU; 8MJM; 8MNJ; 8NE; 8ZA; 8ZE; 9AA; 9AAN; 9AIO; 9APW; 9AR; 9ARE; 9ARK; 9ARU; 9AYH; 9AYZ; 9BAQ 9BBU; 9BDE; 9BEZ; 9BG; 9BHO; 9BPK; 9BPM; 9BVY; 9CGT; 9CJH; 9CLH; 9CUK; 9CVN; 9DA; 9DKP; 9DKU; 9DMF; 9DUM; 9DZP; 9EIB; 9EMR; 9EPI; 9EQC; 9ESO; 9EYW; 9EZN; 9FDI; 9FJ; 9FOE; 9QI; 9FS; 9FZ; 9FZY; 9GEG; 9GHY; 9GIC; 9GOI; 9GYK; 9HCR; 9HLG; 9IMZ; 9$WX; 9IZT; 9JNG; 9JNI; 9JSZ; 9JZA; 9KBM; 9KFA; 9KFL; 9KGL; 9LBM; 9LD; 9LGT; 9LOG; 9MBM; 9MEL; 9MRH; 9MYI; 9NBE; 9NGZ; 9NKS; 9NOR; 9OLY; 9OP; 9CYP; 9PEO; 9RGF; 9RGH; 9RIY; 9RNX; 9RUK; 9SGY; 9TDI; 9UVC; 9WBR; 9ZD. — VE 1AW; 1AX; 1CR; 1DC; 1 DQ; 1DR; 1DT; 1ET; 1GH; 1GR; 2AR; 2BE; 2BG; 2CA; 2CN; 2CR; 2DX; 2EE; 2ER; 2EW; 2EY; 2FQ; 2GP; 2GT; 2HK; 3BF; 3BK; 3DB; 3DF; 3EO; 3GK; 3HC; 3IX; 3JV; 3KF; 3LL; 3NF; 3OX; 3PM; 3QJ; 3QS; 3TD; 4AW; 4CW; 4DU; 4HQ; 4IX; 4MO; 4MY; 5ES; 5HU; 5JB; 5OT.

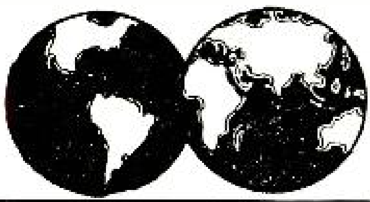
(3.9 Mc. phone)
W 1ADM; 1ADZ; 1AQM; 1AVP; 1BES; 1BMT; 1BNO; 1BR; 1CND; 1CVF; 1DVR; 1EEV; 1FCE; 1FRI 1FVO; 1HZU; 1IYI; 2AGA; 2AHU; 2AU; 2BDT; 2BIT; 2BJT; 2BTZ; 2BZR; 2EVL; 2FBA; 2HS; 2HYP; 2JJ; 2JP; 2KR; 2TC; 3AHR; 3AN; 3AXR; 3BJ; 3BJP; 3CWG; 3DKX; 3DMR; 3DQ; 3DRY; 3EHY; 3EFS; 3FEQ; 3GY; 3IS; 3LA; 3NK; 3WX; 4AGB; 4ALD; 4AVH; 4COT; 4CPG; 4CVQ; 4DQ; 4NN; 5DVK; 5MS; 8AY; 8BFD; 8BRC; 8BWH; 8BXB; 8CTN; 8CUO; 8DEE; 8DK; 8EQN; 8GLC; 8IKA; 8JJM; 8JOE; 8KIR; 9BBU; 9ETT; 9LSU; 9PZ. — VE 1BO; 1CA; 1CR; 1EI; 2BA; 2HK; 2HN; 3EU; 3JI; 3RI; 3WV.

L. F. Stroble, W8BRS, 2626 Sixth Street, Cuyahoga Falls, Ohio

(14 Mc. c.w.)
CE7AA; CP1AC; CT1BY; CT1JU; CT3AB; CX1CG; CX2AK; CX2BG. — D 4ARR; 4BIU; 4CSA; 4GAD; 4GJC; 4GWF 4IJH; 4JPK; 4QET; 4VRR; 4XCG; 4YJI. — EA 3DL; 3EG 4AO; 4AP; 4AY; 4BM; 5BS; 7AV; 8AB; 8AF; 8AO. — EI6F;

[*Continued on Page 83*]

DX



By HERB. BECKER, W6QD

Readers are invited to send monthly contributions for publication in these columns direct to Mr. Becker, 1117 West 45th Street, Los Angeles, California.

Now that the summer holidays are about over, we are just about ready to blow off steam again on DX.

In a letter from K4KD, he discloses that he has worked 59 countries and 20 zones with his 203-A. This fellow Mayer has been working some nice stuff and really gets out from ol' P.R.

An idea of what he has done is shown by the 536 stations in 45 districts (4 bands) that he snagged in the last dx brawl, score 72,000. He says that since K4SA has "gone blah-blah on 14 mc. fone", K4KJ is really the one who is knocking them off now.

News from England . . . G6WY, Ham Whyte has been clamping down on the Asians lately. Some of the good ones worked by Ham include VU2BA, VU2AU, VU2EB, VU2EP, VU2DR, VU2FD, VU2DY, VU2JB. Boy, that's a flock of 'em. Others are, HS1PJ located in Saladeng, Bangkok, Siam (frequency is 14,130 kc.), VS1AA, VS1AF, VS2AE, VS3AE, J2LU, J5CC, and XU3FK. A new one started up, CR9AB, whose name is Chaves and cards should be sent to Post Office, Macao. CR9AB has a 500 cycle note and was on about 14,180 kc. Ham had never worked Mexico until recently, when he hooked XE2N. G2ZQ worked him right after G6WY, and it added a country to both of their lists. K6LEJ and K6NCW are heard quite a bit but neither of them seems to listen for Europe. The boys are somewhat irked at W5CSR in New Mexico, as both G6WY and G2ZQ have used many watts calling him . . . so that they could add that elusive state to their lists. S'matter, W5CSR? VQ4KSL is on 14,350 kc. G6WY has 129 countries to his credit, G2ZQ 122, and G5YH, 111. G5YH and G2ZQ went to Berlin for the Olympics and from reports they must have had a game all of their own, "beer guzzling". John, G2ZQ, says that if Harold, G5YH, could work dx as well as he can guzzle that beverage, he would be pretty durn good.

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I think now I should give a little dope on our friend F. E. Burke, W8AAX. Burke came on the air in 1923 as 8DGE, and the first station worked outside of Pittsburgh was 8GU, Bliley, in Erie, Pa. Previous to this he was on the air with a loop-modulated fone signing 8U-Hoo. In 1925 he obtained his present call, W8AAX, and it wasn't until about two months ago that he made his w.a.c. Burke was on during that first trans-continental relay. He sneaked in under a bunch of high power boys and hooked 3SU, who had the message, but got so darned excited he couldn't copy it. It is interesting to notice the difference between rigs of those days and the present day outfits. W8AAX was using a 50 watter, self-excited Hartley, with p.d.c. on the plate from a 48-jar chemical rectifier. The transformer used was home made and he has since discovered that at no load it gave 1850 volts but under load it dropped to 915 volts.

Now and then we run across some guy who doesn't like this or that . . . or has a gripe on general principles. W1HEN says a few good bets are being overlooked in the dx section by not having more dope on the east coast boys. So what???? No one would like to have more information available from the eastern gang than I, and it might be said that the DX Ed. should get out and scrape up the necessary material. Possibly a telegram to every ham in the call book, pleading for dx news would help the eastern quota.

From W1IEK in Worcester, Mass., I learn that SM7UC is gunning for a QSO with some guy in Rhode Island. Here's a chance for W1HEN in Providence. SM7UC comes in best around 2200 g.m.t. and his frequency is 14,338 kc. W1IEK has worked him a few times.

W8OSL ex-W8DVS works YV5AP for country no. 100. Other new stations for Jule are: J5CC, KA1US, U9AC, FB8AB, ZT6AL, ZS1D, CP1AA, CP3ANE, K7ENA, OH5OD, OH2OV, YR5VC, U3BC, ES5C, I1ZZ, D4WYG, and YM4AF. Jule is the Pres. of the "210 DX Club" and all his work is done with 100 watts to a '10. He has done quite a bit of 5 meter dx lately, working Mars and getting a QSL card for the QSO. Mars is 20 miles distant in Penna. His best dx on 5 though is about 75 miles . . . W. Virginia.

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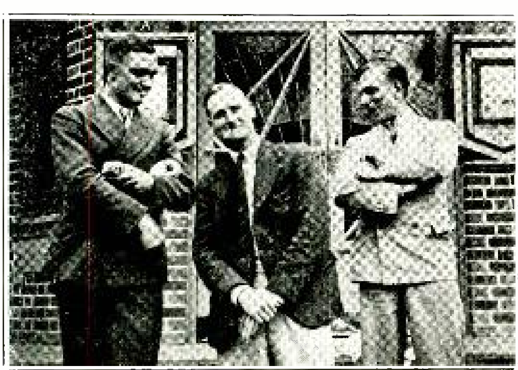
Harold Chorley, G5YH, shoots in some nice news and scandal . . . "Conditions on 14 mc. still erratic. YN1AA has been worked by several G's . . . SV1KE, a genuine station in Athens, is on daily working dx. A W6 who claims to have worked LZ1A will be



LEFT: D4CSA, G2PL, and G2TR (Minus Y.L.'s) After a Swim

glad to know that LZ1A is a prominent European station having fun. There are no hams in Bulgaria. G5YH worked W5FRR in New Mexico, which is an achievement for a G. W6KSO in Arizona was heard R7 on phone. All the calls in G2, 5, and 6 are allotted and a new series has been started. G8AA and G8AX are on the air . . . Off frequency operation is increasing, especially with the VE's and PY's . . . Wish CP3ANE would listen on other frequencies than between his usual 14,350-14,400 kc. . . . G6QB has come to life again . . . VU2CQ was heard QSO an OZ; miracles still happen. VU2EP on 14,160 with T6 . . . Mexicans being heard, XE1AG, XE1AX, XE1CM, XE2C, XE2N, XE2O, all coming in well. G2ZQ still pounding away . . . G6WY not so busy . . . G5YH increased power to 250 watts . . . G2PL works everything. The brother of VQ8AB, now in England on a visit, will be on the air when he gets home in a few months. VQ3FAR puts out an FB signal . . . G2ZQ works PZ1PA . . . VS7GJ, VS7RF, VS7JW, VS7RA are quite active . . . and the old gang from W6 and W7 pound in with regularity."

G5YH also offers this . . . "73 Cuagn" means "Thank goodness, that's finished.". . . also "Pse QSL" really means . . . "You are my first (W6, W7, European, VK, ZL) and I require your card for w.a.c. If you don't send it I shall consider you a mean hound and a blackhearted hijacker, but under no circumstances will I send my card." Good stuff, Harold.

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Ol' Ming Toy Lucas, W8CRA, hasn't been on very much during the summer but managed to hook J9PA for his 121st country. Other stuff that Frank has been working includes KA1RR, KA1ER, KA1EL, VS1AF, VS1AA, VU7FY, VS7RF, J8CF, XU3FK, XU8AL, XU2FB, YS1JC, PK1JW, J6DO, VQ4KSL, VU2BY, PK2HD, XU8SM, XU8SA, XU3YK, XU2HY, PK4YY. Frankie says he has heard CR9AB but he is keeping him secret for a while. Of course, youse guys who have a memory will look back in these columns to see what G6WY says about CR9AB, frequency, etc.

VK2EO, Dave Duff, is now VK3EO, having moved a few hundred miles . . . PK6DX is supposed to be the first active station (ham) in New Guinea, and he can be reached thusly: A. Bles, c/o N.N.G. P.M., at Babo, Dutch New Guinea . . . Will be on mostly between 1000 and 1400 g.m.t., 7 and 14 mc. . . . What, another? . . . W2MU has been after Asia for w.a.c. for 11 years, then finally snags U9MI in Siberia for the missing link. W1CNU over thar in Stamford, Conn. is trying to find time to build his new rig using a 150T in the final; so until then all Ralph can do is to poke his head into his new RME-69 and listen and listen and listen.

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Ah! here's where the W9's come in . . . W9BYE, whose handle happens to be Earl Krainik and whose xmtr. happens to have a 150T in the final, and whose receiver happens to be an HRO, and who uses 3 antennas (no, not all at once, you dope) . . . well, doggone it anyway, Earl has been doing some very fine work, among the best that have been duly entered in his log are . . . VU1AN, J2HQ, FB8AB, J2CC, J5CC, U9MF, U1BL, U3AG, U4LD, U7SE, YM4AA, LA4K, OZ7CC, LY1J, ES1C, ZB1E, ON4CJJ, ZU1T, ZS1AH, YL2BB, HB9AC, OK2DF, CP1GB, CE3EL. Says he heard some cluck signing CZ2G . . . Does anyone know him? W9BYE works at WPDK, which is the Milwaukee Police radio station. Other hams there . . . W9NY, W9OT, W9EA, W9DTK, W9UIT, W9NAV, W9FSV. And that seems to me to take in about the whole Milwaukee Police Dept.

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W2GWE seems to be able to get on enough to get after the D's in their contest . . . W2BJ must be flitting hither and yon as no sign of him on the air . . . W3ANH is being a dutiful father; it was a daughter a few months ago . . . W3BBB is still playing around in that b.c. station . . . W3SI, Charlie Myers, is incommunicado . . . whatever that means. Probably he's planning for next year's dx brawl . . . W6GRX and W6FT, both "former" dx'ers, are now blasting holes in the clouds with their new 160 meter phone rigs . . . W6CXW is on now and then . . . and while I think of it they say Henry's brother Sam has a new y.l. . . . Buck McKinney, W5ATF, and his bride spent a few days of their honeymoon on the west coast. Speaking of brides, weddings, honeymoons, and other foolishness, it reminds me that a couple of other dx men have chosen that way out . . . W6EXQ, Ralphie Heiges, was married in June, and headed for a few weeks' trip to Alaska. W6FAL got the same fever and is now a happily married man . . . He is not on the air anymore. To show that they seem to have the same ideas in other countries, VK2KB and wife spent a couple of months in USA, on what Alan called a combination honeymoon and business trip. We took in a few spots around Los Angeles and if I had only read a few more books on salesmanship they might have been induced to stay.

"WAZ" HONOR ROLL

W3SI	39	W9KG	34
W6CXW	39	W8KPB	34
W4DHZ	39	W9LBB	33
W8CRA	39	W5AFX	33
W6GRL	39	W9ARL	33
W6ADP	39	W5EHM	32
W9TJ	38	W5CUJ	31
G2ZQ	38	W9IWE	30
G6WY	38	W6HX	30
G5YH	37	W3EYS	28
W8OSL	37	W6CEM	28
W6FZY	37	W6GNZ	27
G6NJ	35	W6FZL	27
W2BSR	35	W6IDW	26

If you have worked more than 25 zones and are willing to produce confirmation on demand, send in your score on a postcard.

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Now that we're away from that "I love you truly" business, here is what some of the other dx owls are doing . . . W9TJ is still at large . . . touring the country . . . W9KG is hearing so much good dx at his summer QRA that I'm afraid he will develop fannyitis . . . Where is W9MKZ??? . . . W8DWV, W8OSL, W8BSF, W8PT, and W8CRA are going to

F. E. Gilfillan, VQ4CRO

attend the Central Div. Conv. . . . Take a mop, fellows. W6GRL has worked his 114th country and has a 2 hour w.a.c. on phone to his credit. . . . W8KPB, Ned, was visiting W8OSL for a while. .Where are W8BTI, W8BCT, W8ZY? Come on, you guys, come clean; let's have some news . . . F8EO is still going to town and is without a doubt, week after week, one of the most consistent Europeans . . . No news from G6NJ; guess he's off on a tear.

In sending in your news for November RADIO, please mail it so that it will be here by 20th of September . . . this being necessary due to the publication date being advanced considerably. For those not being fully acquainted with what sort of news is wanted, I'll repeat that any dx information that has to do with rare stations worked, their frequencies, tone, and time usually heard . . . also any personalities regarding dx men always make good reading . . . new ideas in antennas, in fact any bit of news that may be interesting to the dx man is acceptable . . . And now, gang, when each of you drop a line to this department, please don't forget to include the number of zones you have worked. We will print a list of them and as the number of zones worked by you change, it will be corrected in subsequent issues of RADIO . . . so let's hop on it and make the next month's dx section the largest yet . . . we've got the space and it's up to us to use it.

O. W. ("Pye") Reid, ZS2A

Activities at W6QD have hit a new low this summer. Oh, almost forgot the night when I went up to the shack and had swell luck . . . Worked W9's with reckless abandon, two in a row . . . Yes sir, *reckless abandon* . . . See you in 30 days . . . if I get out.

◆

28 AND 56 MC. ACTIVITY

By E. H. CONKLIN, W9FM

The summer short skip did not bring the expected number of contacts during the past several months. Conditions were satisfactory, it appeared, but a sufficient number of stations was lacking. We admit that it is quite a "grind" to keep listening and calling on "five and ten" when we should be out in the sunshine. That long five meter work was possible since the memorable night of May 9 is evident from short-skip conditions on ten meters. J. J. Michaels, W3FAR, reports from North Wales, Pa., that 28 mc. signals from as close as Cleveland (on June 16th) have been heard in June and July; on other occasions Indianapolis, Chicago, and other stations were heard. Five meter work over a distance of 700 to 1000 miles was probably possible at the same time.

British Accomplishments

From E. H. Swain, G2HG, we have received several very nice letters on the subject of five meter dx reception. Table 1 shows how many signals—mainly commercial harmonics but some amateurs—have been heard from *four continents*. The c.w. station calling "cq dx" on May 23 was outside of England because G stations must use "test"; the signal had a bad flutter and only a 9 and a Y were made out. The station was not W9NY. The c.w. station heard two days later was actually calling "cq dx 56 mc." On that day between, fading phone carriers were heard by two different British stations.

We have often expressed question as to whether or not the received signal travelled on 56 mc., but later check-up usually has been successful in showing that the receiver was not also sensitive to a 28 mc. signal. The G stations reporting the above dx reception have been active on both 28 mc. and 56 mc.; we do not doubt the accuracy of the data. A few of the commercial harmonics may have been on a frequency several megacycles lower, such as LCP on 44 mc., but like long distance reception of U.S.A. police transmitters on 40.1 mc., this work is notable. G2GH makes these comments:

"In addition to the stations listed in the schedule (see table 2) I know that G2AW, G2MV, G5CM, and G5OJ are using plain c.w. on 56 mc. There are, of course, plenty of chaps using the usual self-excited oscillators on phone. From the logs, it is apparent that there should be every chance of G-W work on this band. It is a great pity that most of your fellows are not keen on c.w. reception down on five, because I think you will agree that plain c.w. stands a better chance for working dx than phone, especially if a modulated oscillator is used."

VK2LZ Reports TDC

Not all of the 56 mc. dx reception has taken place in Europe. According to the May issue of *Amateur Radio,* published in Australia, VK2LZ has built a new super that goes down to 56 mc. He has heard TDC on it. The latter station, we understand, is in Manchuquo or thereabouts.

South Africa Also Active

A letter from O. W. Reid, ZS2A, states that last season he heard *police cars* and dispatcher stations regularly, also a station broadcasting music well below them. Reid is using a 35T on exactly 56,000 and 57,600 kc. ZS1H and ZS2Y are also preparing to make a hole in the five meter band.

Since our reports of long distance five meter work carried in the June and July issues, we have received quite a number of confirmations from both the eastern and mid-western stations. John Videberg, W1IYX, of Waterbury, Conn., describes his work as follows:

"I had the antenna pointed toward New York City. The W2's were coming through very poorly—it was not a 'good' five meter night. Then I heard a couple of ninth district stations. When I pointed the beam toward Chicago they came up to R8 and R9. I heard W9LBP and another. Then I worked W9UAQ who was R9. These signals were characterized by short and rapid though severe fading, always coming right up instantly. This was between 11:30 p.m. and 1:00 a.m. Eastern daylight time."

Videlberg said that on April 29 and May 1 the band opened up for the first time this year for 100-200 mile dx. Again from June 6-11 the W2 and W3 stations were coming through in Waterbury, Conn. This work is not, of course, K-H layer dx, and often carries through until sunrise or later. A very long list of W2 and W3 stations were worked, making use of an H-type heam with a similar reflector. This type is simple to build, holds the beam down to useful low angles, and is not too highly directional.

Very little 100-200 mile work is reported from the midwest. This might be due to the absence of high

TABLE I

British Reception on about 56 Mc. as Reported by G2HG

Date 1936	*Time G.C.T.*	*Phenomena or Signals Heard*	*Observer*
May 7th	2100-2125	Harmonic of LCJ (Norway)	G2HG
12th	0900-0930	Commercial Harmonics on 46 & 57 mc.	G6DH
22d		IBD heard on 50 mc.	G6DH
23d	1830-1835	Mush level suddenly jumped	G2HG
	1840-1915	Unidentified com'l. harmonic	G2HG
	1843	*CC signal calling "CQ DX"*	G2HG
24th	1110-1130	Harmonic of EAN (Spain)	G5LB G6DH
	Afternoon	*'Phone carriers fading*	G5LB G2GB G2HG
25th	1710-1730	Harmonic of IAC (?)	G5LB
	1745	*Unidentified CW station calling CQ DX 56*	G5LB
	1820-1945	Harmonic of IRU (Italy)	G2HG
June 1st	1815	Harmonic of EAM on 58 mc.	G6DH
11th	1830-1840	Unidentified commercial harmonic (?IRU)	G2HG
12th	1300-1310	Harmonic of HAS2 on 56 mc.	G6DH
13th	1300-1310	Italian commercial (IRU or IRJ)	G2HG
16th	1800	Mush level suddenly jumped in a similar manner to the 23d of May	G5LB G2HG
22d	1755	Unidentified com'l. harmonic	G2HG
25th	0905	Unidentified tel. 55.8 mc.	G6DH
	0920	Harmonic of FOX	G6DH
26th	——	Unidentified com'l. 55.9 mc.	G6DH
	1220-1315	Unidentified commercial fone harmonic 58 mc.	G6DH
	1235	Harmonic of EAN 58.3 mc.	G6DH
26th	2215-2235	Harmonic of LCQ	2AVP
28th	1010	*Harmonic of WLM (tel.)*	2AVP
	1115-1150	Harmonic of DFC	2AVP
	2030	Harmonic of FYM	G6PG
29th	1300-1800	*Harmonics of WFX,* DFE, JNG, FYT	BBRS 2138
July 3d	1802-1840	Harmonics of LCP & LCB	G2AW
	2120-2140	Harmonics of PCT & JBG	BRS 2138
	2315	*Harmonics of WQV & PLV*	BRS 2138
4th	1250-1300	Harmonic of ICJ (N. Africa)	G2HG
	1300-1405	Com'l. telephony on 58 mc.	G2HG
6th	1815-1850	Harmonic of ICJ	G5LB
	1845-1930	Harmonic of IRU	G2HG
	1845	Harmonic of ICJ	G2HG
	1850-1930	Com'l. telephony on 58 mc.	G5LB G2HG
8th	2153	Harmonic of FYN	G2GB
12th	1730-1855	Harmonic of IRU	G2HG
	1830	Harmonic of ICJ	G2HG
18th	1730	Harmonic of ICJ	G5LB
24th	0800	LCP on 44 mc.	G6DH

Call	*QRA*	*Freq. (Mc.)*	*Days and Times (B.S.T.)*
G2GB.	Shortlands. Kent.	56.784	Wed. & Sat. 1130-1230
G2HG.	London.S.E.26.	56.32	Sat. 1430-1700 Sun. 1000-1300 1400-1800 and most evenings 1900-2200
G5FN.	Gillingham Kent.	——	Sat. 1500-1700
G5LB.	Beckenham. Kent.	56.72	Mon. Tues. Thur. Fri. 1830-1930 Sat. 1600-1700 1800-1900 Sun. 1200-1300
G5JU.	Bristol	57.4	Sat. 1500-1530 Sun. 1100-1200
G6PG.	Gravesend. Kent.	56.36	Mon.Wed.Fri. 2130-2145 Tues.Thur.Sat. 2015-2030 Sun. 0900-0915 1715-1730

TABLE II

British 56 Mc. transmission schedules as of August 2, 1936, as reported by G2HG. Times are Greenwich after daylight saving time ends October 4; one hour earlier before that.

hills, the lower density of population, and the failure to use beams. W9PEI in Chicago, we understand, occasionally hears a high-powered Kalamazoo, Michigan, station as loud as local 56 mc. phones. Apparently, Chicago stations have been unable to raise the Kalamazoo station. Because 28 mc. c.w. stations are often heard at 100-300 miles, we suggest that the gang on "five" arrange their receivers for straight c.w. reception and cover the band occasionally for weak carriers and code signals.

To increase the chance of hearing dx, we suggest improving the antenna input to the receiver by stacking the antenna and tuning the transmission line or feeder properly. A vertical double-zepp. at least might be used, for good low-angle pickup without directivity.

28 MEGACYCLES

After hearing NY2AE pound in on ten meter phone Sunday, August 16th, and old time conditions during the evening of the 17th, we feel like broadcasting news of returning excellent conditions on "ten". In five minutes we heard W1DZE working VK4BB, W4EEV working W8AGU and talking ahout raising VK3BD, W4DSY discussing the same with W4BEB, XE1AY calling CQ then calling W3HC, a W3 calling a W6. Some of these were R9 phones with the usual chance of error in phone calls. A combination of short skip plus dx signals made for interesting work.

The ten meter band has been open with short skip a good share of the time this past summer, but the absence of consistently good dx conditions has taken its toll of stations. Throughout the summer, there have been occasional contacts with all southern hemisphere continents, and once in a while, a signal gets across the Atlantic—but generally much later than the time considered usual last winter.

Many logs show reports of 1000 mile contacts when neither station could hear another signal, while often there were numerous harmonics of 14 mc. sta-

[*Continued on Page 78*]

An A. C. Operated Remote Control Unit

By Lyman E. Rinker,* W7AZD

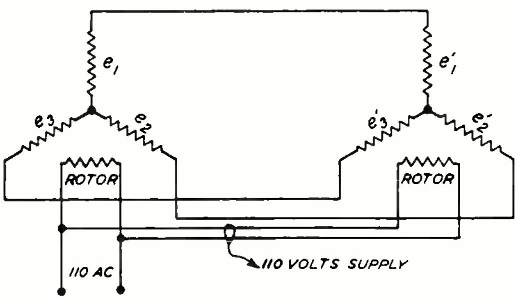


Figure 1
Connections of the Generator and Motor, Heart of the System

Many articles have been written on the subject of "remote control" as applied to the small transmitter; these usually being clever adaptations of current relays. The writer has used a number of such combinations, both of other people's contributions and of his own manufacture, but none of them seemed quite to satisfy.

In keeping with good engineering practice, the writer decided that the following requirements would have to be met: The apparatus must be simple in construction, simple to operate, equally well adapted for long or short distance installation, independent of ordinary voltage fluctuations, and reasonable in cost.

This entirely new system (for amateur applications) possesses all of these requirements with one reservation. The cost is only partially dependent upon the number of operations controlled. Therefore, if but a few circuits are to be controlled, relays may be more economically installed; the more circuits controlled the lower the relative cost.

The purpose of this article is to present the theory and general nature of the system rather than a cut-and-dried installation, in order that individual problems can be solved according to their unique limitations.

The fundamental unit consists of a generator and motor, each having its field (in this case the rotor) excited from some a.c. source. See figure 1. The stators are tri-polar, Y-connected with three external connections for the line wires. Simply stated and without delving into mathematics, the system functions as follows:

For any instantaneous value of excitation voltage on the generator there is induced in each of the secondaries three other voltages, e_1, e_2 and e_3. Likewise, there are voltages e_1', e_2' and e_3' induced in the secondaries of the motor. When the motor and generator are both excited from supplies of equal voltages and the same phase, and the rotors have the same relative position, $e_1 = e_1'$; $e_2 = e_2'$; and $e_3 = e_3'$; and no current flows through the line wires. However, if the positions of the rotors are not relatively alike, e_1 does not equal e_1', etc., and a current flows from the generator to receiver, producing a torque tending to synchronize the two rotors. Thus the motor position follows any movement of the generator rotor.

The next thing is to apply this to our problem. The motor could be direct connected to a rotary switch, each position performing some different function. A new switching device was developed by the writer so that his transmitter could be remotely controlled as follows: Position "a", turn on all r.f. and rectifier tube filaments; "b", apply plate voltages and close the keying relay circuit; "c", turn on all r.f. a.f., rectifier tube filaments and close microphone line circuits (the same set of wires used for the microphone as for keying); "d", apply plate voltages.

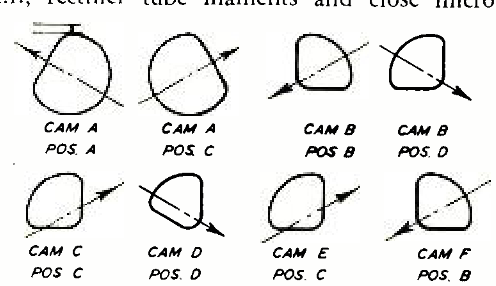


Figure 2
The Cam Switching Arrangement Described in the Text

The switch consists of a number of cams (figure 2) which close the necessary switches according to their rotated position. Cam "A" turns on the r.f. and rectifier filaments; cam "B" applies r.f. tube plate voltages; cam "C" turns on audio and modulator and their respective power supply tube filaments; cam "D" applies audio tube plate voltages; cam "E" closes microphone circuits; and cam "F" closes the

*4225 S. E. Oak St., Portland, Oregon.

keying relay circuit. Figure 3 shows construction of the cams.

There are many other combinations that can be secured and it is hoped that the material presented will be of help to the amateur fraternity and open a new field for the experimenter.

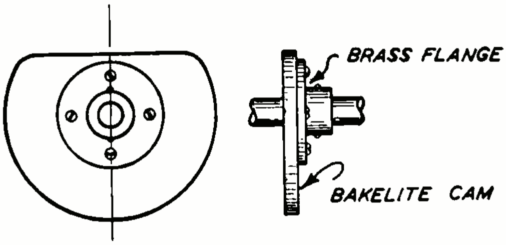


Figure 3
Showing Construction of the Cams

These motors and generators have been used in commercial indicator and control systems for a number of years, and may be obtained from the following manufacturers:

Pioneer Instrument Co., Inc.
Brooklyn, N. Y.
(Trade name: *Autosyn*)

and

General Electric Co.
Schenectady, N. Y.
(Trade name: *Selsyn*)

This system fills all the requirements as originally stated. The following precautions must be observed in usage: If the excitation is dropped on either unit for any length of time the units will burn up. Also if any one of the line wires is broken the units will also burn up in time.

At the present time the writer is doing some experimental work on rewound motors of the ordinary variety in the hopes of producing a more economical system, and more dope on practical installations will be forthcoming.

◆

Mislaid Regeneration

In some receivers we have in the past allowed regeneration to appear intentionally. By simple use of "intelligent carelessness" one can have moderate regeneration and improve gain and selectivity when using such tubes as the 24, 35, 6D6 *et al.* The tin tubes are not so. For instance, a 6J7 has about 60% as much feedback capacitance as the foregoing, and to boot it is largely self-shielding. If one has been working on a "slightly-regenerative" basis either by accident or on purpose, these newer tubes and their metal relatives may be disappointing.

F.C.C. DOINGS

Commercial "Extra Firsts" Abolished

The Telegraph Division on July 22, 1936, deleted Rule 421 and paragraph (1) of Rule 439 prescribing the qualifications and renewal requirements, respectively, for the commercial extra first class radio operator license, and amended paragraph (2) of Rule 439 by striking the word "Other" at the beginning of the first line and substituting therefor the words "All operator". The Commission further ordered that existing licenses of this class will remain valid until expiration and when submitted for renewal will be considered as radio telegraph operator first class licenses bearing radiotelephone operator first class endorsements.

The commercial extra first class operator license and the radiotelegraph first class operator license bearing radiotelephone first class license endorsement are identical, with respect to the class of stations that may be operated by holders of these licenses. However, the requirements for renewal of the commercial extra field class operator licenses have been less stringent than those prescribed for the radiotelegraph and radiotelephone licenses. Therefore, the deletion of the rules in question will eliminate this inequality.

Only a small number of commercial extra first class operator licenses have been issued due to the higher initial requirements for this class of license. Those requirements provided, among other things, at least 18 months satisfactory service as an operator at stations open to public correspondence during the two years previous to application for examination and the ability to transmir and receive at a speed of 25 words per minute in the American Morse Code and 30 words per minute in Continental Morse Code. Since these higher requirements did not accord the holder of the commercial extra first class operator license any additional privileges, the deletion of this class of license will result in further simplification of the Rules Governing Operator Licenses.

Defense Test Communications

The Commission on March 11, 1936, adopted the following rule:

"Rule 212(a) The licensee of any radio-telegraph or radiotelephone station, other than broadcast, may, if proper notice from authorized government representatives is filed with and approved by the Commission, utilize such stations for military or naval test communications (messages not necessary for the conduct of ordinary governmental business) in preparation for national defense during the period or periods stated in said notice subject to the sole condition that no interference of any service of another country will result therefrom. Nothing herein or in any other regulation of the Commission shall be construed to require any such station to participate in any such test."

Phone Band Extension Hearing

The Federal Communications Commission on June 9, 1936, ordered that a public hearing be held before the Telegraph Division in the offices of the Commission at Washington, D. C., beginning at 10 a. m., on October 20, 1936, for the purpose of assisting the Commission in determining the action to be taken on the request of the Board of Directors of the American Radio Relay League that the Commission's Rule 377 be amended to permit Class A amateur radiotelephony operation (type A-3 emission) on the band 3850 to 3900 kilocycles in addition to the present 3900 to 4,000 kilocycle band. The proceeding was assigned Docket No. 4010.

It was further ordered that all persons desiring to be heard should file with the Commission a notice of such intention, not later than 10 days prior to the hearing, stating their interest in the proceeding and in a general way the nature of the testimony to be presented.

◆

Variable-mu Eyes

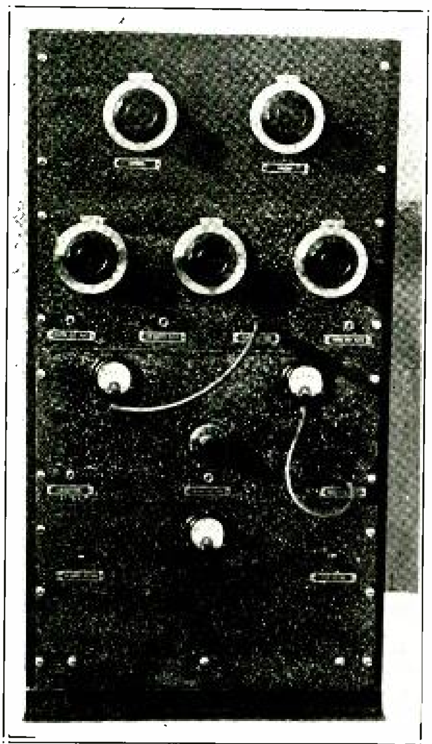
No, the 6G5 "licorice eye" will not show anything that can't be shown with the older 6E5. It simply has a variable-μ grid to avoid the overloading of the 6E5, which varied the shadow angle 100 degrees for an 8 volt bias change, while the new tube requires 22 volts change for that effect.

A 50 Watt General Purpose Transmitter

By H. Rexford Brokaw,* W6COO

This general purpose 50 watt transmitter is inexpensive to build, is simple to operate, has excellent quality on phone, and presents an attractive appearance. The construction used allows any part of the transmitter to be worked on without disturbing the rest. Also, all components and wiring are readily accessible.

When designing a low power phone-c.w. transmitter the tentative power output, for various reasons, usually resolves itself to a figure in the neighborhood of 50 watts. Among the reasons why this works out as an optimum output are the following: 50 watts of carrier



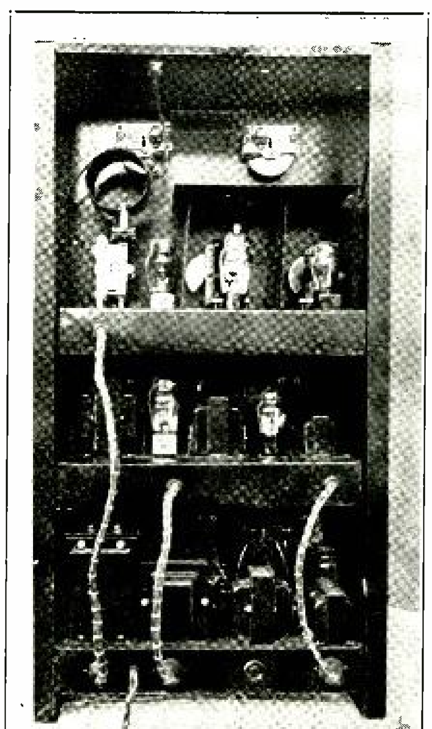
Front View of the Complete Transmitter

is adequate for reliable communication over considerable distance, provided a good antenna is used. Then too, the "dollars per decibel increase" quotient goes up fast when one goes to a power much greater than 50 watts. It is necessary to increase power about 8 times before a really noticeable difference in signal is effected, and a 400 watt rig costs considerably more than a 50 watt outfit, particularly if phone operation is to be included.

*856 Lighthouse Ave., Monterey, Calif.

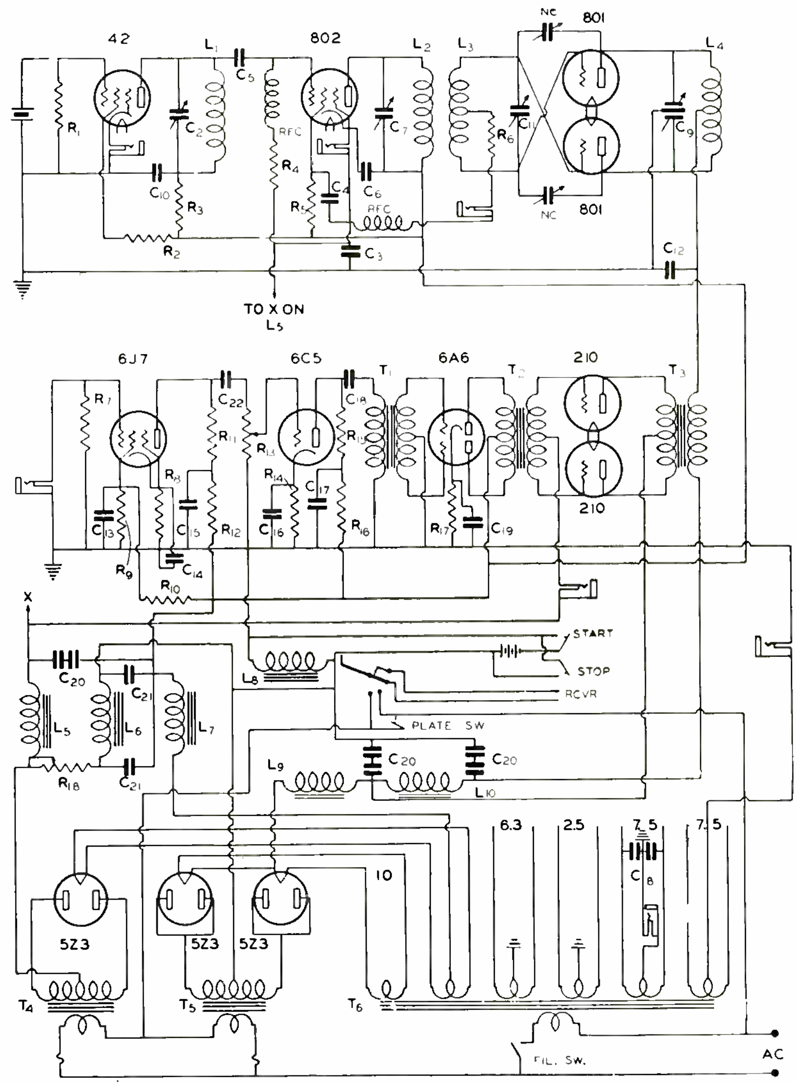
If one does wish to put more money in the transmitter at a later date and add a half kilowatt amplifier, the 50 watt rig will provide just about the right amount of excitation. Thus it can be seen that a rig with 50 watts output makes a very satisfactory basic unit, to which a high power amplifier may be added at a later date.

The transmitter shown in the photographs, using 801's in the output stage, actually puts out close to 65 watts with 600 volts on the 801's (drawing slightly more than rated maximum plate current). However, to be conservative, it is classed in the "50 watt" group.



Back View of the Transmitter, Showing Construction

Because of its ability to turn out considerable r.f. power with a minimum of grid drive, and because it requires no neutralizing, an 802 was chosen for the buffer. This permits low voltage



General Wiring Diagram of the Transmitter

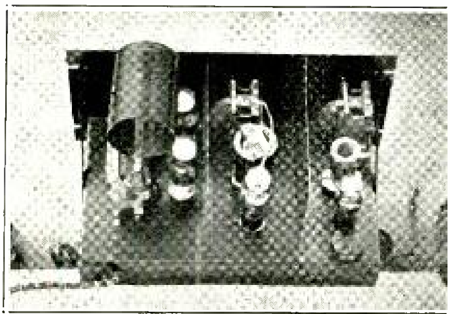
R_1—15,000 ohm, 1 watt carbon
R_2—20,000 ohm, 10 watt
R_3—4,000 ohm, 10 watt
R_4—30,000 ohm, 2 watt carbon
R_5—15,000 ohms, 10 watts
R_6—5,000 ohms, 25 watts
R_7—5 megohms, 1 watt carbon
R_8—3,500 ohms, 1 watt carbon
R_9—50,000 ohm, 1 watt carbon
R_{10}—200,000 ohms, 1 watt carbon
R_{11}—250,000 ohms, 1 watt carbon
R_{12}—50,000 ohms, 1 watt carbon
R_{13}—500,000 ohm variable potentiometer
R_{14}—3,000 ohm, 2 watt carbon
R_{15}—50,000 ohm, 2 watt carbon
R_{16}—5,000 ohm, 2 watt carbon
R_{17}—500 ohm, 10 watt
R_{18}—1,000 ohm, 100 watt adjustable
C_1—.002 μfd. mica
C_2—100 μμfd. variable
C_3—0.1 μfd. 600 v. paper
C_4, C_6, C_{10}—.002 μfd. mica
C_5—0.00005 μfd. mica
C_8—0.01 μfd. mica
C_9—Split-stator variable, 210 μμfd. per section, 0.070" airgap
C_{11}—75 μμfd. air padder (160 meters only) inside coil form
C_{12}—0.0001 μfd. mica
C_{13}—1 μfd. paper
NC—Double spaced 15 μμfd.
C_{14}, C_{16}, C_{19}—10 μfd., 50 volt electrolytics
C_{15}, C_{17}—2 μfd.
C_{18}—0.5 μfd.
C_{20}—Dual 8 μfd. paper with sections in series
C_{21}—8 μfd. paper, 500 volt rating
C_{22}—0.1 μfd.
L_5, L_6—15 henry chokes, 85 ma.
L_7—Swinging choke, 10 to 30 henry, 150 ma.
L_8—Relay coil
L_9—Swinging choke, 12 to 38 henry, 280 ma.
L_{10}—Filter choke, 20 henry, 150 ma.
T_1—Input transformer, to p.p. grids
T_2—Driver transformer, 1½ to 1 step-down ratio
T_3—Modulation transformer, 210's to r.f. load
T_4—Power transformer, 1400 volts c.t., 150 ma.
T_5—Power transformer, 1500 volts c.t., 250 ma.
T_6—Multiple filament transformer
RFC—2.5 mh. chokes

to be used on the crystal oscillator, and the crystal does not get itself all worked up into a fever trying to handle a lot of crystal current.

A 42 pentode is used as a straight crystal oscillator, the 6.3 volt filament allowing it to be run from the same filament supply as the 802.

The speech consists of a 6J7 metal pentode in a high gain stage resistance-capacity coupled to a 6C5 metal triode, transformer coupled to a 6A6 driver. This lineup gives sufficient gain to work directly from a diaphragm type (high output) crystal microphone. The gain control is placed in the grid circuit of the second stage to reduce noise originating in the first (low level) stage. With the gain control wide open, there is no advantage in having the gain control in this position, but as it usually is operated "backed off" a bit from maximum gain, the tube noise and other background noise in the first stage are reduced with the gain.

Although a pair of 45's would give slightly less distortion than the 6A6 driver, the 210's do not have to be "kicked" very hard at 600 volts to modulate the r.f. stage 100% on speech, and the 6A6 seems to do the job with negligible distortion. The use of the 6A6 instead of 45's enables one to get by with one stage less of speech, because of the much higher gain of the 6A6. If it were necessary to drive the 210 modulators really hard, low impedance driver tubes



The Three-Stage Radio Frequency Unit

would be required, an extra stage of speech making up for the lower gain of the low μ tubes.

The whole transmitter is arranged to fit on a four-panel 19 inch relay rack, using 10″ x 17″ x 2.5″ metal chassis. The rack was made from 1¾″ angle iron, the iron being cut to length and electric arc welded. After the welding, the burrs were cleaned off with a file and the rack scrubbed with a wire brush, preliminary to giving it a coat of black lacquer. Holes for standard panels were then drilled and tapped to take 10/32 machine screws.

The chassis were made from 20 gauge galvanized iron, cut to size and bent on a tinsmith's brake. After bending, the corners were soldered to make a rigid unit. The price for crackle finished panels is quite reasonable; so these were purchased ready made. The final touch for the rack and chassis before mounting the components (after all holes were drilled) was to give them three coats of black lacquer.

As the photographs show, the transmitter is arranged with the power supplies on the lowest panel, concentrating the weight at the bottom. Next in order are the speech unit, the r.f. unit, and the universal antenna coupling unit at the top.

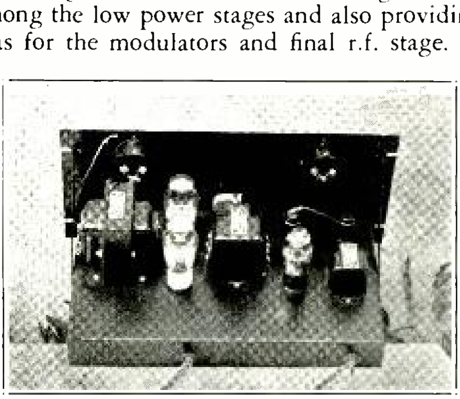
The oscillator and buffer tuning condensers are mounted on small standoff insulators, as the rotors are not at ground potential. Large holes were cut for the sockets which hold the plug-in coils, and the sockets mounted well above the chassis by means of spacers. This cuts down the amount of metal in the field of these coils. Shields were placed between stages to reduce coupling, and no trouble was experienced on that score.

Fixed condensers, resistors, and nearly all wiring are placed below deck. This adds to the appearance and allows shorter leads, leaving the space above for the tank circuit leads.

The oscillator and buffer coils are wound on standard 1½″ plug-in forms, except the 160 meter buffer coil, which is wound on a giant 2½″ form. The grid windings on all coils except the 160 meter buffer coil are untuned, the coils being "pruned" for each band. As it was impossible to get sufficient turns on the 160 meter grid coil, a small adjustable padding condenser was mounted inside the 160 meter buffer coil and resonance obtained in this manner.

For maximum efficiency, the coils for the final amplifier and also the antenna network are of the self-supporting "air-wound" type. Two milliammeters, one 50 ma. and the other 250 ma., are used to measure all plate and grid currents by means of extension leads and plugs which are patched into the various circuits by means of the jacks provided for the purpose.

The power supply deck carries two separate power supplies, one delivering 600 volts for the class C stage and modulators, and the other delivering 525 volts, the latter being divided among the low power stages and also providing bias for the modulators and final r.f. stage. In



The Speech Unit, with 210 Modulators

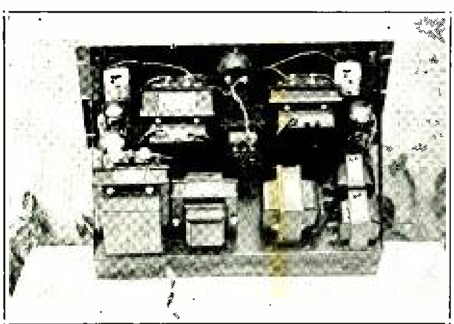
the 600 volt supply, two 5Z3's are paralleled to give heavy current carrying capacity and low voltage drop without the "hash" common to mercury vapor tubes.

A variable resistor, R_{18}, between the negative of the 525 volt supply and ground, provides

COIL TABLE

Band	L_1	L_2	L_3	L_4
160 meter band 160 meter crystal	50 turns no. 26 closewound on 1½" form	40 turns no. 26 closewound on 2¼" form	50 turns no. 26 closewound on 2¼" form	45 turns no. 12 spaced with no. 18 3" diameter
80 meter band 80 meter crystal	29 turns no. 22 closewound on 1½" form	30 turns no. 22 closewound on 1½" form	32 turns no. 26 closewound on 1½" form	25 turns no. 12 spaced wire dia. coil dia. 2½"
40 meter band 40 meter crystal	16 turns no. 18 closewound on 1½" form	17 turns no. 22 closewound on 1½" form	17 turns no. 24 closewound on 1½" form	13 turns no. 12 spaced wire dia. coil dia. 2½"
20 meter band 40 meter crystal	16 turns no. 18 closewound on 1½" form	7 turns no. 18 spaced wire dia. on 1½" form	14 turns no. 20 spaced wire dia. on 1½" form	7 turns 3/16" copper tubing 2½" dia. spaced 3/16"
10 meter band 20 meter crystal	7 turns no. 18 spaced wire dia. on 1½" form	4 turns no. 18 spaced wire dia. on 1½" form	8 turns no. 18 spaced wire dia. on 1½" form	5 turns 3/16" copper tubing 2" dia. spaced 3/16"
	The spacing between L_2 and L_3 is ¼" on 40, 80, and 160 meter bands, and is 0.4" on 20 and 0.5" on 10 meters. All final L_4 coils are spacewound and self-supporting. All coils except the final plate tank are wound with d.c.c. wire.			

bias to the modulators and "protective bias" for the 801's, the latter getting the rest of their bias from a grid leak. The amount of bias is adjusted by varying this resistor until the 210 modulators draw about 35 ma. static plate current.



The Two Power Supplies, Bottom Tray

The 802 cathode is connected to the extreme negative leg of this power supply in order to get the benefit of the full 525 volts on the 802, as this voltage is necessary in order for the 802 to drive the 801's fully, especially when doubling in the 802 stage. Keying of the transmitter is accomplished in the cathode circuit of the 802 stage by inserting a key in the meter jack in the cathode lead.

A single filament transformer with multiple filament windings was used to supply filament voltage to all tubes. An a.c. voltmeter was permanently wired across the 7.5 volt winding to keep tab on the filament voltages. When the 7.5 volt winding is "on the nose", it is known that all other filaments supplied from this transformer are also o.k. By means of a tapped primary and a s.p.s.t. switch, the filament voltages may be kept at the proper value in spite of varying line voltages.

Several unique arrangements, the heart of which is the relay, are employed to simplify operation, and at the same time protect the apparatus. The relay was made from an old fashioned "B" eliminator relay by rewinding the coils and adjusting it to hold on a current of approximately 300 ma. This relay is placed in the ground return of the two plate supplies, and closes the circuit to the two plate transformer primaries as long as the required current flows through the coils.

Fuses are placed in the primary of both plate transformers, and in the event of failure of either supply the relay opens and cuts off all plate voltages. The relay will also open should the load be removed from the class C stage, protecting the components from excessively high peak voltages that result from modulating an unloaded class C amplifier.

To actuate the relay, a push button on the microphone base in series with a 4.5 volt "C" battery across the relay windings is momentarily closed, starting the transmitter. A second button connected directly across the relay coil is momentarily closed to stop the transmitter. A switch is connected across the relay contacts for

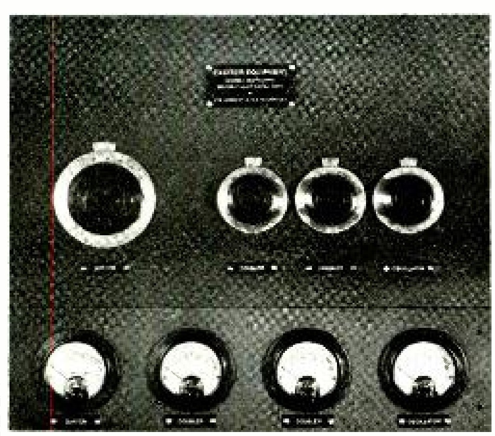
[*Continued on Page 77*]

A Sure Fire 10 Meter Exciter or Transmitter

By Faust Gonsett, W6VR

No neutralizing, no trick circuits, 30 watts output on either the 10 meter amateur band or the 8½ meter police band, this unit may be used either as an exciter for a high power stage or as a transmitter. If used as a transmitter, it may either be used as is for c.w., or plate-and-screen modulated for telephony.

Although there are dozens of trick methods of getting down to 10 meters from a 40 meter crystal "in a hurry", and in spite of the fact that most of these circuits can be made to work satisfactorily after much juggling of constants and shifting of components, it is highly



The 30 Watt 8.5-10 Meter Unit

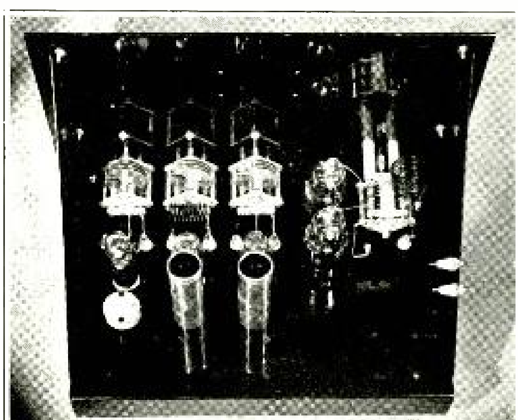
doubtful if the saving in equipment is justified, unless space is a prime factor. There is no denying the fact that a string of straight doublers is easier to get going than a regenerative quadrupler, and where reliability is of importance, the cost of an extra receiving tube and inexpensive midget condenser is a minor item.

The unit shown in the photographs was designed as an exciter unit for a pair of type 800's on 8½ meters, running 24 hours a day in a police transmitter. Naturally, for such work dependability is of greatest importance. For that reason, straightforward design was followed in preference to innovations.

Cathode bias on all stages makes operation practically foolproof. If the crystal fails to start, or for any other reason should any of the stages lack excitation, no apprehension need be felt for any of the tubes, as the plate current falls to a safe value.

In case you wonder why 41's were used in place of 42's, the 41 was found to be a better doubler than the 42 at 10 meters, probably due to less interelectrode capacitance. In fact, when using a 42 in the 10 meter doubler in place of the 41, it was necessary to prune a turn off the coil to hit resonance (the doubler coils are cut to resonate at a very low value of tank capacitance). 41's were used in the oscillator and first doubler stages merely for the sake of uniformity. Then too, as 41's are used in the police car receivers, it is unnecessary to add another tube type to the stock kept for spares.

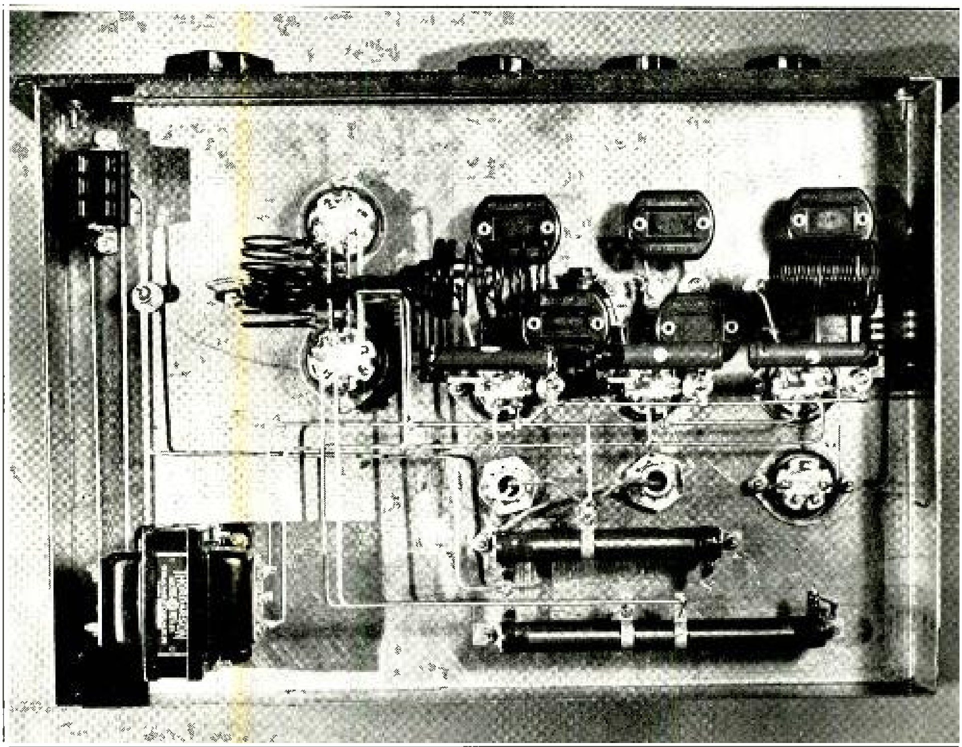
Filament supply is obtained from a 6.3 volt transformer mounted on the underside of the chassis. Plate voltage is obtained from an external power supply that delivers 600 volts under load, the 500 volts for the oscillator and buffers being obtained from the 600 volt supply through an adjustable dropping resistor of 1000 ohms, set to give a 100 volt drop under load. This resistor, not shown in the diagram, is of 50 watts rating and may be seen in the photo showing the bottom view of the chassis.



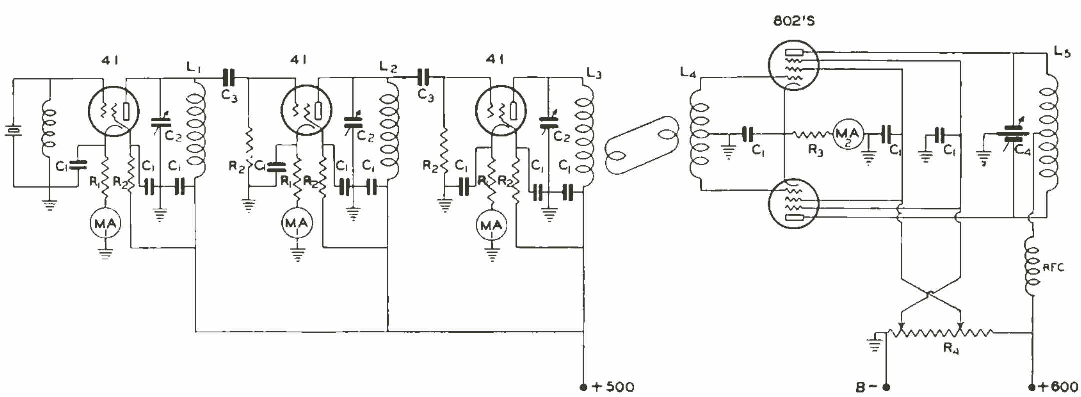
Looking Down on the Unit, Showing Construction

If desired, the plate voltage for the three 41 stages may be obtained from a separate power supply.

Although the plate voltage on the crystal oscillator may seem rather high (500 minus the cathode bias) the crystal current is not suffi-



Under Chassis View. Layout of Parts Should Be Followed Exactly



The General Wiring Diagram

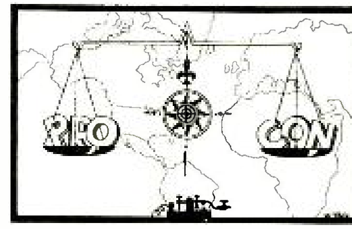
C_1—.004 µfd. mica
C_2—35 µµfd., 2000 volt spacing
C_3—50 µµfd., mica
C_4—25 µµfd. per section, 2000 volt spacing
C_5—Two 4 µfd. 700 volt paper condensers in parallel to provide additional filtering on 500 volt supply (not in diagram)
R_1—750 ohms, 10 watts
R_2—50,000 ohms, 3 watt carbon
R_3—300 ohms, 20 watts
R_4—25,000 ohms, 75 watts, adjustable taps
MA_1—0-100 ma. d.c.
MA_2—0-150 or 0-200 ma. d.c.
RFC—2.5 mh. pie wound
Coils—See coil table

cient to endanger the crystal, and if an "AT" cut crystal is used there will be no noticeable drift, even if left on for long periods of time. The low crystal current is due to avoidance of grid leak bias and to the fact that low screen voltage is used.

The three coils L_1, L_2, and L_3 should be squeezed together or pulled apart until each tank resonates with the condenser plates nearly all the way out. The coil L_4 should be adjusted the same way, being adjusted for maximum

[*Continued on Page 84*]

THE OPEN FORUM



W.P.M. PLUS!

Inglewood, Calif.

Sirs:

I received a letter from Ted McElroy, W1JYN, saying among other things that his latest code speed in a contest is 77 words per minute.

Wondering just how fast that is I doped out the following: 77 words of 5 letters per word is 385 letters per minute. That is 6.4 letters per second. Whew!

So next time you think you hear a 60 cycle raw a.c. note, first make sure that it isn't just W1JYN playing with the dot lever on his bug.

George Dery, W6HG.

•

UNLICENSED TRANSCEIVERS

Federal Communications Commission
Washington, D. C.

Sirs:

This Commission has from time to time received complaints to the effect that a number of so-called "transceivers" and other types of low-power transmitters sold by radio dealers are being operated as unlicensed radio stations. These stations are in use in all sections of the country and are often operated in the amateur bands, the nature of the transmissions usually being of the type carried on by amateurs.

Such operation challenges this Commission's authority to regulate radio communications, and serious interference has resulted to the television, amateur, and commercial service bands.

The Communications Act of 1934 confers upon this Commission, under the provisions of Sections 2(a) and 301, authority to regulate all interstate and foreign transmissions of energy and communications by radio which originate and/or are received within the territorial limits of the United States. Accordingly, all persons who are engaged in the operation of apparatus which is used for the transmission of energy, communications or signals by radio, regardless of location, frequency or power used, are required to obtain from this Commission a permit and license to authorize construction and operation thereof.

Questions have arisen in the past as to whether or not this Commission may exercise jurisdiction over radio stations of low power, the transmissions of which are intended to be received wholly within a given state. You are advised, however, this question has been adjudicated. The courts, without exception, have held that the radio signal is inter-state in character and that the provisions of the Communications Act of 1934 apply to all stations which produce radio emissions intended for reception. (See *U.S.* v. *Allison,* Equity No. 780, in the U. S. District Court for the Northern Division of Texas (November 1933); *Radio Commission* v. *Nelson Brothers Bond and Mortgage Company,* 289 U. S. 266; *Whitehurst* v. *Grimes,* 21 Fed. (2d) 787).

In the field of engineering it is an established fact that in any use of radio the signals will at times have effects which extend beyond the borders of a state and/or interfere with transmission to or reception from other states; and the question of this Commission's jurisdiction over the operation of such stations is too well settled to any longer admit of doubt or leave room for serious question in any judicial proceeding.

All persons who desire to construct and operate a radio station of any type are required to obtain authority to do so from this Commission. Appropriate forms to be used in applying for construction permits and licenses will be furnished upon request.

John B. Reynolds,
Acting Secretary.

•

QRO AND LOCAL QSO'S

Wetaskiwin, Alberta.

Sirs:

Taking the good advice of C. W. Cover in the May issue of Radio we built ourselves an auto-transformer.

The low power rig here uses a 47 'xtal to single 45 with normal input of 30 watts.

On a recent local QSO we QRP'd step at a time till we got down to the lowest tap, which left our input at 0.4 watt (5 mils at 80 volts), and found we were still putting an R9-plus signal across town. So it looks as though we need very little soup for local work, and a more general use of the autotransformer would help towards lessening the QRM.

Percy J. Maggs, VE4KT.

[*Continued on Page 80*]

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FIRST BLUE-RIBBON EDITION!

IT'S here—a great N-E-W BLUE RIBBON RADIO CATALOG issued by Wholesale Radio Service Co., Inc., *the largest radio supply house in the world*. Every radio item listed in this big catalog has been checked and approved in our huge Testing Laboratories and has been awarded the *Blue-Ribbon Seal*—your guarantee of positive "purchase-insurance"!

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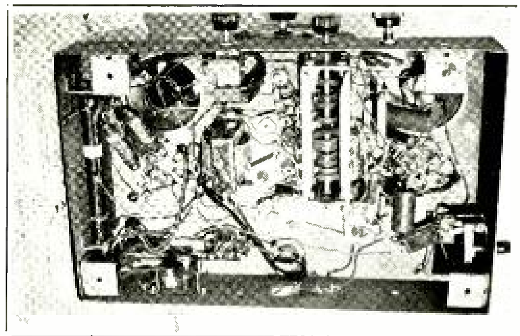
Economical Preselector

[*Continued from Page 45*]



Under-Chassis View, Showing the Ganged Cam Switches

If you wish to go to the additional expense, the unit can be further improved at a later date by changing the 24A tubes to 58's and using a receiver power supply of higher potential (substituting an 83-V will help), and I am sure that the results would justify the change. There is also sufficient room on the chassis for a receiver power supply to be built and I am planning on doing this in the future.

Parts Needed:	*Philco Part No.*	*Price*
1—balancing condenser	04000-E	.09
1—potentiometer	4513	.60
1—24A tube		.53
1—shield can	8005	.06
1—base for can	8004	.01
1—grid clip		.02
2—500-ohm fixed ½ watt resistors		.30
1—40,000-ohm fixed 2 watt resistor		.20
1—50,000-ohm fixed 2 watt resistor		.20
1—2,500-ohm fixed 2 watt resistor		.20
4—0.1 μfd. tubular condensers	304170	.60
1—balancing wrench	3164	.12
20—feet single strand push-back wire		.15

◆

"Two in One" Transmitter

[*Continued from Page 16*]

Five meters has not as yet been tried on the final amplifier due to lack of time, but as the output tubes are known to work well at that frequency, there is every reason to believe a husky 5 meter signal will be put on the air. Operation of the amplifier on 40, 20, and 10 meters is very similar, the efficiency being surprisingly high on all these bands.

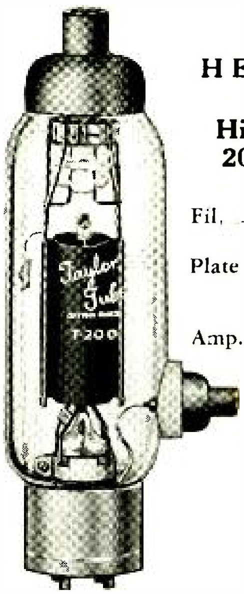
◆

Now that we have WAC, WAZ, WAS, etc., why not *worked all planets?*—W1CWF.

Taylor HEAVY CUSTOM BUILT DUTY Tubes

HIGH POWER ● HIGH EFFICIENCY ● LOW COST

"More Watts Per Dollar"



T-200

HEAVY-DUTY

for use on

High Frequencies 200 Watts Plate Dissipation

Fil. ....10 Volts
4 Amps.

Plate ....2000 Volts
350 M.A.

Modulated
Amp. Factor 17

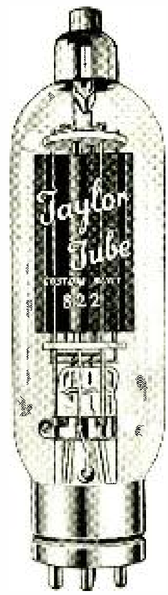
Size ....9½" High
3¾" Dia.

Plt. to Grid....7 MMF.

Carbon Anode

Easy to Drive!

$21.50



814 and 822

The IDEAL HIGH POWER TUBES . for 80 and 160 METERS

200 Watts Plate Dissipation. Both are identical in appearance and general characteristics.

Fil. ....10 Volts
4 Amps.

Plate ....2000 Volts
300 M.A.

Modulated
814 Amp. Factor..........12
822 Amp. Factor..........27

The 814 is a high-efficiency tube for Class C. The 822 is efficient both as a Class C Amp. and as an Audio Amp. A pair in Class B Audio will deliver up to 600 watts.

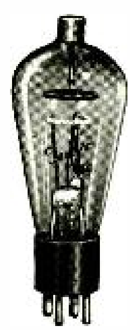
$18.50

T-55

The Season's Fastest Selling Transmitting Tube.

Compare the characteristics . . . and you'll buy the T-55.
Fil..........7.5 Volts—2 Amps.
Plate..........1500 Volts—150 M.A.
Modulated
Amp. Factor..........25
Grid. to Plate..........2.5 MMF.
Full rated inputs can be run into the T-55 on frequencies up to 2 meters.

Easy to Drive! **$8.00**



866

The World's Fastest Selling 866

Standard characteristics. Multi-strand filament construction gives 100% more emitting area. Use of Svea Metal anode prevents flash-backs. Taylor 866's stand up in Heavy Duty Service. You can pay more . . . but you can't beat Taylor Quality 866's.

$1.65

Buy Taylor Tubes and Spend the Savings on Other Parts!

The hard service they will stand . . . and their long service life . . . are proof of Taylor Tubes' Supreme Quality. You get increased performance and longer tube life at much lower cost. Buy Taylor Tubes and spend the difference on better parts . . . you'll have the "most rig per dollar."

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TAYLOR TUBES, INC.

2341-B WABANSIA AVE. CHICAGO, ILLINOIS

Dressing Up the Station

[*Continued from Page 35*]

of rectangles each hide two coils (two per receiver). A number of methods may be worked out whereby the mechanical details for such an arrangement will be satisfactory. However, don't forget to provide *good* shielding for the whole business! As a tip, it might be said that our pet dime store has some elegant little drawer pulls in different colors and about two inches across which are great for the handles of the twin plug-in coils.

The battery of "vertical" rectangles shown above those just described are idle coils for the respective receivers. We decided to let them rest right in the unused part of the panel 'cause we hate to see idle coils lying on the desk or in a drawer. They're right there on the job when needed. Each receiver, by the way, has coils for four bands, in this design.

The next panel-chassis combination holds the power supplies or supply. If only one power supply is to be used, make it a husky one and also subtract a couple of toggle-switches from the array at the bottom of the receiver. The pilot lights are for the filament and plate voltages of each receiver.

A pair of five or six inch speakers is mounted on the top panel. If only one is desired, keep in mind the fact that the audio outputs of the receivers must be arranged so as to feed the one speaker.

Vertical mounting of the power supply chassis is recommended to increase the stability of the rack. It will also allow the receiver to occupy less "forward" space on the operating table.

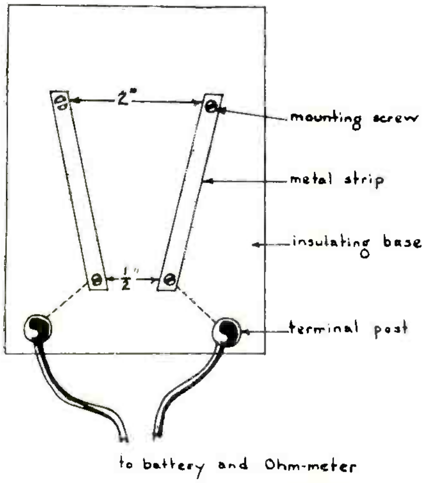
A swing at diversity reception could be taken with this "twin". Don't forget to use antennas which are some distance away from each other and which are at right angles to each other, as well as "tied together a.v.c." on phone, if possible. Simultaneous tuning is, of course, out of the question with this set up; however, as the idea of the undertaking would be only an experiment, satisfaction should be had by tuning the receivers individually. The "twin" was not primarily meant to be used for diversity work; but it might be fun to try it.

As for the rack-and-panel, well, it's a case of our old standby as far as the panels are concerned. The uprights of the rack may be of 1" x 2" pine, and the base of ¾" plywood, 19" x 10". It will be well to use right-angle braces at the corners, and also to use wood-screws throughout; nails are not satisfactory. And don't forget the black paint and crackle-finish for a smart appearance.

◆

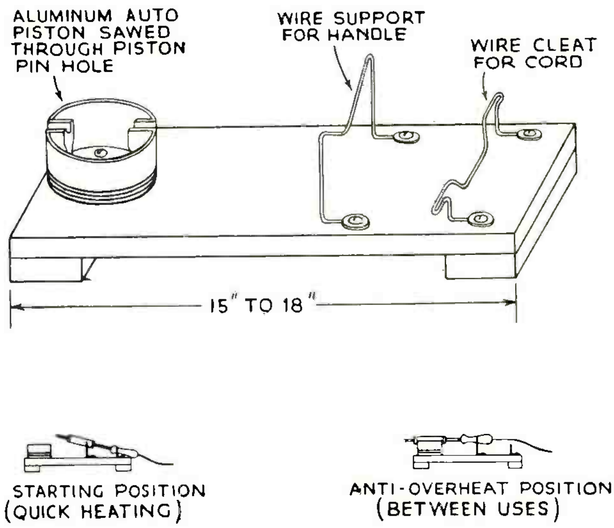
Are there two Chicagos? We note that folks always put an explanatory "Illinois" after the city's name but commonly say "New York City" without explaining that it isn't in Kansas.

HAM HINTS



QUICK RESISTOR TESTER

This handy gadget provides quick contact when testing quantities of resistors of different lengths, allows one hand free to turn the selector switch on an ohmmeter.



SOLDERING IRON HEAT CONTROL

"Revamping" Receivers

[*Continued from Page 23*]

use .0005 to .00007 μfd., depending on the tuning range wanted.

The shielded output lead was abandoned in favor of a simple insulated wire extended out of the coil can toward the last i.f. tube, where it was soldered to an insulated standoff lug for stability. Inside the can this lead was coupled to the oscillator by a few turns of no. 30 wire connected to the plate (or screen) end of the coil L_2 and wound a few times around the insulation of the "antenna". This excites the antenna very weakly so that its position is not so critical as for a "hotter" and shorter radiator. In some sets it is necessary to use the figure 3 circuit to secure enough "hop" to drive the receiver to a good beatnote, especially if the intention is to connect to one of the diode plates rather than to run the beating oscillator into the last i.f. grid. Circuit 3 is stronger in harmonics than 4, which accounts for the apparently senseless shunting of the plate resistor by the .0005 μfd. condenser as a harmonic-shunt. Regardless of the chassis, circuit, or tube, the following adjustment is in each case necessary to secure good action. This same adjustment can be used as a check-up on other sorts of amateur receivers.

Adjusting the Beatnote Oscillator

A strong c.w. signal or strong phone carrier produces a louder beat signal if a close oscillator coupling is used, but such a coupling completely blots out weak signals. On the other hand, a weak oscillator will in turn be knocked out by strong signals leaving mere key thumps. Therefore begin by cutting off the a.v.c. and tuning in as weak a c.w. signal as can then be heard (as a change in background or key clicks). Do this most carefully. Then turn the oscillator on and with weak coupling to it trim the oscillator to give the pitch of note which you prefer. Shut off the oscillator and repeat on other weak signals until satisfied that the oscillator is set correctly "off tune". Now without further change of oscillator trim, adjust the oscillator-to-detector coupling by adjusting the coupling winding previously mentioned (takes place of C_1) and by moving the output wire to and from the i.f. tube. Attempt to find a setting which does not push down the weak ones, while still permitting the strong ones to come through. After this is done, cut in the a.v.c. and make sure that operation continues to be satisfactory, for even if the a.v.c. is not used in c.w. reception you will want to be able to use it in conjunction with a beatnote on some phone work. The best adjustment for this is not the same as the best c.w. adjustment, and a person must choose in favor of one or else compromise.

[*Continued on next page*]

Selectivity

Most broadcast receivers have less selectivity than is needed for amateur work, partly because the i.f. trimmers are set to broaden the response so as to permit better fidelity. Most amateur receivers go in the opposite direction by using a low-grade saucer-size loudspeaker, which would not possibly produce good fidelity. In converting the broadcast receiver one has a chance to exercise some choice, by re-trimming the i.f. to get greater sharpness and sensitivity, while still working with an audio system which is at least able to reproduce what we do let through the i.f. For c.w. we cannot make the i.f. too sharp, of course. For phone there is no agreement, as our crowded voice-bands have produced all shades of belief, from those who wish to listen only to outstanding signals giving high-fidelity, to those who are interested in working on weak and distant signals dragged out of the bedlam with all their high pitches scraped off by 3 kc. selectivity.

Crystal Filters

There is a reasonable doubt as to the utility of some crystal filters, which introduce an unpleasant effect variously described as "hollow", "draggy" or "echoey". Side-by-side comparisons have repeatedly shown something which is not apparent from selectivity curves for such a receiver. While the receiver seems to be reducing noise in a very useful way, it may be introducing the distortions just named to such an extent that signals are less readable than with a less costly non-crystal receiver. Therefore it is reasonable to think that a crystal filter does not by any means insure a good receiver; neither does its omission make a receiver bad. Usually a crystal is difficult to work into a converted receiver, so that one had better consider other ways of getting selectivity, while saving the great loss of gain which appears with some crystal filters.

One fairly obvious method of increasing selectivity is to change the i.f. transformers to the iron-core type such as Aladdin type A-100 (interstage) and type A-201 (diode input). These transformers have a coupling adjustment and can be sharpened by melting off the wax sealing the lower coil in place and giving the adjustment about 1 turn clockwise. If you want a lot of selectivity use an A-201 followed by a second A-201 reversed, and in turn followed by an A-100, the whole trio to be between two i.f. tubes, both pentodes such as 6K7 or 6D6. The difficulty is to fit all the transformers into the space. In any case, while the iron-core transformers improve the receiver, especially one of several years ago, I doubt whether the additional cost of air-trimmed transformers is often justified in this type of job.

An alternative scheme is to tinker with the coupling of existing i.f. transformers—usually unprofitably.

Tuning and Signal-Strength Indicators

A "tuning meter" in the broadcast-receiving sense seems rather pointless since such a device is seldom permitted to work without interference, besides which the operator is concentrating on the signal and will tune it in "on the nose" without any meter-waverings to advise him. Therefore, merely putting a d.c. meter into the plate-supply lead common to the i.f. tubes, while easily possible, was not done on the set shown here, because it had not been useful during the "breadboard" stage. Incidentally such meters start to operate about the time the a.v.c. goes to work, and are therefore useful mainly on strong signals of the "R9 plus plus" sort which we get on alternate Fridays, free enough from interference to know which signal the meter is reading.

On the other hand, it is certainly interesting to know something about the signal strength, which may justify such a meter. It must then be read with some fixed position of the manual gain control governing the r.f. and i.f. tubes—for instance, wide open. As an alternative you can always adjust the meter to the same place on its scale by setting the manual gain control to get that reading. This is the scheme used in the well-known ACR-175 receiver, and of course requires some sort of a signal-strength scale on the gain control. If you can borrow a "microvolter" you can calibrate this control in microvolts as in the ACR-175; otherwise just "guess in" an "R" scale by listening. Since meters are somewhat slow in action, it is just as well to drop the meter idea altogether and instead use a 6E5 "electric eye" kit as an indicator, gauging the signal strength by the setting of the gain control which will just start the "eye" to flickering on c.w. or just start it to close up on voice. This is, incidentally, useful for detecting any serious modulation faults on a voice signal—but don't take that too far.

Odds and Ends

I do not know how many amateurs receive with headsets nowadays, but find that my own tendency is to use the headset only when the receiver has a particularly terrible loudspeaker. In this case no headset jack was incorporated at all, nor has there been one on any recent receiver used at W1FG. When a headset is needed it is connected in by clipping one cord tip to chassis, and the other to the plate of the output tube in series with a pair of condensers (which are in series, because one might b-eak down and it is a good headset). The audio gain is lowered to give a proper headset level and the speaker is essentially silent. At least the plan is simple. I like it; but mostly I like a speaker—a good big decent speaker. The baffling on the rig shown is not all that could be desired, by the way. It is good enough for c.w., but for voice this baffle is extended by "wings" of thick celotex extending backward from the speaker panel at both sides and at the top. Note that the rack uprights extend above the panel to permit this. The wings are a foot wide fore-and-aft and make quite a difference. Incidentally, if you use a cloth-covered grill it will be found hard to cement the cloth to either metal or masonite until one uses canvas cement such as employed in building canvas canoes. This is tremendous stuff; don't let it dry on your fingers!

One parting warning. Some receivers have the trimmers in the most impossible places, and there always comes a time when one needs to get at them. In the case of the A-82 shown here all trimmers are accessible when the set is mounted as shown: that is, screwed down with its original mounting screws passing through a pair of 1" x 2" wooden strips held by wood-screws passing through the steel brackets into the end of the strips. By merely unplugging the speaker and dismounting the lower panel, nearly anything can be done to the receivers. The "sentry box" unit which contains the r.f. system can be dismounted if necessary. It is almost equally easy to take the set from the panel, as it is only necessary to remove the control knobs, lean the panel forward, and unscrew the 4 hold-down screws. From a repair standpoint, the panel mounting is more convenient than the original cabinet, besides putting the controls nearer the table top and within easier reach.

◆

Three Tube Kilowatt

[Continued from Page 27]

coil of the individual band giving the trouble or more capacity may be added to the circuit from the neutralizing end of the coil to ground, until this capacity is equal to the inter-electrode capacity of the tube. Of course, the neutralizing end of the coil should be connected to the ro-

[Continued from Last Text Page]

tor of the condenser, since the frame will probably have enough capacity to ground to furnish the necessary balance. Try neutralizing for one band; if you have to change it when you shift bands, add more capacity to the neutralizing side.

For class "C" operation the RK20 and the grid to the final are adjusted for maximum grid current. Cut-off bias or slightly more is furnished by the batteries and the remainder is secured from the rectified excitation current flowing through a grid resistor of approximately 7000 ohms. This value was determined after extensive experimenting with different types of bias supply, such as cathode, and also with different values of grid resistor. The measured bias voltage is actually about 2½ times cut-off, with 50 ma. of grid current flowing. For 1 kw. input the 4000 volt tap is used, and the plate current is 250 ma.

For 20-meter operation a 40-meter crystal is used, doubling in the second section of the 53, the RK20 running as a straight amplifier. For 40 meters all three stages run straight through. On 75 either a 160-meter crystal is used doubling, or a 75-meter crystal is used straight through. For 10 meters the input to the final may have to be reduced, due to lack of excitation when the RK20 is used as a doubler, the regular 20-meter set-up being used in the exciter unit. It is believed that a 20-meter crystal would give better operation but none was available at the writing of this article.

◆

The "Selectosphere"

[Continued from Page 31]

rally its use on telephonic signal reception does not afford what could be termed good quality; the intelligibility of the speech is comparable with that experienced when a quartz crystal intermediate frequency filter is used (clipping the side bands). Although the successful use of the selectosphere does not require a receiver employing a crystal filter or noise suppression circuits, it is interesting to note that its adaption to receiving systems so equipped demonstrates a marked improvement in overall performance. The selectosphere, used on reception tests over a period of several years on many makes of receivers, stands by itself in displaying a stably peaked transducer unit which is readily attached and effective in action even when used with receiving systems of moderate design (such as the improved t.r.f. types). The selectosphere can be used with tuned and regenerative audio frequency amplification where such performance assists the peak frequency of the selectosphere (same peak frequency). That this device is a successful adjunct when operating with a de luxe receiver is also well established by test. In fact, a single signal superheterodyne equipped with noise suppression and working into a selectosphere offers about the present ultimate in receiving equipment (usable only on frequency-controlled[1] transmissions).

In conclusion it can be mentioned that there are other applications for the selectosphere, and considerable success has been obtained with active transducers or motor-generator devices acting as interstage audio frequency peak-response elements, but they and others will be the subject of future writings. The author wishes to acknowledge the aid of M. P. Powers, S. J. Freno, and A. F. Graham, who were instrumental in carrying out some laboratory tests and measurements pertaining to the development of this device.

[1]All crystal controlled transmitters do not produce signals of high stability.

Battery Portable

[Continued from Page 49]

Another reason for using a storage battery filament supply was that not much saving could be realized by using filament type tubes in the receiver and turning it off while transmitting, and the desirability of using the cathode types of 6.3 volt tubes swung the issue to using a small regenerative type of receiver with either detector and one audio or a simple type of tuned r.f. receiver with one audio stage, with the filament supply from the same battery that supplied the transmitter.

For an emergency standby receiver, a logical companion unit would be one utilizing a 112-A regenerative detector, transformer-coupled to a 12-A audio stage, running off a single 45 volt block for B supply, and obtaining filament supply from the same 6 volt battery that supplies the transmitter. The send-receive switch could consist of a toggle switch in one of the filament leads, further conserving the batteries. 201-A's could be used instead of the 12-A's, but 12-A's seem to be a little "hotter" than their older cousins, and do not draw any more filament current.

◆

Magnetrons for U.H.F.

[Continued from Page 40]

lengths, say from two to ten meters, it may be more convenient to use conventional tuned circuits in place of the Lecher wires. The shortest dynatron wavelength attainable will depend largely upon the diameter of the plates and how much voltage the tube will stand. Fifty centimeters is about the lower limit with average tubes.

Electronic oscillations, while of much shorter wavelength, are more difficult to obtain, as the adjustments are much more critical. These oscillations occur in the neighborhood of the critical point on the I_p—I_h characteristic (point "A" in figure 6). Since the electronic oscillations are of much lower amplitude than the dynatron oscillations, it will be necessary to use a very sensitive bulb, such as the two-volt pilot light bulbs. These bulbs draw only 60 ma. or 120 milliwatts and, of course, will indicate a much lower power. After adjusting the magnet current I_h to the critical value, tilt the tube about eight degrees and test for oscillations by sliding the bulb along the primary Lecher

[*Continued from Preceding Page*]

wires. If no oscillations are found, try slight changes of filament current, field current, and angle of tilt. In case no oscillations are found, repeat the process at a considerably different value of plate voltage. Once oscillations are observed, the field, filament, and tilt angle should be adjusted for maximum output. The angle of tilt is often quite critical; so provision must be made for clamping the tube firmly in position when the correct angle is found.

Communication with Magnetrons

Magnetrons are interesting playthings in the laboratory, but the amateur wants to know how to use them for communication. Three items need consideration: antennas, modulators, and receiving circuits.

The antenna systems for dynatron oscillators, and the methods of feeding them, are quite the same as those commonly used with ultra-high frequency feed-back oscillators. Directive antennas are very useful, but they should be simple affairs not requiring critical adjustment.

Simple half-wave antennas with parabolic or cylindrical-parabolic reflectors are best at wavelengths below fifty centimeters. To be highly effective, the aperture of a parabolic reflector should be at least several wavelengths. This is the reason that parabolic reflectors have not been used extensively on five meters and lower wavelengths. However, at ten centimeters, the reflector from an ordinary radiant bowl electric heater makes a very effective parabolic reflector. Since few amateurs have the equipment required to spin their parabolic reflectors, the simpler cylindrical-parabolic reflectors will prove useful. These may be bent up from a sheet of ordinary galvanized iron. The solid reflectors are much better than those made up from wire grids. The type of metal used for the reflector is not important. Sheet iron seems to work as well as copper.

Dynatron oscillators may be modulated by connecting the modulation transformer in the plate supply lead, just as done in ordinary plate modulation. The modulation will be fairly linear over a considerable range. The modulation of electronic oscillators presents a more serious problem. A slight change of plate voltage will stop the oscillations completely; so ordinary plate modulation is out of the question. Plate modulation can be used for tone telegraph but the distortion of voice transmission is serious. A better scheme is to use "gas modulation".[2] Apply the modulation to a large neon tube placed in front of the antenna. The varying ionization of the neon will "valve" the radiated signal.

The magnetron may be used as a very satisfactory ultra-high frequency detector, the rectified signal appearing in the plate supply lead. The adjustment for receiving is not very critical, but greatest sensitivity will be obtained with the tube adjusted to oscillate at the frequency of the received signal. Super-regeneration may be used as shown in figure 8, but the results are seldom as satisfactory as with triodes at lower frequencies.[3] Considerable audio amplification will prove desirable.

The similarity between transmitting and receiving circuits suggests the use of magnetrons in "transceiver" circuits. This is quite possible, but, unfortunately, the power supply requirements and the weight of the magnet form a serious obstacle for portable work.

What can be expected from micro-rays? Don't expect transcontinental dx! Reflection from the Heaviside layer occurs very rarely at five meters and is practically unknown at shorter wavelengths. The shorter wavelengths behave in much the same manner as light and, except for temperature inversions or reflections

[2] "Ionized Gas Modulator for Short Waves" by E. G. Linden and I. Wolf. *Proc. I.R.E.* Vol. 22, June, 1934, pages 791-793.

"Transmission and Reception of Centimeter Waves" by I. Wolf et al, *Proc. I.R.E.* Vol. 23, Jan., 1935, pages 11-23.

[3] British Patent 433,427 on super-regenerative reception with magnetrons, issued to the Compagnie Generale de T.S.F. Also, British Patent no. 340,456 and U.S. Patent no. 1,846,888 on reception with magnetrons.

from surrounding objects, we can only expect transmission over optical paths.

Micro-rays are already finding many commercial applications, and in years to come we will certainly see intense activity on the wavelengths below one meter.

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General Purpose Transmitter

[*Continued from Page 61*]

testing purposes. Back contacts on the relay operate the receiver communication switch, making it necessary merely to press a button to switch over from "send" to "receive" or vice versa. Snappy break-in operation is possible with a minimum of effort.

During normal operation the crystal oscillator cathode current will run about 30 ma., the 802 about 60 ma., and the 801's about 150 ma. These values include grid current, and are slightly greater than the actual plate current drawn by the tubes.

This transmitter, under the call of W6MJT, has hung up an excellent performance record, the signal strength and quality being reported as unusually good. If the diagram and layout are followed faithfully, there is no reason why the performance cannot be duplicated with little trouble.

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With the Editors

[*Continued from Page 9*]

gating Committee) consisting largely of persons permanently located at Headquarters and dominated by Warner, *actually* runs the League.

Now, how to preserve this delightful situation? Well, in addition to keeping controversial subjects out of the pages of *QST*, so as to keep "us ordinary people" quiet and uninformed, the administration decided to try to bring about a cleavage between the Directors and their constituents. The idea was to convince the Directors that they should act like Statesmen, not like mere Representatives, and that they should (more or less) disregard the wishes and desires of the members who elected them, and decide questions according to their *own* ideas of what was best for us.

Warner expressed this thought in writing, several years ago, in a circular letter which he mailed to the Directors. It told the *Directors* how to act but some of these gentlemen resented this no-doubt-well-meant and great-souled advice.

For some time thereafter there was silence from Mount Olympus.

Then the administration took another track. Wouldn't it be smart to address the words of wisdom to the *membership* instead of to the Directors? By carefully choosing the phrases, the vanity of the Directors could be tickled, and the ignorant membership dumbfounded. Why, of course!

On page 11 of the September issue of *QST* one can see the result. It is clever propaganda, in a way, but it doesn't quite "ring the bell". Many thinking amateurs will recognize it for what it really is—a piece of insolence.

[*Continued on Next Page*]

[Continued from Last Page]

Now, since when has it been headquarter's proper place to tell us that we cannot instruct our Directors? And how, pray tell, can we at the "grass roots" be properly represented in any true sense, if our chosen representatives are to be entirely free to place their own estimates on facts and policies?

It is true that no Director can be *prevented* from casting his vote as he pleases, at a Board Meeting. *But should not the expressed wishes and desires of a Division be controlling, in the absence of some very good and compelling reason to the contrary?* And shouldn't a Director who disregards or overrules the mandate of his constituency be morally obligated to justify and explain his acts to his Division by clear and convincing reasoning?

These questions, we believe, pretty well answer themselves.

The administration is really getting worried. At the last Board Meeting Warner hung onto his $12,000.00 per year salary by only *one vote.* The specter of "instructed Directors" gives him the jitters; and with several big conventions in the offing, he fears that some of them may furnish the setting for a little heart-to-heart talk between the Directors and the visiting "hams". Maybe they can't be "instructed" in the sense that they are legally bound to do as you say, but most of them will listen to reason.

—W9HCC.

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Mr. David L. Marks, well-known to radio amateurs as "Uncle Dave", sailed on the Queen Mary August 26 for a three month business trip through central Europe. This is his ninth crossing.

28 and 56 Mc.

[Continued from Page 55]

tions to indicate wide-open ten meter conditions. Several stations have reported calling CQ when the band appeared dead, a fine QSO with someone resulting.

Southern Hemisphere Conditions

Winter conditions in the southern hemisphere permit very fine east-west work on "ten", although the low number of active stations in South America and Africa makes conditions seem spotty to observers, particularly those in Australia. The VK's find that W signals are weaker and that those using beams are most successful even though low power is used in some cases. Only a few Europeans are getting through to Australia.

The VK's claim that the equinox periods—roughly March, April, September, and October—are the best. On the average for the world we can agree, but midwinter seems very satisfactory for east-west work provided that the distance is not so large that the daylight path doesn't extend to both stations, such as Japan and Eastern U.S.A.

Night Conditions

During the late spring and summer there have been numerous reports of abnormally late reception. Just as last summer, two way U.S.A. work was apparently at its best from dark to midnight. G2YL mentions that LU9BV, PY1AW, and the six eastern W districts were heard from 2100 G.c.t. until after midnight on May 24. G6DH worked W2DTB after midnight, British daylight time. On June 24, a weak W3 phone was heard five minutes after midnight—the only W signal heard that month in England. Aussies have been working W stations evenings rather than mornings, just as during last summer. In early May, VK's heard J working LU at 0700 G.c.t. —which would be 4 a.m. in Argentina!

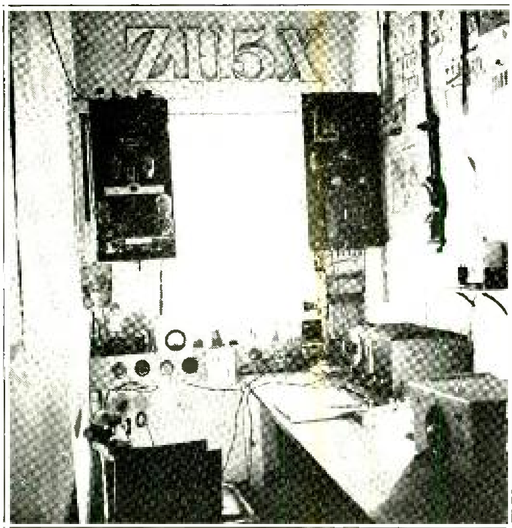
28 Mc. Station Reports

G2YL: In May, 38 countries, all continents were heard by G's. Australians came through on 9 days, mainly early in the month. The only Asians were J2CE, J3DC, U9AV, U9ML and VS6AH, all before the 10th. South Africans came in as well as ever on at least 22 days. Central and South Americans from 8 countries were heard on 13 days. North Americans were audible on at least 7 days. Europeans and North Africans of 20 countries were better than at any time since August, 1935. May 24 was the best day, 22 countries in five continents being reported. June conditions were disappointing, ZS1H being most consistent, getting through on at least 15 days. No Asians. VK3CP was the only Australian, whom G6DH worked on June 7. LU9AX and PY1AW came in on the 6th and 17th, a week W3 phone at 0005 G.c.t. on June 24. Africans included ZE1JJ, FB8AB, FB8AG, ON4CJJ, SU1JT, FA8BG, CN8MQ.

G5LA: Conditions in Europe, Asia and Africa were worse than ever in July. Some dx and Europeans worked by G's but quite unsatisfactory on the whole.

G6DH: Worked XE1AY and heard PY1AW on June 30. Worked ZS1H July 5 and 19, but otherwise poor conditions in July. On 15 days, no amateur signals were heard.

HJ3AJH: Made 289 contacts in 41 hours on 28 mc., 322 in 38 hours on 14 mc. during March dx contest. Worked J3FJ at 9:25 p.m. on March 27 for w.a.c. and 30th country on this band. The JNJ harmonic just outside low frequency end of band peaked to a steady R9 from 8:00 p.m. to 10:30 p.m., March 28. This harmonic averaged R4-5 during the same period throughout the past (Northern) winter. On April 26, heard ZS1H, up to R5, for first South African on 28 mc., though had worked FA8BG earlier. From May 15 to June 10, no Europeans, Africans or South Americans were heard. W5, W6 and XE coming through best during daytime until 8:00 p.m. with consistently good strength; other W/VE districts generally weak. K6 and VK came through from seven to eleven p.m. but rather weak.



ZU5X, Located at Durban, South Africa, Operated by D. R. Boyce

Most of the time band "dead" with apparently very few stations on air, but conditions generally fair during this period. Am using 28,636; 28,074; 14,318 and 14,037 kc.

SM6WL: Gained first Scandinavian 28 mc. w.a.c. on April 25 by working VS6AH.

ZS1H: No Asians, North or South Americans heard in first three weeks of June. Best day was June 1, with 20 contacts with VK, J and Europe. Next good day was the 7th, with 11 European QSO's. Blank until weekend of 20th-21st, when 12 contacts were had, with old time conditions for VK's and plenty of Europeans. Not so good in July.

TI3WD: Was on 28 mc. during March, contacting many W and European stations as well as South America. The band was crowded from 8 a.m. to 6 p.m. Central standard time. Many Californian station worked at noon, all R9. Europeans R8/9 all the time. Lately band rather dead. Am waiting for it to act up again.

NY2AE: Use 500 watts on pair of 860's in final, plate modulated. Antenna is 80 meter zepp slanting up to water tank. Had many QSO's last spring. K6MVV one of most consistent—was QSO hours one day without another signal being heard at either end. PY2MO came through so loud once that his key clicks were audible. The band opened up again on August 16, had phone QSO's with W8OSK W9JGS, W3ATR, W3AED, W4BBR, a W6 and others. Using 28,172 and 14,086 kc. mainly. Will be on "ten" week-ends. Will be glad to meet amateurs visiting the Canal Zone; telephone F. S. Fritts at Coco Solo, from Colon or Cristobal.

ON4NC: Conditions getting gradually worse in May, June and July. About the same now as in preceding year, occasionally some dx but mainly European stations. In May the J's came through very nicely, LU9AX from South America, no W. Only VK3CP from Australia. Lots of Africans. In June and July, only Europeans, and ON4CJJ and ZS1H from Africa were heard.

VK3RJ: Reported to a G station that conditions were still good for VK6 and for W, on July 6th.

W3FAR: Most complete daily reports consistently received from this station. May 26-30, heard only K4DDH and XE1AY, both quite well. On May 31 worked ZS1H, heard W9's, XE1AY, VE1DC around noon. LU9AX on phone R7 for an hour at 5:30 p.m., west coast phones heard to 9 p.m. In June, heard VK3BD on the 1st and 3d. K4DDH on the 8th. HJO on the 17th and 23d. W stations heard only on the 3d, 9th, 16th, 18th, 24th and 26th, sometimes only one or two stations but band sometimes open for R8/9 signals from the few stations. In July up to the 19th heard only W4EEV on the 17th, nothing else.

W5WG: Worked K6MVV, LU9AX and HJ3AJH in June. Very few W signals—mostly W8 and W9. Still hear a few W6's. Band often seems dead.

W9JGS: Able to raise someone on the majority of calls in June, July and August, mostly in late evenings but a few contacts were as early as 7 a.m. Central time. Dx was OA4J on May 31, some Mexicans June 6, LU9AX on June 14 on which day VK3BD answered my CQ! LU9AX came in again June 21, VK3BD the next day. K5AC was heard June 28. Worked NY2AE August 16. Band wide open for all East coast W, XE and VK on August 17.

28 and 56 Mc. Reports

Reports and other material referring to the 28 and 56 mc. bands, should be sent to E. H. Conklin, W9FM, Assistant Editor of RADIO, 512 No. Main St., Wheaton, Illinois, who will correlate and assemble the data for publication. Reports should *reach him* by the 22d of each month.

Open Forum

[*Continued from Page 64*]

Hawthorn, Victoria, Australia.

Sirs:

Being an interested reader of your fine magazine I thought that the following information might be of interest to your vast army of readers.

Over here we have for years past had an "open go" on telephony with practically no restrictions, and the resultant mess was something awful. Some of the hams thought it the proper thing to play gramaphone records all night on the 7000 kc. band, and some even did so on the 14,000 kc. band. You can guess how the dx merchants looked upon their brothers!!! Anyway, things came to such a state that the Radio Department was requested by the Institute to look into matters, and they have now issued the following new regulations to come into effect on 1st September next:

(a) The transmission of music on the 7,000 and 14,000 kc. bands is prohibited between the hours of 5 p.m. and 8 a.m., local standard time, and all other telephony transmissions are to be restricted to genuine experiments. Any one session should not exceed 30 minutes in duration.

(b) Transmissions on the 7,000 and 14,000 kc. bands will be permitted only where the oscillator is sufficiently controlled in the case of c.w. or employs a crystal or M.O.P.A. system of control in the case of telephony. In addition, all power and modulation systems employed should be of high efficiency.

(c) Telephony transmissions on the 7,000 and 14,000 kc. bands are in *all* cases to be restricted to a power of 25 watts input to the final amplifier stage.

(d) All new licensees will be required to serve a probationary period of six (6) months. During that period a maximum power of 25 watts (d.c. input to the final stage) to be permitted, but the licensee is *not* to be permitted to use telephony on any frequency during that period. In the event of the Department not being satisfied with the operation and general conduct of the licensee's station during the probationary period, a further probationary period of three (3) months is to be served. Each licensee should make application to the Senior Radio Inspector in the State concerned for permission to use telephony should he desire to do so on the expiration of the probationary period.

(e) A Vigilance Committee will be appointed in each State by the Department. The Committee will observe all transmissions and log any experimental station whose transmissions are contrary to Departmental Regulations. The Committee will also, with the authority of the Department, issue a warning to any licensee guilty of a breach, and, should this warning be ignored, will supply the Department with full particulars so that action may be taken.

You will see that an endeavour is to be made to clean up the VK stations, and although some of the restrictions may appear to be harsh, I think the general opinion will be that it is all for the good of the game.

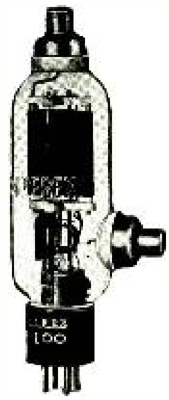
Another matter that deserves mention in RADIO is the QSL question. Many of the W stations plead so much for a card that one is led to believe that these fellows don't know of the QSL service provided by QSL Bureaus. In the case of practically every VK station who works regularly, all cards are sent via the QSL Bureau each month to save postage. I know in my own case that this would amount to a considerable sum if individually mailed, as it's nothing unusual to work 100 new W stations each month. I myself send a card to all worked, but never direct unless there is something special to be said. I thought a reminder to W stations that most dx they work send their cards via the Bureaus might save them worry as to when they are going to get their cards, and also to be sure to send envelopes to their QSL Bureaus.

If you know of any 14 Mc. hams in Idaho and Wyoming I'd be glad if you'd ask them to listen for me on the low frequency end of the band, as I need those two states for w.a.s.

Wishing the magazine and yourself continued success,

ALAN G. BROWN, VK3CX.

NEW TUBES



AMPEREX HF-100

A low voltage, high frequency power amplifier and oscillator (triode).

High μ, high ratio of transconductance to inter-electrode capacitances, and high power amplification.

TENTATIVE CHARACTERISTICS

Filament:	Voltage	10 volts
	Current	2 amps.
Amplification Factor		23
Grid to Plate Transconductance @ 100 Ma.		4200
Direct Inter-electrode Capacitances		
Grid to Plate		4.5 $\mu\mu$fd.
Grid to Filament		3.5 $\mu\mu$fd.
Plate to Filament		1.4 $\mu\mu$fd.

TENTATIVE MAXIMUM RATINGS

For operation at:	*30 Mc. or lower*	*60 Mc.*	*120 Mc.*
Plate Dissipation	75 Watts	60 Watts	50 Watts
D.C. Plate Voltage	1500 Volts	1200 Volts	1000 Volts
Modulated D.C. Plate Voltage	1250 Volts	1000 Volts	800 Volts
A.C. Plate Voltage	1500 Volts	1250 Volts	1000 Volts
D.C. Plate Current	150 Ma.	130 Ma.	120 Ma.
D.C. Grid Current	30 Ma.	30 Ma.	20 Ma.
Max. D.C. Grid Bias Voltage for Class C operation	-300 Volts	-225 Volts	-150 Volts
Max. Attainable Plate Power Output	170 Watts	100 Watts	50-60 W.

DIMENSIONS

Height Overall	7½ inches
Bulb Diameter	2-1/16 inches
Base	Standard UX-4 prong for filament connections only.
Plate Terminal	Heat radiating top cap, diameter .500 in.
Grid Terminal	Side cap, diameter .500 inches

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W.E. 258B Mercury Vapor Rectifier

This useful rectifier tube is used in the newer 100 and 1000 watt Western Electric broadcast transmitters and is ideal for high power amateur use.

It is a half-wave, mercury vapor, hot cathode rectifier and has a 2.5 volt 7.5 ampere oxide-coated filament. The maximum peak space current is 1.5 amperes and the maximum inverse peak plate voltage is 7500 volts at ambient temperatures in the normal range from 10 to 40 degrees centigrade. Physically the glass envelope is slightly larger than an 866 type and all the usual precautions concerning the operation of hot cathode vapor rectifiers should be observed.

A maximum average d.c. space current of 1200 ma. can be safely drawn through a pair of these tubes if a high-inductance input choke is used in the ripple filter.

The tube has a somewhat unusual base. It is a special W.E. 2 pin base and fits a standard coil chuck. Both pins are the same size. One advantage of this type of base is that the tube may be periodically reversed in its base, which tends to equalize the load on the filament. It is obvious that as long as there is a voltage drop across the filament, the most negative portion of the filament will do the most work. Thus, reversing the filament connections every month or so will add to the life of the rectifier tube.

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Receiving Tube Data

The octal base is being standardized for all new and replacement glass types, including the two volt battery operated series.

Every metal type now has a glass or "G" counterpart as well as an "MG" or metal-glass equivalent in some lines.

New tubes are raining down thick and fast and we show below some notes on the newer ones.

A few of the tubes in the "G" group do not have equivalent types but do have similar types. The characteristics and circuit applications for these tubes are the same as the similar types except where some slight change has been made in characteristics. Reference may be made to the similar types for preliminary technical data.

There are three tubes in the "G" group which are entirely new in characteristics. These are types 1E7G, 6J5G, and 6K5G.

"G" Type	Characteristics Same as	"G" Type	Characteristics Same as
1C7G	1C6	6F5G	See Below
1D5G	1A4	6F6G	42
1D7G	1A6	6H6G	See Below
1E5G	1B4	6J5G	*
1E7G	*	6J7G	77
1F5G	1F4	6K5G	*
1F7G	1F6	6K6G	41
1H4G	30	6K7G	78
1H6G	1B5/25S	6L6G	6L6
1J6G	19**	6L7G	See Below
5V4G	83V	6N6G	6B5
5X4G	5Z3	6N7G	6A6
5Y3G	80	6Q7G	See Below
5Y4G	80	6R7G	See Below
6A8G	6A7	6X5G	84
6B4G	6A3	25A6G	25A5
6B8G	6B7	25Z6G	25Z5
6C5G	See Below		

**Except filament current (240 ma.)
6C5G same as 6C5 except for capacities.
6F5G same as 6F5 except for capacities.
6H6G same as 6H6 except for capacities.
6L7G same as 6L7 except for capacities.
6Q7G same as 6Q7 except for capacities.
6R7G same as 6R7 except for capacities.

Table Courtesy Sylvania

The "G" tubes shown above all use the ST envelope, octal base and the new miniature top caps. The operating characteristics are usually identical or at least quite similar to the metal or older glass-equivalent types. In most cases the only differences lie in the shunt capacitances and shielding characteristics.

The 1E7G, 6J5G, and 6K5G are new types announced by Sylvania, and are described below.

1E7G: This tube is a double pentode with a 2 volt low drain filament. It is designed for use in the audio output stage of battery operated receivers and allows high undistorted class A output to be obtained with low plate and screen current drain.

6J5G: This tube is an octal-glass type quite similar to the 6C5G. It is a general purpose triode with a medium μ. Its electrical characteristics are essentially similar to the type 76 triode. It has no top cap.

6K5G: This tube is an octal-glass high μ triode somewhat similar to the 6F5G. The electrical characteristics are somewhat similar to the triode section of the 6Q7 and the 6Q7G. The control grid is brought out to the top cap.

6B8 and 6B8G: The 6B8 is the metal equivalent of the older 6B7 duo-diode-pentode. The G type is practically identical except that it is the glass-octal equivalent. The pentode portion has a variable μ control grid so it can be used in r.f. and i.f. as well as audio circuits.

RCA 1603: This tube is a pentode voltage amplifier designed to have low noise and microphonic characteristics for use in very low level preamplifiers. Its electrical characteristics are practically identical with the 6C6 which it can directly replace in suitable circuits.

RCA 920: This tube is a new twin phototube designed for use with dual (push-pull) sound track motion picture equipment. Its overall height is 4 inches and it uses the small 4 pin base. This is a gas type of phototube and the usual precautions to be followed with all such phototubes should be observed for long life.

HK-154 Gammatron

Heintz and Kaufman announce a new "Gammatron" to be released October first. This new triode is characterized by the ability to deliver high power at comparatvely low plate voltages (750 to 1500 volts) and by a novel design, in which the grid lead emerges from one side of the straight-sided envelope and the plate lead from the other side. This allows very short leads, making an excellent u.h.f. tube.

The new tube is designed for both r.f. and audio applications. It is designated as type HK-154, and measures 2" in diameter and 6.75" from top to toe. The filament is thoriated tungsten, the grid and plate tantalum. Tentative general characteristics are as follows:

HK-154 Characteristics

Filament Voltage	5.0	volts
Filament Current	6.5	amps.
Plate Dissipation	50.	watts
Plate Voltage	1500.	volts (max.)
Plate Current	175.	ma (max. average)
Grid Current	30.	ma (max. average)
Plate Resistance	1750.	ohms
Amplification Constant	6.7	

High Power Rectifier

Amperex Electronic Products, Inc. announces a new mercury vapor rectifier tube, the 575-A. It is an intermediate rectifier planned to fill the gap between the 872-A and 869-A. Designed and proportioned along the lines of the 869-A with only slightly lower voltage-current characteristics, it is considerably lower in price.

Ratings and characteristics of the 575-A half-wave mercury vapor rectifier are: Filament voltage, 5 volts a.c.; current, 10 amperes; overall length, 10½ inches; maximum diameter, 3 3/16 inches; plate cap diameter, .500 inch; base, standard 50 watt. Maximum ratings: For operation at supply frequency up to 150 cycles and ambient temperature range of 15°-50° C.; peak inverse voltage, 15,000 volts; peak plate current, 6 amperes; average plate current, 1.5 amperes; average tube voltage drop, 10 volts.

Low Drain 6 Volt Tubes

Raytheon announces three new octal-glass receiving tubes characterized by the use of 0.15 ampere 6.3 volt heaters. These include the 6S7G, the 6Q6G and the 6D8G.

6S7G: This triple grid variable μ voltage amplifier pentode is very similar to a 6K7G except for the use of the 0.15 amp heater instead of the 0.3 amp. heater used in the 6K7 and 6K7G.

6Q6G: This octal-glass tube is a single diode-high μ triode in one envelope. The single diode is applicable to detector and a.v.c. use where a common diode is used for both applications. The high μ triode portion of the tube has an amplification factor of 65 and the operation of the tube will be quite similar to that of a 75, 6Q7 or 6Q7G. The heater current is 0.15 amps.

6D8G: This octal-glass tube is a pentagrid converter that is very similar to the 6A8-6A8G types except that the 6D8G heater current is only 0.15 amps.

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Calls Heard

[*Continued from Page 51*]

EI8B; EI9B; EI9G; ES5C. — **F** 3AD; 3AU; 3EL; 3LE; 8DR; 8EB; 8EO; 8FA; 8JI; 8JJ; 8JK; 8NR; 8QM; 8TQ; 8XH. — FA8BBG; FB8AB; FM8AD. — **G** 2DP; 2MI; 2PL; 2TM; 2TO; 2ZP; 5BJ; 5KG; 5IS; 5LA; 5MP; 5PP; 5QY; 5SO; 5SR; 5YG; 5YH; 6AZ; 6BS; 6DX; 6GN; 6IR; 6JW; 6LK; 6LZ; 6NF; 6QK; 6QX; 6VP; 6VX; 6ZU. — GI5QX; GI5UR; HB9J; HB9AQ; HJ3AJ; HJ3AJH; I1TKM; J2HJ; J2LU. — **K** 5AC; 5AL; 5AY; 6AJA; 6AKP; 6AUQ; 6BAZ; 6BHL; 6BUX; 6COG; 6GQF; 6FAB; 6HZI; 6IDK; 6JPD; 6LEJ; 7ELM; 7ENA; 7PQ; 7UA. — **LU** 2AX; 3DH; 4AJ; 5BZ; 6DG; 7EF; 9AX. — NY1AD; NY2AB; NY2AD. — **ON** 4CC; 4DS; 4DX; 4HC; 4HM; 4NC; 4UU. — OA4J; OA4M; OA4N; OE3FL; OE7JH; OH3NP; OH3OI; OH5NR; OH8NF; OK1BC; OK2AC; OZ2G; OK2AC; OZ2G; OZ2M; OZ4C; LA3B. — **PA** OCE; OMQ; OPF; OQQ; OTSK; OUN: — PK1BO. — **PY** 1DC; 1DW; 2BB; 2BU; 2BX; 2DC; 2ER; 2MO; 2QD; 5AB; 8QA; 9AH. — PZ1AA; SM5SX; SM5WM; TI2FG; TI2AV. — **U** 1AL; 1AP; 1CN; 2NE; 3AG; 3CI; 3VC; 3QE. — UE3EL; SU1SG. — **VK** 2AG; 2AN; 2AS; 2BD; 2BW; 2CP; 2DA; 2DI; 2EO; 2EX; EY; 3GR; 2HL; 2HV; 2IG; 2KR; 2LA; 2LZ; 2MT; 2QU; 2RX; 2UD; 2UU; 2VA; 2WA; 2XA; 3CP; 3CX; 3CZ; 3DD; 3DM; 3GE; 3GP; 3HK; 3HT; 3JB; 3JK; 3JZ; 3KA; 3KR; 3LA; 3MR; 3NM; 3NW; 3OC; 3OW; 3RX; 3WP; 3WW; 3WX; 3WY; 3XP; 3XQ; 3XU; 3ZB; 4GK; 4JC; 4LW; 4US; 5BY; 5FM; 5GW; 5HG; 5JC; 5KL; 5LN; 5LY; 5MD; 5OA; 5RY; 5WR; 5XA; 6AA; 6CA; 6FL; 6SA; 7JB; 7PA. — VP1MR; VY1WB; VP2TG; VP2BX; VP5AD; VP7NB; VS6AK; YN1AA. — **ZL** 1CK; 1DI; 1DV; 1HY; 1KE; 2AP; 2CD; 2CI; 2FA; 2GQ; 2HR; 2II; 2KD; 2OD; 2PV; 2QA; 2QM; 3AX; 3AZ; 3DJ; 3GM; 3GR; 3JA; 3KG; 4CK; 4BQ. — ZB1H; ZP2AC; ZS1AH; ZS1AL; ZT6AK.

Bert Bowbay, Smith Street, Dartmouth, England
Received via W9PIL
(14 Mc. phone)

W 5AK; 5BEE; 5BUK; 5FWB; 6GAT; 6GOM; 6HF; 9BOH; 9BUM; 9OLY; 9PIL; 9POZ.

◆

Spitch

According to "Uncle Tom" who writes for the *T. & R. Bulletin,* official organ of the Radio Society of Great Britain, *spitch* is over-modulated or frequency-modulated telephony.

We believe that we have heard a little of it on this side of the pond too.

Metal Tube Hint

When purchasing new tubes of the 6L6, 6N7, 6F6, etc. type for their *transmitters,* amateurs will do well to get them in the "G" series (glass equivalent). Besides being slightly cheaper, these tubes seem to stand up better under conditions of abuse such as they receive in amateur work. Also, less trouble will be had with them flashing in the base (seals) when used for r.f. or at higher than normal plate voltages.

grid drive to the 802's. A ½ watt neon bulb touched to an 802 grid, or a small flashlamp and loop coupled to the coil itself, will facilitate this adjustment.

The final coil, L_5, should be adjusted in the same manner, until the condenser resonates with the plates from a quarter to a third of the way in. Low "C" is also desirable in this tank, but it should be not too low. In the oscillator and doubler stages, the lower "C" the better.

The method of placing the coils automatically provides all the necessary shielding. As may be seen in the photograph, the 10 meter final grid coil and last doubler coil are below deck, shielding the 10 meter input circuits from the 10 meter final plate circuit. Only the final amplifier plate coil and the 20 meter doubler coil are above deck, all others being below.

The coupling link between the last doubler and the 802 grid coil consists of 3 turns on each end. Some juggling may be necessary here to load the doubler fully. When properly loaded and operating correctly the cathode current (plate current, grid current, and screen current) should read between 45 and 50 ma. on each of the 41's. If the last 41 does not pull that much current, it needs tighter coupling to the 802 grids. It may be necessary to use 4 turns on one end of the link in some cases, as the transfer of energy with link coupling seems to fall down at frequencies above 25 mc. But even so, it is much more efficient than capacitive coupling at those frequencies.

The final tank coil should be mounted in the clear, as far from any mass of metal as possible, and not closer than an inch to the condenser or panel in any case. The ends of the coil should not be closer than 2 inches from any metal in the direction of the axis of the coil, as the field is much stronger in that direction than off the sides of the coil.

The most important thing to observe in wiring the unit, besides short grid and plate leads, is to run separate ground returns on all bypasses and return circuits to a *common point for each stage.* Ground each cathode through a condenser with as short a lead as possible, and then run all other ground leads for that stage to the point at which the cathode bypass

COIL TABLE

	8.5 Meter Police Band	10 Meter Amateur Band
L_1	20 turns slightly spaced	22 turns slightly spaced
L_2	9 turns space wound	10 turns space wound
L_3	5 turns space wound	6 turns space wound
L_4	7 turns space wound	8 turns space wound
L_5	8 turns space wound	9 or 10 turns same

All Coils Are Wound with no. 12 Enamelled, 1⅜" Diameter.

RECEIVER CONTEST

For the best receiver article submitted to "RADIO" before November 30, we are offering the winner his choice of the following transmitting tubes: One HK-354, one Taylor T-200, one Amperex HF-300, two Eimac 50-T's, two Raytheon RK-35's, or one RCA-805.

RULES:

1) *The story must be original and must not have appeared elsewhere.*
2) *All articles accepted for publication will be paid for at our regular rates without regard to the contest. The winner, in addition to the usual cash payment for his manuscript, will receive his choice of the above prizes.*
3) *No rejected manuscripts will be returned unless accompanied by a stamped, self-addressed envelope.*
4) *The members of the* RADIO *technical staff will act as judges.*
5) *Manuscripts must be postmarked by November 30, 1936.*

The receiver does not have to be elaborate to win, may have as few as three tubes. Originality, performance, unique features, and mechanical construction will determine the winner, not the number of tubes. Diagrams may be rough pencil sketches, and the article does not have to be written in flowery language, as the diagrams are redrawn anyhow and the manuscript can be rewritten by us if necessary. However, *good clear photographs* will be a deciding factor in choosing the winning manuscript. Also, be sure to list the components *both* by value (ohms, etc.) and manufacturer's type number. Before announcing the winning receiver, it will be duplicated in our laboratory to confirm the author's performance claims.

is grounded. After the wiring is finished, take a piece of number 8 copper wire and bond together all of these ground points.

Do not rely on the chassis for the ground return for the variable condensers, even though they all have their rotors grounded. Run a wire from each condenser frame as directly as possible to the common ground point for that stage.

If the unit is used as a driver for a high power stage, the two should be placed close enough together that the coupling link is not over 2 or 3 feet long. There will be considerable loss in the line if it is much longer than this. Using manufactured 72 ohm cable (the type designed for twisted pair fed doublets) will help to minimize this loss. Do not use the cheaper grade antenna feeder cable sold for b.c.l. all-wave antennas. Most of this b.c.l. cable has stranded wire conductors, which are unsatisfactory at high frequencies.

The screen and suppressor voltages for the 802's are obtained from the voltage divider, R_1. After the 802 stage is working, the sliders should be given a final touch-up with the 802's delivering power under normal load, as the voltages will change somewhat when the final tank circuit is loaded and the screen and suppressor currents change. Adjust the taps so that the suppressor reads 50 or 60 volts as read on a high resistance voltmeter from suppressor to *cathode*, not from suppressor to ground. Adjust the screen tap to 150 or 175 volts as measured from screen to *cathode*. Then take another look at the suppressor voltage to make sure that it is still in the neighborhood of 50 volts positive with respect to cathode, as the adjustments will interlock somewhat.

It is important that in the 10 meter stages the sockets be of good grade ceramic material. Fiber sockets will introduce considerable loss at that frequency.

When working properly and at the voltages specified, the 802's will draw about 150 ma. cathode current when detuned from resonance. (*Warning*: Do not let them run that way for more than a few seconds.) When properly loaded and tuned to resonance, the stage will draw from 125 to 130 ma. cathode current. At this input the measured output should be between

25 and 30 watts, and if this output is secured, the efficiency will be high enough that the tubes may be run all day at the input specified without danger of their getting too hot.

For c.w. use, the plate voltage on the 802's may be run up to 650 or 700 volts, and the stage loaded up to 145 or 150 ma. cathode current. However, at this input the key should not be held down for any length of time, as the input is considerably in excess of the rated maximum for the tubes. A keying jack may be inserted between MA_2 and ground for c.w., thus keying the cathode circuit of the 802's.

◆

CONTEST WINNER

W. S. Cobb, W6KOB, and Wife

More than ten thousand entries, from this country and abroad, were received in a contest to select a name for the United Transformer Corporation new transformer kits (Variactor carrier control system). The winner, Mr. W. S. Cobb, whose call letters are W6KOB, of Santa Maria, California, submitted the chosen name, "UNITYPE". Judges were Frank Jones and L. M. Cockaday, two nationally-known editors.

WHAT'S NEW

Special Purpose Mike

The Astatic Microphone Laboratory, Inc., of Youngstown, Ohio, has developed a new single diaphragm crystal microphone, known as Model 218, that is especially designed for effective pickup where the microphone is to be concealed or hidden. The interior assembly is cushion mounted, permitting use under adverse conditions of vibration. It is so designed that a long cable may be used without serious loss of output. It has a wide angle uni-directional pickup with an output level of approximately −56 db. using a 5.0 meg. load. Net weight is 3½ ounces—is 2⅛" in diameter by ⅞" thick—with flat back, domed screen front, and provided with spring clip for attachment.

Plastic-Sealed Transformers

The Jefferson Electric Company of Bellwood, Illinois, has just announced its line of "Plastic-Sealed" audio and output transformers and chokes.

The construction is similar to Jefferson's standard line, but the complete assembly, instead of being housed in a metal case, is enclosed in a special molded plastic of high melting point, which insures positive protection against moisture and condensation.

The delicate windings of the transformer are completely protected at all times. The plastic jacket is non brittle—it will not chip or crack to allow absorption and condensation of moisture to endanger the useful life of the windings.

New I.F. Transformers

Meissner Manufacturing Co. at Mt. Carmel, Illinois, has just recently announced a new series of units. They are the new Align-Aire type of i.f. transformers which completely eliminate "drifting" and supersede the standard transformers using a variable mica condenser, the permeability-tuned transformer using fixed mica condensers and the air-tuned transformer using open plate midget condensers.

Align-Aire i.f. transformers are double tuned, with top-tuning for ease in aligning circuits, and use the new Meissner Perma-Strut construction, permanently placing every lead so that they will not "shift." They are furnished in either air-core or iron-core (Ferrocart).

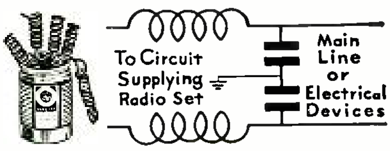
Align-Aire transformers are available in all frequencies from 170 k.c. to 3100 kc., both in the Ferrocart (iron-core) and in standard air-core. They are supplied in either input, interstage, output, center tapped output, beat frequency oscillator, noise silencer and band expanding units.

Universal Equalizer

After two years of research and development, UTC has released a universal equalizer for broadcasting and recording service. This unit is of a depressed chassis rack panel construction. It incorporates separate controls for high and low frequency equalization. A switch is provided on the low and control to obtain maximum equalization at 25, 50 or 100 cycles. Another switch is used for the high frequency end at 4,000, 6,000, 8,000, and 10,000 cycles.

Calibrated T-type attenuators are used for low frequency equalization and high frequency equalization, permitting accurate control from 0 to 25 db. This unit is recommended for use in equalizing broadcast lines, microphones, pickups, amplifiers, and other radio equipment. This equalizer is also applicable to standard amplifiers for home and PA service where overall high fidelity is essential. This unit is described in the new UTC equalizer bulletin. A copy can be obtained by writing to United Transformer Corp. at 72 Spring Street, New York City.

Main Line Noise Filter

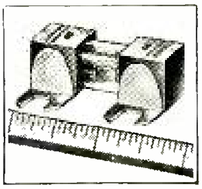


Blocking line noise before it reaches the house wiring system is the function of the latest F1005DH Filtercon made by Continental Carbon Inc., 13900 Lorain Avenue, Cleveland, Ohio.

The Filtercon may be connected between the main line fuse plugs and the individual circuit fuse plugs. It is provided with a mounting bracket for open panel installations. Its small size, 4⅜" x 3" in diameter, permits mounting within most of the larger metal cabinet fuse boxes. It is conservatively rated to carry 10 amperes at 110 or 220 volts.

Noise, originating from devices in the same building, may be blocked at its source with the Filtercon. Familiar items which often cause noise are old style electric refrigerators, stokers, oil burner ignition systems, job printing presses, neon sign transformers, and laundry mangles.

Aircraft Fuses

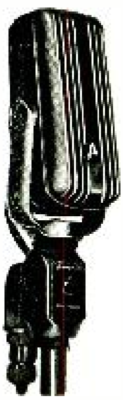


A new line of aircraft fuses has been developed for heavy duty service in the 110 volt 800 cycle line circuits of transport planes.

United Airplanes accomplished the experimental work in conjunction with Littlefuse Laboratories of Chicago.

Heavy brass end caps 9/32 inch square with right angle lugs for mounting directly to the bus bar. Both lugs and caps are welded together and cadmium plated to resist all forms of weather conditions. The body is glass to facilitate inspection in service. The overall length is 1½" and the unit weight is 1 ounce. The distance between lug centers is 1 inch for mounting inside standard fuse boxes. Anti-vibration features are also incorporated into the design to prevent blow outs in normal service. The standard overload is 10 per cent and the blowing point is 150 per cent of the fuse rating. Standard ratings now in commercial use are from 40 to 100 amperes, and are adapted for any power circuits up to 110 volts in aircraft service.

High Level Velocity Mike



The new velocity microphone Model RBHn by Amperite gives studio type reproduction at unusually high outputs. It is acoustically designed to eliminate any possibility of cavity resonance. Triple shielding is used to prevent the pickup of any stray field. Shock absorption at two different points eliminates mechanical vibration. A switch is provided for turning the microphone on and off, and a new cable plug having a positive locking device permits disconnecting the cable at the microphone.

The new nickel aluminum magnets are included in this latest design of microphone. Obtainable with either low or high impedance outputs in either gunmetal or chrome finishes. Its streamlined, compact and modern design will harmonize with most surroundings.

Cornell-Dubilier Catalog

A special catalog has been issued by Cornell-Dubilier as a result of recently revised prices on their line of "Dwarf Tiger" condensers.

This catalog, listing the new reduced prices, is available from dealers as No. 132A, or may be obtained by writing the Cornell-Dubilier Corp., 1000 Hamilton Blvd., South Plainfield, New Jersey.

NEW BOOKS
AND REVIEWS of CATALOGS

New Rider Text

RESONANCE AND ALIGNMENT, John F. Rider, 1440 Broadway, New York City, author and publisher. 91 pages; illustrated; stiff cover; 60c in U.S.A.

This newest of the series of Rider's manuals is a very useful presentation of a rather dry subject. Tuned circuit theory and practice are far too hazy in the minds of the average service man and amateur experimenter. However, this 91 page manual presents the underlying fundamentals in a simple, concise and understandable way. We were surprised at how effectively the subject was handled without mathematics or big words.

Besides covering tuned circuit theory and fundamentals, the book goes into the theory and practical aspects of alignment procedure. The subject of oscillator alignment and tracking is very completely explained and the general principles given should allow any type or make of receiver, whether superheterodyne or t.r.f., to be properly aligned, even without the manufacturer's service notes.

The use of the cathode ray oscilloscope in alignment problems is completely explained and many photographs of representative scope traces are shown to illustrate various alignment faults.

Every point is both explained in detail and then illustrated by an example using standard receiver schematics of several well-known sets.

Transmitter Design Book

PRACTICAL TRANSMITTER DESIGN (Amateur Radio) by Howard S. Pyle. Published by Western Technical Press, 807 Fourth Ave., Seattle, Wash. $1.00 postpaid in U.S.A.

This useful little book contains detailed constructional data on a very modern and straightforward general purpose transmitter. The author, Mr. Pyle, is W7ASL and was formerly Asst. Radio Inspector. He obviously knows what he is talking about and has laid out and built a very sensible and practical transmitter in unit construction, allowing various power outputs up to about 400 watts. He starts out with a choice of two exciters, a 47 crystal oscillator or the Jones 53-6A6 harmonic oscillator arrangement. He shows data and detailed sketches and photographs of various types of buffers and doublers, each of which can be used as a final amplifier for low power use. His high power stage is a pair of 211's. Various antenna coupling networks are shown for various power outputs, and for the phone man there are three optional modulation methods shown. The author shows three separate audio channels: a five watt, a ten watt, and a thirty watt channel to modulate various power combinations. A builder can have his choice of 15 watts of carrier, 30 watts of carrier or about 100 watts of carrier.

Mr. Pyle is to be congratulated on his avoidance of a common pitfall in using the newer trick circuits and tubes. He properly limits his designs to those arrangements that have the fewest bugs and give the most watts per dollar of cost. The book contains little theoretical discussion but sticks to practical constructional data. The gear described is modern and will have few or no constructional bugs to lick.

Service Men's Business Manual

The first authoritative volume to analyze and explain the best known methods and procedure of conducting a radio service business has just been released by R.C.A. under the title, "Radio Service Business Methods".

This 220-page volume, a complete treatment of the subject, was co-authored by John F. Rider, widely known radio service expert, and J. Van Newenhizen, radio auditor and accountant, after a lengthy and comprehensive survey of thousands of service businesses. The book discusses such important topics as A Profit on Your Investment; What to Charge; Simplified Records and Bookkeeping, and others closely allied with the conduct of a thriving service business. Primarily, the authors seek to help the radio service engineer, unfamiliar with bookkeeping, maintain an orderly accounting system which will keep him constantly informed of his financial progress with the minimum expenditure of time and effort.

All service engineers may obtain a copy of Rider-Newenhizen's "Business Methods" by special arrangement with either R.C.A. Tube or R.C.A. Parts distributors.

Equalizer and Filter Bulletin

UTC has just announced the release of a new bulletin covering equalizers and filters for broadcast, recording, and similar service. A complete analysis of various types of filters and their application is given with schematics, frequency curves, and description of the standard items they manufacture. Included in this leaflet are data on simple equalizers —resonant equalizers—universal equalizers—divider networks—application of equalizers—high Q coils—band pass filters—band elimination filters—low pass filters—and high pass filters.

A limited number of copies are available. Write to United Transformer Corp. at 72 Spring Street, New York City.

Diathermy Tube Catalog

United Electronics, 42 Spring St., Newark, N.J., has released a special engineering bulletin on tubes for diathermy oscillators. It is available on request.

Treatise on New Alloy

The Magnet Steel Division, of the Cinaudagraph Corporation, Stamford, Connecticut, has made available a catalog describing in complete detail the unusual characteristics of Nipermag, the new permanent magnet alloy. This new magnetic material of exceptionally high coercive force has been recently introduced to the radio field in Magic Magnet Speakers. The brochure will be of particular interest to the design engineer in the electrical, radio, and industrial fields. Many new and interesting applications of this magnetic material are discussed. Copies are furnished free on request at the home office of the Cinaudagraph Corporation, in Stamford, Conn.

There has also been made available a reprint of an article on magnetic circuit calculations, giving the most economical manufacturing procedure for the proper design of permanent magnets.

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HAMFESTS AND CONVENTIONS

New York

Schenectady Amateur Radio Association is taking time off on Oct. 2 and 3 to entertain approximately 500 hams at the eleventh A.R.R.L. Hudson Division convention in Hotel Van Curler, Schenectady, N. Y.

Minnesota

The last of this month—Sept. 27 and 28—will find about 104 amateur radiomen at the annual convention of the Southern Minnesota Radio Association, slated for Rochester, Minn.

Kansas

The famous Kaw Valley Radio Club will be the host-group to about 450 radiomen gathering in Topeka, Kans., Oct. 17 and 18 for the Midwest Division Convention. Among the speakers will be Clark Rodimon, assistant editor of *QST*.

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Frank Lucas, W8CRA, recently worked YJ2K, New Hebrides, for his 122d country. YJ2K uses 12 watts on 14,320 kc., T9, and comes in quite well. New Hebrides should make another country for most dx men, as very few amateurs have ever worked this country.

Notes on Receiver Performance

By Elmer H. Conklin, W9FM

The Crystal Gate

The first "stenode" or single signal receiver which the writer had an opportunity to examine was one built by Fred Schnell, W9UZ. The crystal used in it happened to be a poor oscillator—discovered later when a second receiver was built—but nevertheless was such that anyone could operate the set without previous experience with the breed. The resonance peak was four or five hundred cycles broad, and the audio image, on the "other side" of zero beat, was completely absent except on a few local signals. The effectiveness of this receiver was demonstrated when the owner of the station complained that his transmitter, remotely controlled fifteen floors above, must not be working. The only trouble was that he had not tuned to the transmitter frequency, and elsewhere could not hear it!

Less convincing was an experience with one of the early popularly priced superheterodynes, in which the crystal resonance was so sharp that the tuning could not be held on a stable local oscillator for more than a second. The tendency was for the operator to run the gain up to where the background was of more normal volume, and disregard the resonance peak. Washing the crystal in carbon tetrachloride (Carbona) changed the picture considerably.

It took several days of operation to get used to the crystal in the series position. Those who have not handled a single-signal super for a few days probably never have appreciated the value of the crystal. A very important rule for c.w. reception is to keep the volume control at or below the point at which it would be operated with the crystal out. The full advantage of noise suppression and selectivity is then available. For ordinary use, the writer sets the selectivity control at the broad position, where there is no "pinging" with noise peaks, and where the receiver need not be tuned so slowly. Still, the advantage over the straight super position is tremendous.

Band Spread

In our opinion the most satisfactory method of spreading our bands on the dial is one which makes use of a single control without requiring any resetting of a main control when the bands are changed. It is a pleasure, for instance, to be able to set the dial at 87 and hear J2GX—if he is coming through and using that crystal—without fishing around.

While we are on this subject, have you noticed in some receivers how the band is jammed together at the low frequency end of the dial? Years ago the frequencies were run together at the high end, but this was cured by the use of a straight-line-frequency condenser. Now, numerous receivers are straight-line on the general coverage coils but are over-corrected on the band spread ranges. Inasmuch as the receivers are mainly used in the amateur bands, why not put in tuning condensers that will give straight line tuning in the bands? The dials, too, could be numbered 0 to 100 over the portion covering the band even if divisions outside the band are not numbered; then the frequency to which the receiver is tuned would immediately become apparent. There would be 5 kc. per dial division on the 3.5 mc. band, 3 kc. on 7 mc., and 4 kc. on 14 mc. A dial setting of 20 would be 3600, 7060 or 14080 kc. in these three bands, and the operator would feel at home with a neighbor's set even if it were of another make, if it used the same system.

Set Noise

Quite often, the limit of reception is the set noise—that which would still be present when the antenna is removed. The difficulty

PEAK • PEAK • PEAK • PEAK • PEAK • PEAK • PEAK • PEAK •

LINEAR DETECTION

RADIOTELEPHONY MONITOR

This instrument is indispensable to the Amateur who wishes to keep a constant check on his phone transmitter. It provides aural monitoring of the emitted signal. Distortion, audio hum, carrier hum, frequency shift, and break-down or any other irregularity are immediately apparent.

By the addition of a milliammeter, visual check of the carrier is afforded, showing carrier shift, **over modulation**, etc.

RANGE — 5 to 200 meters, continuous.

(Broadcast band coverage available)

Diode detection is used in a **tuned** input circuit—a method especially suitable for aural monitoring as its operating characteristics are essentially linear, making the received signal as free as possible from distortion.

The **PEAK M-2** employs a built-in power supply designed for 24 hour a day operation. It delivers humless power to the resistance coupled audio amplification stage which brings the monitored signal up to headphone volume, even with very little pick-up. Operates on 105 to 125 volts, 50-60 cycle.

PEAK M-2
COMPLETE
Less Tubes
List price, $33.00
Net to Amateurs
$19.80
At all leading Amateur Supply Houses

All components are housed in a durable metal cabinet 8½" high, 6" wide, and 10" deep, attractively finished in black crackle. The silver plated contact frequency range switch, the tuning control, phone jack, volume control, AC switch, and pilot jewel are all conveniently located on the front panel. Uses one 84 and one 85 tube.

A Prime Necessity for EVERY Phone Man!

• WRITE FOR LITERATURE •

PRE-SELECTOR

REGENERATIVE PREAMPLIFIER

The PEAK regenerative High-Gain Pre-selector tremendously increases the sensitivity and selectivity of **any** receiver! Rejects image. Greatly decreases noise to signal ratio.

9 to 200 Meters • Two Tuned Stages • Silver plated contact band change switch • Self contained heater supply • Automatic changeover switch • Smooth control.

The P-11 is so easy to use: a moment and it is connected to any receiver. Every one is sold with an **unqualified guarantee** to markedly improve reception with **any** receiver—far beyond any similar unit sold. It will make a **NEW** receiver out of an **old** set. (Even new receivers with built-in preselection will be improved.)

PEAK P-11
is highly recommended by Amateurs and Commercials all over the world! Bring your weak, unreadable signals up to R-9. YOU CAN'T WORK 'EM IF YOU DON'T HEAR 'EM!

YOU JUST CAN'T AFFORD TO BE WITHOUT THE PEAK P-11!
PEAK P-11. Complete, less two 58 tubes. List price . . . **$33.00**
Amateur net price
$19.80
At all leading Amateur Supply Houses.

• **WRITE FOR LITERATURE** •

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HK-354 $24.50
RK-35 $8.00
RK 36 $14.50
RCA - De FOREST
802 $3.90 — 803 $38.50
Taylor T-55 $8.00—866 $1.65

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List 75c; **Special 15c ea.;** 5 for **60c**

XMITTING R.F. CHOKES
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29c each; 3 for **74c**

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All Metal.................................**$1.03**
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2½ volts. 12 Amps. Uncased. 7,500 volt insulation.................. $1.47

MIDGET FILAMENTS
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Any type .... 79c each

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OIL FILLED CONDENSERS
5 Mfd. 1500 DC WORKING
Real oil-impregnated, oil-filled condensers. Conservatively rated at continuous DC working voltage. Fully guaranteed. Metal case
3¼" x 3¼" x 1⅞"......................... $1.45

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usually becomes noticeable on the 14 mc. band, and a problem at 28 mc. One approach to its solution is improved antenna pick-up or tuning the antenna to resonance—thus getting a louder signal to ride over the noise. We have run into several receivers that do not bring in very many signals on 28 mc. until the antenna is tuned. We have heard two in which the set noise is very low, but there are no signals on the ten meter range!

Because the successive stages amplify, attention to the first tube in the line-up should bring results. Some individuals blame the beat oscillator for the noise, just because the noise becomes apparent when the oscillator is switched on. But the use of a crystal before the i.f. amplifier cuts the noise down enough to demonstrate that the oscillator just beats into audibility noise which was generated ahead of the crystal. Removing the first detector coil should kill the noise completely, and usually does. The answer, therefore, seems to be high gain in the first tube, whether it is a first detector or a preselector. We have heard that the six volt series of tubes have lower hiss but have no figures to substantiate the claim. Also, it is said that the metal 6L7 is better than the present glass tubes as a first detector—particularly where there is no high-gain preselector. Improved gain in a preselector through better coupling, etc., should help; the small antenna winding on the first detector coil, often used as a preselector plate coil, probably should be increased to almost the size of the tuned winding. Still another approach might be to discard the second oscillator which at present is tuned near the intermediate frequency, and use a tunable oscillator near the signal or first oscillator frequency; in this way it may be possible to avoid heterodyning much of the noise to an audible frequency.

Regeneration

Regeneration in the first circuit improves selectivity and gain but brings the tube noise right up with the signal. It is useful; but for low set noise, it seems that the stage should first have good non-regenerative gain.

The disadvantage in using regeneration in a stage coupled to the antenna is that antenna absorption may make it necessary to readjust the regeneration control over a wide range for reception at different points in a band; also, a different antenna might require a change in the coil tap. Variable antenna coupling is an aid but is also a complication. And use of an untuned antenna may provide less signal input, with a poorer signal to noise ratio.

Outside Noise

Advances in the use of noise limiters and suppressors have lately been made. The need for this move was often voiced last year in the 28 mc. section of this magazine. Getting the exposed portion of the receiving antenna away from the source is often a help. The writer uses a 66 foot horizontal antenna with a center-connected two-wire transposed feeder slightly shorter than the flat top. The antenna is resonant on three bands and can be used excepr for extreme dx on 3.5 mc. The reduction in noise from a neighbor's oil burner was a phenomenon.

Speaking of oil burners, the type using continuous spark ignition ought to be legislated out of existence. A line filter is provided which permits normal broadcast reception in the same city block, but on high frequencies at least one manufacturer recommends a "head filter"—probably resistors in series with the spark electrodes. The cost, in the one case, was $3.00, but experience with its effectiveness is lacking.

◆

RMA COLOR CODE

It is not generally known but the color code used by all manufacturers that are members of the Radio Manufacturers Association applies to fixed condensers as well as fixed resistors.

The code is the same for both and the units are ohms in the case of resistors and *micro-micro*-farads in the case of condensers.

Body Color		*End Color*		*Dot Color*	
Black	0	Black	0		
Brown	1	Brown	1	Brown	0
Red	2	Red	2	Red	00
Orange	3	Orange	3	Orange	000
Yellow	4	Yellow	4	Yellow	0000
Green	5	Green	5	Green	00000
Blue	6	Blue	6	Blue	000000
Purple	7	Purple	7	Purple	0000000
Gray	8	Gray	8	Gray	00000000
White	9	White	9	White	000000000

The body color is the first figure of the value.
The end color is the second figure of the value.
The center dot indicates the number of ciphers following the first two figures.

◆

PRIMARY KEYING NOTES

In the good (?) old days when break-in operation was necessary on spark and c.w. transmitters, primary keying was common. It is less used now, possibly because power transformers often have plate and filament windings—and it isn't considered good practice to key filaments. Yet primary keying completely eliminates clicks, rectifier hash, bleeders, surges and peaks on filter condensers, and reduces personal danger from getting across the high voltage. If a "sticky" relay is used, though, a 110 volt bulb might be placed directly across the primary to warn the operator in case the relay sticks, leaving the a.c. on the recrifier tubes.

An objection frequently voiced is that an adequate filter means keying tails. If two stages are keyed there will be no tails with ordinary filters. If a buffer only is keyed, using a small amount of filter, surplus excitation will "wipe out" the modulation.

The real difficulty arises when a large transmitter is keyed, particularly if the plate transformer pulls heavy line current on occasional keying impulses. The old spark sets usually were keyed without relays, using a husky pair of contacts. These were often Uncle Sam's 25c pieces soldered squarely to the old contacts.

When some manufacturer produces a popularly priced a.c. relay that can handle 20 or 30 amperes in keying service, primary keying will probably become more common, even on 1 kw. rigs.

◆

Announcement of a Magic Voice series of serviceman's meetings covering the new R.C.A.-Victor instruments and the most recent technical developments in the radio art was made by F. B. Ostman, R.C.A.-Victor Service Manager. Beginning September 14th, the lecture-meetings will take place in over a hundred and fifty cities throughout the country and come to a close October 23d.

As in the past, the meetings will be conducted under the joint auspices of the R.C.A.-Victor Service Department and the radio and parts wholesalers, who will announce the date and meeting place for each locality.

Radio, Information Free Dept.
Dear Sir Hon Ed. and gentlemen:

I are wishing you would inaugurate a movements compelling all feemail amachoor radiophones ops. to indicate truthful status of same regardings to if married up or single. Scratchi are in hot water, Hon. ed., in more ways than one, and all on acct. because of common practice for x.y.l. operators to deceive hams they work into thinking they are still singles. It increase percentage of come-backs 500% I understand. They liking to be "y.l." to fellow at other end of QSO. Now this are perfectly harmless subterfuge, hon. ed., except that it result in Scratchi being thrown in hoosegow, where are now reposing behind large Faraday screen made of one-inch iron bars. Also Scratchi are being sooed by irate husband for alienations of infections. Now I are really innocence as a lamb, hon. ed., and it all make me very sorrow that it are happen.

First off hon. ed. I would like to say that in spites of fact that they say all handsome gentlemans are conseated, I are not so the least bit. However, will haveing to admit that I are some hots stuff with the wimmen even if do having to say so myselfs. None can slay 'em like I, and when Scratchi give them the old razzle dazzle, the old razamataz, they melts right now. Those fellow Gable are have nothing on me, hon ed.

Well, Scratchi strike up acquaintance with lady phone op. across town, and get on pretty friendly terms. She send me photo of herself (which I later find are picture of Merle Oberon in Japanese make-up) and do not letting on that she are married. Oh, oh, do Scratchi go for her in big way. We have sked every night and I are about to pay her surprise visit when it happen. I are giving myself big build-up in preparation for visit and tell her that any woman what marry Scratchi will be lucky girl because in addition to being handsome I are making as much money as K. B. Warmer (which are slight eggsageration of course, about 900%). You see, hon. ed., when I looking at that beautiful picture with such tender sentiment on it (on bottom are write "To Scratchi, a darling, with my undying love and objection, your sweet-pie, *Kayoto Hamasaki*") I are feeling like a million bucks even if creditors are threaten Scratchi with beating up.

Well, this day her husband stalk in just after reading story in American magazeen in which hero beat up on villian for insulking sweet young lady by saying, "gets hots, babe", which evidently are very indecent thing to say to respectable young lady according to story. He barge in just as I are in midst of telling her about fat salary I are (not) getting.

"Say," he storm, "who are this fresh guy what say, 'Kay be warmer'?" Then Kay tell him that it are only Scratchi, a young punk she are having some fun with, and have been kidding him along. Oh, oh, do he fly into a rage. "So this are why you taking such a interest in amateur radios," he bellow. "This are the blankety blank whippersnapper what you have been talking to every night and who are wrecking my home."

Besides, hon. ed., how was I to knowing that her husband are the local chief of poleece?

Respectively yours,
HASHAFISTI SCRATCHI.

◆

The Gyppum Specialties Co., which had a 1/4 page ad in the June, 1935 issue of *R/9*, promised to pay for their ad only if we would rerun it for them in this issue of RADIO. Therefore it appears here. Now our advertising department has *two* ads to collect for. Names of particularly hard-boiled collection agencies are earnestly solicited.

◆

Knock Knock

"Who's there?"
"Ray."
"Ray who?"
"RADIO magazine knocks 'em for a loop."*

*We Cy Noff with apologies for such feeble humor.
—EDITOR.

Until October 15th Only . . .

ONE YEAR* OF

"RADIO"

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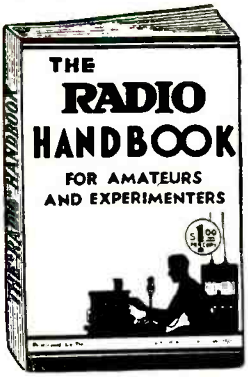

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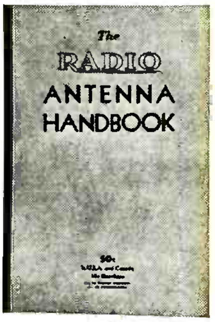
• Offer positively expires October 15th; orders postmarked after that date will not be filled at this price.



ALL SPECIAL OFFERS EXPIRE OCTOBER 15, 1936 . . .
• In order not to compete with our book distributors during the busy season all special offers involving books are cancelled as of the above date.

DO IT NOW! ORDER BEFORE IT IS TOO LATE . . .

• If you already have a copy of the "'Radio' Handbook", an extra copy will make an ideal Christmas gift for that ham friend.

OPTIONAL OFFER: One half-year* subscription to "RADIO" and one copy of the "'RADIO' ANTENNA HANDBOOK" for $1.25 (U.S.A. and Canada). (For foreign rates see coupon below.)

*See frequency notice on page 6.

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Ports Manufacturing Co.

3265 E. Belmont Ave. Radio W6AVV

National FB7-SW3 and Parts; Hammarlund, Cardwell, Bliley Crystals; Johnson Insulators Distributors RCA-DeForest Transmitting Tubes

Established 1914 *Send for Wholesale Catalog*

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Radio Supply Company

912 So. Broadway

THE AMATEURS' HEADQUARTERS OF THE WEST

All Nationally Advertised Parts for Receiving and Transmitting Carried in Stock at All Times. 9 Licensed Amateurs on Our Staff

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2085 BROADWAY

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OFFENBACH ELECTRIC COMPANY

1452 Market Street

"The House of a Million Radio Parts"

Hammarlund and National sets and parts
RCA and EIMAC Tubes.
Arcturus Receiving Tubes.
Trimm Phones, all types.
Johnson Antenna Feeders, Insulators, Transposition Blocks.

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CHICAGO RADIO APPARATUS CO., Inc.

Established 1921

415 SOUTH DEARBORN STREET
(Near Van Buren Street)

ALL SUPPLIES FOR THE SHORT WAVE FAN AND RADIO AMATEUR QUOTATIONS FREELY GIVEN ON ANY KIT OR LAYOUT

Short Wave Receivers Taken in Trade
Get our low prices

PARTS REQUIRED FOR BUILDING EQUIPMENT SHOWN IN THIS ISSUE

The parts listed are the components of the models built by the author or by "Radio's" Laboratory staff. Other parts of equal merit and equivalent electrical characteristics may usually be substituted without materially affecting the performance of the unit.

●

General Purpose 50 Watt Transmitter

C_9—Cardwell XT-210-PD
C_{11}—Cardwell ZU-75-AS
NC—National UMA-25 double spaced
L_5, L_6—Thordarson type R-196
L_7—Thordarson type 6405
L_9—Thordarson type 6315
L_{10}—Thordarson type 6409
T_1—Thordarson type 6750
T_2—Thordarson type 5100
T_3—Thordarson type 6425
T_4—Thordarson type 6280
T_5—Thordarson type 7041
T_6—Gardner type 1217
RFC—Hammarlund CHX

CHICAGO—Illinois

Mid-West Radio Mart

520 South State Street

Rex L. Munger, W9LIP, Manager
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Complete Stock of Amateur Radio Supplies at Wholesale Discounts

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Tri-State "Ham" headquarters
Standard apparatus—standard discounts

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Spokane Radio Co., Inc.

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The Marketplace

(a) Commercial rate: 10c per word, cash with order; minimum, $1.00. Capitals: 13c per word. For consecutive advertising, 15% discount for 3rd, 4th, and 5th insertions; 25% thereafter. Break in continuity restores full rate. Copy may be changed often as desired.

(b) Non-commercial rate: 5c per word, cash with order; minimum, 50c. Available only to licensed amateurs not trading for profit; our judgment as to character of advertisement must be accepted as final.

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(d) No display permitted except capitals.

(e) Used, reclaimed, defective, surplus, and like material must be so described.

(f) Ads not relating to radio or radiomen are acceptable but will be grouped separately.

(g) No commissions nor further discounts allowed. No proofs, free copies, nor reprints sent.

(h) Send all Marketplace ads direct to Los Angeles accompanied by remittance in full payable to the order of Radio, Ltd.

(i) We reserve the right to reject part or all of any ad without assigning reasons therefore. Rates and conditions are subject to change without notice.

120 WATTS OF AUDIO from 4 6L6's with our type 6L6-4 transformers, $16.50 per pair. 60 watts from 2 6L6's and type 6L6-2 transformers, $10.00 per pair. Power transformer to deliver 450 volts at 500 mills from filter, $9.75. Swinging and smoothing choke 500 mills each in single case, $11.00. Amplifiers and modulation equipment built to order. Prices net, FOB Los Angeles. Transformers guaranteed for one year against defects in material and workmanship. LANGRICK RADIO ENGINEERING SERVICE, W6PT, 626 Maltman Ave., Los Angeles, Calif.

PORTABLE racks for your equipment. Send for circulars. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

QSL's. 300 one-color cards $1.00. Samples. 2143 Indiana Avenue, Columbus, Ohio.

SALE: Complete CW transmitter 20 and 40. 59 triter-pentode oscillator, parallel 59's buffer, Sylvania 830 final, antenna coupler, 3 power packs all oversize. Mounted in two iron frame dural dustproof cases and prettied up. Photos. Make offer. Bob Richolt, W6JUN, 626 N. Harvard Rd., Burbank, Calif.

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TRANSFORMERS REWOUND and built to specifications. Very best quality materials and workmanship. Ecoff Transformer Co., 7721 St. Albans Pl., St. Louis, Mo.

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RAW QUARTZ—finest quality, for the manufacture of piezo crystals. Largest, most complete and varied stock in America. Brazilian Importing Co., Inc., 6 Murray St., New York City.

EIDSON T9 40-meter X cut crystals, dependable, powerful; $1.50, very close frequency. Satisfaction guaranteed, instant service. Efficient low-loss ceramic plugin holder, $1.10 postpaid. Shipments C.O.D. if preferred. "Eidson's", Temple, Texas.

SPECIAL 866B's—$3.75. 866's—$1.65. Guaranteed six months. F. B. Condenser mike heads $10.00. 100 watt Universal Class "B" transformers $8.00 pair. Langrick Radio Engineering Service. W6PT. 626 Maltman Ave., Los Angeles, Calif.

TRADE: National A G S for Leica or Contax camera or accessories. Meyer Solzman, Route 1, Council Bluffs, Iowa.

STEEL shield cans, chassis, panels, racks, cabinets. Send sketch for estimate on your layout. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

DID you ever hear of FABERADIO, Sandwich, Illinois?

CRYSTALS: AT cut with shielded mounting. 80 and 160 meter bands, $2.35. White Radio Laboratory, Sandpoint, Idaho.

WANTED—Used Collins transmitter complete. Also 1000W DC to AC converter. W1AGM, Box 144, Wrentham, Mass.

POWERFUL 40-meter crystals unconditionally guaranteed $1.85; 80-160 bands $1.50. Our crystals must satisfy you. Jobbers write. Omaha Crystal Laboratories, 544 World Herald Bldg., Omaha, Nebr.

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METERS repaired—reasonable prices. Braden & Apple Co., 305 Park Drive, Dayton, Ohio.

QSL SWL Cards, neat, attractive, reasonable. Samples free. Miller, Printer, Ambler, Pa.

STAMP brings you sample Radio Data Digest. Keeps posted. Saves money. Kladag, Kent, Ohio.

QUICK SERVICE on QSL cards. Send for samples. Radio Printers, Lewiston, Minn.

BLILEY CRYSTAL bargain. Write W8DED, Holland, Mich.

PR-16-C communication receiver crystal and speaker. Complete, $75. SWL-KL, 6140 Alcott, Los Angeles. YOrk 4141.

TRANSFORMERS—new, guaranteed. HILET, 2½ Kw., 160lb., cost $78. Sell $35. State voltages wanted, get details, photograph. Leitch, Park Drive, West Orange, N.J.

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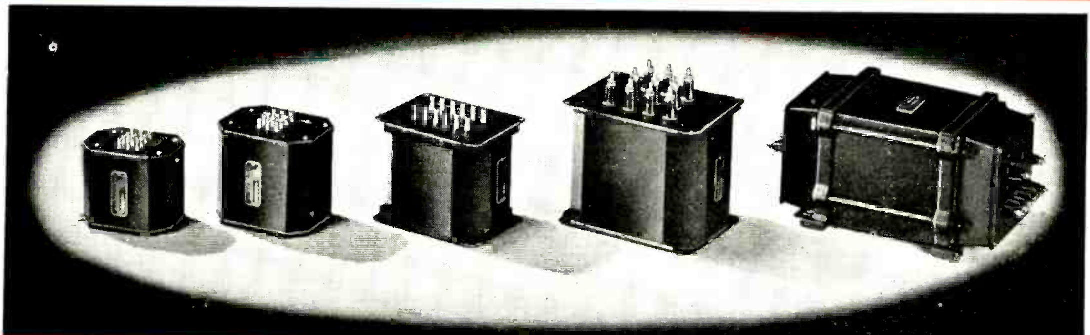
TRANSFORMERS, chokes, all types. Reasonable. Guaranteed. Special universal class B inputs and outputs 100 watts audio—pair $8.00. California Radio Labs., W6CYQ, 2523 South Hill Street, Los Angeles.

Most Complete Transformer Line in the World

QUALITY · RELIABILITY



VM-1 VM-2 VM-3 VM-4 VM-5

Don't Forget . . . the NEW UTC VARIMATCH Modulation Transformer will Match ANY Modulator Tubes to ANY RF Load . . . .

The Varimatch transformer will not only match PRESENT available modulator tubes, but any tube that may be released at a FUTURE date. All you have to decide is the DC input to your RF stage. Then just pick the VARIMATCH output transformer that will handle the maximum audio power required. These transformers will also match the line impedance output of PA or similar amplifiers direct to Class C tubes.

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VM-5 Will handle any power tubes to modulate a 450 watt to 1 KW plus, Class C stage
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The secondaries of all Varimatch transformers are designed to carry the Class C plate current.

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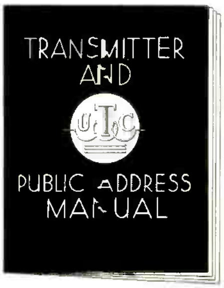
NEW VARIMATCH INPUT TRANSFORMERS

Type	Description	List Price	Net to Hams
PA-49	Push pull 45, 59 or 6L6 plates to push pull 845A prime grids. PA-2	$7.50	**$4.50**
PA-50AX	Single 53, 56, 6C5, 6C6 triode, 6A6 to Class B 53, 6A6 or 6E6 grids or single 89 to Class B 89 grids. PA-1	5.50	**3.30**
PA-51AX	Single 46 or 6L6 to Class B 46 or 59 grids. Single 45, 59, 2A3 or 6L6 to Class B 46 or 59 grids. Single 49 to Class B 49 grids. Single 37, 76, 6C6 or 6C5 triode to Class B 19 or 79 grids. Single 30 to Class B 19 or 79 grids. Single 89 to Class B 19 or 79 grids. Single 2A5, 42, 45 triode plate to A prime 45's, 2A5's or 42's. PA-1	5.50	**3.30**
PA-52AX	Push pull, 45, 59, 2A3 or 6L6 plates to 2-46 Class B grids. Push pull 45, 59, 2A3 or 6L6 plates to 4-46 or 59 Class B grids. Push pull 2A3's to 2-841 Class B grids. PA-2	6.50	**3.90**
PA-53AX	Push pull 42, 45, 50, 59, 2A3 or 6L6 plates to two 210, 801, RK-18, 35T or 800 Class B grids. Push pull 2A3 plates to two 838, 203A, 50T, 35T, 211A, 242A, 830B, 800, RK-18, 801 or 210 Class B grids. PA-2	$7.50	**$4.50**
PA-59AX	500, 200 or 50 ohm line to two 805, 838, 203A, 830B, 800, RK-18, 801 or 210 Class B grids	7.50	**4.50**
PA-238AX	Push pull parallel 2A3, 45, 50, 59 or 6L6 to four 805, 838, or 203A Class B grids. Push pull parallel 2A3, 45, 50, 59, 6L6 or two 211A, 845 plates to Class B 204A, HF-300 or 849 grids. Push pull parallel 2A3, 45, 50 or two 50T, 211A, 845 plates to Class B 150T or HF-200 Class B grids. PA-3	17.50	**10.50**
PA-512	500, 200 or 50 ohm line to two 150T, HF-300, HF-200, 204A or 849 Class B grids. PA-3	20.00	**12.00**



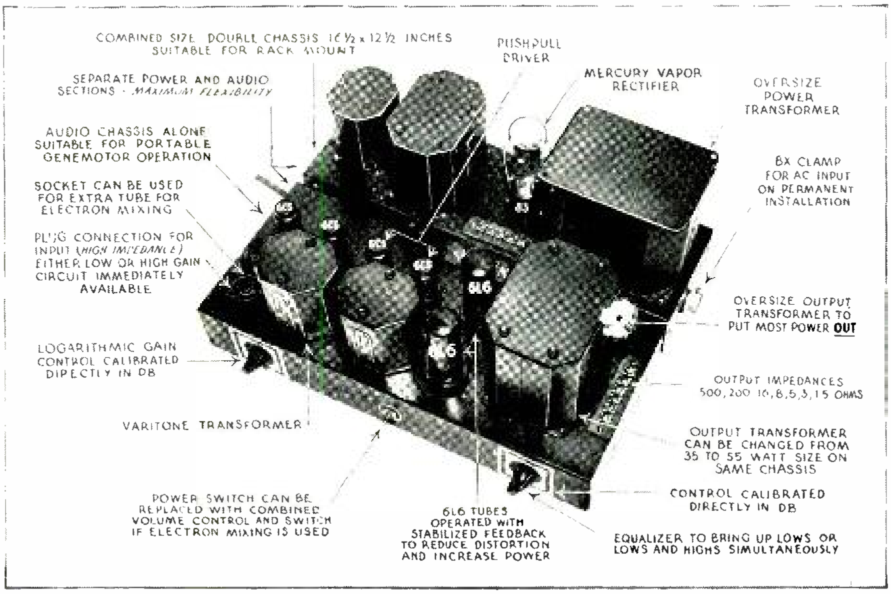
VALUABLE . . . Our engineering staff has compiled a thorough study of transmitter design, public address hookups, circuits and applications into a 44-page illustrated bulletin. It is now available at your local distributor for only 25c.

● WE THANK THE JUDGES for their co-operation in our recent Transmitter Kit Contest. It was no easy task to select ONE name from TEN THOUSAND ENTRIES. We give you the winner . . .

"UNITYPE"

Submitted by W. S. COBB, W6KOB, Santa Maria, Cal.

New VARIMATCH transformers used in the UTC 6L6 Universal Beam Power Amplifier



PAK amplifier kits feature: Power output 35 watts self bias, 55 watts fixed bias; gain 118 DB, immediate change-over to 95 DB; separate power supply and audio decks; stabilized feedback; mobile operation with genemotor—20 watts output; provision for electron mixer or low impedance input if desired.

● **PAK-1** Self bias amplifier kit. 35 watt operation. Output transformer impedances 500, 200, 16, 8, 5, 3, 1.5 ohms. Includes all accessories, including perforated covers, except tubes. Fully mounted.
List price, $75.00; Net to Hams **$45**

● **PAK-1X** Same as PAK-1, but with Varimatch modulation output transformer.
List price, $75.00; Net to Hams **$45**

● **PAK-2** Fixed bias amplifier kit. 55 watts operating condition. Output transformer with impedances of 500, 200, 16, 8, 5, 3, 1.5 ohms. Includes all accessories, including perforated covers, except tubes. Fully mounted.
List price, $80.00; Net to Hams **$48**

● **PAK-2X** Same as PAK-2, but with Varimatch modulation output transformer.
List price, $80.00; Net to Hams **$48**

New UTC Transformers for 6L6 Tubes

PA-428
Power transformer for push-pull 6L6 tubes, self or fixed bias. Primary, 115 v. a.c., 50-60 cycles. Secondaries 450-0-450 at 250 ma.; 6.3 VCT-4A, 6.3 VCT-2A tapped at 2½ volts-3A, 2½ VCT-3A, 5 VCT-3A. Separate bias winding.
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PA-233
Input transformer from two 56, 6C6, 6C5, or similar tubes to 6L6's self bias.
List price, $6.00; Net to Hams **$3.60**

PA-333
This input transformer is designed to operate from 6C5's, or similar driver tubes to two 6L6's fixed bias.
List price, $6.00; Net to Hams **$3.60**

PA-433
From 45 or 2A3 plates to two or four fixed bias 6L6 grids.
List price, $6.50; Net to Hams **$3.90**

***PA-2L6**
6600 ohms, plate to plate. Will match 35-40 watts output. Secondary impedance, 500, 200, 16, 8, 5, 3, 1.5 ohms.
List price, $10.00; Net to Hams **$6.00**

***PA-4L6**
3800 and 3300 ohms, plate to plate. Will match two 6L6's fixed bias, 60 watts output; four 6L6's self bias, 60-80 watts output. Secondary impedance, 500, 200, 16, 8, 5, 3, 1.5 ohms.
List price, $15.00; Net to Hams **$9.00**

**These transformers incorporate the new UTC Feedback (patent applied for) Winding, which reduces harmonic distortion, increases available power and reduces plate resistance tremendously. No resistors or condensers are necessary.*

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What about Driving Power?

WHEN making a selection of tubes to be used in your transmitter, consider the driving power required to obtain full output, since the driving power required by the final stage will influence greatly the cost of the exciter stages.

Values of d-c grid current and driving power required to assure full output from a transmitting tube are subject to wide variations depending upon the impedance of the load circuit. High-impedance load circuits require more driving power and grid current to obtain the desired output, while low-impedance circuits require less. With low-impedance load circuits, however, plate-circuit efficiency is sacrificed.

In general, the driving stage should have a tank circuit of good regulation and should be capable of supplying considerably more than the required amount of driving power.

RCA Transmitting Tubes are designed to require very low driving power consistent with good operation. Nominal driving power requirements for all RCA Transmitting Tubes are given in our technical bulletins. Consult these bulletins and see for yourself how little driving power is required in each instance.

The low driving power requirements of RCA Transmitting Tubes make them economical to excite, their long life makes them economical to use and their low cost makes them economical to buy.

RCA

for Amateur Radio

Address Amateur Radio Section, RCA MANUFACTURING CO., Inc., Camden, N. J.

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