RADIO

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THE WORLDWIDE TECHNICAL AUTHORITY OF AMATEUR SHORT WAVE AND EXPERIMENTAL RADIO

This Month

Small But Effective Flat Top Beam

A New Method of Speaker Baffling

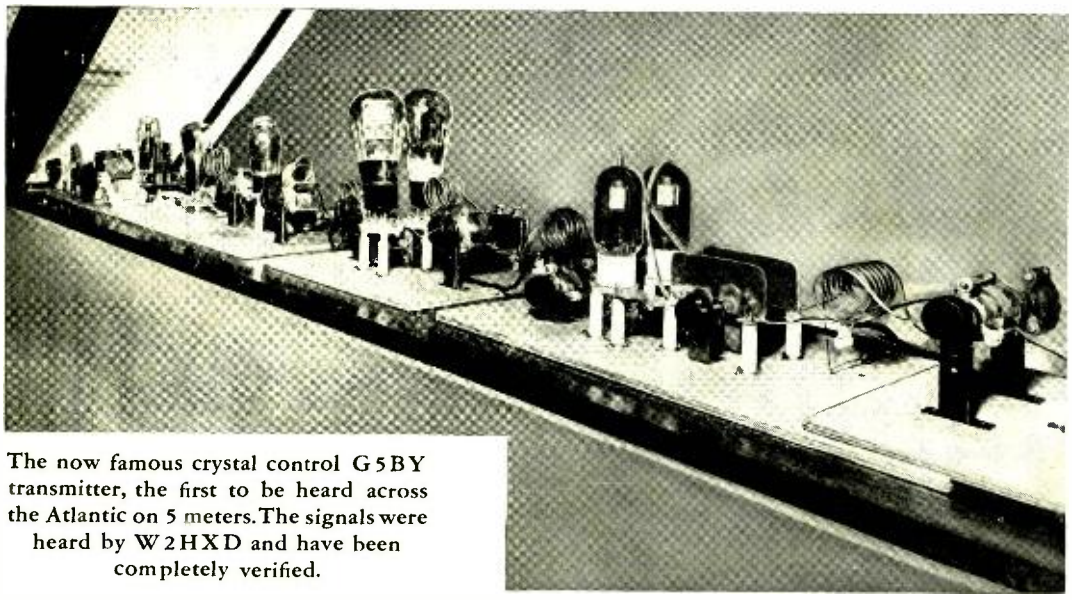
Notes on Class C Amplifier Design

Clean Primary Keying with P.D.C.

Flood QRR Work and Portable Gear

G5BY Bridges Atlantic on 5 Meters!

Hand and hand with world famous experimenters **EIMAC** *tubes are aiding in the conquering of new fields*



The now famous crystal control G5BY transmitter, the first to be heard across the Atlantic on 5 meters. The signals were heard by W2HXD and have been completely verified.

G5BY uses two **EIMAC** 35T's in the final amplifier with inputs of 100 to 250 watts. G5BY says *"thanks for turning out such a fine tube...it makes 5 meter operation like 40!"* Why buy copies of these internationally famous tubes. The *original* **EIMAC** tubes cost no more.

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San Bruno, California, U. S. A.

RME

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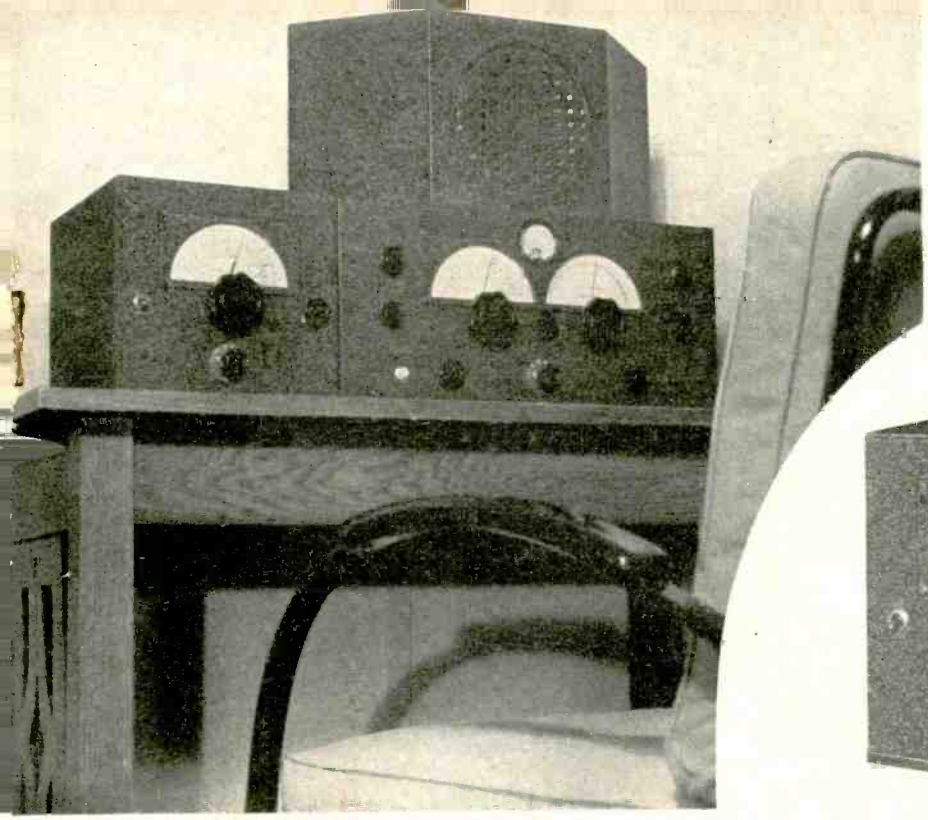
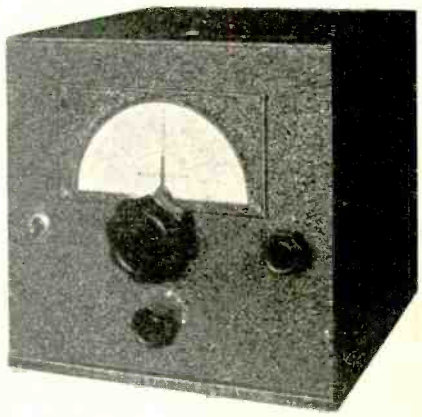
DB-20





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1. The under side of the DB-20 chassis.
2. Top view of the chassis showing two 6K7 RF stages and built in power supply.

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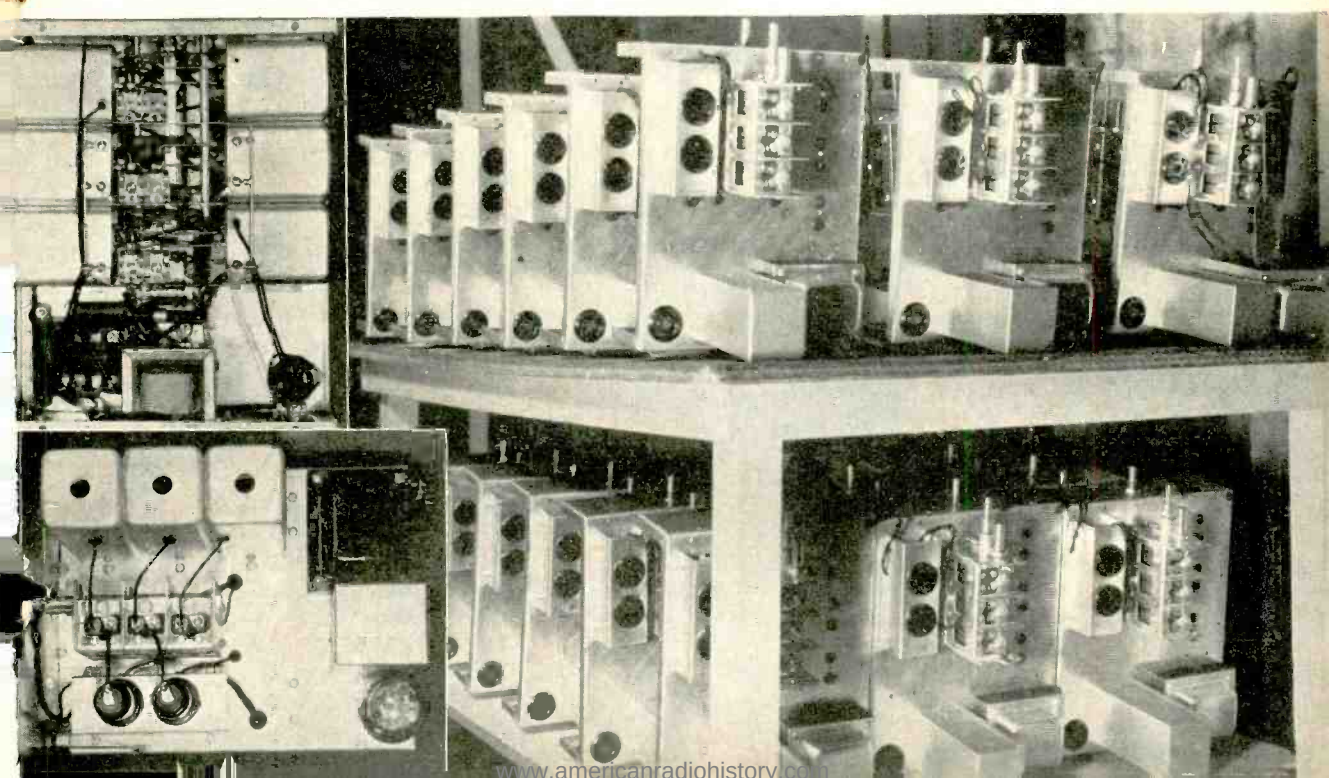

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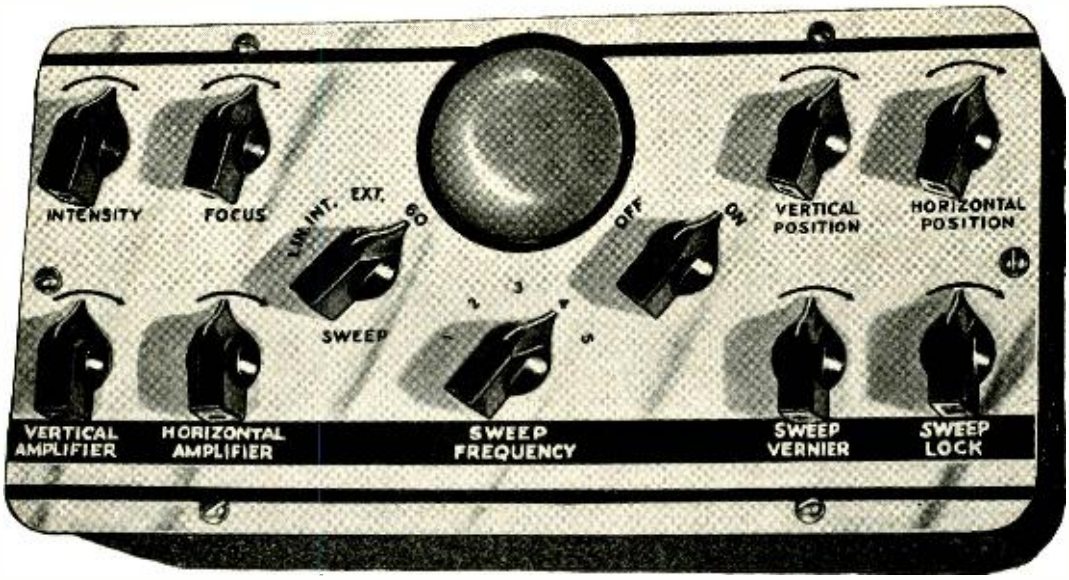

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Intensity and focusing controls	5 range sweep (20-12,000 cycles)
Horizontal and vertical amplifiers	500,000 ohm input

Enlarging lens and etched panel optional

Available in "Build It Yourself" foundation unit at your favorite supplier.

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

RADIO

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No. 217 March, 1937

CONTENTS

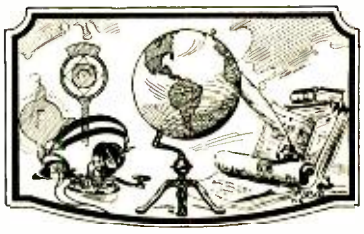
"RADIO" CONTRIBUTIONS

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.

The Reinartz "Squirrel Cage" Beam Antenna System in Commercial Practice

RADIO with the EDITORS



That "Flood Traffic Mixup"

Yes, it is admitted that for several days there was a flood-message mixup on the amateur bands. It was a good, enthusiastic mixup. There was plenty of "out loud" worrying about it on the air and a denial would be dishonest.

The question is—did any harm result? We say—none *whatever*, and offer the following account to prove that claim.

As eastern amateurs know, the so-called "jam" was well developed by Saturday, January the 30th, at which time the Ohio-Kentucky territory was the focal point. A beautiful system of channels to the east coast had been completed and stood ready for any number of messages from the flood area. But where was this big business? Stations in the 1st, 2d, and 3d call areas seemed to be spending their energies mainly in hunting something to do! Being very anxious to help, they were finding it very hard to wait quietly for orders from the 8th and 9th districts, the proper place for orders to originate at that stage. The hungry east-coast wanted an active job and presently began to fret. The drizzle of necessary (?) reports to coastal agencies and authorities were no adequate load for the eager stations. The messages concerning really important matters of emergency transport and supplies no longer filled these channels either, because there were now *many* good channels.

It is quite unimportant who first thought of filling the channels with "personal" messages at this stage; nobody will gain glory from it. At the moment it looked like a fairly good idea, as excess facilities existed. At any rate, attempts were made on the 30th to stir up this type of "traffic" by various means, including the broadcasting of a message reading:

> QST QST
> The Federal Communications Commission interprets its flood order to permit the handling of personal messages to and especially from refugees. Please spread this word.
> Sig.
> ARRL

Fortunately no immediate effect resulted. The personal messages *from* the flood area failed to materialize. Accusations began to fly around the east because everyone was tense and tired. Several eastern stations seemed to think that one midwestern office of the F.C.C. had caused the jam by ordering a stoppage of personal messages.

What of that? Numerous stations had interpreted the original F.C.C. order as precluding personal messages and had said so. Why not? It was a most natural interpretation of the original shut-down order. Furthermore, it was a *most fortunate* reading of the order—fortunate for both the flood area and for amateur radio. It would have been most unfortunate if a stream of personal messages had descended on the amateur bands prior to the 30th. Amateur radio can run up impressive message totals but it could not have replaced the Postoffice and the A.T.&T.

Fortunately the attempt did not succeed; it would have made a mess of the main job. That main job must always be the handling of relief agency messages. If such messages become scarce during any emergency, is it wise to load up with personal messages which must be delivered? It seems better to fill in with innocuous "contacts" which may be dropped instantly when a real message appears.

Something like that seemed to go through the heads of coastal amateur operators, for by 3 p.m. of the 30th some bands sounded almost normal.

"A Policeman's Life Is Not a Happy One"

At this stage it was interesting to watch the "selected" stations, especially the "monitor" stations. While personally sharing the anxiety to be doing something, these stations were charged with the job of keeping others off the air—a job resembling that of the "cop" who holds a road vacant for a parade that isn't arriving!

It began to be both irritating and funny. By 5 p.m. this coast had learned why some commercial channels resort to "V wheels" and "dotters". To hold things together something simply had to be said by the "selected" stations. Perhaps that triggered off the renewed broadcasting of restrictive orders, quite a splattering of messageless "contacts", and some harmless ragging about such "emergency work".

The monitor stations observed from here handled this thankless situation well enough, though the manner of the operators varied from

[*Continued on Page 30*]

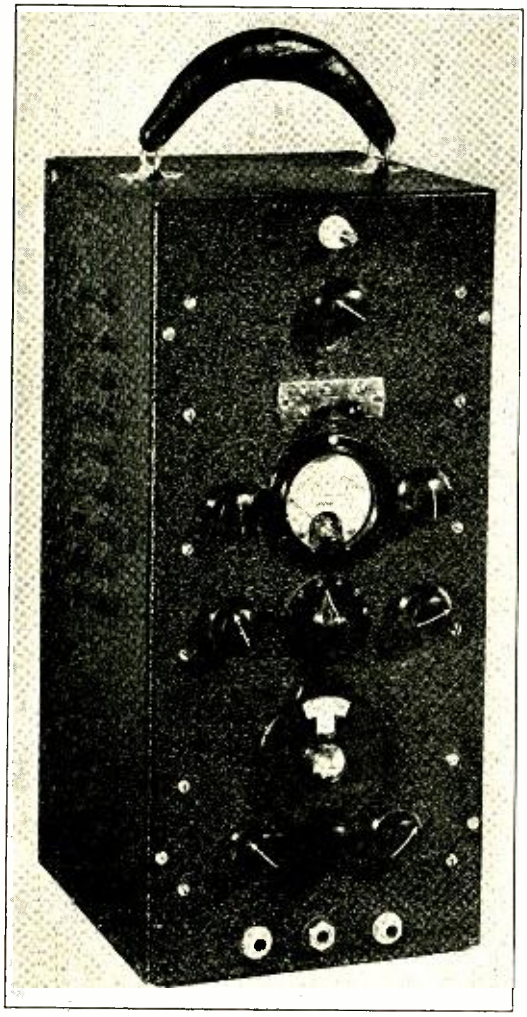
A Really Portable 75-160 Meter Phone-C.W. Rig

By Faust Gonsett, W6VR

Here is a 75-meter crystal-controlled transmitter that may be used either on dry batteries or in conjunction with a 6 volt car battery and vibrator power supply for greater power. It is very light, compact, works on most any type antenna, and makes an ideal portable or emergency rig.

If you have ever tuned around just below the 3500 kc. edge of the 80 meter band, you have probably heard the little forest service portable rigs making quite a hole in the air with their battery-powered phone-c.w. sets. It is really surprising what a couple of watts will do in a good antenna. And when one is out in the wide open spaces where one can tie to a couple of high trees or stretch a wire across a canyon, a really good antenna is not hard to put up.

"All Ready to Go Walking"



Ultra-high-frequency battery-powered gear provides much fun in the way of experimentation, but when one wants to talk to a station 100 miles or more away, and there are a few hills or mountains in between, it is necessary to resort to the lower frequency bands.

If one is to work phone, the rig automatically resolves itself into a crystal controlled transmitter. Because of the low power, and the fact that the oscillator can run at the same voltage as the final amplifier, a buffer stage is really not necessary. To make a long story short, the circuit shown in the wiring diagram seems to be the answer. Under average conditions and with a good antenna, a consistent range of 100 miles can be covered (QRM permitting) in the early morning or evening on 75 meters, or at night on 160 meters. The nighttime range on 75 meters is hampered by the fact that on most nights the skip will be so great that the signal has to compete with too many others when it comes down—300 or more miles away. The "occasional" range is much greater. 500 miles on 160 or 1000 miles on 75 may be covered in the wintertime under favorable conditions.

The foregoing applies to a 250-volt vibrator power pack for transmitter plate supply. If dry batteries and lower voltage are used, the range and signal strength will drop a little, but not as much as one would expect. With 135 volts of "B" battery instead of the vibrator supply the reports will drop only one "R" point.

It can be seen that besides making an excel-

RECEIVER COIL TABLE

	80 meters	160 meters
Grid coil	35 t. no. 20 d.c.c. close wound	65 t. no. 24 d.s.c. close wound
Tickler coil	15 t. no. 20 d.c.c. close wound	20 t. no. 24 d.s.c. close wound

Both coils wound on standard 1½ inch dia. form. Tickler should be placed at the ground end of the grid coil (same polarity as in diagram but at opposite end of grid coil). Tickler should be spaced from grid winding by ⅛ to ¼ inch.

lent portable rig, it provides a standby transmitter for use in time of emergency and power failure. In an emergency one need but scrape up a few B batteries or rob 250 volts from an auto receiver, and reliable communication up to 50 miles is insured. Most emergency traffic need not make longer hauls than that distance, and in most cases 10 or 20 miles is sufficient to get the traffic to a land line or a station with 110 volt power. The rig may be relied upon to cover that distance under all conditions, by using 75 meters in the daytime and 160 meters at night.

To cut down the necessary replacement tube complement (spares) type 49's were used throughout in the transmitter and modulator. All are connected in the class B connection (high μ) except the driver for the modulators. This is connected class A (low μ). By running the r.f. tubes high μ, the plate current drops to a very low value when the oscillator is kicked out of oscillation. This is important, because the tubes are rather fragile and will not stand the abuse amateurs are in the habit of inflicting upon heater type receiving tubes. It also makes it possible to key in the grid lead of the amplifier stage for c.w., a very effective method with tubes of very high μ.

The receiver is somewhat of a compromise. A superheterodyne is out of the question for strictly portable work because of the number of tubes and parts required. A t.r.f. job was considered, but because no extreme dx is going to be worked and therefore there is no need for hearing it, the r.f. stage was finally given up for the sake of compactness and simplicity. A tuned r.f. stage would make rather elaborate shielding between that stage and the detector necessary, besides requiring considerably more room. The receiver shown in the diagram has sufficient "punch" to work a magnetic speaker so that it can be heard for quite a distance when a good antenna is used (meaning a good transmitting antenna, because the same antenna is used for both receiving and transmitting).

It most be admitted that the set is not highly selective, especially on loud phone signals, such as from a station only a mile or two distant. However, this is not a very serious problem, because the set is usually used only when "out in the country", and there are no nearby stations to cover the whole phone band. On c.w. the situation is not so bad, both because the 80 meter c.w. band is 4 times as wide as the 75 meter phone band and because the receiver

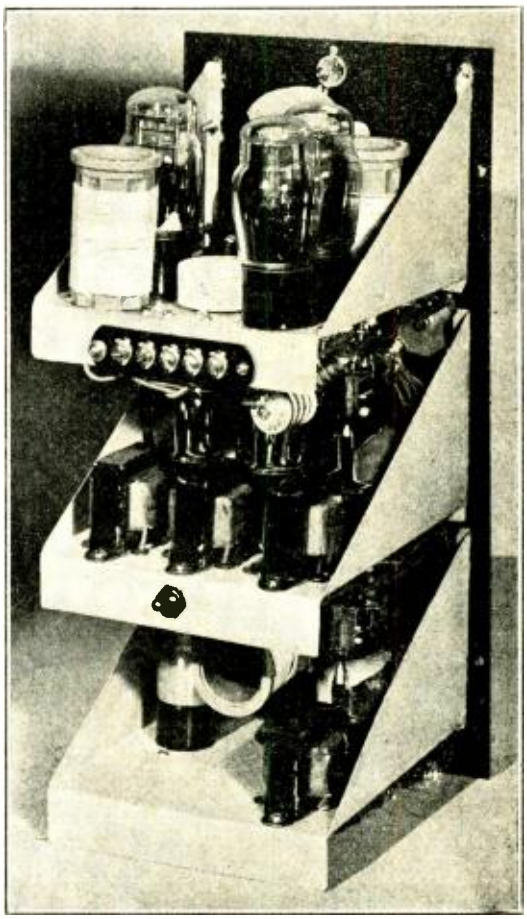
TRANSMITTER COIL TABLE

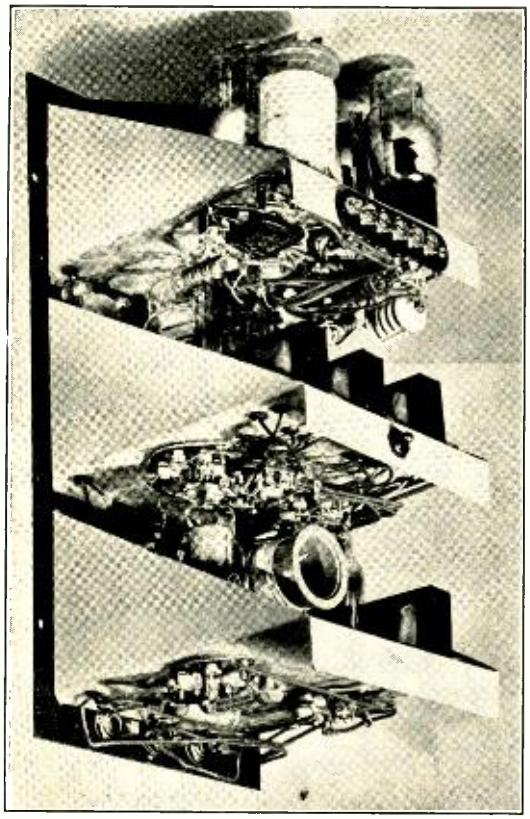
	80 meters	160 meters
Oscillator	44 t. c.t. no. 20 d.c.c. close wound	68 t. c.t. no. 24 d.s.c. close wound
Amplifier	56 t. no. 20 d.c.c. close wound	60 t. no. 24 d.s.c. close wound

is inherently more selective on c.w. signals. In time of emergency one should have little trouble because the band will probably be pretty well cleared anyhow if the emergency is serious. Besides, if there is no power available, there will be no nearby high-power transmitters in operation.

The receiver requires 90 volts of B battery for operation regardless of what sort of power supply is used on the transmitter. It is difficult

Below: Back View with Cover Removed. Receiver Bottom, Modulator Center, and R.F. Section Top Tray.





Worm's Eye View of the Three Chassis.

to get all the hash out of a vibrator power supply when using it on the receiver, even though the filtering may be sufficient for a b.c.l. auto set. If desired, the same 90 volts may be used for the transmitter. This can easily be seen from the diagram. Or, additional batteries may be added for the receiver; for instance, four 45 volt blocks may be used for the transmitter, the receiver being tapped across two of the blocks to give 90 volts. If a vibrator supply is used for the transmitter, the receiver batteries may be of the midget type, as the drain is very small. However, if the same batteries are used for the transmitter, it is advisable to use heavier ones, unless one is satisfied with short life for the sake of lightness. The midget batteries will give a surprising number of hours even in transmitter service, but the larger blocks give many more hours operation per dollar.

Saving Filament Drain

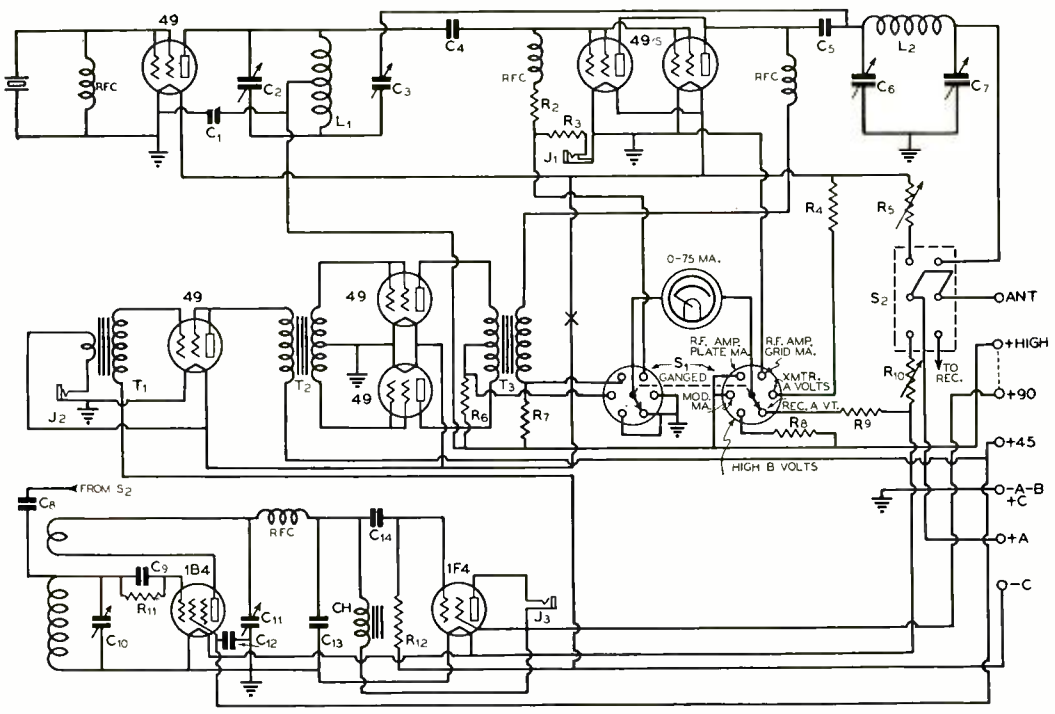
When the switch is thrown to "send", the filaments on the receiver are killed. This also kills the plate current drain of the receiver. When the switch is thrown to "receive", the filaments on the transmitter are killed, which removes both filament and plate current drain. The switch (an "anti-capacity" switch) also throws the antenna from transmitter to receiver and back when switching over. A small toggle switch in series with the modulator filaments is mounted on the back of the modulator shelf in order to kill the speech filaments permanently when working c.w. If a vibrator power supply is used, it will also be necessary to put a switch in the 6 volt lead to the power supply in order to kill the vibrator when receiving.

A 45 volt tap is brought from the receiver batteries to feed the screen of the detector and the driver stage in the modulator unit. This stage is run at 45 volts because if more plate voltage were used it would be necessary to use a C battery of more than 7½ volts. This stage does not have to deliver much power; the main reason for using the low μ connection is to keep the plate resistance down (desirable in a driver for a class B stage) and not because this connection gives more power output. No difference in operation will be noticed between 45 volts and 135 volts, the latter voltage requiring a 22½ volt C battery, which is too large to fit in the available space. Besides, the 7½ volts is just right for bias on the 1F4 audio stage in the receiver.

The audio components are the ordinary standard "transceiver" type. They are sufficiently large to carry the currents used, and with a single-button mike no improvement in quality is noticed by substituting heavier transformers. The class B output transformer was the only one we were really doubtful about, and after trying it out found to our satisfaction that it is sufficiently husky for the job.

The transmitter and receiver are housed in a small, commercially manufactured portable cabinet. Trays were cut and bent of galvanized iron to support the three units. Each is supported from the front panel, as may be seen in the illustration showing the back view. The cabinet measures only 7 x 8 x 15 inches, and the completed unit is surprisingly light.

The meter switching arrangement permits one to measure grid and plate current on the amplifier stage, plate voltage, and filament voltage on both transmitter and receiver. The two rheostats should be adjusted to give 2 volts on the tubes at all times. It will not be necessary to reset them often until the A batteries start to give out. If a single cell of an auto battery



Wiring Diagram of the Portable Unit

C_1—.005 μfd. mica, 500 v.
C_2—50 μμfd. midget
C_3—35 μμfd. max. mica trimmer
C_4—40 μμfd. mica, 500 v.
C_5—.004 μfd. mica, 1000 v.
C_6—140 μμfd. midget
C_7—350 μμfd. midget b.c.l. condenser
C_8—35 μμfd. max. mica trimmer
C_9—100 μμfd. mica, 500 v.
C_{10}—50 μμfd. midget
C_{11}—140 μμfd. midget
C_{12}—.004 μfd. mica, 500 v.
C_{13}—100 μμfd. mica, 500 v.
C_{14}—.01 μfd. tubular
R_2—2500 ohms, 1 watt
R_3—100 ohms, ½ watt
R_4—100 ohms, 5 watts (wire-wound)
R_5—3 ohm, four watt rheostat
R_6—100 ohms, 1 watt
R_7—100 ohms, 1 watt
R_8—10,000 ohms, 5 watts wire-wound
R_9—100 ohms, 5 watts wire-wound
R_{10}—10 ohm, four watt rheostat
R_{11}—3 meg., ½ watt
R_{12}—500,000 ohms, ½ watt
J_1—Key jack
J_2—Microphone jack
J_3—Phones or speaker
S_1—Double pole (2 gang) six throw (point) band-switch, non-shorting type
S_2—Anti-capacity switch, double throw and neutral position
CH—250 or 500 hy. midget audio choke (or grid winding of midget audio transformer)
T_1—Midget mike transformer ("transceiver" type)
T_2—Midget class B driver transformer
T_3—Midget class B output transformer, 5000 ohm secondary tap

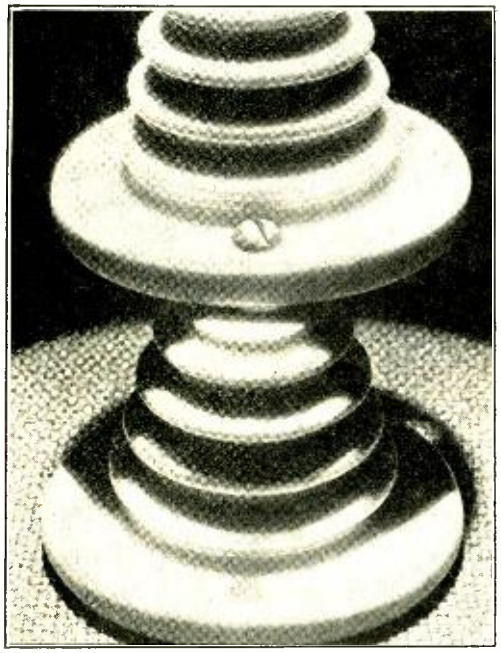
is used for filament supply, the rheostats may be turned full on and no more attention paid to the filament voltage.

The meter, a 75 ma. d.c. milliammeter, is used with a 100 ohm 5 watt wire-wound resistor to act as a 7½ volt voltmeter. At two volts the drain will be 20 ma., but this is not enough to cause much of a voltage increase when the meter is switched out of the filament circuit.

The 10,000 ohm resistor makes it a 750 volt scale voltmeter. Reading up to 250 volts it will not draw over 25 ma., which is not excessive. Wire-wound resistors are used in the voltmeter positions of the switch because they are more accurate than carbon resistors. The current shunts merely provide a path for the current when the meter is not closing the circuit. No accuracy is required, and therefore carbon resistors are used in these positions for the sake of economy.

The meter should always be switched to read plate current to the amplifier stage when the transmitter is being used, either for phone or c.w. The other positions should be used only when tuning up or for a check on the filament voltage. Incidentally, the rheostats are of the correct value for operation from a 3 volt supply (two dry cells). So do not apply over 3 volts to the "A" terminals.

The 7½ volt C battery is very small and is mounted right inside the cabinet, though connections are made through the terminal strip



Two Little Stand-off Insulators Revealed in Intimate Contact by a Merciless Camera with Triple Extension Bellows. Prize Winning Photo by Robert Hertzberg, Well Known New York Amateur.

at the back of the set. If it is mounted outside, the long leads will make it necessary to bypass the C minus lead to ground with a 0.5 μfd. tubular condenser.

The regeneration control is very smooth and has very little tuning effect. The set slides into regeneration without the customary "plop" and is a pleasure to operate. By using this type regeneration, and choke instead of resistance coupling out of the 1B4, it is possible to run full voltages on the screen and plate of the tube, giving much louder signals than if resistance audio coupling and screen potentiometer control of regeneration were used.

By tying an "outboard" 500 μμfd. b.c.l. tuning condenser across the 160 meter coil, the set can be used for broadcast reception. It will work either a cone or small permanent magnet dynamic, and has as good quality as a lot of the midget sets we have heard. This makes a nice combination to take out on a boat or to the beach or wherever there is no 110 a.c. and the car radio won't serve the purpose.

The transmitter is neutralized and tuned the same as for any conventional grid-neutralized transmitter. For data on adjusting the simplified antenna coupler see either the *Radio Handbook* or the *Jones Handbook*. Inductive coupling would be preferable from several standpoints, but for portable use the coupling shown is probably the best bet, inasmuch as operation with any common type of antenna is possible without altering the transmitter.

Take along a piece of pipe to drive into the earth for a ground connection. If this is not done, it will be difficult to load up the final stage, especially if the antenna is end-fed and is an odd number of quarter waves long. For best results the antenna should be an even number of quarter waves long for this type (end-fed) operation. This will cut down the current in the ground lead, and any losses due to ground resistance will be minimized.

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Radio Service Encyclopedia

Differing markedly from anything previously available, the Mallory-Yaxley Radio Service Encyclopedia is a single book designed to place complete service information on more than 12,000 models of radio receivers at the finger-tips of the service man.

The radical advance of the Encyclopedia is that it places all the technical data of a single model receiver in one listing—a listing which not only gives the proper replacement for the volume control, tone control, filter condensers, vibrators, vibrator buffer condenser, and electrolytic bypass condenser, but also gives the circuits in which these parts are used. The single listing also gives the intermediate frequency transformer circuit and the types of tubes used.

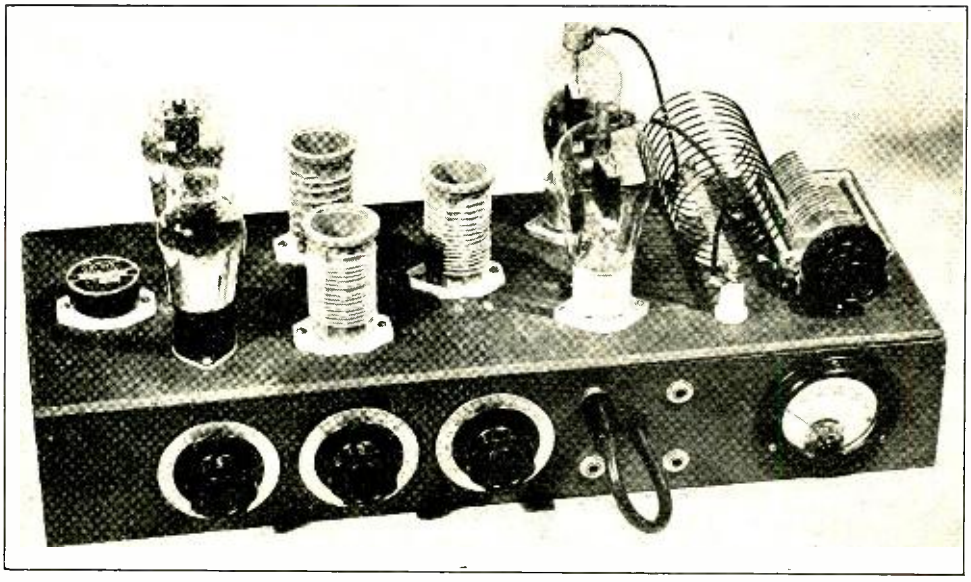
The standard circuits used as references in the book are complete and cover every hook-up in common use. Full technical information is given on the circuit action of each hook-up, explaining both how and why in the simplest every-day English.

The subject of alignment is covered in detail, with much new information which has never previously appeared in print. Complete data on automatic frequency control is included together with practical methods of adjusting such receivers. There are nineteen pages of the latest tube data, seven pages on measurements, including constructional data on a practical bridge and a vacuum tube voltmeter. Other subjects covered in detail range from antenna design and auto radio interference to voltage doublers.

The Mallory-Yaxley Radio Service Encyclopedia has 224 pages, 8½ x 11 inches, and is profusely illustrated. This book is attractively bound in a stiff washable waterproof cover and is priced at $2.50 list. This book is sold only by authorized Mallory distributors.

The New T-20's in a Three Band Transmitter

By Ray L. Dawley, W6DHG



The General Type of Construction Is Similar to the 100TH Rig Shown Last Month.

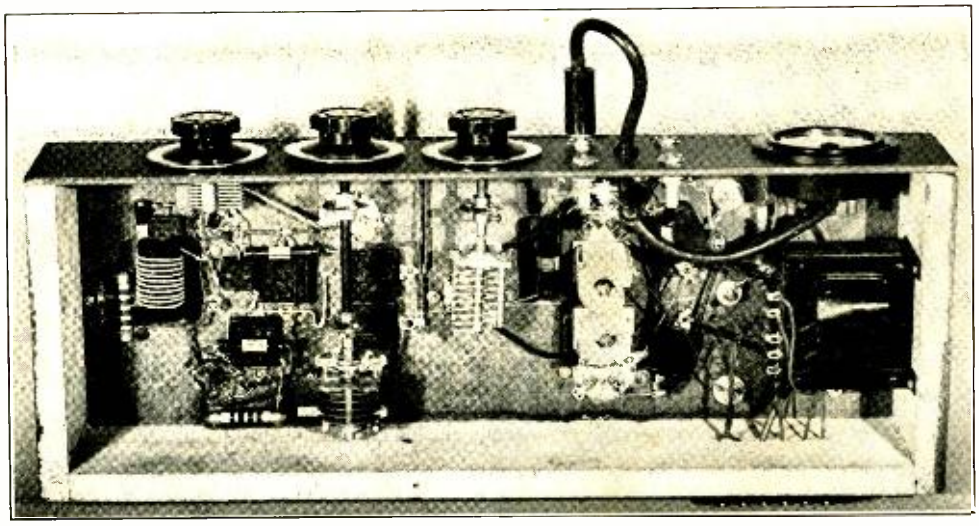
There undoubtedly will be quite a large number of amateurs who will look upon the 1 kw. 100TH rig shown in the last issue and say to themselves, "Well, that rig may be inexpensive as far as 1 kw. jobs go, but it's still too much of an investment for me." For those in this class, which includes a very large percentage of us, the T20 rig was designed and built.

Lowest cost consistent with good flexibility, and a reasonable amount of power output were always kept in mind. Since the 1 kw. rig shown before was also designed with these principles in mind, a number of ideas incorporated in the original transmitter lent themselves conveniently to use in this smaller edition. The masonite and wood subchassis, the plug and jack metering system, and the fixed cathode coil 6L6G crystal oscillator all were borrowed from the original.

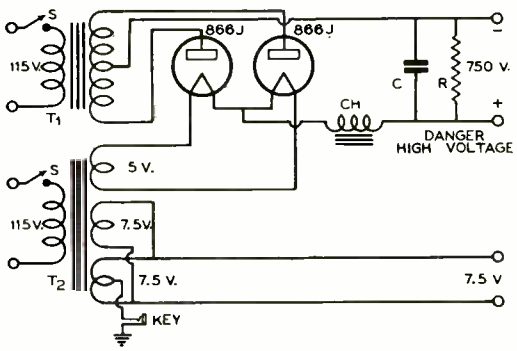
During the time the lower powered rig was still in the "mental development period", Taylor announced its new T20 triode. This tube is just about what the doctor ordered for a rig of this type. Low excitation requirements, satisfactory power handling capabilities, low interelectrode capacities, and low cost make the tube very suitable for the "medium-low" power station. Consequently a pair of them was used in the push-pull final amplifier.

The whole transmitter is designed to operate from one 750 volt 250 ma. power supply, which supplies all plate and screen voltages. This supply uses a pair of the new 866JR rectifiers that were announced at the same time as the T20's.

The rig is designed primarily for c.w. operation on the 7, 14, and 28 Mc. bands. If desired, slight changes can be made in the manner in which the crystal oscillator and buffer tubes derive their plate voltage (run a separate lead from their dropping resistors to the power supply), and the final stage may be plate modulated for phone. The full rated input of 750 volts at 150 ma. can be used on either phone or c.w. on any band. It seems a shame that the tubes do not have a higher plate voltage rating, as their insulation would appear to be entirely adequate for somewhat higher plate voltage. However, it seems more than likely that the manufacturers are merely anticipating the common ham procedure of tube overloading by giving the tube a very conservative rating. At the rated input of 112 watts on the T20 stage there are certainly no signs of stress apparent, and the tubes just "loaf".



Underchassis View, Showing Layout of Parts.



The Power Supply

T_1—900 or 1000 volts each side c.t., 250 watts
T_2—5 v., 3 amp. and two 7.5 v., 2.5 amp. (designed for 210's)
CH—5-25 hy., 250 ma. swinging choke
C—4 μfd., 1000 working volts (8 μfd. if phone is used)
R—50,000 ohms, 20 watts

The Exciter Section

A 6L6G tube is used as the crystal oscillator in the same circuit as that used in the 100TH transmitter shown last month. A fixed cathode coil provides sufficient regeneration to allow the oscillator to put out 15 to 20 watts on either 7 or 14 Mc. simply by putting in the proper plate coil and tuning the plate condenser to resonance. For operation on either of these bands the output of the oscillator is coupled by means of a link to the grid coil of the final stage. As a matter of fact, if operation is desired only on these two bands, the doubler stage may be dispensed with.

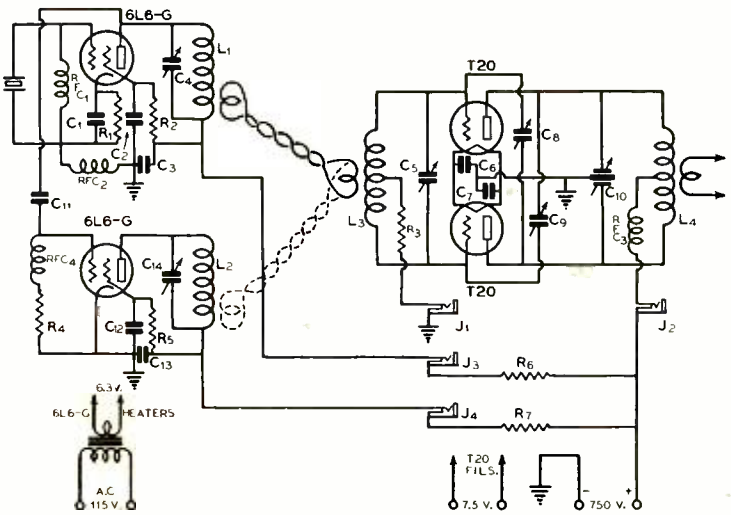
The plate voltage for the oscillator is obtained from the 750 volt supply by means of a 5000 ohm, 20 watt dropping resistor; the screen voltage is obtained from the plate voltage by means of another dropping resistor.

The 28 Mc. doubler stage also utilizes a 6L6G tube operating as a tetrode. Its grid is capacity coupled directly to the plate of the crystal oscillator and it derives its plate and screen voltages through series dropping resistors in the same manner as the first stage.

The layout of the oscillator and buffer stages is somewhat unconventional. The plate coils are placed the same distance from the grid coil on the final amplifier. To do this they are placed one in back of the other instead of the more usual procedure of having the buffer or doubler between the oscillator and the final amplifier. With this layout, the oscillator in front and the doubler in back of it, their two respective plate coils are the same distance from the grid coil on the final. Through this expedient it is

COIL TABLE

	7 Mc.	14 Mc.	28 Mc.
Oscillator	17 turns no. 18, 1½" dia. 2" long	11 turns no. 18, 1½" dia. 2" long	
Doubler			7 turns no. 18, 1½" dia. 2" long
Final Grid	28 turns 1½" dia. spaced to 2"	14 turns 1½" dia. spaced to 2"	7 turns 1½" dia. spaced to 2"
Final Plate	22 turns 2¾" dia. spaced to 5"	11 turns 2¾" dia. spaced to 5"	6 turns 2" dia. spaced to 5"



Wiring Diagram of the R.F. Section

C_1—100 μμfd. mica
C_2—.004 μfd. mica
C_3—.004 μfd. mica
C_4—100 μμfd. midget
C_5—35 μμfd. midget, double spaced
C_6, C_7—.004 μfd. mica
C_8, C_9—Double spaced midgets, 15 μμfd. or more max.
C_{10}—75 μμfd. per section, 3000 volt spacing (2000 sufficient if stage is not modulated)
C_{11}—100 μμfd. mica
C_{12}, C_{13}—.004 μfd. mica
C_{14}—35 μμfd. midget
R_1—500 ohms, 10 watts, wire-wound
R_2—10,000 ohms, 10 watts
R_3—3000 ohms, 10 watts
R_4—50,000 ohms, 4 watts (two 100,000 ohm, 2 watt carbon in par.)
R_5—10,000 ohms, 10 watts
R_6, R_7—5000 ohms, 50 watts
RFC_1—2.5 mh. 125 ma. r.f. choke
RFC_2—10 turns no. 20 d. c. c. 1" dia., spaced to cover 1½"
RFC_3—2.5 mh., 500 ma. r.f. choke
Meter: 0-200 or 0-250 ma. d.c.
Note: Heater of 6L6-G oscillator tube should be grounded at socket.

only necessary to move the final grid link from the oscillator tank to the doubler tank to change from 7 or 14 to 28 Mc. It is advisable, however, to remove the 28 Mc. doubler tube from its socket when this band is not being used. This reduces the load on the oscillator stage in addition to cutting down unnecessary drain on the power supply.

The Final Amplifier

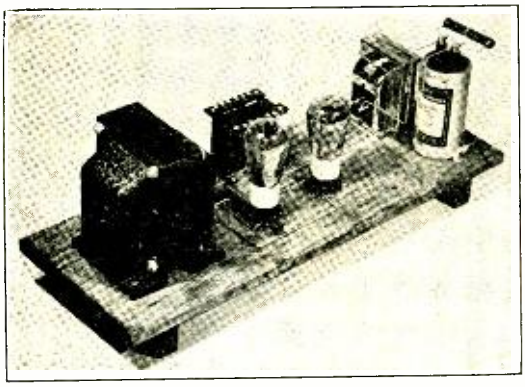
The final amplifier is a conventional split-stator neutralized affair using a pair of T20 tubes. The rotor of the split plate condenser is grounded to provide the return for neutralization. A single section condenser is used in the grid circuit because of their lower cost as compared to a split-stator unit. No difficulties due to unbalance were experienced. This probably was true because of the small size of the condenser and the fact that there is no large mass of metal on the rotor to cause an unbalance.

The neutralizing condensers are mounted vertically through the sub-panel with their screwdriver adjustment available from the top of the panel. Under normal conditions of operation and with the condensers shown, the tubes will neutralize with the two condensers just barely meshed from the minimum position. Once set, the two condensers need not be readjusted for other bands.

With the value of gridleak shown and with full excitation the grid current for the pair of tubes will run from 35 to 50 ma. on the three bands. The final tubes seem to be very uncritical as to excitation; that is, quite a large change in excitation power seems to make very little change in output. There is, of course, a reduction in efficiency that is evidenced by an increase in plate current as the grid current is reduced.

The Power Supply

The power supply is conventional and uses a pair of the new junior 866's with their filaments series-connected to operate from a five-volt winding on the filament transformer. This same transformer has a pair of 7.5 volt windings which are paralleled to operate the filaments of the T20's in the final amplifier. The two



The 750-800 Volt Power Supply.

6L6G's have their own filament transformer built into the transmitter itself.

To allow for warm-up of the filaments before the plate voltage is applied, separate switches are used on the filaments and the primary of the plate transformer. Provision is made for center-tap keying of the final amplifier by bringing a lead from the center-tap of the T20 filament transformer to the terminal strip. By connecting a keying relay with an appropriate click filter between this lead and ground, efficient keying of the final amplifier is obtained. For operation on phone, this lead is jumpered to ground and modulation is applied to the final amplifier plate circuit in the conventional manner.

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AMATEUR STATION CU2L

By the OWNER-OPERATOR

(Forwarded by VU7FY)

Amateur Radio Station CU2L is unique. It is situated in a lonely spot thousands of miles from nowhere, but in contact with everyone everywhere.

The transmitter follows no particular circuit, as the purpose of any transmitter is simply to oscillate. No attention is paid to the quality of the signal emitted, as wireless signalling simply consists in making and breaking oscillations so as to form the dots and dashes of the Morse code. If this is done the note can take care of itself. For the sake of decorum, however, all reports received whether T1 or T2 are always entered in the station log book as T9.

Keying is accomplished by making and breaking the aerial, this system being very positive. Complaints are continually being received about key thumps, but those are ignored, as according to b.c.l. licenses, necessary in this country, they must not use their receivers to cause annoyance to others.

CU2L has the distinction of being the only station possessing both w.a.c. and w.b.e. without actual contacts being made. The difficulty was overcome, by having special QSL cards printed to suit the various continental areas of the world. To date 175 countries have been printed.

The antenna system at CU2L does not follow any hard and fast rules. Hams in the past have been giving too much attention to formulas and books instead of thinking for themselves.

The receiver at CU2L is the good old straight three valver, the kind so much favored in 1914. Oscillations on the present receiver have been reported from a distance of 50 miles. Modern practice is against this, but then the writer was not a signatory to any International Radio convention. Neither has he been consulted, and further the air is free to all, and cannot be made the monopoly of anyone. The receiver is used as a standby for local contacts and serves the purpose well, and is a splendid example of what a transceiver should be.

No experimenting is done at CU2L as it is obvious that spending hours upon hours trying to find things out for oneself is a sheer waste of time, when one considers the information can be obtained from the fellow who knows, or a book can be borrowed.

Monitors are not used at the station, since the other fellow always gives a report on the note, and should the transmitters wander off frequency, it gives the opportunity of making acquaintance with commercials and so enhancing the station's international reputation.

In the good old days the station was very successful in winning many international competitions. Those were the days when it was only necessary to send in a log showing the call signs of the stations worked. The latest call book was of great assistance and obviated the necessity of spending long hours at the key.

Now-a-days with the exchange of QRK, etc., etc., the station has abandoned competitions, owing to the other station's inability to read the call sign correctly and enter it in his log.

Logs are carefully kept up to date to coincide and agree with the many QSL cards which the station possesses. Reports, QSL's, and presents are welcome, but all letters bearing official stamps, or marked "Official Business", "G.P.O.", etc., are endorsed *"Not Known"* and promptly returned to the postman.

The station spends hours and hours sending out CQ for code practice and to keep the wrist flexible. As this is only practice the call sign is not given. CQ is chosen as it is the most commonly used code word and attracts the most attention.

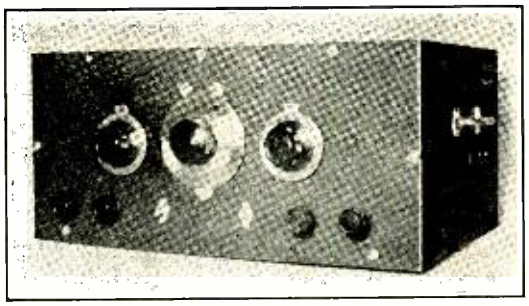
The station has made many applications for membership in scientific bodies and radio societies, but as they all insist that the yearly subscription fee must accompany the application for membership, it has aroused misgivings in CU2L's mind, as it would appear that they are more concerned with the subscription than the distinguished applicant. One society did kindly waive this rule, but after 18 months during which time they had written many rude letters they informed the writer, without rhyme or reason, that his name had been removed from the list of members by default. Their monthly magazine was very helpful, while it came.

The call sign of the station was adopted as being the most appropriate in courtesy to fellow hams, and means "see you too, later", as so many stations answer CU2L's CQ calls. The station's log shows that on all occasions when the station has signed off de "CU2L very 73", the other fellow has always

[Continued on Page 84]

A Receiver for the Dx Man

By R. M. Barnes,* W4EF



Here is a receiver that offers just about everything for the dx man, whether he be a phone bug or a c.w. hound. It has high sensitivity, selectivity, stability, and neat appearance. In spite of its fine performance and good looks it can be quite easily duplicated, and at a very reasonable price, considering the results obtained.

The receiver herein described was built with four main points in mind: First, minimum tube noise, so that very weak dx signals could be brought up to readability without having tube rush waking up everyone in the block. Second, selectivity, so that signal overlap could be cut down to a minimum in the present overcrowded bands, both c.w. and phone. Third, sensitivity, and fourth, ease of control, even on the 28 Mc. and 56 Mc. bands.

It is a fact that the major portion of the set or tube noise in a superheterodyne receiver is generated at the first detector in the form of conversion hiss. This is largely due to the overloading of the first detector with r.f. energy from the heterodyne signal oscillator (in other words, enforced electronic bombardment within the first detector tube). To prove this fact, open up the gain on your present super (antenna removed) and then remove the first detector tube from its socket. You will find that practically all the tube noise will be eliminated. However, we can hardly expect to receive weak dx signals with the first detector tube removed from its socket.

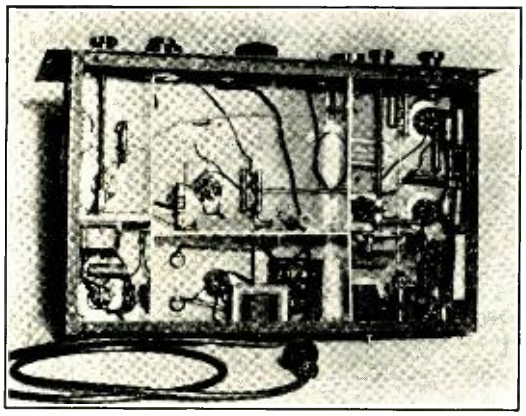
We have tried, during the past four years, every type of first detector circuit and every type of heterodyne coupling of the r.f. energy from the signal oscillator. For one reason or another each had to be discarded until we decided to try a little-known circuit that, for some strange reason, has never found use in commercial receivers. This circuit is known as the space charge detector circuit. This system gives ideal coupling conditions from the signal oscillator through the control grid and allows grid leak detection, which seems to be far superior on weak signals. It certainly does show its superiority on the 28 Mc. and 56 Mc. bands. This circuit is just as sensitive on those bands as it is on the lower frequency bands, as we proved last fall when we were able to work "J" stations on the 28 Mc. band weeks before conditions had improved enough for other east coast ten meter enthusiasts to realize that Asian signals were getting through to us. We were also able to receive west coast signals, both phone and c.w., R9 on 56 Mc. in the early spring of this year.

The selectivity problem is solved by using a regenerative pre-selector to cut down the overloading effect on the first detector of strong local signals, by using two stages of intermediate frequency amplification, and by incorporating a crystal filter for c.w. work. We tried using two stages of high gain intermediate frequency amplification, using iron core transformers, but the instability offset the small additional gain of the second iron core transformer. Therefore, we replaced one of the stages with an air core transformer, which still gives the additional selectivity of the two stages of i.f. yet is as stable as a single stage, if proper precautions are taken in shielding and in using leads as short as possible. The gain is so high in the i.f. amplifier that the desirable pentode second detector, which is far superior in receiving extremely weak signals to a triode using plate detection, may be biased so high that there is no blocking tendency even on extremely strong signals.

The selectivity of the i.f. amplifier is such that the side bands on phone signals are clipped to a point where any more clipping would affect intelligibility.

The crystal filter is used almost all the time on c.w., as there is no decrease in signal

*1026 Bellevue Dr. N.E., Atlanta, Ga.



Under-chassis View of the Receiver

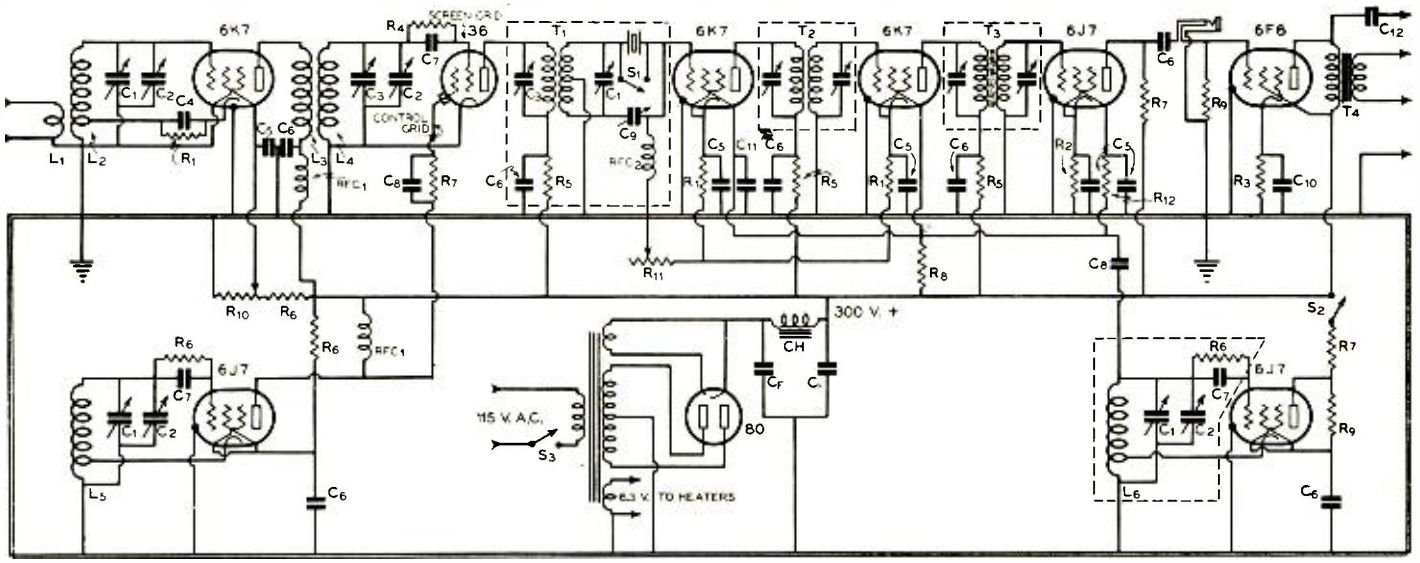
strength with the crystal in the series position with maximum selectivity setting. The i.f. and second detector circuits must be tuned "on the nose" with the frequency of the crystal to keep from losing any signal strength when the crystal is cut in. Perfect alignment of the i.f. transformers is accomplished by putting the crystal (in its holder) in an oscillator and tuning the i.f. stages according to the data found in the *Radio Handbook*. In order to get them tuned "on the nose" with the crystal, allow the tubes to settle to their normal operating temperature. Then, by using an output meter at the speaker terminals or a 0-1 ma. d.c. meter in the cathode circuit of the second detector, the circuits can be set exactly on the frequency of the crystal by aligning the circuits by meter deflection. If an output meter is used, the plate supply voltage to the oscillator must be r.a.c. without any filter, as the oscillator output must be modulated to operate the audio output meter properly.

The sensitivity problem is solved by using a regenerative pre-selector stage with plenty of coupling turns between the plate circuit of the pre-selector and the grid circuit of the first detector. To keep capacity coupling between stages to a minimum, the two windings are space wound and inter-wound. The sensitivity is such that the receiving antenna, used exclusively on all bands, is a piece of wire 5 feet long running vertically upward from the antenna post of the receiver. With the regeneration control set just under the point of oscillation, the preselector is so sensitive and sharp that the band-spreading condensers must be aligned perfectly on the main tuning dial. For this reason the control knob on the band setting condenser for the preselector was brought out to the front panel so that on extremely weak signals the preselector could be touched up a bit, if necessary. But if the coils are shifted around and the small band-spread condensers are aligned properly, there will be no need ever to touch the control knob on the pre-selector once the band is set. The main dial tracks perfectly on this receiver.

It may seem that too many controls are brought out to the front panel to call the receiver a single control job, but after many years of digging weak signals "out of the mud" we have found that the additional controls do help. Looking at the receiver from the front, the controls are: bottom row, left to right, pre-selector band setting condenser; pre-selector regeneration control; receiver on-off switch; beat oscillator on-off switch; beat oscillator beat note control; and i.f. gain control. Top row, left to right, signal heterodyne oscillator band-setting condenser; main band-spread tuning dial; and crystal filter selectivity control. If the band-spread condensers are perfectly aligned, the pre-selector band-setting control may be eliminated and the tiny midget condensers mounted inside the plug-in coils, as is done in the case of the first detector. But if the receiver is not well shielded, some difficulty may be encountered in monitoring the signals from the station's own transmitter without detuning either the pre-selector or the first detector band setting condensers during monitoring periods. With the shielding shown in the photos, perfect monitoring of both phone and c.w. of our own 400 watt transmitter, which is only four feet from the receiver, is accomplished by merely backing off the regeneration and i.f. gain controls to minimum.

There is really no need of a vernier scale dial on the selectivity control, but as it is essential to have some close reading dial on the signal oscillator band setting condenser to set the band when changing from one band to another, and since we used a vernier dial in this capacity, a dial of the same kind is used on the selectivity control so as to balance the receiver panel. Besides, the dials used are relatively inexpensive.

The wiring diagram and photos clearly show the construction of the receiver. Soldering lugs are bolted to the chassis under the tube socket lock bolts to insure short ground and by-pass connections, and these ground connections *must*



The General Wiring Diagram

C_1—100 μμfd. midget variable
C_2—20 μμfd. midget variable
C_3—"APC" type 100 μμfd. sub-midget
C_4—.002 μfd. mica
C_5—0.1 μfd. tubular
C_6—.01 μfd. tubular
C_7—100 μμfd. fixed mica
C_8—50 μμfd. fixed mica
C_9—35 μμfd. midget variable
C_{10}—8 μfd. electrolytic
C_{11}—0.5 μfd. paper
C_{12}—0.5 μfd., 600 w.v. paper
R_1—300 ohms, ½ watt
R_2—25,000 ohms, ½ watt
R_3—400 ohms, 1 watt
R_4—½ megohm, ½ watt
R_5—5000 ohms, 1 watt
R_6—50,000 ohms, ½ watt
R_7—100,000 ohms, 1 watt
R_8—20,000 ohms, 1 watt
R_9—250,000 ohms, 1 watt
R_{10}—50,000 ohm wire-wound pot.
R_{11}—25,000 ohm wire-wound pot.
T_1—465 kc. air-tuned i.f.t., center-tapped secondary
T_2—465 kc. air-tuned air core i.f.t.
T_3—Iron core, air-tuned i.f.t.
T_4—Pentode to voice coil output trans.
RFC_1—2.5 mh. pie-wound chokes
RFC_2—25 mh. receiving type choke
L_6—Sec. of c.t. i.f.t.

COIL DATA

	10 meters	20 meters	40 meters
Form Diameter	1¼"	1¼"	1½"
Preselector L_1 L_2	3 turns closewound 4 turns spaced to ⅝"	4 turns closewound 7 turns spaced to ¾"	5 turns closewound 12 turns spaced to 1"
Cathode tap from gnd. end	¾ turn	¾ turn	1 turn
1st detector L_3 L_4	Each 4 turns interwound to cover ⅝"	Each 7 turns interwound to cover ¾"	10 turns 12 turns (interwound to 1")
Oscillator L_5	4 turns spaced to ⅝"	7 turns spaced to ¾"	12 turns spaced to 1"
Cathode tap from gnd. end	1½ turns	2 turns	3 turns

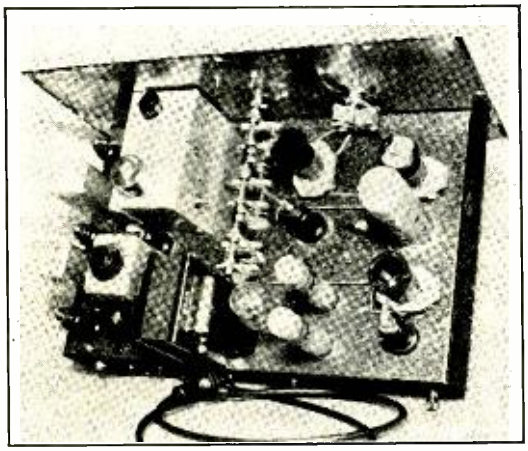
The 5 meter coils are somewhat critical. Specifications may be had from the author by sending a stamped, self-addressed envelope.

be good. Leave a little of the burr, caused by the drill in drilling the holes, wherever a soldering lug is to be bolted down. This insures a good ground to the chassis when the bolt is tightened down on the lug. The use of small brackets in mounting the by-pass condensers and resistors not only makes a neat mechanical job but insures against shorts wherever there are resistors and condensers crowded into a small space. The sectional shielding shown under the chassis is cut from strips of aluminum a half inch wider than the depth of the chassis. The extra half inch is bent under and holes are drilled, by which the sections are mounted to the chassis. It seemed probable that shielding would be needed between the pre-selector and the first detector above deck, to keep down any tendency toward interlocking, but after lining up the receiver upon completion we found that there was absolutely no interlocking effect. However, a different mechanical layout from the one shown might result in that trouble and require a small sheet of aluminum between the stages above deck.

After trying several methods of coupling the beat note oscillator to the second detector, we found that the one shown gave much better results as regards ratio of hiss to signal, both on weak and strong signals.

Provision for plugging in headphones was made in order that the neighbors would not be kept awake in the small hours—to say nothing of our own family! However, if you have no scruples against creating a disturbance in your own neighborhood, the headphone connection may be eliminated, as any signal that can be copied on headphones can be read perfectly on the speaker.

A study of the photos will show that the plate lead from the first detector to the crystal filter unit is rather long. We realize that, being shielded, the long lead probably loses a bit of the 465 kc. r.f. energy, but there is still plenty left to do the job (to excite properly the i.f.



Looking Down into the "Works"

amplifier so that it may amplify the 465 kc. conversion output of the high frequency front end).

If the coil data given with the wiring diagram is followed closely the bands will hit with the band setting condensers about 75% of full capacity. As the author never has occasion to use the 1.75 Mc. or the 3.5 Mc. bands, no coils have been wound for those bands. However, for those who desire to use those bands, or any of the short wave broadcast bands, coils can easily be designed for the band or bands desired. As a matter of fact, the 20 meter coils will hit the 19 meter and the 16 meter broadcast bands, and the 40 meter coils will hit the 32 meter and the 25 meter bands if less capacity is used on the band setting condensers.

In aligning the high frequency end of the receiver for the first time it will probably take a local high frequency oscillator, such as the station transmitter, to spot the bands correctly on the band setting condenser. The proper procedure is to set the pre-selector and the first detector band setting condensers about half scale and then back off the regeneration and i.f. gain controls. Then set the main tuning dial at about 50 and, with the transmitter low power stages turned on, slowly tune the signal oscillator band setting condenser throughout its full scale, noting the readings wherever a signal is heard. There will be two points where the signal will be much louder than the others. These two spots are the correct harmonics from the transmitter on the band being set. Either one of the two settings may be used, but the high frequency setting seems to work better on this receiver, simply because of the fact that it gives perfect tracking on the main tuning dial. However, with other coils or with different wiring capacities, the low frequency setting might work best, which makes it advisable to try both settings for best results. After the oscillator is set it only remains to set the pre-selector and first detector band setting condensers for maximum signal strength, and the band desired will be on the main tuning dial. After lining up the main tuning dial for as near perfect tracking as possible, the oscillator, pre-selector, and first detector can be shifted slightly to put the high frequency edge of the band near the high scale reading on the main tuning control. If this scheme is followed on all the bands it will be easy to keep an accurate calibration of the various bands. This is very helpful in spotting dx signals whose frequencies are known.

For those who wish to use 2.5 volt tubes it may be said that there will be very little difference in results, as this receiver is an exact duplicate of one built before it using 2.5 volt tubes, with the exception that the three high frequency stages were not ganged on the main tuning dial and the power supply was not mounted on the receiver chassis.

The following tubes replace the 6.3 volt tubes used in this model: 58 for 6K7, 24A for 36, 57 for 6J7, and 2A5 for 6F6.

If plenty of care is used in the construction of your receiver, you will have the satisfaction of knowing that you can hear anything that is putting any sort of a signal into your location. And that's what it takes to work those rare ones.

◆

When Measuring Crystal Current

When using a thermogalvanometer to measure crystal current, put the meter in the *ground* lead. Otherwise the meter may introduce extra feedback and higher crystal current than is present with the meter removed from the circuit. If you are using a push-pull oscillator, your guess is as good as ours.

Incidentally, the leads to the meter should be short and well-separated; otherwise the shunt capacity will result in a false (low) reading.

Using a pair of twisted leads connected to a plug in order to measure r.f. crystal current is O-U-T.

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In the January issue there appeared a list of calls heard at Eastbourne, England, by G5PL. Mr. Philpot, G5PL, denies having submitted such a list; he has not been in Eastbourne since 1916!

Flood QRR

By JOHN HUNTOON, W9KJY

Holding true to their long-standing and meritorious record of public service, the radio amateurs of the nation stepped into place and provided the necessary communication wherever ordinary commercial routes had been disrupted by the greatest flood disaster the Ohio River and adjacent districts have ever seen.

Telephone, telegraph, and power wires went down; power for broadcast radio stations failed; railroad tracks were swept away; bridges and roads were washed away; airports were flooded, boats were scarce, and the danger of navigation great; the only means of communication with many towns and cities was via amateur radio!

The "cogs in a gear" and "it takes pennies to make dollars" axioms are never more true than when applied to amateur activity during emergencies—the spirit of cooperation prevails, and each man's part, however small it is (or appears to be) is essential to the success of the group. It is not feasible to attempt to relate each man's individual part, because in an untold number of cases they will never be known, and we can only "hit the high spots" as we know them.

Credit is due to the ham who stood by, spending hours doing nothing but listening, occasionally breaking in to tell a control station that some new station had appeared on the air, arranging contact between the two and thereby providing another effective link or "feeler" into the disaster area. Or perhaps they would silence an interfering station. There were thousands of such instances which would not have been possible had the monitoring ability of just the few actual operating stations been the sole means of knowing new developments as they occurred.

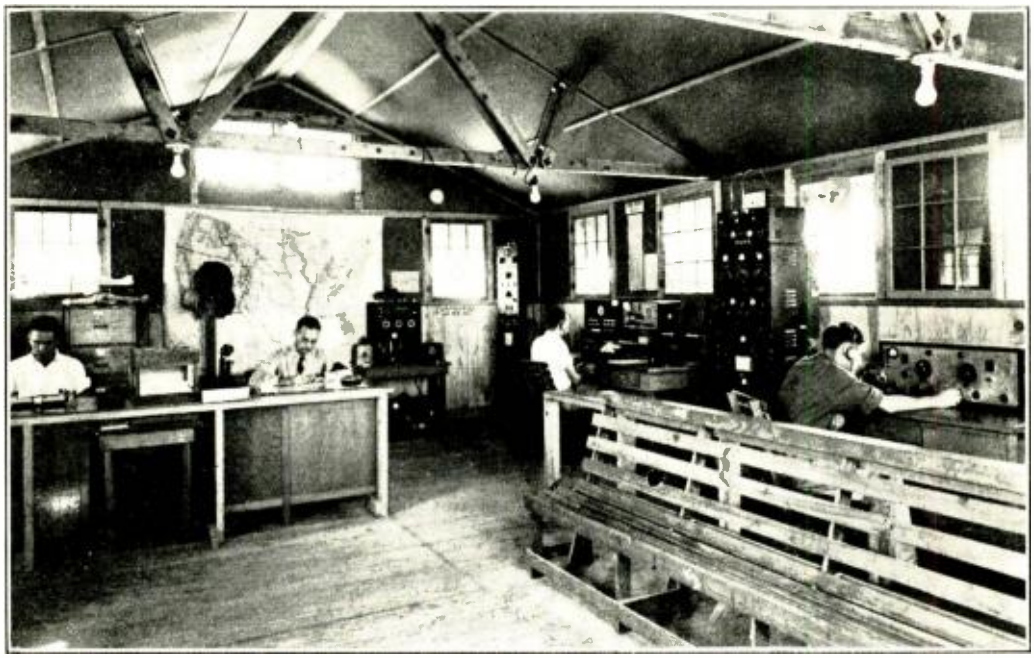
The phone lads, typical of their work in past disasters, were slow in organizing their stations into any sort of a system, and the first day or so of flood work went past with the majority of conversation "how does my rig sound, o.m.?" But after they read in the papers about the flood, they really did a nice job as a group. A goodly percentage of the most active phone stations were so because their employers (such as NBC, CBS, various individual radio stations, military organizations, colleges, and other similar groups) relieved them of regular duties so that they might be active the majority of the time.

The Fifth Corps Area, A.A.R.S., did a peach of a job. Long before the actual breach in commercial communication occurred, Windy, W8ZG/WLH, had his boys on 3497.5, keeping schedules every hour or so, with at least one station active at all times. At regular intervals, the various stations in the net would report the river height, temperature, weather predictions, and general conditions in their respective locations, Huntington, Pittsburgh, Cincinnati, Louisville, etc., and they handled supplementary communications for the crowded (or nonexistent) commercial mains, such as Red Cross, military, etc., traffic. W8UW was using an army portable transmitter. W8BBH, W8KWA, W9EDQ, W8ISK were other members of this net.

The Kentucky net, like the A.A.R.S., was prepared, and the 3810 kc. channel was alive with emergency traffic. FQQ, AUH, ELL, and others in Louisville, THS in Fort Knox, AZY in the capitol, Frankfort, covered the vital points, while EDQ, CDA, BOF, and others rounded things out. AUH and ELL (phone) finally losr their power, and FQQ, with batteries, kept Louisville represented. AZY handled traffic for the Governor, regarding requests from stricken cities (such as Paducah) calling for supplies, food, etc. W8ZG skipped back and forth between the A.A.R.S. and KYN. W9FS, across the river from Cincinnati, had a phone line into that city, and handled much important traffic, with that part of the city still served by local phone communication. Many power companies and similar groups routed their messages via amateur radio.

Many outside organizations, such as the American Legion, C.C.C. camps, etc., offered their services, supplies, etc., to the stricken area. They were either advised not to come, account impossibility of passage, or were guided into their destination by ham radio, after being furnished the best route. W9THS handled traffic for the army post, Fort Knox, and helped arrange for several detachments of trucks to the stricken area.

Many varied routes were used on both phone and c.w. to get a message to its destination. In one, traffic was handled to W8YX (U. of



WUGA, net control station of district "E", C.C.C. radio net, 4130 kc. After 5:30 p.m. the equipment is operated in the 80 meter phone and c.w. amateur bands under the call W5FSI. The equipment is all home-made except the Lafayette 100-watt transmitter and Super Sky-Rider and ACR-175 receivers. The main transmitter, in the foreground, is a 1 kw. c.w. and 400-watt phone job. Portable gear and emergency power generators insure uninterrupted communication in times of emergency. Such stations as these are invaluable in times of disaster, handling traffic with a dispatch of which the Army and Navy might well be proud.

Cincinnati) who phoned WLW (on emergency power) who broadcast the message to Louisville listeners. Much inter-net and inter-service work was done. Airlines stations, police stations, hams, commercial b.c. and c.w. stations, worked each other on various frequencies. Military and reserve groups assigned themselves various calls, such as FA, LC9X, etc., for operation in ham bands. The Naval Reserve route was the only one into Evansville for a long period of time.

W8YX had connection with power mains the majority of the time; the power company was arranging to install a special line if necessary. And down in the basement, a reassuring Diesel engine with generator was ready at a moment's notice. Paducah called on Chicago for typhoid vaccine, and the message went via W9CHL, W9HQD (Harrisburg) and W9WC, Chicago; a few minutes later, the Commanding General of the Sixth Corps Area was making arrangements to send an amphibian with the necessary medicine. W9UKD, Owensboro, Ky., W9LRH of Frankfort, Ind., W9NKD of Campbellsburg, Ky., W9SDP, Greenwood, Ind., W9CHN, Shelbyville, Ky., W9AEN, Maysville, Ky., were among the many participating in handling communications for their respective territories.

A request by the F.C.C. to all amateurs to lessen interference and help expedite handling of emergency traffic was misconstrued, but proved a highly effective weapon in convincing the more stubborn operators that they should postpone their ragchewing.

W9NLP and W9ETI put in many hours of operation in Chicago. W4CRE represented Memphis. W5EIP was Blytheville's (Ark.) only communication. W8DQM kept the gang informed of Pittsburgh flood conditions. WLM of the A.A.R.S. handled traffic for the Red Cross headquarters, arranging for supplies, food, medicine, etc., for the needy. Due to premium on time being so great, the benefits of personal traffic so small in comparison with Red Cross, military, etc., communications, the available channels so scarce for handling the multitude of the latter class of traffic, and the

hardship on both operators and equipment (when battery operated) it was not felt desirable to handle personal traffic when doing so would risk the possibility of severance of communication which might be more urgently needed later. At that time, it was a virtual impossibility to deliver personal traffic, excepting by broadcasts from WHAS, WSM, etc., because nearly all of the residents of the various areas had moved temporarily to other localities.

Phone operation, sometimes unfortunately, is the mouthpiece by which the general public comes to know and form an opinion of amateur radio as a whole. On the train going to work the mornings after and returning at night, and during lunch hour, when it is possible to overhear a large portion of public reaction to the flood (a natural topic of conversation at this time) the majority of comment and the general attitude when our hobby was mentioned were appreciative and commendatory. In the course of conversation with his neighbor about the flood as narrated on the front page of his morning paper, Mr. Jones would say, "Y'know, Tom, I heard a flock of these amateur guys on my all-band set last night; it was on the eighty-meter frequency—the green dial—between 78 and 85 on the dial. You should've heard them sending emergency messages. I heard lots of stations right in the flood area, Cincinnati, Louisville, etc. Sometimes when two stations close together on the dial were talking with each other, I could hear both sides of the conversation. One fellow from Louisville sent a message from the authorities to a Chicago newspaper, requesting food, clothing, medicine, etc., the Chicago amateur phoned it to the paper, and a few minutes later, I heard him handle the answer, stating the supplies would soon be on the way. I read about it in the paper this morning, too."

Throughout a long period of listening, one thing has impressed me personally: the ham's sense of humor. Those fellows down there sitting at their transmitters, with little sleep, no doubt cold and hungry, were never too busy nor discouraged to add as a parting transmission, "Careful you don't drown", or, "Did you wear your rubbers, o.m.?" Never objectionable nor disrespectful, these simple remarks provided a relaxation from the strain, whether consciously or not.

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A headline in a Washington, D.C., paper mentions the death of a *Mrs. Ham,* RFC employee.

G5BY Gets Across on 5 Meters

On December 27, 1936, at 15:10 G.m.t., Hilton L. O'Hefferman pounded out a "test de G5BY" on 56,208 kc. i.c.w. 3500 miles away, across the blue Atlantic, W2HXD was writing in his log: "15:10 G.m.t.—test de G5BY—56.2 Mc.—1000 cycle tone modulation."

This was no surprise to O'Hefferman. In fact, he would have been surprised had his 56 Mc. signals not eventually got across "the pond". It was just a matter of time—the conditions would be just right sooner or later.

The reason for this assurance was careful planning and attention to every detail. G5BY uses a pair of crystal controlled 35-T's on 56 Mc. with from 100 to 250 watts input. The antenna is a rhombic affair, "aimed" at a point between Boston and New York. The diamond is 33 feet above ground, and fed with a 100 foot tuned feeder.

The 56 Mc. transmitter is shown on the opposite page (top). From left to right we see a type 53 tube acting as a 3.5 Mc. crystal oscillator and frequency quadrupler to 14 Mc.; next a Mullard PENA-4 (audio type pentode) doubling to 56 Mc., driving two Mullard PM24D's (25 watt audio pentodes) in push-pull as a 56 Mc. buffer stage; then the two Eimac 35-T's in push-pull feeding the diamond. The transmitter is remote controlled.

For many years the signals of G5BY have been well known throughout the world to amateurs on the lower frequency bands. In 1929 this station won the A.R.R.L. award for the world's best amateur radio station. This trophy may be seen in the lower photo in the window just in back of the operating table. To the left may be seen the 500 watt modulator and control panel for all transmitters. On the table, left to right, are the monitor, frequency meter, 56 Mc. receiver, 1.7 to 14 Mc. receiver, and 28 Mc. receiver.

The transmitter on the right is the regular 3.5- 7- and 14-Mc. crystal controlled transmitter, which is either used on c.w. or plate modulated for phone. Above this transmitter is the first British phone w.a.c. certificate.

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Having just turned the ripe age of ten, Harold Baker of New York is the proud possessor of a radiotelephone operator license.

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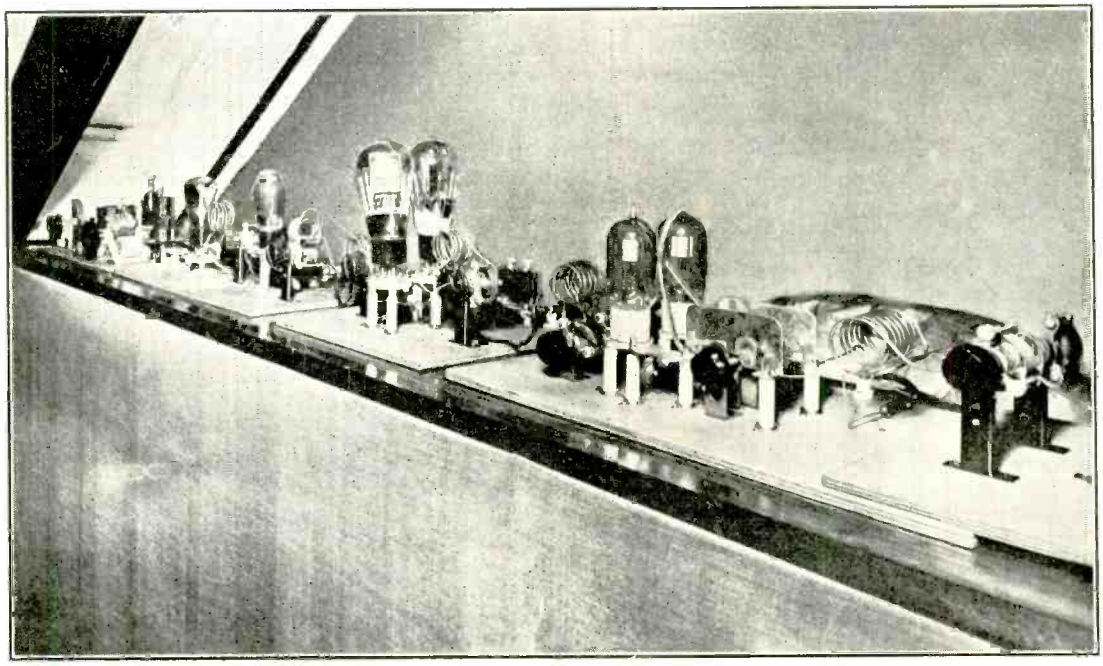
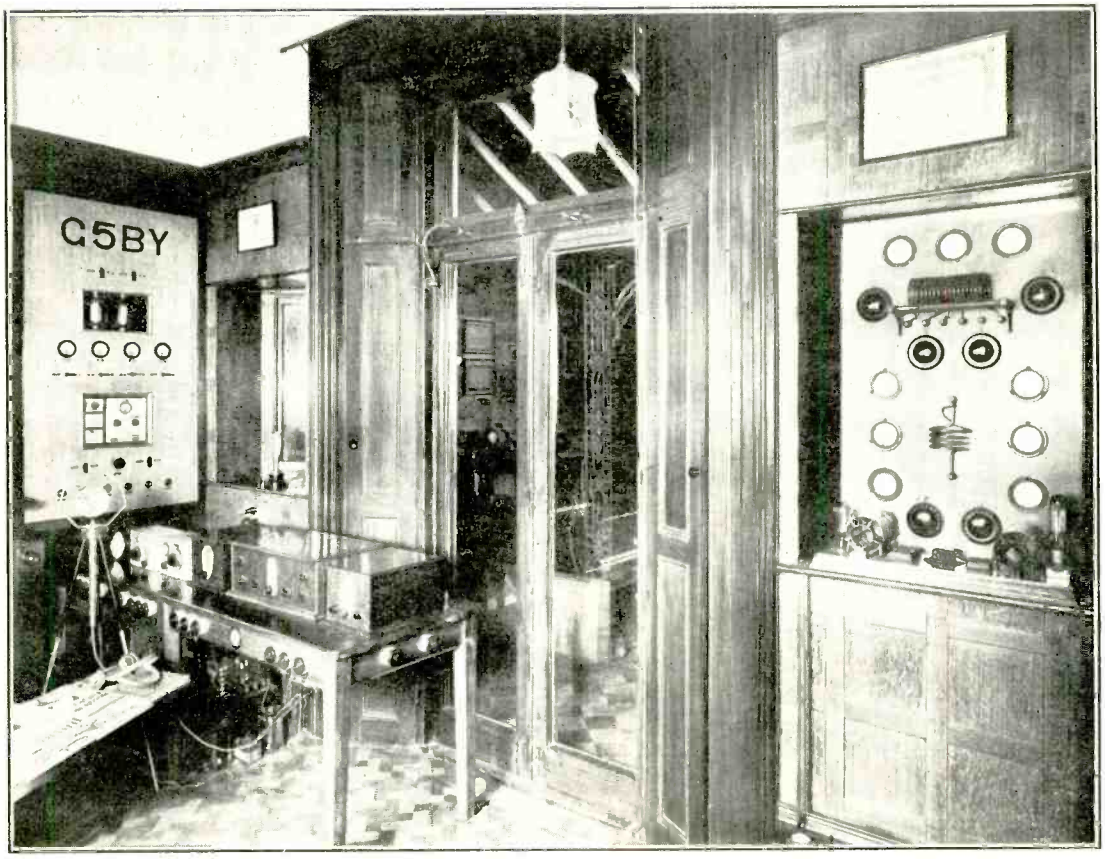
Said the buffer to the amplifier, "Don't excite yourself, old timer."





28 and 56 Megacycle Activity

By E. H. CONKLIN, W9FM

56 Mc. Intercontinent Dx

Via G6DH and G2YL we learn that CN8MQ has heard a 56 Mc. harmonic of LY1KK, and the five meter transmissions of G5CM—the latter fading from R3 to R0. He has also heard harmonics of PA and OUN, as well as an unidentified signal calling "CQ 56". F8OL heard CN8MQ on December 24 when on 56 Mc. G2HG heard CN8MQ on December 27.

It certainly looks like dx on "five" will be an accomplished fact if enough stations work on the problem for the next two years or so. North-South work over long distances seems most possible, suggesting that if some Central and South Americans devote time to the band, they will probably be heard by W's. We urge automatically-keyed transmission during daylight and evening hours, whether or not any attention is given to receiving. Receivers capable of getting c.w. should certainly be used—if only to locate weak signals by their carriers.

VK2LZ is reported to be using a superheterodyne on 56 Mc., with push-pull 800's in his transmitter putting out almost as much as from his 14 Mc. rig. Using an 80 meter antenna on "five"!

Horse Heard on 56 Mc.!

During a field day, VK3KQ claimed to be the first to hear a horse. When the laughter died down, he pointed out that there were static discharges from the hoofs, and the clicks in the receiver corresponded with the action of a horse trotting along the track at the foot of the hill. After all, gasoline trucks drag chains to discharge the static.

North Wales, Pa., Project

J. J. Michaels of W3FAR points out that there is a licensed amateur for each 400 people in North Wales, and most have commercial tickets. Over the cracker barrel they decided to go after the first two-way five meter contact with Europe. They approached Smitty, W3DDT, for the use of his corn field on which to point a beam at London, but couldn't sell him. He said, "I am of the firm belief that you should learn to stand up on your feet before you start to walk." They did sell him on an attempt to New York and Boston, and if successful, then to Europe.

The early experimenters gave up short waves because of rapid attenuation beyond a few dozen miles. It was some time before the "skip" phenomenon was discovered, showing that if the early experimenters had started at a long distance rather than at gradually lengthening distances, the value of the lower wavelengths—below 200 meters—would have been discovered earlier.

It is the writer's contention that 100 mile dx on the ultra-high frequencies does not involve a refraction from the upper layers, and is approximately a low-atmosphere transmission. On the other hand the numerous trans-continental and inter-continental reports of 56 Mc. signals involve "short skip" just in the way that 300-400 mile signals are sometimes heard on 28 Mc., both involving a silent zone between. Transmissions on 56 Mc. probably should take place at rather low angles—perhaps at 5° to 10°—but simply because power at higher angles may not return to earth. Very high antennas and high-gain beams have not proven as necessary for five meter work beyond 600 miles or so, while they have been practically a necessity for working from 50 to 200 miles. We urge separation of the two ideas—continuous dx to 100 miles or more, and dx beyond a silent skip zone. G2HG and others are very anxious to arrange schedules with W stations. They have already been successful in hearing both code and phone signals from North America, Africa, Europe, and Asia!

Code Tests for U.h.f. Licenses?

Now and then someone suggests making licenses easier for five meters. Because of the large number of stations using the band in congested areas and the necessity of cleaning it up, we propose an alternative—that if the provisions be relaxed, it be done on the 2½ meter band where more stations are needed for development work and there is not now a QRM problem.

28 Megacycles

Len Holmes, W9JGS, called us the other day to point out that it is now hard to locate a W code station on the ten meter band. We feel that the frequencies available on this band are such that it is the best band for phones, and don't feel that phone should be discouraged. We need to populate the 29-30 Mc. range and find out if it acts much differently. Is there any objection to a proposal whereby 28.0 to 28.3 Mc. be reserved for code, while the unrestricted portion for phone or code use be extended to 30 Mc.? Further, should the requirement for stabilized transmitters be made "below 29 Mc." rather than "below 30 Mc." to help populate the 29-30 Mc. range?

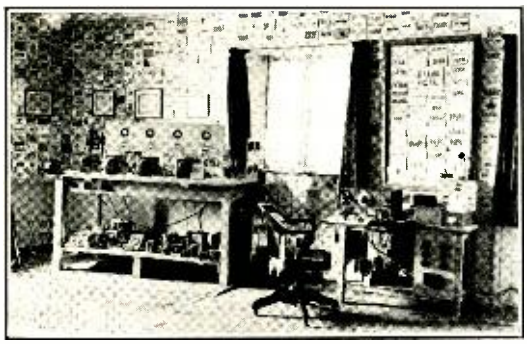
Permit us to repeat our request for frequencies of dx stations. When reporting, you might mention whether the frequencies are approximate as from your estimated frequency, or exact as given by the station over the air or by card. You might mention your own frequency also.

Conditions

There has been some shortening of the hours during which the 28 Mc. band has been open, but this may be the usual mid-winter slump. Things are expected to open up in February and March. Get ready for the J's then, too, in late afternoon and early evening.

Station Reports

G2YL: G6DH was awarded Powditch 28 Mc. transmitting trophy. December conditions, though slightly inferior to November, were more reliable than a year ago, there being no really poor day. Summer weather probably accounted for decrease in VK-ZL signals, though a number were worked. VK2GU said Finnish stations are louder than most Europeans. Asiatic activity lower, though JNJ comes through most mornings; J2CE and VS6AH were only amateurs reported. Apart from XE1AY and an occasional LU, Central and South Americans appear to have deserted the band, but FM8AA and HI7G were heard for first time. The Africans came through but generally weaker. ZE1JJ on December 2 reported conditions poor on all bands. North Americans were audible daily from about 13.00 G.m.t. with all districts except W7 and VE5 heard consistently. Police transmitters also loud, including



G2YL, the Famous Station of Miss Nelly Corry, Surrey, England

W2XLM on 9 meters. YL2BB reports that Latvian stations are at present licensed only for this band but hope to be allowed to work on 14 Mc. soon.

CM2AD: Conditions a little poor lately—as reported January 12. Regenerative receiver troubled with line voltage fluctuations. (Use a B battery on detector screen to eliminate this trouble—W9FM.) Transmitter on 28,652 bad for working Europe.

W3FAR: In early January, European signals excellent for few hours, beginning around 8 a.m., sometimes lasting till noon. U.S.A. usually good beyond Colorado and Texas but on the 3d the skip was shorter and Minnesota, Wisconsin, Michigan stations were heard. Band usually closes between 6 and 7:30 p.m. Locals working short haul during late evening—good band for this purpose. During second week few dx stations heard and bad W conditions also. On the morning of the twelfth, with no signals audible, there was a high-pitched background noise. Europeans good again by the 17th. K6MVV was heard on 3d and 16th. Africa on 3d and 17th. May try 56 Mc. dx.

Brokates: (Reports from Port Clinton, Ohio [call?], for month beginning December 22 when received new HRO.) 28 Mc. open every day I was on except January 14 (W3FAR heard and worked only D3DSC, and a few W's in evening, that day). In 18 days had 62 dx contacts using RK23 triret, RK20 doubler, pair 801's final with 100 watts. Band seldom open more than two hours for Europe and Africa, averaging 9-9:30 to 11-11:30 a.m., E.s.t. Except for the 10th when dx conditions were excellent (W3FAR reported few Europeans, loud W's that day), conditions were only fair to very poor, nearly every European contacted reporting the same thing. Nothing heard from Asia. South America or Australia. More German QSO's were had than any other country.

VK3GP: Pinch-hitting for VK3JJ in the column in "Amateur Radio" reported some interesting things. He mentions the "long way around" QSO's of VK3YP in October with W8CRA, W4BPP and others, in the morning, U.S.A. time. A peculiarity has been noticed on signals getting through after 10 p.m. from Europe—a heavy back wave or echo. This might be the old "both-way around" echo that used to trouble commercials.

If somebody has to do some "pinch-hitting" for W9FM in February or March, it is because the W9FM-W9SLG-W9ZA combination went down to Mexico. So if you hear a new fist at XE2N or somewhere, don't be too surprised.

56 Mc. Dx Heard by G2HG

We have a letter dated January 25 from E. H. Swain, G2HG, saying the great event since his last communication is the reception of G2BY at W2HXD at 15.10 G.m.t. on December 27 when G5BY was keying his tone-modulated signal on 56.208 kc. The only other bit of dx news was the reception of CN8MQ's 28 Mc. harmonic on five meters, at G2HG. However, Swain has heard plenty of European signals from long distances, even though they were harmonics from lower frequency transmitters. Here is the list:

November	14	SP1LP	at 1300 G.m.t.
November	15	OH3OI	1225
December	3	LY1KK	1430
December	27	PA0KW	0930
December	27	PA0UN	1030
January	3	PA0ZB	1030
January	3	D4KPJ	
January	3	D4VDV	1230

Swain reports that conditions at CN8MQ seem much better than in England. He also mentions that OH7ND is hunting for 56 Mc. dx Sunday mornings.

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.

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Radio waves one centimeter in length are being generated by means of "sub-acorn" vacuum tubes at the California Institute of Technology. The grid of one of the tubes is smaller than the eye of a house fly!

Waves of about the same length have been generated by using spark oscillators or magnetrons, but up to this time, never with vacuum tubes. The power generated by these tiny three-element tubes is very small, but is nevertheless useful for experimentation in the fields of biology, medicine, and chemistry.

◆

In the January issue, we mentioned W9HP as the highest-powered call in the book. The next month, W9COW corrected us with the note that W9KW is several horsepower higher in power. Now, W9WAM takes exception, since, as he says, W6CKW outshines them all. Says he, "You never can tell about these California kilowatts!"

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The English telephone people permit their subscribers to select any number that appeals to them, provided the number is not already assigned. Requests for special ham calls became such a nuisance that our Radio Commission had to adopt a negative policy in the matter several years ago.

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Extract from a letter received by the dx editor: "On eighty meters I have worked stations all over the United States and Canada, and parts of Tennessee and Missouri."

With the Editors

[*Continued from Page 9*]

pompously authoritative to firmly courteous (W1ZK please take bow on the latter). As darkness grew the 8th and 9th district stations were increasingly heard complaining of the dull evening. Some were now heard begging for "personals" (in or out).

Some major message traffic continued to appear. Lest one think of this as purely c.w. business, a typical piece of phone relaying shall be related here. A 26 word message regarding a large emergency supply went from West Liberty, Iowa, to Claremont, N.H., thence to Elmer, N.J., addressed to a Philadelphia firm. A Philadelphia operator heard it on the original transmission, "hopped" it to another Philadelphia station nearer to the addressee, lined up a more direct route with a couple of space "copying" stations, and went to bed, showing that radio amateurs do sleep.

Meantime the stations in the flood area (broadcast, amateur, and governmental) had kept up their local and near-local work. The outbound "personals" were still scarce—and Saturday was over.

Sunday the 31st

On Sunday forenoon the bands sounded like a rather dull weekday forenoon. Even at 1:00 p.m. there was little stirring. Even the 160 meter voice "chaos band" seemed to be occupied by a tester and a couple of puzzled CQ callers. The east seemed to be contributing mainly a rather good grade of silence. For the coast this was doubtful but it helped as much as anything could have. At about this time power was uncertain or missing in parts of the flood area, compelling amateurs there to depend to some extent upon low-power transmitters. Their difficulties were sufficient without a burden of "personals". In fact these personals which did trickle into the flood area now seemed to be received without pleasure, even by stations which had asked for them when the facilities still existed. Some inbound personals were delivered (!) by broadcast from WHAS because nobody knew where the refugees were. What a gosh-awful mess there would have been if the personal-message "traffic" *had* equalled the hasty wishes.

So Sunday afternoon wagged along. At sunset there arose something resembling the usual early-evening chatter, promptly opposed by further broadcasting of orders. This time some of the monitors replaced "QST" with the unholy phrase, "calling a broadcast"!! Beat that. Other funny things were heard. For instance, we learned that you can cure a cold with a tumbler of rum and one of hot water. The method is to go to bed after drinking—the hot water. The rum is to be poured into the sink.

But there was nothing funny about the statement of the F.C.C.'s chairman in his broadcast speech the same Sunday evening. Of radio amateurs he said:

"They have greatly aided in the present emergency by providing communication with isolated points which could not be reached in any other way."

Was that true? Most assuredly it was; nobody questions it.

Were worth-while major messages handled? Yes, by hundreds.

And, though the radio channels never ran bank-full of "personals", a great number of such messages was actually put through by c.w. and voice, all in due course.

It is a good record. Let it stand.

—*R.S.K.*

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Gratitude

We don't know just whose fault it is, but the public in general still is grossly ignorant as to the different phases of amateur radio. The average man-in-the-street has only a vague idea as to what a radio amateur is and still less of an idea as to his activities and privileges.

An editorial in the Phoenix, Arizona, *Republic* is a typical example of just how unenlightened even newspaper men can be in regards to amateur operation. This masterpiece of misinformation suggests that amateur radio stations might readily have been the reason for the failure of the pilot of the ill-fated W.A.E. transport to locate the "localizer" beam at Burbank, Calif., recently.

"For one thing," states the article, "there are far too many amateur stations broadcasting. This is proven by the fact that a plea has been made for such stations to cease operation during the flood crises in the Ohio and Mississippi valleys."

The average reader will interpret the latter statement to mean that *all* amateur stations were ordered to cease operating so that *other* services in the flood area would not be interfered with. Does the following order from the F.C.C., in effect for approximately 10 days, look that way to you?

FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.
January 26, 1937.
PRESS RELEASE

TO ALL AMATEUR LICENSEES:

The Federal Communications Commission has been advised that the only contact with many flooded areas is by amateur radio, and since it is of vital importance that communications with flooded areas be handled expeditiously,

IT IS ORDERED that no transmissions except those relating to relief work or other emergencies be made within any of the authorized amateur bands below 4000 kilocycles until the Commission determines that the present emergency no longer exists.

BY THE COMMISSION,
JOHN B. REYNOLDS.
Acting Secretary.

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QRR and the F.C.C.

By RUFUS P. TURNER, W1AY

The recent flood emergency, one of the most acute of the several disasters felt by the nation in late years, made merciless demands upon the country's various communications systems. Every demand and every opportunity for service was met by immediate, unstinted action. Certain of the amateur bands were cleared of all communications except flood traffic, by special order from the F.C.C., and they remained so until the hazard had passed. Not until the regular communication channels were revitalized did amateur radio resume its more leisurely course. Throughout the hectic period, when destruction ran amuck grimly over a large sector, amateur stations situated strategically in the inundated area were given absolute priority over all the others relaying flood messages. In one case, that of W5BFH at Greenville, Miss., a ham station was authorized to use *any* frequency not allocated for government service!

Quite unlike the situation in previous catastrophes, when often the radio amateur fought alone, other radio services, notably the broadcast outfits, this time pooled their efforts with him more than ever before. Several broadcast stations in or near the stricken zone ran uninterrupted schedules for days at a stretch. For a fortnight unprecedented actions were the custom of the day. The F.C.C. at Washington maintained a twenty-four hour watch for several days in order to grant special authorizations without delay and red tape to broadcast stations which might not otherwise handle flood traffic under their licenses. Special land wires were kept open into Washington for the purpose.

NBC was granted permission to rebroadcast information received from amateur stations in the devastated section. Similar permission was granted WREC at Memphis. A large number of broadcasters were given special authorizations to carry on emergency communications. WOKB at Chicago was permitted to use police and amateur frequencies, and the use of amateur phone equipment for relay broadcast purposes at KFVS, Cape Girardeau, Mo., was approved.

At this writing, with the hazard abating, the F.C.C. has sent into the stricken community two of its assistant chief engineers, A. D. Ring and A. W. Cruse, to study each experience which might be beneficial in coordinating efforts in future emergencies. The commission plans a permanent organization: a communication unit or network of units capable of swinging into immediate action when disaster strikes in any part of the country. The lessons learned by America's communication reserve in this most recent emergency will thus influence in a large degree the plans for future protection.

◆

Phony Definitions

Xylophone: Voice xmitter run by a married lady ham.

Bluffer stage: The dummy tube (with only the filament in the circuit) used by certain manufacturers to make a five-tube out of a four-tube midget.

Seance: The visiting b.c.l.'s term for what we call a QSO.

◆

Otto B. Shott, local pest, is quite confused. He read a sign on a "steak house" the other day advertising "Certified K-C Corn Fed". Otto says he didn't know that it was kilocycles that are corn fed; he thought all the time that it was kilowatts that were supposed to be corn fed.

◆

Master Sgt. Stanley R. Morgan, though ravaged by pneumonia himself, sent out an emergency call from his ham station in Alaska for flu serum to check an epidemic in his community. Morgan, it will be remembered, recovered the bodies of Will Rogers and Wiley Post.

◆

Karl Detzer has a pip of a piece of fiction on radio hams in the January *American* magazine titled, "Local Static". If Detzer is not a ham, his story belies much listening-in on ham phone QSO's.

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.

ON4AU First to W.A.Z.

Some time ago we heard that ON4AU had worked all of the 40 zones, and just the other day we received complete confirmation from him on all 40. We want to congratulate Mr. Mahieu for this great achievement, as being the first ham in the world to contact the 40 zones and have them confirmed to our satisfaction. This department thought it would be a good idea to present to you the list of stations, since ON4AU is the first to receive the honor.

Stations Worked by ON4AU for W.A.Z.

Zone	
1	K7BC, VE5KZ
2	W10XFP, Natl. Geo. Inst., 77 N. by 77 W. WNP, along Baffin and Labrador Coast
3	VE5HC, and many others
4	Many
5	Many
6	X1AA (now XE1AA) and many others
7	VP4AA, and many others
8	NJ2PZ, and others including VP2, 5, 6, 7 and Antillas
9	PZ1PA and others
10	OA4Z and others
11	SP2A, and others such as PY and ZP
12	CE7AA and others
13	LU1EP and others
14	CT1, 2, EA, HB and many others
15	Many
16	Many
17	U9MI and other U8 and U9
18	U9AY and old RAO
19	AS-RAO3 (University of Vladivostock)
20	Many
21	AQ1LM and other Irakians
22	VU2LJ and others
23	AC4AA QSO on July 14, 1928
24	MX2B and AC9AA (Macao)
25	J8CD and J8CF
26	HS1PJ, AF1B (Indo-China)
27	OM2MA and others
28	SS2SE (Singapore in 1926) and many others
29	VK6FL and others
30	Hundreds
31	Many K6, including K6COG on fone
32	Dozens of ZL's
33	Many
34	Many SU's and Capt. Filipini of Tripoliin Libya on March 14, 1927
35	Many
36	Many, and including FQPM in Cameroons
37	Many, and almost every country in this Zone
38	Dozens
39	Several FB and VQ8
40	OX7ZL

This is another 'first' that ON4AU can add to his already long list, and while I think of it, you might be interested in reviewing his other accomplishments.

ON4AU was the first station in Europe to contact Nigeria, Gold Coast, Guam, Bolivia, and Hawaii (Hawaii on fone), and on 10 meters he was the first in Europe to work South America, Oceania (VK4 and VK6).

ON4AU was the first in Belgium to hook up with Indo-China, Japan, Peru, and Thibet, and on 10 meters the first to work U.S.A. and many other countries.

The above paragraphs will give an idea what stations can be worked in their respective zones. It is true that a lot of them worked by ON4AU at one time or another have folded up; but don't give up, as new ones are always appearing and sooner or later you will get stations in the zones you need.

Our hats are off to ON4AU . . . . . the first in the world to "W.A.Z." Now . . . . who will be the first W . . . . . the first G . . . . . first F, VK and so on. Check up on your zones and keep an ear open for those missing ones.

EL2A Returns to U. S. A.

I guess you birds will be out of luck, if you haven't already worked EL2A. He is on his way home. Karl Duerk, W8ZY, was his last QSO before leaving, and Karl passes along the info that EL2A had lost 28 pounds during his two cracks of malaria and isn't taking chances on another. We are sorry for the touch luck that Hank has had while in Liberia, but when he gets back home he'll be his ol' self and we'll be able to pounce on him under his W call, W8BIS.

Look what popped out of the mail bag . . . . . a letter from o.m. W7BB. . . . Ed Stevens. Thought he had packed up for good but it seems he is, in Ed's own words . . . . . "a guy who travels for the engineering end of the Seattle Radio Supply" . . . . . (not a plug). Anyway, Ed says he has little time for ham radio anymore (most traveling men haven't), but he and W7DL have combined at DL's QRA. They have a couple of jugs on the air . . . . . but Ed wouldn't tell me just how large they are . . . . . but goes on to say "and no cracks about the California kw" OK Ed . . . . . how about the "Washington kw", He has worked 39 zones and by examining his cards you would be able to see that 39 of 'em were on 7 Mc. Boy, that's really something . . . . . just dig out that zone map and see how near you can approach that number on the 40 meter band. Remember W7BB with that tuned something or other up around 7000 kc. or less . . . . . and a note all the way from T9 to T3? 'Them were the days'. He didn't say they were going to be on in the contest, but it would be wasting a good rig not to give it a whirl during those hectic nine days.

W9PK Heard in England on 5 Meters

W9PK, on January 8th, running 400 watts on 10 meters, was heard by G2CAG on 5 meters at 2215 G.m.t. RST 558. I presume by the call the G is an English receiving station, and this definitely shows that 5 is not to be forgotten or overlooked. Nice going, W9PK.

W6DOB in L. A. and W3SI are constantly hammering away on 5, and are keeping record of conditions on that band. One of these days DOB will spring loose with some darn good dx in 5 meters.

W9OHK has discovered never to call a W6 on 20 . . . . . and reports that while QSO with K5AG he found out the K5 was thoroughly griped because he had bet all his pay on the wrong Rose Bowl team, and was therefore taking it out on his key, I guess. . . . . W3AIU lays claim to being the first W to QSO a VU on 28 Mc. His was done on March 2, 1936 . . . How's that stack up, fellows? . . . W6FZA has been calling Europeans for months but n.d. . . . . got mad and shifted the angle of his antenna . . . . BANG . . . . YM4AA right off the bat, and now W.A.C. . . . . W8DMK, on the air chasing dx after a two year layoff, is kicking because he can't hear the Asians . . . . Mebbe he better shift his antenna . . . . . anyway, he is getting out well with his RK20 and seems to get into Europe alright. W6CLS says that G6RV in Scotland is looking for W6 and W7 stations on 80 meters. Didn't say what time . . . . but if you did know it would make it too easy. G6RV is using a Gammatron in the final.

VE5OT of Vancouver has worked 22 zones on 20 meter phone. VE5OT is owned by Marvin Thoreau, and he reports that VS6AQ told him that their contact was the first VS6-VE phone QSO. Rig uses 2 RK20's in p.p. Antenna is a half wave doublet, running north and south, 65 feet high . . . . . EO1 cable for transmission line.

From W1APU of Dover, Maine comes this . . . . . VE5TV in zone 2 is on nearly every evening around 8:30 p.m. e.s.t. on 14,285 k.c. He uses phone and will be glad to QSO either fone or code stations. His location is on Nottingham Island, over Quebec, and he will QSL all contacts, but will be unable to send them until he comes out next fall. All cards to him, however, should be sent in care of the Government Radio Station at Port Churchill, Manitoba. VE5TV says he is the only station in zone 2 at the present time . . . . . so there you are gang. W1APU has 28 zones and 66 countries.

W8KKG of Lost Creek, W. Va., has 34 zones to his credit and 87 countries. Uses two Gammatrons in the final. Some of his dx includes KA1US, FB8AB, FB8AF, J2JJ, J2MH, U9AL, U9MF, U8MJ, EL2A, VQ4CRG, PZ1AL, PZ1PA, PK1PA, PK1PK, VP3BG, VQ8AC, VQ8AA, ES5C and 27 South Africans.

W6BAM works VU2DY for zone 32 . . . . . CX1BG, CN8MB, OZ2M, EL2A, U1AD, PA0IW, W9KYJ worked YR5VC, LU3EV, ZE1JG, ZE1JV, PA0XM, and VQ8AA . . . . all during December . . . . . W4MR has 30 zones and 78 countries as checked against official list . . . . . W8FJN worked SX3A for his 29th zone, and his rig is Eimac 150T's in p.p. . . . . W8LEC snags TF3AA for 37th zone. . . . . the TF was on 14,325 kc. and says to shoot your cards via TF3EA, and 8LEC has 91 countries Official list. W6CII says CR7AC on 7250 kc. and VU2AM also on 40 are coming thru in the mornings . . . . . W2BJ sends New Year Greetings two weeks late, or mebbe it's for next year . . . . . W9UBY had a QSO with NX1Q on January 2nd, and he gave his location as 68 degrees North and 24 West . . . . . quick Watson, the map . . . . . frequency 14,120 kc. . . . . W6GNZ is rebuilding into p.p. HK-154's . . . . . W1ZB and W1CC have 36 zones each now . . . . . VE5TV made zone 36 for 1CC, but ZB says that VE5RV is also in that 2d zone and his frequency is 14,420 kc. . . . . new ones by ZD are HD2A Galapagos, YJ1RV 13,995 kc., J8CD 14,350 kc. Countries by CC, 87 and by ZB, 88 . . . . . W2BRS works

"WAZ" HONOR ROLL

ON4AU	40	G6CL	33
W8BTI	39	W6VB	33
W7BB	39	W6BAM	32
G2ZQ	39	W6KIP	32
W3SI	39	W8AAT	32
W6CXW	39	W8BTK	32
W4DHZ	39	W5EHM	32
W8CRA	39	W9EF	32
W6GRL	39	W6NHC	32
W6ADP	39	W6FL	31
W3PC	39	W2BJ	31
W9TJ	38	W3DCG	31
G5YH	38	W5CUJ	31
G6WY	38	W9KA	31
W6CUH	38	W3EXB	31
W6QD	37	W3EVW	31
W8BKP	37	W6KWA	30
W2GWE	37	W4MR	30
W8OSL	37	G6GH	30
W6FZY	37	W8DED	30
G6NJ	37	W3CIC	30
W2DTB	37	W6GHU	30
LY1J	37	W9IWE	30
W8HWE	37	W6FKZ	30
W8LEC	37	W8OQF	30
W8DFH	36	W6DIO	30
W9ARL	36	W3AWH	29
W1ZB	36	W9LW	29
W1CC	36	W6HJT	29
W9PTC	36	W8FJN	29
W6GAL	36	W2AAL	29
W6AM	36	G6ZU	28
W9KG	36	W1APU	28
W2HHF	36	W3TR	28
W3EDP	36	W8DOD	28
W2BSR	36	ZU1T	28
W6GRX	35	W6CGQ	28
W8CJJ	35	W6GNZ	28
W2AIW	35	W5EOW	28
W6HX	35	W9JNB	28
W6EGH	35	W6HJT	28
W8KPB	35	W3EYS	28
W8KKG	34	W6CEM	28
W3EMM	34	W6JBO	28
W2BJ	34		
W8LEC	34	Phone:	
W3EJO	34	W5BDB	27
W2FAR	34	W3SI	25
W9PK	34	W3EMM	24
W9LBB	33	W6ITH	23
W5AFX	33	W6AM	23
G6QX	33	VE5OT	22
W9AFN	33	W6LLQ	22
W9ALV	33		

If you have worked 28 or more zones and are willing to produce confirmation on demand, send in your score on a postcard.

Phone stations need work but 20 zones, but stations must be raised on phone. Stations worked may be either c.w. or phone.

Rene Kersee, ON4GW, at his Transmitter

TF3C for his 36th zone. Speaking of QRP, W6NIK in Anaheim, Calif., uses a single 45 TNT with 8 watts input . . . . is w.a.c. and worked 4 Europeans one day on 10 meters.

Dx Man Taken by Death

Buck McKinney, W5ATF, had his last QSO. On Feb. 7. Buck was taken from us; we have lost a swell pal. He was known throughout the world, principally by the dx gang; and even those in the U.S.A. not interested in dx will remember many fine rag chews such as those he and W6CXW had for so long. We will all miss Buck's snappy operating.

W6HX and W6FZL are combining their wits, operating ability, and last but not least, their stations for the contest . . . W3BBB, who has not been heard lately, is attending Lehigh University; Electrical Engineering is it . . . W4DHZ, Dave Evans, "The Georgia Kid", says not to tell anybody he has been on 10 meter phone; so remember, gang, don't breathe a word of it to a soul . . . W6BYB, the Mayes brothers, John and Bill, are back on the air after a lay-off of 2 or 3 years. Here are two fellows that come right out into the open and admit they are going into the dx contest with a vengeance. Two brand-new rigs are all ready to go. John was married about 3 years ago; so he may have a legitimate excuse for not being on the air, but I don't see how that kept his brother Bill off . . . W6CXW says, "No, I guess I won't get into the contest this year, too busy." Two days later they add two Eimacs, a Gammatron, filament transformers, and other parts to their collection. Then a few days after that, VK3EG while QSO told me he had heard CXW testing on 80 meters so I suppose inasmuch as they are not in the contest they are getting ready for some plain and fancy traffic work . . .

W4DHZ is another one not getting ready to enter the contest, but I have a hunch he will be changing his mind any day now. Remember his score last year? Over 90,000 points! . . .

W7AMX hasn't been on a great deal lately but sends in some very good info anyway . . . He says that the HAF boys have apparently dropped the F in their prefix, as he has worked HA8C, and W7BD told him that he had heard a couple without the F. Art has built one of those conversion exciters as written up by W6BC in RADIO some time ago. He says he can QSY from one end of the 40 meter band to the other, and the note has that good old crystal ring to it. He had fooled around with E.C. oscillators but they always gave a "crumby" note. Here are a few stations AMX worked recently . . . VQ4KSL 14,396 T8; VQ4CRI 14,275 T8; VQ4CRH 14,375 T8; VU2AU 14,275 T9; U4UL 14,440 T7. Art heard ex-G5YG working a J and signing GM5YG, and explaining to the J that GM was the new prefix for Scotland. The photo appearing in this section this month was loaned by W7AMX.

G6GH says that his pal ex-G2LR is now stationed in the Sudan and hopes to be on quite soon with an ST call, around 14,320 kc. G6GH is also going to keep us posted on this station there. 2LR has 30 zones . . . W9CWW in Leavenworth (Kansas, not the pen) gives some dope on LA5N. Name is Fredrick A. Lovaas, located in Oslo, Norway . . . is an American from Brooklyn and has been there two years now. The tube lineup and his rig at present is 59-59-10 into an 800 with 50 watts input. Receiver is a simple t.r.f. but has a new one under construction using 16 tubes. He is getting ready for the dx contest next month and will probably be heard on either 14,080 or 14,200 kc.

W9CWW has worked TF5C for zone 25 . . . He is still using a couple of 210's . . . W5EKK says that he was QSO this guy, IF2OT, and that he is not in Ethiopia at all, as was rumored in this "colyum" last month. He was on a ship QRD Panama, and had not been near Africa. Well, I'm glad that's cleared up.

W9KG shoots in a report of activity around Kansas City: W9TPK is 20 meter phoning at present . . . W9TOQ is doing OK on 10 but can't seem to get an angle on what he is working . . . W9GDH is about ready with his p.p. 150T's . . . W9CWW works his 25th zone by snagging HS1RJ in Siam . . . W9CU is doing his stuff on 40 using a Taylor T200 with 750 watts . . . CU is an OT and is an op at the K. C., Mo., police station . . . And now what's this? Two more hams in Leavenworth are starting to blaze away on 20 . . . W9AOQ and W9TAE . . . W9LBB is still on the road selling and from all reports the farmers have their daughters well in hand. W9LM still after 20 meter dx . . . and W9EIB is on with a neat kw. on 20 phone, p.p. HK-354's. At 9KG, Keat hit a new low due to the

B. A. "Buck" McKinney,

W5ATF

noise and rotten conditions, but at his other station, W9ALV, things were somewhat better, as usual . . . OH1NL, VU2DR, HAF4H, ZT6AU, U9AL, OH5OH, SP1BQ, D4VRR, PA0KW, I1KN, HR7WC, G8DL, G8IK, G2PU, SM6QN, OZ5R, D3BMP, OZ5M, and on 40 meters . . . YM4AA, G6HQ, and G6VQ. Fellows, remember that G8 is not a different country; it's just another call letter series in England . . . the G2's, G5's, and G6's having been used up.

Reg Tibbetts, W6ITH, says that one Saturday night, 20 was so hot that he had sixteen 100% QSO's with VK's in three hours, and more were

[*Continued on Page 83*]

Notes on Class C Amplifier Design

Considerable has been written on the theory, tuning, and operation of the classic "class C amplifier". However, we note a dearth of information regarding the important considerations pertaining to mechanical construction. These are just as important as bias, excitation, etc., and some of the things to observe in constructing a class C amplifier stage are given herewith.

R.F. Leads

Do not use tinned wire for leads that carry any appreciable amount of r.f. energy. Use heavy gauge bare copper wire (no. 10 or larger) or enameled if this is not available.

Grounds

Be careful about common grounds. Return all grounds for each *stage* to a common point approximately at the electrical center of the circuit. The point where the filament center tap by-pass condensers are grounded is usually a good point. Then run a lead from each stage ground to a common ground *point* in the *transmitter*. If a good external ground is close at hand, ground this point to it by means of a heavy conductor. If the external ground is too far away (especially on the higher frequencies) it is frequently better not to use it at all. However, all the equipment in the shack should have a common ground lead.

Filament By-pass Condensers

The filament by-pass condensers for each stage should, as mentioned before, be at about the electrical center of the stage. The filament transformer can be located at any convenient place that is consistent with low drop in the filament leads. The center-tap of the filament transformer should be grounded at the transformer.

Mechanical Layout

It is generally a good idea to lay out a stage mechanically very much similar to the electrical layout shown in a good circuit diagram. While this does not always hold true, it will quite frequently give an idea as to the most efficient arrangement.

Push-Pull Stages

In laying out a push-pull stage, do *not* lay it out perfectly symmetrically. Perfect symmetry will almost invariably give place to ultra-high frequency parasitic oscillations. Very often these are quite difficult to detect. Especially is this true in phone rigs where the parasitics will only show up on high modulation peaks. Also, they sometimes show up in a low-level-keyed c.w. rig when the key is up with full plate voltage on the amplifier tubes.

As the shunt capacity in the grid circuit is usually greater than in the plate circuit, the grid leads should either be very much shorter than the plate leads or slightly longer. In the ordinary arrangements the most convenient layout is too frequently the one where the grid leads are slightly shorter than the plate leads. This should always be avoided.

It is generally a good idea to make the plate leads fairly long and approximately symmetrical. The grid circuit, in this case, should not be laid out symmetrically; one lead can best be made very short and direct and the other one considerably longer.

Neutralizing Leads

Place the neutralizing condenser or condensers in a position where their leads can be made as short and direct as possible right to the elements of the tubes. Do *not* make neutralizing condenser leads to a tank where the grid or plate lead connects; make them directly to the elements concerned. Where this is not possible, make them as close to the actual connection to the element of the tube as can be managed.

Metal Chassis

Where a push-pull stage is to be laid out on a metal chassis, make sure that each side of the circuit is balanced with respect to any large mass of metal such as the chassis or the front panel. The capacity unbalance that may be caused by poor layout can easily cause the stage to be difficult to neutralize or cause one tube to take more than its share of the load.

Simplicity

Do not use any more parts in a circuit than are absolutely necessary to its operation. If an r.f. choke or a by-pass condenser can be eliminated without affecting the apparent operation of the circuit, the rig will more than likely be better rather than worse after the operation has been performed.

Stray Inductive Coupling

In laying out the tank coils be careful to make sure that there will be a minimum of mutual induction between them. The following

[*Continued on Page 74*]

"Let's Take a Portable"

By Carlos S. Mundt,* W6ZI

The old Kemper portable b.c.l. receivers, of which quite a number were sold, may now be picked up for a song, and make an excellent foundation for a portable transmitter and amateur receiver. There is no law that says you must use any particular circuit when making the conversion, but here are some considerations to keep in mind when designing a portable transmitter and receiver.

Did you ever get ready to go places and have that flash of an idea hit you? Have you ever been invited for a week's stay at Aunt Agatha's place? Have you ever gone on an extended auto tour? Have you ever found it necessary to visit with the ex-y.l.'s family? In all these cases and many more you say immediately with true ham spirit, "Let's take a portable." Naturally, you want to keep in touch with ham doings and not lose out for even a week's time. Besides, it is much more fun than working the regular set at home.

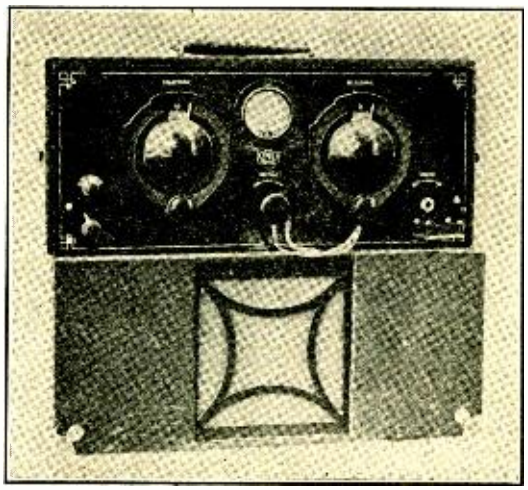
This is the story of a portable that *is* a portable. No trailer or small truck is required to carry it around; and no two men are required to handle it. The construction is simple and direct so that it may be built up in an afternoon. One of the older b.c. sets is the nucleus, making the whole problem very easy. From this we get case, panel, and two nifty dials all thrown in for nothing.

Before embarking on the story of the set let us reflect upon the merits of a good portable. In brief, they are as follows: (1) crystal control, thus dispensing with monitoring gear; (2) portability in weight, which rules out heavy henries and overgrown power transformers; (3) portability in size, which means a restricted circuit (an oscillator and amplifier); (4) minimum number of controls; (5) no trick circuits, thus insuring reliable performance; (6) *one*-man operation, thus allowing the ex-y.l. to visit with the relatives to her heart's content.

After a number of experiments, plus much perusing of literature, we decided that the rig here described fulfills the above prerequisites. The setup is a 41 crystal oscillator plus a 6A6 amplifier. The principle advantages of this choice are the low filament consumption (being easy on a storage battery), simplicity and ease of operation, and good output, even at low plate voltages. Remember that we are dealing with a low-voltage rig, so do not turn up your nose because this is a small wattage job. A watt is a watt in all countries, so that we cannot expect big output from small input, but we can get a kick out of taking a small powered job and really doing something with it.

The second tube is utilized in a number of ways, depending upon the preference of the builder. Straight amplifier, with the elements in parallel, was preferred by the writer, though this of course requires neutralization. Next in order of choice is perhaps push-push doubler, though this requires an extra control. Last is perhaps the ordinary distortion doubler. The choice of the manner of operation of the second tube depends largely upon your own experience and is left to the individual. For simplicity the use of a doubler is of course an advantage.

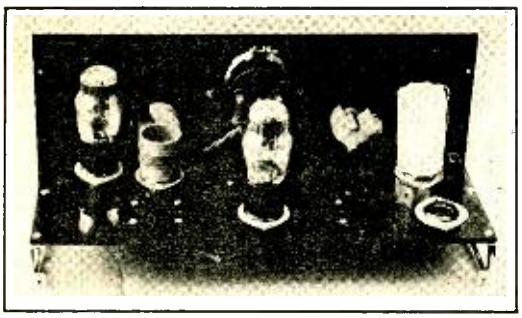
The construction is simple. First obtain an old Kemper b.c.l. set. It is housed in an ideal



You would swear the Kemper cabinet was made to order for its new job

type of case, providing room for the transmitter above (in place of the receiver already there) and three compartments beneath for batteries or powerpack plus a midget ham receiver. Altogether the outfit may weigh around thirty pounds, which is not much when you

*126 Meadowcroft Drive, San Anselmo, Calif.



The 41 Oscillator and 6A6 Amplifier

see some of these so-called "portables" which require two men to handle them!

The re-building process is easy. Remove the entire b.c.l. set, retaining the panel and dials. Two brackets with a brand new sub-base are fitted to the panel and a new meter (0-50 or 0-100) is installed. Minor changes were made in the location of the various jacks and switches to accomodate the new layout to the best advantage. The speaker in the lower center compartment was removed as the added room is worth while.

Note that there are several types of Kemper portable sets. The one illustrated (with meter in center) is to be preferred, but the one with meter at one end is useful, provided that certain location changes are made.

New midget variable condensers of the cheaper kind were used. Parts as a whole should be good, though not necessarily expensive. Power supply depends upon the location in which the rig will be used. A small b.c.l. transformer makes a good bet, with but one small choke (100 ma. rating) and one filter condenser. A good plate voltage is 300 or 350. For use in the "open spaces" we must of course rely upon storage batteries and either B batteries or an "auto B supply" (vibrator type). No coil or antenna data are given as they will vary with the parts used, and many hams would build this out of the junk box parts they may have. See any handbook for coil data.

The power output of this portable naturally cannot compare with the home installation, but is quite sufficient for its purpose. Besides, it is quite a bit of fun to see that we are getting out with such a modest amount of power.

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"Radio cannot be made to distinguish between man and man—a free radio recognizes neither class, nor caste, nor creed. It is the authentic voice of democracy."—*David Pool.*

A PEEK AROUND THE CORNER

Public service rather than public exploitation is the motivating force impelling television engineers in their preparations for high definition commercial television in the future. This was revealed by Albert F. Murray, engineer in charge of Philco television.

"Firmly believing that the users of television should have the right to enjoy high definition pictures, as nearly nation-wide coverage as possible, the possibility of a selection of programs, all these with the easiest possible tuning and at the lowest possible receiver cost, the Radio Manufacturers Association has formulated recommended television standards. We hope the government will adopt these standards," Mr. Murray stated.

These standards were formulated by the RMA Television Committee, members of which are representatives of Farnsworth Television, Inc., General Electric Company, Hazeltine Corporation, Radio Corporation of America, and Philco Radio and Television Corporation. Some of them are: Pictures of 441 lines, frame frequency of 30 per second, negative modulation, aspect ratio 4 to 3, channels 6 megacycles wide. It is recommended that the frequency band 42 to 90 megacycles be reserved for television with a band above 120 megacycles for future television experimentation.

While television has been making progress during the past seven years, Mr. Murray declared that there are still many unsolved problems, for instance: (1) a camera tube which will give better resolution, better sensitivity, and less extraneous signal; (2) wide band amplifiers, in which the disturbances due to inherent tube noises are reduced or eliminated; (3) ultra-high frequency transmitters of large power, giving outputs equal to or greater than our largest sound broadcasting station, 500 kw., and capable of being modulated by frequencies up to 4 Mc.; (4) a system of single side band transmission which will permit increased picture detail while permitting a reduction in width of the communication band; (5) simpler radio receivers which will reproduce the very high modulating frequencies required and still have a sufficient selectivity to separate television transmitters; (6) a picture tube which will give larger, brighter, clearer pictures.

In commenting on this situation, Mr. Murray said that while the majority of workers in the television research laboratories come from the

[*Continued on Page 74*]

Flood Brings New Type Emergency Radio Net

By Robert S. Kruse*

While the flood crest was still approaching Cincinnati and Louisville, there had already leaped into swift action a new sort of emergency radio net, of an effectiveness new in all radio history.

Part of this unique effectiveness of the 1937 net was due to the great increase in stations and their better tie-ins. Partly it was due to the position of the flood—squarely across the main east-to-west channels of travel and communication.

The first thing to impress the listening outsider was certainly the highly energetic Volunteer Inter-City Network of broadcasting stations, which tossed profit overboard and for many days kept 24-hour emergency-message schedules. From this eastern point it was possible to hear many hundreds of emergency calls handled by WHAS, WSM, WKRC, and WLW, sometimes with makeshift power, with curious patch-works of wire and shortwave links, with technical and announcing staffs dog-tired, but with the job being done. They did a job no other type of station could have done, for on their frequencies there were innumerable receivers suited to use in trucks, boats, passenger cars, and households, to which the superior power of these stations delivered good signals despite rain, wind, and flood. Thereby many mobile rescue units were able to work to far greater effectiveness, to effect much faster relief of distress, to do the job at hand better by virtue of help from the men behind the mike. All honor to them.

No "Rubber Stamp" Traffic

Does this sound to you as if amateur radio had missed the boat? Do you perhaps feel that it got a black eye by being restricted by the F.C.C. during this flood? Not in the least. Quite the contrary; this was one time when amateur radio was relieved of the curse of "rubber stamp" traffic and able to do something useful instead. Here was the order, as it was being broadcast on the evening of the 26th of January by stations selected by F. E. Handy, the capable boss of the A.R.R.L. Communications Department:

> "It is ordered, effective January 26th, by the Federal Communications Commission that no traffic except that relating to flood or other emergency work be handled (?) on the regularly authorized amateur bands below 4000 kilocycles until the F.C.C. determines that the present emergency no longer exists."

By 9 o'clock that evening (eastern time) the bedlam of the 160 meter band had begun to quiet down and the broadcast-amateur stations had gone to their next task, calling individual stations and asking them if they were aware of the order. Most of them were surprised and apologetic; a few were a little hurt because they had honestly been under the impression that they were helping by handling the personal "How are you and Mary" type of flood message. Well, they had been helping Mary and her folks but it was pretty tough on the poor devils with more serious messages, and as far as I was able to hear these conversations, every station saw the point and acted properly—silently. It seemed to me tactless and officious to suggest monitoring and reporting when this peaceful procedure could do the job of clearing the bands. However, such a suggestion was passed around, and one only hopes that no station's eagerness to help has caused a tactless temporary authority to blacken his record, and incidentally by that bumptiousness to do amateur radio harm not easily erased.

At any rate, by 9:30 p.m., E.s.t. of the 26th, the air was getting well cleared and the worthwhile things began to come through: message to American Legion Post—report of three portable electric generating plants available—directions for getting a load of supplies to the only road into an Indiana town—stray station still innocently describing its suppressor grid modulation while three stations increase the mess by trying to stop him—Red Cross report jammed (there's an old time expression) by station in West Virginia, please repeat last 6 words—sorry old man but that's the order; so our schedule is off for a while—suggest amateurs not transmitting listen on commercial frequencies between 4000 and 7000, also 2000 and 3500, copy and deliver any emergency messages which might otherwise not arrive—sorry but no personal messages accepted account F.C.C. order.

9:45 p.m.—Remaining 160 meter voice stations gradually shifting around to reduce interference—is there any contact at all with Evans-

*Guilford, Conn.

ville now?—Red Cross calling for medicines from—ample flashlights here, please advise how we shall forward—medicine bottles with corks needed—o.k. old man, I'm in Canada but will stand by with you fellows—impossible receive here but Carl will listen and telephone me; he cannot send; no power there—we are working with police and broadcast stations—he sent message to you blind; call me telephone to avoid transmission—.

None of them quotations, of course, but that is the way it went on the 160 meter band.

On the 80 Meter Band

On the 80 meter band with the too-great night-time range of that band (for this work) the interference was very bad, even as late as 10 p.m. of the 26th, several days after the order was first announced, though that was the day it was supposed to go into effect. In the voice band especially there remained a terrific mess and it seemed that 160 might have been used more. The matter sent was along the same lines: this station working with U.S. army engineers—sand bags—set flares to warn of hot wires near water level—have chartered a plane and are—you are interfering with traffic in the flood district, please use the telephone—dories from Gloucester with crews are being sent—can supply power boats if needed in Louisville; please let this be known by your local broadcast station.

By 10:30 this band also was beginning to clear up, a grand piece of work on an order just gone into effect. From that point forth amateur radio was rid of its overcoat and could really go to work. Even the 40 meter dx bugs crawled into their holes.

I think that in this instance the mike and the key divided the job well. The much more rapid phones carried the volume where there was power to operate them; the key was resorted to where voice was not available and where power had to be economized or mobility made insistent demands for lightness.

As the flood moved down-river the load became steadily greater, keeping pace with the improved facilities: landing directions for seaplanes—extreme emergency landings where a parachute drop was necessary—calls for water to be shipped in where the supply had at last failed altogether — inter-locking arrangements with airways stations—police stations—between police stations of various towns—freshly arrived military stations—shaking down the communication into regular schedules—whittling the stations down and deciding where the scanty supply of engine-driven generators should go—arrangements for directing planes and trucks in by messages sent to them from broadcasting stations which will receive them via shortwave station from the American Legion—directions received from the C.C.C.—arrangements for replacing stations about to lose power or the whole station—patching in for the telephone or telegraph systems and retreating as they resume the load—.

Bidwell's Dream Comes True

Do you notice that it has all begun to shake down into a pattern, an orderly pattern not due to any one authority but to simple cooperation between rational communication men and relief workers? One feels that at last we have an emergency where radio has come of age and is doing its job, that George Bidwell's dream has come to pass this year. Yes, it has taken a good many years. It was a long time ago that he first proposed an emergency radio system of a purely amateur sort. He was received most coldly at that—was told to take a few men and prove that the thing was any good before bothering any organization with it. Let us be thankful he saw it through—even though it took more than 10 years, during which radio amateurs gradually became radio professionals. Let us be thankful that those early tests encouraged the cooperation of the Pennsylvania railroad and lead to "QRR". This year we certainly cannot prove that "amateur radio did the job"—decidedly not. But the job is being done by broadcasting stations with professional-amateur operators sprinkled liberally through the staff, by police stations with similar staffs, by C.C.C. stations of the same stripe, by aviation stations, by military stations, by coast guard and Naval stations, by other commercial stations, and regardless of the present percentage of the amateur participation, the whole thing does really seem to rest on the foundation George Bidwell built and the example he set and defended.

I'm sure he claims no credit; he never did. His interest is the same as it always has been: *that the job be done.*

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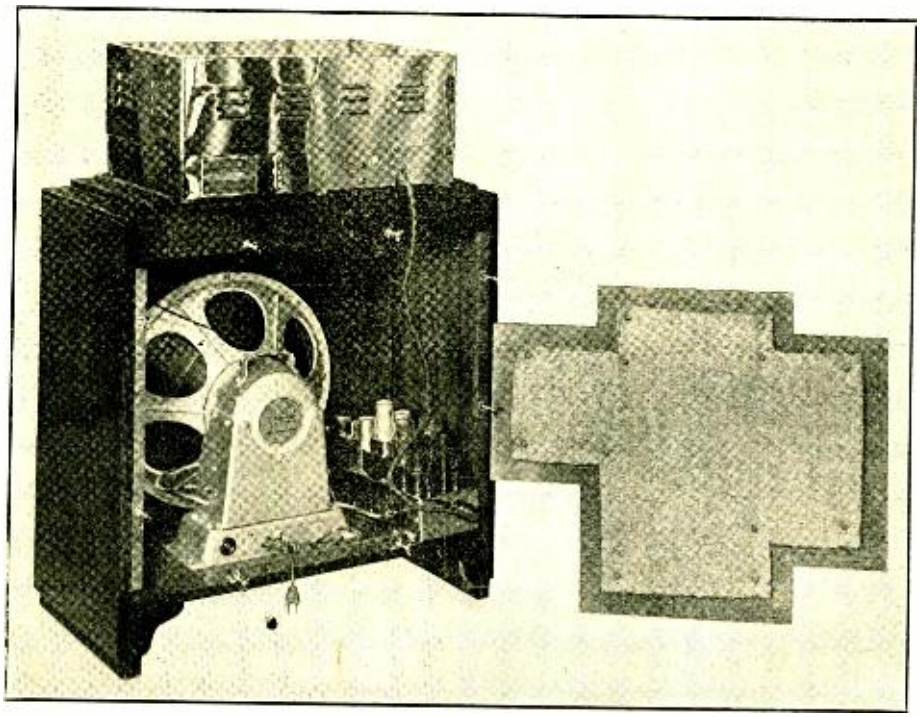
Radio Therapy

Those interested in the evolution and different applications of radio therapy should not fail to read the article "To Health by Radio" by Conrad K. Gale in the February issue of *Coronet*. The different effects produced by different frequencies, etc., are discussed as are statistics as to the improvement and cure of various diseases.



A New Method of Speaker Baffling

By McMurdo Silver*

Because of his closer connection with radio, the average amateur is somewhat more critical as to fidelity of musical reproduction than is the average b.c.l. We present herewith a new idea in speaker baffling which greatly improves the bass reproduction, giving true, and not "synthetic", bass reproduction. The baffle may be constructed quite easily and inexpensively by anyone handy with tools.

For many years past the limitations upon the low-frequency fidelity of sound reproducing systems, particularly upon radio broadcast receivers, have been well recognized. The first of these is available baffle area for customary dynamic loud speakers. In radio consoles, particularly, the physical limitations upon the baffle provided by the console are such that it is seldom indeed that such a system will reproduce below 130 cycles, except through the questionably desirable aid of rather unpredictable resonances due to the size of the speaker compartment and the volume of air contained within it. In table models and midget radios the situation is appreciably less satisfactory, and the cut-off frequency at which the cabinet acting as a baffle ceases to aid reproduction is more usually at about 180 cycles.

The extent to which loud-speakers will dip into the low bass range is limited due to mechanical limitations inherent in their design and commercial production. The usual 12-inch dynamic speaker in an infinite baffle will seldom function below 50 or 60 cycles, but even this response may not be had in customary consoles by an octave or more. Smaller speakers will cut off at increasingly higher frequencies.

Upon the assumption that the average ear perceives the low bass notes ordinarily only by virtue of their harmonics, the question of what practical improvement may be had over existing sound reproducers may be asked. This appears a good question when the relatively satisfactory reproduction of the better commercial radios

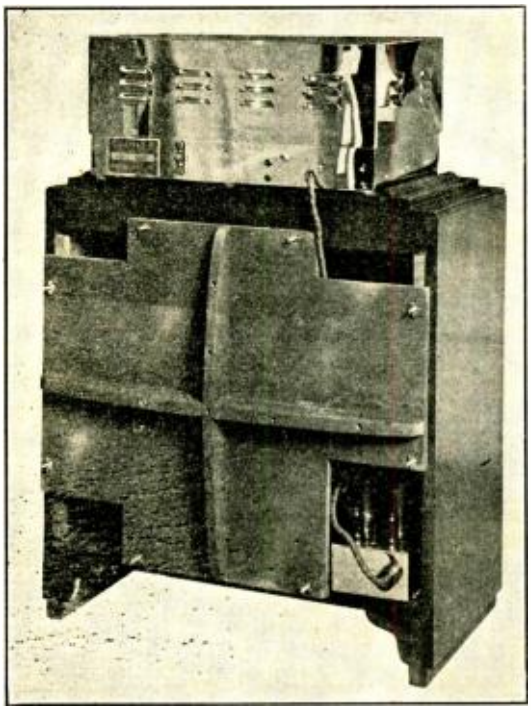
*Chief engineer, McMurdo Silver Corp.

is considered—reproduction not too badly deficient in bass (due to harmonic generation) to the untrained ear.

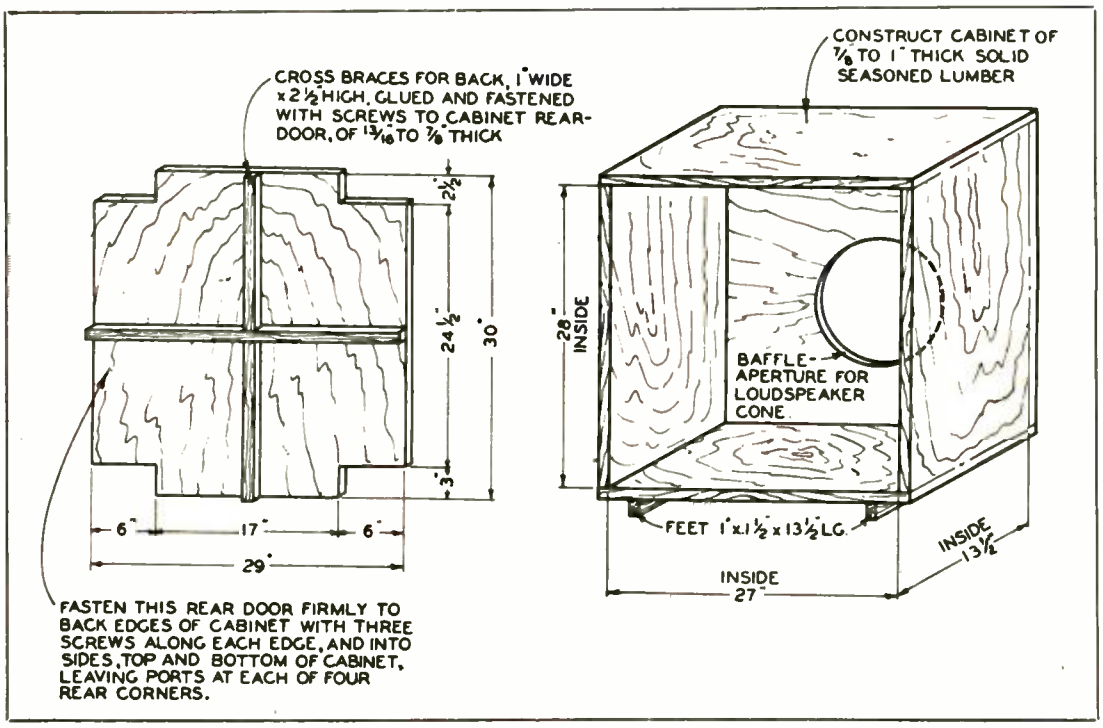
It is interesting to consider operational modes concommitant to such harmonic reproduction. In the reproduction of broadcast or recorded music, frequencies as low as 50 cycles and sometimes lower will be encountered. The customary inadequate radio console baffle cutting off quite sharply at about 130 cycles, results in no appreciable air-load upon the speaker diaphragm or cone at frequencies below this, except for the resonance peaks due to the cabinet structure and air content. On frequencies below cut-off the unloaded loud speaker cone develops excessive mechanical excursions which, though they do no useful work at their fundamental frequencies, tend to develop excessively strong harmonics, those above baffle cut-off being heard. This is obviously undesirable.

Radio cabinets of today invariably introduce resonances which result in the "boominess" so destructive to speech, but often superficially beneficial on musical reproduction. In the main, these impair rather than aid quality of reproduction.

A number of papers recently delivered by Hugh S. Knowles, chief engineer of Jensen Radio Manufacturing Co., have brought his de-



Showing Cabinet with Special "Rear Door" in Place.



velopments of the "bass-reflex" and "peri-dynamic" principles to the attention of four I.R.E. chapters and the Engineering Institute of Canada. These developments are most interesting, permitting as they do in a radio console of practical size, reproduction *exceeding* that possible through the same loud speaker in an infinite baffle.

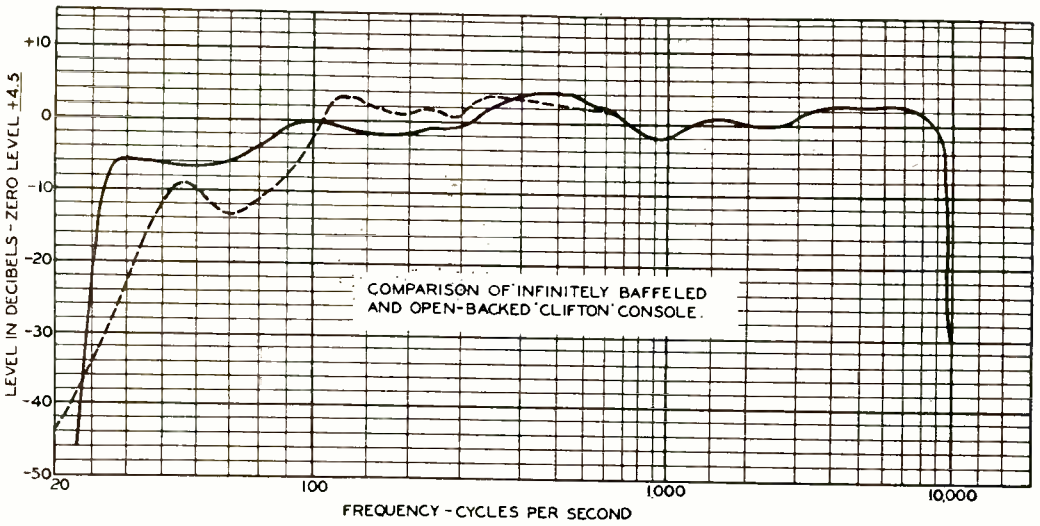
Several recent developments upon this line of attack are familiar to readers. One mode attempts to provide an approximation of an infinite baffle through the labyrinthine folding back on itself of the front-to-back air path within a radio cabinet. Space limitations plus the need of considerable deadening of the folded path to avoid resonances mitigate against the benefits of this method. A second method has involved the sealing in, by a closed back, of the loud speaker compartment, with air vents in its bottom topped by tin pipes. It would be possible were these pipes resonated in the bass range, for them to augment, somewhat, bass response through their coupling by the air in the console to the loud speaker diaphragm. A third acoustic treatment in an open-backed console, consisting of additional diaphragms disposed about the console, and relatively free to vibrate, has obvious drawbacks.

Providing reproduction exceeding that possible to an infinite baffle, the "bass-reflex" and "peri-dynamic" principles go beyond these initial attacks on the problem when in suitable combination. The extent, however, to which their application may extend the bass range of a sound reproducer is dependent upon the size and design of the loud speaker itself. With them, the bass cut-off frequency may be determined by the loud-speaker itself rather than by its cabinets, indeed a surprising condition to radio engineers.

Large and extremely efficient 18-inch speakers permit this cut-off to be set as low as 30 cycles, while with ordinary 12-inch speakers, it will usually be between 50 and 60 cycles. The benefits of elimination of harmonic distortion will be apparent in both cases, as will be the elimination of cavity resonances in a suitably designed console.

Complete enclosure of the loud speaker in a sealed console of ample content (8 cubic feet or more for 18-inch speaker), of heavy non-vibratory construction to prevent spurious contributions through sound radiation due to vibrating panels acting as secondary sound sources, involves the "peri-dynamic" principles. Resonance of the volume of air within this enclosure should be deadened by discreet amounts of jute or other absorbents affixed to one or more inside panels.

The "bass-reflex" principle consists of the utilization of the usually wasted or detrimental back radiation of the loud speaker. It involves the provision of ports approximately resonant in the extreme low-frequency range in the console in such manner that in relation to the cubic content of the console, the phase of the back radiation is reversed. Thus, back radiation at the ports appears in phase with direct or front radiation and adds thereto in a most beneficial manner.



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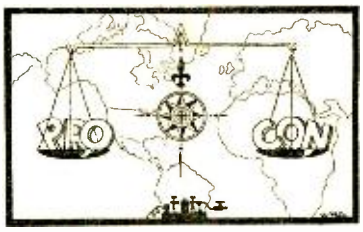
THE OPEN FORUM



INCONSIDERATE "OLD TIMERS"

Kansas City, Mo.

Sirs:

Howard S. Pyle, W7ASL, hits the nail right on the button in his Open Forum letter, p. 46 of February issue, when after 28 years of copying "underneath" he suggests limited operation for c.w. on the 80, 40, and 20 meter bands as the logical solution to the existing QRM problem.

The idea isn't new but to my knowledge nothing has ever been done about it.

If the phone bands were helped by limited operation, it's obvious that the *principle* would not only apply to c.w. but would apply to a much greater extent, because of the larger number of such stations.

W7ASL referred several times to the beginners as causing most of the trouble. Perhaps he's right, but a little reflection will show that *lack of consideration* (for the dx QSO) is quite frequently found in the "old-timer". In that case it's a human weakness for which there is no remedy. But, the beginner that's criticised for *un-intentional* bad operation is the victim of unjust circumstances, and he is the person that would be most benefited by restricted operation. He would never develop into the inconsiderate type of "experienced" operator.

Boy, there's more reason than one why c.w. should be restricted.

JIM TRACY, W9KNQ.

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"SHAME," SEZ HE

Spartanburg, S.C.

Sirz:

How in all tarnation air we ever goin' to get eny co-woperashon when all haff the fellers kin dew is to yap erbout condishons on 160 meter fone, and the other haff say that there is nothing wrong with 160, and anyway it's not as bad as 75 and 20, which is supposed to make it alrite.

Naow take this here feller Conner, W9FOO. Good nite shirt, why here he is talkin' erbout freakancy mopalashon just becuz that pyor lettle rig in June RADIO didn't have no buffer stage. There is a heap of fellers rite naow usin' a two-stage crystal xmitter on 160 fone and I'll bet he couldn't tell the difference frum a ten-stage rig. Wunder if he ever heard an absorpshun mojalated self-pusher oscillator. Naow that was sompin.

Anyway, I think the most important thing is to clean up the langwich on 160. The guys up there must not have much respeck fer there rigs, on account of they don't seem to think that they are gettin' out at all. Yew noe dern good and well that no feller is agoin to say anything bad when he nose it's agoin to be heerd. The thing to dew is to QSL these birds a leetle and let 'em noe that they are reely gettin' out. I'll bet thet will stop it.

I set many a nite out here in the middle of a 4 aker cotton patch and lissen to these 160 fone birds. There quality ain't near as bad as there langwitch.

The b.c.l.'s don't know the difference between a freakancy mojalated signal and an amplitude mojalated one. But most of 'em recognize cuss wurds and durty stories when they hear 'em.

W. H. HUMPHREY, JR., W4BPL
The Old Southern Cotton Planter.

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A NEW ANGLE

Albany, N.Y.

Sirs:

It seems that the phones are complaining about crowded conditions, while the code boys are afraid that the large frequency requirements per phone station will eventually mean more crowded bands for all if phone bands are continually expanded.

The radio magazines are not helping the situation when they publish articles on the construction of small phone rigs for the man who doesn't already own one. The phones aren't interested in building new low power rigs, while the code men can get elementary instructions from handbooks if they really have the urge. So it seems that neither phone nor c.w. men need the elementary phone articles.

If all parties concerned would agree to publish no more elementary phone articles, the phone gang would be satisfied with more advanced technical articles (and less QRM), while the c.w. fellows wouldn't miss the articles the least bit.

GEORGE CARLSON.

W7ASL RANG THE BELL

Minneapolis, Minn.

Sirs:

Howard Pyle, W7ASL, has "got something there" in his letter in February RADIO!

His plan provides the newcomers with a good dx band, 28 Mc., a good traffic and "RC" band, 1.7 Mc., and a good experimental band, 56 Mc.

The only thing that I might suggest is that many of the c.w. men will object to the requirement of a class A license for c.w. work. Anyone who is not interested in radiotelephony doesn't want to learn all about "mojulators" so he can work 7 Mc. c.w. telegraph! What about a special endorsement on the license available to class A, B, and C licensees alike if these licensees can pass a 25 w.p.m. code test? This test could be given right along with the class A and B examinations and could be the same tape used for the 13 w.p.m. test, run off at 25 w.p.m. just before the 13 w.p.m. test is given.

I hope we can do something about this instead of merely discussing it in the pages of RADIO until it finally dies out.

ROBERT W. SCHOENING, W9TKX.

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NOT ONCE, BUT TWICE

West Hazleton, Penna.

Sirs:

I cannot resist endorsing the ideas of Mr. Howard S. Pyle, page 46 of the February issue. He thinks he is "tough", huh? Well, it sounds milk fed as compared to what the situation *should* be! Maybe the mess can be credited to the "commercializing" of ham radio. At any rate it is high time that serious minded amateurs *do* something about it. If Mr. Pyle could listen to a few of these "good enough" 80 meter phones pulling the Noah act in the flood emergency, he would be east bound on horse back, loaded down with well oiled shootin' irons, to clean house.

But why go on? Every one wastes so much time and printed matter popping off about what should be done and no one is doing anything about it. So W7ASL and W8BQ will just sit around and chew their fists until such time as someone steps up and actually *does* something about it. Whoever "he" is, will be well supported, I think, if he has the proper goods.

H. M. WALLEZE, W8BQ.

AN INEXPENSIVE PHOTO QSL

Shepherd, Tenn.

Sirs:

Wish to enter my QSL card in the contest announced in your magazine.

When o.m. Confucius (or was it Wun Wey or Ling Po?) said that "One picture is worth ten thousand words", he proved that the Chinese know their proverbs as well as their flat irons. My card is dedicated to, and built around, the idea. (A very nifty card, designed around a cemented-on photo.—EDITOR.)

The photos are the same proportions (but slightly smaller) as the popular vest pocket size. They are not stuck on as if by a kind of an afterthought, but made the principal theme, with the call letters and station data grouped around it.

The face of the card carries in "boxes" the usual items that go to make up a report. Since more than one transmitter is in use here, provision is made for a report on apparatus used at this end of the QSO. This is done by means of a * put before the transmitter used here. Also, if it developed during the QSO that we had something like o.r.s. or w.a.s. in common, attention can be called to that by means of other asterisks.

Any "remarks" are put on the other side of the card where there is more room, and where they will not detract from the appearance of the card as a whole.

The card is flexible as regards to the photographs used, too. Nine-tenths go out with the station photo. But, if the QSO has developed the fact that we have another hobby in common, like fishing, or motorcycling, or camping, a photo of the o.m. engaged in some of these sports might be more appropriate and more appreciated. I generally print nine-tenths station photos, and the other tenth is split up among other hobbies that I might have in common with other hams.

The card is three ply stock, flexible enough to go through a typewriter without cracking, and stiff enough to keep from curling *if* the photo is mounted with gelatine mounting tissue. (And mine are.)

I drew the call letter monograms with photo box between them myself, and had a cut made of it. This cut is my personal property and can be used just as often as I want to print cards. It cost me $1.75, which is perhaps a little cheap for it.

With my furnishing the cut to the local printer, I get the stock furnished and cards printed at $6.00 per 1000, or 0.6c each. Not bad.

I do the photographic work myself, of course. A piece of Velox paper the size of the prints used costs ¼c each, and I can mix up enough developer to print a thousand of them for a nickel. By the way, I am not in the photographic business in any way; these prices can be duplicated by anybody who knows how.

Total cost of a card with photo, ready to have the stamp licked, is a little under a cent. Again, not bad.

I have experimented with QSL's made from photo post cards, both with straight photos on them, and with photos of line drawings.

However these all have inherent disadvantages; for one thing, they always curl in time. They lack color unless you go to a lot of trouble, and the report, etc., has to be on the reverse side. They lack the appearance of a QSL card. And they cost more than the cards I described, which combine all the advantages of both kinds. They are inexpensive, don't curl, look like a QSL, and have the photo feature.

BENTON WHITE, W4PL.

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NOT NEW, BUT GOOD

Los Angeles, Calif.

Sirs:

The enclosed idea is not new, but should be of importance now that the F.C.C. monitoring stations are helping Uncle Sam's mail business by sending poor unsuspecting hams those "off frequency" reports. Since our prefix is "W" instead of something else, the ham bands are not made of rubber. For us in the U.S.A. they do not stretch to 14,500 kc. or so.

This information is of interest mainly to the dx man whose crystals are near the edge of the bands, such as 7000, 14,000, 14,400, and 28,000 kc.

Just build a standard regenerative detector (1 to 3 meg. grid leak) that will tune over the entire broadcast band. This can be made from the junk box. Put it into oscillation and zero beat any of the stations in the following list, and then zero beat the harmonic of your local oscillator on your receiver.

Since the F.C.C. requires all broadcast stations to keep within a few cycles of their assigned frequency, and since most of the better ones keep within about 5 cycles, therefore the probable maximum error with this method is 5 times the harmonic used in cycles. So by using 560 bc. for 14,000 and 600 kc. for 14,400, the maximum error is 125 cycles, or a little more than 1/10 kc.

The following list of b.c. stations is taken from the R.C.A. reference book (pocket size) for 1937. All have 1 kw. or more of power. It does not include the large group of regional low power stations.

B.c. Frequency	*Harmonic Used*	*Frequency*
1600 kc.	9th	14,400 kc.
1440 kc.	10th	14,400 kc.
1200 kc.	12th	14,400 kc.
960 kc.	15th	14,400 kc.
900 kc.	16th	14,400 kc.
800 kc.	18th	14,400 kc.
720 kc.	20th	14,400 kc.
600 kc.	24th	14,400 kc.
1400 kc.	10th	14,000 kc.
1000 kc.	14th	14,000 kc.
700 kc.	20th	14,000 kc.
560 kc.	25th	14.000 kc.

HANDY REFERENCE LIST

Midwest		*West Coast*	
WIND	560 kc.	KSFO	560 kc.
KLZ	560 kc.	KFSD	600 kc.
KWTO	560 kc.	KHJ	900 kc.
WNT	600 kc.	KFVD	1000 kc.
WLW	700 kc.	KGFJ	1200 kc.
WGN	720 kc.	*East Coast*	
WBAP	800 kc.	WQAM	560 kc
WFAA	800 kc.	WIS	560 kc.
WKY	900 kc.	WFIL	560 kc.
WLBL	900 kc.	WDEC	600 kc.
WHO	1000 kc.	WJAX	900 kc.
KXYZ	1440 kc.	WBEN	900 kc.

This should be of interest to the dx man who is preparing to "knock 'em dead" on 14,399.5 during the March dx contest.

ROY H. RAGUSE, W6FKZ.

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THE OTHER ANGLE

Granada, Colo.

Sirs:

After reading the letter from W8DED in the Open Forum in the February issue of RADIO, I just had to write this in regard to the "too much space" that he claims is taken up with traffic work in the bands.

I think traffic work is the best and most interesting kind of work that a ham can do. I have handled lots of traffic, from the kind that W8DED claims not worth while to the kind that might have saved a life, and every time I handle a message I get a thrill out of it.

[*Continued on Page 76*]

Clean Primary Keying and a P.D.C. Note

By Harry G. Burnett,* W1LZ

Just key the last two stages of your rig in the 110 volt line. Use less filter on the buffer-driver and more on the final stage, removing the bleeder on the latter. Connect a very simple bias pack to the final amplifier, and you have the answer. The filter you take off the buffer can be used to advantage in the bias pack, as it needs a high voltage filter condenser. Simple enough?

The case for p.d.c. is ably stated and enforced by the Federal Communications Commission. Section 382 of the present Rules Governing Amateur Radio Stations and Operators says: "Power supply to transmitter.—Licensees of amateur stations using frequencies below 30,000 kilocycles shall use adequately filtered direct-current power supply for the transmitting equipment to minimize frequency modulation and to prevent the emission of broad signals." Although at first the regulations were not as strict, and n.d.c. was permitted on the final stage, on June 23, 1933, the Federal Radio Commission, as per the A.R.R.L. Board's recommendation, required adequately-filtered d.c. power supply on *all* stages on frequencies below 14,400 kc. Again, on June 18, 1935, this stipulation was extended to include the 28 Mc. band. At the present writing, therefore, the F.C.C. requires and is enforcing the use of *adequately* filtered d.c. on all stages of transmitters working below 30,000 kc.

Quoting from page 86 of the *Radio Handbook* for 1936, we have a good summary of the important advantages of primary keying: "This is a type of keying which permits a grid-leak bias to be used on the keyed stages. This method prevents clicks and safeguards the filter condensers in the keyed stages, and in addition, does away with the necessity of using a high-current bleeder and eliminates back wave 100%, if more than one stage is keyed."

Continuing this quotation, we discover the "rub". Primary keying and p.d.c., excellent features when considered separately, are hard to reconcile when employed together. Primary keying "makes perfect keying at high speeds difficult due to the tendency of the filter condensers to add tails to the dots." If the p.d.c. of the type that Mr. Reynolds says is required by the F.C.C. is used on the final stage, this statement will appear rather conservative.

However, many amateurs are keen about primary keying. It has been the "sure-fire" solution for innumerable cases of key-click interference to other amateurs and b.c.l.'s. In addition, many like it for its other advantages. Yet, if we comply strictly with the F.C.C. regulations (and the F.C.C. is gradually seeing to it that we do), many of us are going to be hampered by keying which, to quote one amateur's impression, "sounds like someone whacking a dishpan with a spoon". Enthusiastic as one may be about primary keying, it is apparent that something must be done to improve it, if one is to comply with the law and yet turn out keying that is easily readable.

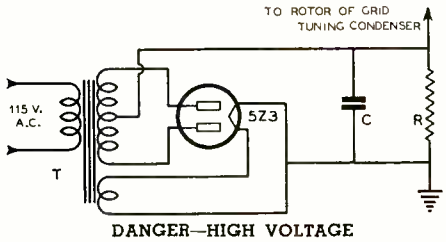
Disregarding the possibility of keying in some other manner and letting ourselves in for much additional expense, and plenty of headaches while attempting to remove all traces of key clicks, we turn to the magazines and handbooks for help in improving primary keying. The only aid we are able to find are Radio's advocation of the resonant filter, and W6BCX's article in *R/9* for January, 1935, on "Keying a Kilowatt". Neither of these cures were quite what the doctor ordered for our particular case.

"Boss" Kettering's method of trying everything under the sun that you can think of, regardless of whether it is quite the accepted way of doing the thing at hand, often surprises us by its success. By persistent tinkering and luck we chanced upon a method which seems to be a good answer to the problem of reconciling primary keying and p.d.c.

A description of the transmitter and its power supplies in use at W1LZ makes a good starting point for explaining the unique (we believe) keying method. The tube line-up consists of a '53 oscillator-doubler, a 6L6G doubler, a 242-A buffer, and an HK-354 final. The power supplies are as follows: 400 volts for the '53 and 6L6G, 1000 volts for the 242-A, and 4000 volts for the HK-354.

The keying system is as follows: The 242-A buffer and 354 final power supplies are keyed simultaneously in their respective primaries. So far we have not departed from conventional

*16 Windsor Rd., Somerville, Mass.



The Bias Pack

The grid leak, R, should be of the same value as if the pack were not used. The filter condenser should be capable of standing the bias voltage developed with the key down. Constants for the 354 amplifier described in the text are as follows:

T—600 volts each side c.t., 50 ma. or more

C—4 μfd., 2000 working volts

R—30,000 ohms, 100 watts

practice. Here is where the innovation comes into the story. Directly across the grid leak of the final, with due care for polarity, a grid bias pack is connected. This power supply delivers 650 volts to the grid of the HK-354 with the key released. When the key is down the grid leak steps into the picture and applies automatic bias to the tube. The bias pack has a potential over twice cut-off. The filter condenser in this bias pack should be rated to stand the actual operating bias voltage developed across the grid leak.[1]

No bleeder is used on the final power supply. That is the whole story of the practical side of the keying method.[2]

The theoretical explanation of how it works follows: When the key is first pressed the transmitter acts as it would under normal primary keying. The filter condensers and chokes sluggishly store up energy. The key is released. Instead of allowing the final filter to discharge its stored energy slowly and produce a distasteful "lag", the grid bias pack goes into action. Because releasing the key stopped the buffer from delivering excitation to the HK-354,[3] the bias pack instantly cuts off the tube before the large filter has a chance to discharge slowly through it. When the key is pressed again the final filter is already charged (shorting the filter with the key up definitely proves this), and the result is that the HK-354 starts to work immediately without the customary primary keying "lag". From now on the keying will continue to be clean-cut, though slightly "soft" as center-tap or blocked-grid keying is when tube keying or any adequate key-click filter is used. It definitely does not sound like primary keying, and will follow a bug. Needless to say, it is click-free.

The size of the filter used on the final does not affect the keying at all when using this new method. A filter consisting of a 40/200 henry swinging choke, one μfd., a 36 henry smoothing choke, and one μfd. was tried. At 4000 volts this is a sizeable filter. Keyed with ordinary primary keying it sounded more like a fading phone carrier than c.w., but the addition of the bias pack gave perfect keying. Reducing

[*Continued on Page 80*]

[1]The filter on the bias pack need not be large for two reasons. In the first place, a heavily excited class C amplifier is rather insensitive to bias modulation. In the second place, and more important, the bias pack as here used goes to work only *when the key is up*. When the key is down, the bias comes entirely from the grid current through the grid leak, and the bias pack ceases to operate, the current through the bias rectifier being nil. When the key is up we can tolerate some ripple in the bias pack, because no signal is being put out; the pack is used merely to cut off the static plate current that would flow with the key up. The bias pack should *not* use choke input.—EDITOR.

[2]It would be an excellent idea, for safety's sake, to provide some means whereby the filter condensers would be discharged within a reasonable time after the rig is shut down. A bank of one megohm resistors (1 watt carbon) in series (one for each 400 volts) would be satisfactory as a bleeder. The resistance would be too high to cause any appreciable discharge of the condensers during each transmission, but would discharge them down to a safe value within a few minutes after the rig were turned off. In the example cited in this article, the 2 μfd. of filter would be discharged from 4000 volts to about 250 volts by 10 megohms in approximately one minute after the switch were opened.—EDITOR.

[3]The keying lag introduced by primary keying of the buffer amplifier is negligible, because a fairly small plate supply filter will suffice in this position. Since the final stage is running class C and utilizes grid leak bias, the r.f. excitation voltage may be modulated as much as 20% without introducing even as much as 2% ripple in the carrier (provided the plate supply to the final stage is p.d.c.). However, this only holds good with an amplifier drawing maximum rated grid current at 3 or more times cut-off bias. At least one buffer stage, with p.d.c. plate supply, is required between the oscillator and the keyed buffer-driver (with skimpy filter) to prevent frequency modulation. For an explanation of the foregoing, see "Keying a Kilowatt" by W. W. Smith, *R/9* for January, 1935.—EDITOR.

Testing Transmitting Tubes

Unfortunately a "static test" is not an index as to the performance of a tube in certain transmitting applications, especially as a class C amplifier. A simple means of checking a thoriated filament transmitting tube is described, reactivation data shown.

The testing of transmitting tubes is an entirely different and much more difficult problem than the testing of receiving tubes. Receiving tubes in all normal everyday applications are seldom, if ever, called upon to deliver anywhere near their peak emission. If, on a static test, the tube can be made to deliver the normal plate current for the conditions of operation desired (i.e., at normal electrode potentials) in nearly every case the tube will be satisfactory for operation.

Transmitting tubes, however, in every class of operation except as class A amplifiers, are continually called upon to pass peak plate currents that may be as much as twenty times the average value as shown by a plate milliammeter. Especially is this true in a doubler stage or class C amplifier. Biased to 4, 5, and even ten times cutoff, with the grid driven far into the positive region, the plate current pulses are of very short duration and of extremely high value. This becomes obvious when you consider the fact that while the plate current may flow over only 1/50 to 1/20 of the cycle, still, integrated over a period of time, there is an average flow (as indicated by the meter) of the normal rated plate current for the tube. It is this peak emission capability of a tube that determines its usefulness as an amplifier in a transmitter.

To check the "peak emission" capability in a static test, it is necessary to exceed either the plate dissipation or grid current rating, which is most damaging to the tube if carried very far. A low-voltage high-current static test will not result in excessive plate dissipation, but it is impossible to get sufficient space current to flow to get any kind of peak-current check without putting such a high positive bias on the grid that the grid will be damaged from excessive grid current.

To measure the actual peak emission capability of a tube is a laboratory problem requiring an extremely expensive set-up of equipment. Due to this fact, the ham who desires to measure this emission capability of a tube must do so indirectly by properly measuring the results of this peak capability. This is the only type of a test that will actually give an idea of the worth of the tube.

The difficulty with most of these methods of test is that they require comparison with a new tube. Perhaps the best of these comparison methods is to set the tube up as a conventional class C amplifier with normal excitation and electrode potentials. First, dip the amplifier to resonance. Then cut off the plate voltage and de-tune the plate tank as far as possible from the resonant setting. Apply the plate voltage for a very small period of time, just long enough to note how far the plate milliammeter swings. Quite a high scale on the meter will be required as the current will probably be two or three times the normal plate current rating for the tube. Then compare the readings obtained with the new tube (or one known to be perfect) and the doubtful one. If the readings compare within a reasonable amount (10 or 15%) and the current flow (out of resonance) is very much greater than the rated value for the tubes, in almost every case the tube under consideration will be found to be in good operating condition. However, be *very* careful and do not allow this high value of plate current to flow for more than a second or so. A perfectly good tube can be seriously damaged in this manner.

Good operating conditions for the tube test would be: 3 times cut-off or greater bias, normal grid current, and normal plate voltage. The plate current flow must be in very short pulses if a good check is to be obtained. The shorter the pulses the better the check will be. If a very low C tank is being used it may be difficult to obtain three times normal plate current when the tank is detuned. If this difficulty is encountered it may be advisable to short the plate tank out with a short piece of heavy wire. This ordinarily should enable a larger plate current flow to be obtained. If the tube shows satisfactory in the above test, the chances are very good that it will give satisfactory service. If it does *not* show up well, the following test should be made. Set the tube up as before and raise the filament voltage about 10% or 15% and check again. An increase in plate current should be

noted. Then allow the tube to stand for a few minutes and check again. If a further increase is noted, there is a possibility that the tube is satisfactory but that the filament has been temporarily damaged by improper operation. However, if a further increase is not noted after the wait of a few minutes, more than likely the tube is plain "tuckered out", and the tube's useful life as a thoriated filament device is ended.

If the tube is a large one, satisfactory operation for some period of time can be obtained if the filament voltage is raised (25 to 40%) until enough emission is obtained. The larger the increase above the normal filament voltage, the shorter will be the life of the tube as a tungsten filament device. In most cases, if this latter procedure is followed, the tube will be satisfactory only as a c.w. amplifier; the peak emission required for phone work will be lacking at rated plate input.

Reactivation

If, however, the emission seems to continue to increase on standing with raised filament voltage, there is a good possibility that the filament has been "poisoned" and can be brought back by proper treatment. The procedure for reactivation has been described many times before but is covered here once more. The procedure is simple enough:

Disconnect all plate and grid voltages and raise the filament voltage to about 20% above normal. Allow the filament to burn in this manner for a few minutes and then check the tube again in the test circuit. If an increase is noted, repeat the burning process time after time until further burning gives no apparent increase in emission. If continued burning seems to have no beneficial effects and the filament still will not emit properly, there is one last resort before the tube is discarded. The filament, with all other voltages disconnected as before, is "flashed" for 10 to 30 seconds at 50% above normal filament potential and "cooked" at 20% above, as described before, for 15 to 30 minutes. If this last procedure obtains no results, the tube is really defunct and had best reside the rest of its days in the junk box. One thing should be remembered, however; each test or operation should not be tried unless the one before has given negative results after repeated trying.

Lastly, it should be mentioned that unless there has been some indication of the tube's demise, it is always a good idea to let well enough alone and wait until something leads you to suspect definitely the tube's ability to take care of the job wherein you are using it. One of the earliest indications of loss of emission is obtained when the tube is operating as a class C amplifier, and a pronounced falling off in grid current is noticed when the plate voltage is applied. A "fall-off" of from 10 to 30% in grid current is normally obtained on applying the plate voltage to a properly loaded amplifier. Anything much greater than this is abnormal and indicates some unfavorable condition and, while something besides the tube may be at fault, the tube should be checked. Another sign that may indicate "flattening out" of the tubes in a class B modulator is distortion or the inability to drive them up as far as was previously possible or as should be expected. While there are a dozen other things that may be at fault: improper driver, high resistance bias batteries, poor regulation in the plate supply, wrong load impedance, etc., in a case where trouble is being had and it is known that all these other things are right, it is then a good idea to look to the tubes.

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New Speaker Baffle

[*Continued from Page 42*]

Of relatively large size in comparison with the average radio console, an example of such a sound reproducer is illustrated in the accompanying photos.

The curves herewith were taken with the console back 2½ inches away from a flat wall. The dotted line shows the cut-off frequency of this large console, with the rise partially accounting for "boominess" at about 110 cycles and the secondary cavity resonance apparent at 50 cycles. The solid line shows the improvement resulting from application of the discussed principles. Here the bass cut-off is determined by the unusually excellent 18-inch speaker only.

As the application of "bass-reflex" and "peridynamic" principles to sound reproducers will extend the usual range of reproduction by several octaves, eliminate harmonic distortion due to inadequately loaded speaker diaphragms, and eliminate annoying boominess of console cavity resonance, these principles should find wide application in sound reproduction.

◆

Several of the larger manufacturers of automatic tuning receivers are making Braille tuning dials as optional equipment at a slight additional charge. The Braille call letters are read as easily by the blind as the customary printed letters are read by those who can see.

CALLS HEARD AND DX DEPARTMENTS

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

R. L. Weber, W6JCH, 1226 Sherman Street, Alameda, Calif.

Nov. 20 to Jan. 2

(14 Mc. phone)

CO2HY-8; HI2T-6; HJ3RC-9.

(14 Mc. c.w.)

AC8EA-4; AC9RM-4; D4BQO-5; D4DLC-4; D4TPJ-3; D4VRR-5; EL2A-8; F8VD-3; G5VD-4; G6XM-4; HH1P-8; HR7WC-5; K5AG-8; K5AY-8; K7BZX-7; LU8EN-7; LY1HB-2; NX1Q-3; NY2AE-7; PA0AZ-3; PA0GN-5; PA0UN-3; PA0XD-3; PA0ZB-3; PK1MO-6; PK1RL-4; PY1AZ-5; PY1DC-5; PY1MK-5; PY2AC-5; PY2BX-5; PY3BP-5; SP1LM-3; SV1KE-5; TI2FG-5; VK2DO-5; VK2DG-6; VK2XD-4; VK3QR-5; VK5ML-6; VK6FO-4; VP2GA-5; ZE1JF-4; ZL2MN-4; XS1AL-6; ZS2P-5; ZS5X-5; ZS6AJ-5; ZS6AY-6; ZT2Q-7; ZT5P-5; ZT6Z-4; ZT6A-5; ZT6AH-4; ZT6AL-5; ZT6AU-6; ZT6N-6; ZU5AF-5; ZU5L-5; ZU6AF-6; ZU6E-7; ZU6L-8; ZU6P-8.

ON4NC, Chateau de Rameignies par Thurmaide, Belgium

(28 Mc.)

D4ARR; F8EO; F8GR; F8VS; FA8BG; FB8AG; HAF2K; HAF6J; HASZ; I1IT; J2CE; J2IF; J3DC; J3FJ; LU9AX; OE1EK; OE1FH; OE3WB; OH7NF; OK1AW; OK2HX; OK2MV; ON4CJJ; OZ5M; SU1RO; U9ML; VK3CP; W8CRA; YU7GL; ZE1JJ; ZS1H; ZU6P.

W. T. Heller, W3BVL, 4501 Powell Ave., Baltimore, Md.

Oct. 4, 1936 to Jan. 3, 1937

(14 Mc. c.w.)

CN8AH; CT1AA; CT1BT; CT1KR; CT1MS; CT1ZZ. — **D** 3BMP; 3CFH; 3DSR; 3FZI; 4ADF; 4BQO; 4BUF; 4GJC; 4HNG; 4NRR; 4QFT; 4RLC; 4SMO; 4SXR; 4TPJ; 4XBG; 4YJI; 4YNN. — EI3J; EI4J; EI5F; EI6G; EI7L; ES5C. — **F** 3ADL; 3AM; 3EY; 8BS; 8CP; 8CS; 8EF; 8NJ; 8NL; 8NR; 8QY; 6RR; 8VD; 8VP; 8WK; 8YG; 8ZZ. — FT4AA; FT4AB; FT4AC; FT4AZ. — **G** 2DK; 2FO; 2GC; 2GQ; 2JF; 2JU; 2LK; 2MI; 2PL; 2PN; 2TM; 2XK; 2YB; 2ZY; 5BJ; 5DR; 5HH; 5JO; 6KA; 5NJ; 5PP; 5QI; 5RF; 5RI; 5SR; 5TP; 5UD; 5WH; 5ZN; 5ZX; 6BM; 6DL; 6DT; 6KP; 6KS; 6LC; 6LD; 6LH; 6MD; 6MK; 6NX; 6SI; 6TD; 6TR; 6UV; 6VX; 6XI; 6XL; 6XM; 6XW; 6YR; 6YU; 6ZV; 8BK; 8CL; 8FZ. — HAF5C; HAF8D; HB9AZ; HB9B; HB9BD; HB9BN; HB9BY; HH2A; HH3L; HH5P; HH5PA; I1IR; I1LD; I1TKM; J2JJ; LY1J; LY1KK; OA4AQ; OH5NB; OH5OD; OK1RO; OK1ZB; OK2LO; OK2PN; OK2RS; ON4DX; ON4FE; ON4FQ; ON4JB; ON4LU; ON4OU; OZ1R; OZ5NB; OZ7CC; OZ7KG; OZ8A. — **PA** 0CE; 0DC; 0GN; 0JV; 0KW; 0LR; 0MF; 0MH; 0PA; 0QB; 0QF; 0SD; 0VB; 0XF; 00XG; 0XM; 0YQ; 0ZB; 0ZK. — PK6AJ. — **PY** 1BR; 2AG; 2BX; 2FY; 5QD; 5QG; 7AB; 7AJ; 8AE. — SM5QU; SM5UU; SM7UC; SM7YA; SP1CS; SP1LM; SU1CH; SU1SG; SV1KE; U1BC; U2NE; U3AS. — **VK** 2AE; 2CE; 2DA; 2DI; 2EL; 2HV; 2IC; 2JX; 2KS; 2LZ; 2OJ; 2QE; 2UD; 2ZC; 3EO; 3GP; 3GQ; 3GV; 3HK; 3JK; 3LA; 3MR; 3OC; 3UA; 3WD; 4BB; 4HL; 4UA; 4YL; 5FM; 5KG; 5LY; 5UK; 5WJ; 5WR; 5XA; 6KB; 6SA; 7AB; 7CK; 7JP. — **VP** 1JR; 2DF; 2GA; 2TG; 4TM; 5AB; 5AC; 5CC; 5ST. — VQ4KH; XU6SW; YM4AA. — **ZL** 1CD; 1CV; 1DM; 1DV; 1FE; 1HY; 1JI; 1LM; 2CP; 2II; 2JQ; 2QM; 4CK; 4FQ. — ZS1AN; ZS1AX; ZS2X; ZS6AY; ZT1Z; ZT2Y; ZT6AK; ZT6AU; ZU1T; ZU5G; ZU6AF; ZU6L; ZU6P.

Adolfo Dominguez, Jr., CM2AD, Milagros 37, Vibora, Havana, Cuba

(14 Mc. c.w.)

W 1KED; 1NI; 2HXT; 6NWQ; 9UIT. — CN8AD; F8EO; HC2CG; HK5FG; K6NLD; LU4BH; PY5QG; SU1CH; SU1RO; VK2VV; VK7LZ; XE1DA; XE3K; ZS2X.

(28 Mc. c.w.)

W 1SPE; 3EMR; 3FAH; 3EYE; 9GIL. — D4SXR; G2NQ; G2PL; G2WQ; G5QY; G5RI; G6CL; G6LH; G6VX; HB9J; K4AAN; ON4NC; PA0AZ; PA0MQ; VE1EA; VE2DM; VO1N; YL2CD; YM4AA.

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

December and January

(7 Mc.)

F8LA; VE3AJS; VPLJR. — **W** 1BWR; 1FHT; 1FZF; 2HWA; 2HZV; 2IXV; 2ON; 3ENV; 5FQK; 5GBA; 5GBP; 6HEW; 6INZ; 6LXY; 7FXG; 8IQE; 8LYW; 8MUD; 9KHU; 9PQP; 9VFZ; 9WIS. — YV5AP.

(14 Mc.)

FA8DA; FB8AF; FM8AD; HCQMO; K5AC; K6FAZ; K6LGY; K6MTH; K7FRU; LA2X; LU4DQ; OA4J; PY2AC; VE3AHN; VE40B; VE4TO; VE4YO; VK2CP; VK3AL; VK4PR; VP4TF. — **W** LAPU; LAQH; LBXC; LCJI; LIOM; LIZY; 2AD; 2CBT; 2DQT; 2HHF; 2HHI; 2JPW; 2KCM; 3BSM; 3CMS; 3FGW; 3FMS; 3FXM; 4AVC; 4DIJ; 4EAV; 5FES; 5FKU; 5KWA; 6NHE; 7ETK; 8BSE; 8NQD; 9ANX; 9CCT; 9DVQ; 9LED; 9MHD; 9NGV; 9PQP; 9SSI; 9TQW; 9TTE; 9UNZ; 9WEN; 9WMQ. — XE1FL; ZL1CV; ZL1HQ; ZS4J; ZU6AF.

(28 Mc.)

OA4J; PA0AZ. — **W** 1AK; 1ALB; 1GAZ; 2BUX; 2ENY; 3DBX; 3DOD; 3EXR; 3GHS; 8HN; 8MCF; 8QJT; 9EF; 9UYD; 9VQJ. — XE2BV.

Howard H. Brokate, Port Clinton, Ohio

Dec. 22 to Jan. 22

(28 Mc. dx)

D 3AAN; 3BEN; 3BMP; 3BXK; 3CDK; 3DBN; 3GRH; 4BUF; 4FND; 4KPJ; 4ORT; 4XJF. — EI8B. — **F** 3KH; 8NS; 8OB; 8QW; 8RR; 8WQ. — **G** 2PN; 2RD; 2WS; 2XC; 2XB; 5CM; 5KH; 6DH; 6IR; 6WY; 6YR. — I1IT; OE1MR; OH7ND; OK2HX; OK20P; OK2RM; PA0AD; PA0AZ; PA0XR; SM6WL; SM7XZ; ZE1JJ; ZS6AJ; ZT2Q; ZT6AQ; ZT6Y; ZU1T; ZU6E; ZU6P.

J. J. Michaels, W3FAR, North Wales, Pa.

Jan. 1 to 17

(28 Mc.)

D3BMP; D3DSC; D4KPJ; D4ORT; D4XLG; F3CX; F8QW; FA8IH; G2RL; G5QY; G6GF; G6HL; G6LK; G6VS; G6UX; G6WY; I1KN; K6MVV; OE1EK; OH7N; VE4BF; ZE1JR. — **W** 3DLY; 3GGC; 4DNV; 5EUP; 6HDU; 6KSP; 6KUI; 7EKA; 7EYE; 8CJM; 8CKY; 9AZE; 9DRQ; 9DTP; 9GND; 9HFF; 9NVE; 9PRI; 9RXL; 9UZL.

J. Vincent McMinn, 12 Edge Hill, Wellington, C-3, New Zealand

Oct. 1 to Nov. 1

(7 Mc. phone)

CE5AA-6; CMX-7; XE1AM-7.

(7 Mc. c.w.)

CE5AA-7; CR7ME-5; D4XBG-6; D4YMI-6; F3CR-6; F8BW-7; HH5PA-6; KA1FM-6; LU9GF-5; PK1MF-5; UE3EA-6; XU2HY-6; XU2Y-6.

(14 Mc. phone)

W 1BR-6; 2KAC-6; 2ZC-6; 3CUB-7; 3EHY-7; 3EKH-7; 4AKA-6; 7IF-6; 8DIA-7; 9EYN-6; 9WEE-7. — CE1AG-7; F8II-7; F8DW-6; F8MG-6; HS1PJ-7; K6DTT-7; K6JPD-6; KA1ER-6; LU6KE-8; LU7AG-7; OA4AB-6; OA4AI-7; PK3ST-6; PY2AK-7; PY2CK-7; PY2ET-6; SU1KG-5; VE4CW-6; VO1I-6; VS2AK-6; VS6AB-6; VU2CJ-6; VU2JN-6; XE1G-8.

(14 Mc. c.w.)

CE2AR-6; CM2BE-5; CT1AA-7; CT1DT-6; CT1CO-5; CT1GU-5; CT1KH-6; CT1KR-7; CT1ZZ-5; CT2AB-6; CR9AB-6. — **D** 3BEN-6; 3BMP-6; 3BRT-5; 3CDK-5; 3DHN-5; 3DLC-5; 3DRF-6; 3DXU-5; 4DMC-5; 4FND-6; 4GAD-5; 4HCF-6; 4MOL-6; 4QFT-6; 4WCT-6; 4XCG-6; 4YJI-6; 4YTM-5; 4YWM-6. — ES2C-6; EI3J-6; EI9G-5. — **F** 3AK-5; 3BR-6; 3GS-6; 3KH-5; 3NA-6; 3NX-6; 8CP-5; 8DC-7; 8DW-7; 8EO-6; 8FC-6; 8FK-5; 8IZ-5; 8JJ-5; 8NV-5; 8RC-5; 6RR-5; 8TG-6; 8TM-5; 8UM-6; 8YG-5; 8ZF-5. — FK8AA-6. — **G** 2AV-5; 2BY-5; 2GC-5; 2KB-4; 2PL-6; 2TD-5; 2WQ-5; 2YL-5; 5GQ-5; 5JO-6; 5JZ-6; 5KG-4; 5MY-6; 5TH-5; 5YG-5; 5YH-5; 6GR-5; 6HB-6; 6JW-5; 6PY-5; 6ZU-6. — HAF1G-6; HAF4H-4; HAF7H-7; HAF8C-7; HB9AI-5; HB9AK-5; HB9AT-6; HB9B-6; HB9BD-7; HB9BK-6; HB9M-5; HB9T-6; HB9X-6; HS1PJ-6; HS1PU-8; I1IT-6; I1KN-6;

I1TKM-7; K5AC-5; K5AG-5; K5AM-6; KA1KR-5; LY1J-5; LU3EV-6; LU9AX-7; LU9BV-7; OE1EK-5; OE3FL-6; OE3KH-5; OE7EJ-5; OE7JH-6; OH3OI-4; OH8NK-5. — OK 1CB-5; 1FK-6; 1FZ-5; 2HK-5; 2HL-5; 2LO-6; 2MV-5; 2OP-6; 2PN-5. — ON4FE-6; ON4GW-6; ON4HC-6; ON4ID-6; ON4NC-6; ON4PA-5; ON4WL-5; OZ3J-6; OZ7CC-5; OZ8JB-6; OZ9Q-5. — PA 0AZ-6; 0DD-5; 0FF-6; 0KW-6; 0MDW-5; 0MQ-6; 0MW-5; 0UN-5; 0QQ-6; 0XG-5; 0ZK-5. — PK1JT-6; PK1MD-7; PK1MF-5; PK1RA-5; PK1RL-5; PK2MO-5. — PY 1MZ-4; 2AC-6; 2AG-5; 2BB-4; 2BU-5; 2DC-6; 2DN-7; 2ET-7; 3BP-6; 4AP-6; 5AG-5; 5QB-6; 5QG-7; 6AB-5; 8AG-5. — SM5CC-5; SP1BA-6; SP1IB-5; SP1IH-5; SP1LM-6; SU1CH-5; SU1KE-5; SU1RO-5; SU1WM-5; U1CN-5; U9AL-5; VE1IW-4; VE2DM-7; VE2IF-6; VE3ADP-4; XE2CG-6; XE2L-5; XU2HY-6; XU2Y-6; XU3YK-6; XU3ZC-5; XU6SW-5; XU8LR-5; YM4AA-5; YM4AF-5; YU7DX-7; ZP6AB-5; ZS4J-5; ZT2B-5; ZU1X-5.

Eric W. Trebilcock, BERS-195, Telegraph Station, Tennant Creek, North Australia

(7 Mc. c.w.)

W 3DBX-6; 5FIH-5; 6AX-7; 6BBY-7; 6IQA-5; 6KFQ-6; 7FOO-6; 7FPK-6; 7FPU-5; 9UAJ-5. — J2IX-5; K5AM-5; K6CGK-7; K6HZI-3; K6MAW-5; K6MZK-5; KA1HR-8; KA1MD-8; KA1RW-6; KA9NE-4; KA9SK-7; KA9WX-7; SP1FF-5; UE3EL-6; VE4GS-5; VE5IR-6; XU3DO-6; XU8KY-7.

(14 Mc. phone)

W 1AXA-7; 1FV0-5; 1UH-6; 2EDW-6; 2HFS-6; 3DNZ-6; 3EOZ-8; 3LP-6; 3SI-6; 3ZX-6; 4BAZ-6; 4DAY-6; 4DBC-7; 4AH-7; 5ACF-7; 5BAT-6; 5ETR-6; 5JC-7; 6AM-7; 6DTE-6; 6FOH-6; 6GNP-6; 6IRX-6; 6ISH-6; 6ITH-8; 6KSO-6; 6LLQ-5; 6LLU-5; 6LR-7; 6LY-5; 6NEH-7; 8ANO-6; 8ANY-5; 8DNY-6; 8JNU-6; 9ARA-6; 9CLH-6; 9GIC-7; 9NGZ-6. — HK1Z-5; HP1A-6; K6CMC-5; K6JLV-6; K6KKB-6; KA1AK-6; KA1AN-5; KA1ME-7; NY2AE-7; OA4R-6; OM2RZ-6; PK1MX-8; PK4AU-9; VQ6AQ-5; ZE2AH-6.

(14 Mc. c.w.)

CM2AI-5; CM2AO-6; CM7AI-6; D4ARR-6; D4GJC-5; D4XCG-5; F8EB-5; F8EJ-3; F8FE-4; F8NY-5; F8PZ-5; F8VM-4. — G 2BM-4; 2PL-5; 2WQ-6; 5PZ-3; 6CJ-5; 6DL-6; 6WY-5; 6XQ-5. — HB9AK-5; HH1P-4; HH5PA-5. — J 2CH-6; 2IF-5; 2JJ-5; 2MI-5; 2MU-6; 3CG-5; 3CR-7; 3CX-7; 3FI-7; 4CT-6. — K 5AA-7; 5AF-5; 5AG-5; 5AY-6; 6AJA-5; 6BAZ-5; 6BHL-5; 6BUZ-8; 6KSI-6; 6KVX-7; 6LBH-6; 6LEJ-7; 6MAW-5; 6NLD-5. — KA1HR-6; KA1XA-5; LU2AM-4; NGO-6; OK2MA-4; OM2RX-8; ON4CJJ-4; ON4FE-6; PA0AZ-5; PK1MO-7; PK1PK-7; PK4CR-5; PK6AJ-7; PK6GF-6; PZ1AA-6; SV1KE-4; U2NE-3. — VE 3IG-4; 3UG-3; 3FB-4; 4AW-5; 4RO-7; 4RU-6; 5JB-5. — VP5AB-6; VP5AD-4; VP5AE-5; VP5PZ-7; VS6AQ-6; VS7JW-6; VS7RA-5; VS8AA-5; VU2JP-6; XE1AK-4; XE1CM-4; XE1DD-5; XE2GQ-6; XE2ZZ-6; XU8SM-6; XU8ZT-7; YN1AA-6; ZB1H-5.

Howard Seefred, W6EA, 343 South Fremont Ave., Los Angeles, Calif.

(14 Mc. c.w.)

CM2JW; CP1AA; CX1BG; F8PZ; G2PL; G2WW; G6AG; G6MY; G6NJ; HAF4K; HC1JW; HH3L. — J 2CL; 2IS; 2KJ; 2LO; 2MI; 3DP; 3FJ; 3FK; 5LJ; 6DK. — K 5AA; 5AC; 5AM; 6DV; 6KLL; 6KSI; 6MEG; 6NRF. — KA1AQ; KA1RR; KA1US; LU1CA; LU5UC; LY1J; NY2AE; OA4Z; OH3OI; OK1BC; OK2RS; PY7AA; SP1BA; TI2LR; VE1AE; VE1EA; VE1EP; VE1KK. — VK 2AE; 2DA; 2DK; 2EG; 2FX; 2IA; 2IG; 2KS; 2LX; 2MH; 2MN; 2NY; 2SK; 2TD; 2TF; 2TI; 2TO; 2ZT; 3EG; 3GP; 3HK; 3JK; 3JT; 3KK; 3KT; 3KX; 3MR; 3OC; 3ZZ; 4EL; 4JU; 4JX; 4KX; 4LE; 4LM; 5CM; 5WJ; 5WR. — VP1AA; VS1AA; VS1AJ; VS2AG; XU8AG; XE1AM; XE1AY; XE1BD; YU7DX; YV5AA. — ZL 1AA; 1DM; 1FE; 1HH; 1KE; 2BP; 2CP; 2CW; 2JQ; 2KD; 2MF; 2PV; 3AD; 3CS; 3GN; 3KS; 4AC; 4AO; 4FO. — ZU6E.

Wm. L. Williams (W6AHP), Aboard Yacht "Stranger", KFSH, South Sea Island Cruise
Xmas Island
Sept. 29

(3.5 Mc. c.w.)

W1ZL; W6MQF; W7ESZ; W9HO; W9SWC.

(14 Mc. phone)

W 5CQI; 5JC; 6ANU; 6DTE; 6FQY; 6ITH; 6IXJ; 6LLQ; 9CXJ; 9NNO. — NY2AE; PY2CK; VE5HI; VK2ABD.

(14 Mc. c.w.)

W 2DRJ; 3AGV; 3CWL; 3FKF; 3FRX; 4KI; 5DFN; 5EAI; 5EBN; 5EHR; 5ENE; 5EOW; 5FFX; 5FRL; 6AAE; 6BAG; 6BAM; 6CSI; 6DFO; 6DZE; 6EUL; 6FMY; 6GK; 6GRX; 6GJP; 6HCF; 6JBO; 6JJU; 6JWT; 6JYS; 6KBB; 6KNF; 6KQA; 6KSY; 6LHW; 6LLV; 6MCG; 6MUE; 6NEP; 6TI; 6WQ; 7BTG; 7EKA; 7EPB; 7EQZ; 7FJP; 9AVO; 9CIH; 9HB; 9HDU; 9PIY; 9RVM; 9UQV; 9VDQ. — K5AA; K5AM; K6DV; K6JPD; K6KSI; K6LGZ; K6MTE; LU5BZ; LU7AZ; PY2BU; VE3WA; VE4OX; VE5KC; VE5MZ; VE5NP; VK2TD; VK3CX; VK3EO; VK4GK; VK5JB; VU2CQ; XE1AM; XE1AX; ZL2MM; ZL2PC.

(28 Mc. phone)

W5BEE; W6BBQ; W6MWO; W6NFA; VK2GV.

(28 Mc. c.w.)

W 6BOB; 6FMY; 6JNR; 6LJD; 6LS; 6MPC; 6NCT; 7BQX; 8BIK; 8NK. — VK2LZ; VK3YP; VK4EI; X1AM.

(DATE AND LOCATION ON FOLLOWING CALLS NOT GIVEN)

(7 Mc. c.w.)

W 2BEZ; 2IRO; 3IG; 4DNH; 5EDDD; 5FEZ; 6AVY; 6BOY; 6CJE; 6DPE; 6EFM; 6KZC; 6MEL; 6MTD; 6MVG; 6NAE; 6NJG; 7BAQ; 7CHU; 7FKT; 8FEY; 8IFE; 8LGO; 8NYY; 9DJX; 9DXZ; 9LBA; 9MKL; 9RXB; 9SJD; 9UXY; 9VZJ; 9WEW; 9WOV. — CE2BX; K6MZK; K7BNW; K7CHP; VE2FJ; VE5MB; ZL2LB.

(14 Mc. c.w.)

W 1FFK; 2DEU; 5CEN; 6DQD; 6IVX; 6LBP; 6LFL; 6LLV; 6QD; 8BTI; 8DFH; 8HFZ; 8INZ. — J2CL; J2JJ; VS7GJ.

Alois Weirauch, OK1AW, Mestec Kralove, Czechoslovakia
Oct. 1 to Nov. 1

(28 Mc. phone)

W 1ADR; 1CCZ; 1CHG; 2ENX; 2FWK; 3CYK; 9IJZ.

(28 Mc. c.w.)

W 1CCZ; 1CFD; 1COI; 1FH; 1HIO; 1OIB; 2DTB; 3CKD; 3CYF; 3EVT; 4AUU; 5AFX; 5BEE; 5FJ; 6FQY; 6GLI; 6GRX; 7AMX; 8CRA; 8GFD; 8IFD; 8IJZ; 8IWG; 8KDO; 8NK; 8OKC; 8IW; 9ANA; 9BYE; 9DTB; 9DZX; 9ICW; 9JFB; 9UYD. — CN8MI; CN8MQ; FA8CR; F8BAB; FT4AG; G2LK; G20A; G5JU; G5QY; G6CW; G6GN; PY2BR; VE1AM; VE2AC; VE3ADM; VE3ER; VE4DU; VK2LZ; VK3BQ; VU2AU; ZS1H; ZT6Y; ZU1C; ZU6E.

Ed. Alcala (W6IGA), U.S.S. Tiger, C.G., Hilo, Hawaii
(Stations all heard at Jarvis Island in South Sea Islands.)
Oct. 21

(160 meter phone)

W 5EEB-8; 5FAC-9; 6AOF-8; 6EEZ-8; 6IO-9; 6KFX-9; 6LXZ-8; 6MCX-9; 6NAL-9; 6NAT-8; 7FAA-7; 9JVO-8; 9ROQ-7.

A. E. Lower, XU3XA, XU8XA, and C. Martineau, XU3CM, XU8CM, KA1CM, P.O. Box 685, Shanghai, China

(14 Mc. phone)

G6YQ-9; PY2CK-9; PY2EC-9.

(14 Mc. c.w.)

D 3BEN-8; 3BMP-8; 3CSC-6; 4AKK-5; 4ARR-9; 4DLC-6; 4GJC-8; 4HCF-5; 4MOL-5; 4TKP-7; 4YTM-5. — EI5F-8. — F 3LK-8; 8IG-7; 8IZ-7; 8JJ-9; 8RJ-5; 8UM-7; 8WK-8; 8YG-4. — G 2CW-8; 2RX-5; 2TM-6; 2TP-7; 2VF-6; 2VV-8; 2YZ-8; 2ZB-8; 5BJ-8; 5CW-7; 5CY-9; 5IL-8; 5JA-5; 5JI-7; 5OV-5; 5TD-5; 5UD-8; 5VQ-8; 6DL-8; 6HM-5; 6KP-6; 6NJ-9; 6PK-8; 6TD-7; 6TI-7; 6QC-6; 6UJ-8; 6VP-9; 6WN-8; 6XW-5; 6YL-4. — HAF1G-9; HB9BD-9; HB9X-8; LA3H-8; LA4DQ-8; LA4K-8; LU2AM-9; LU2FR-8; LU4DQ-8; OK2PN-6; OK3VA-9; ON4CH-4; ON4GK-7; ON4JE-5; ON4RAY-8; OZ2B-8; OZ3J-9; OZ7KG-5; OZ9A-9; PA0CE-9; PA0JV-8; PA0MD-8; PA0TZ-4; PY2CW-9; PY2DN-4; SM2WB-6; SM7WI-5; SP1IB-4; SP1JD-6; SU1SG-5; SU5NK-4; UE3EC-8; UK3AA-7; VK2DG-8; VK2QE-7; VK2VE-8; VQ3FAR-7; VQ4KSL-5; VU2BJ-9; W6IFN(?)-5; W6IFX(?)-4; 6MOJ-6; 7ERA-8; XU3YK-9; YL2BB-9.

W. F. Bellor, W8EBS, 186 Dorsey Road, Rochester, N.Y.

(28 Mc. c.w.)

CO2QQ; D4AUU; D4FND; D4GDF; D4ORT; D4SMO; D4XJF; EI8B; F8EO; F8HZ; F8KJ; F8OB; F8WQ; G5BP; G5PP; G6HN; HB9AW; I1IT; K4DDH; K6MVV; OA4J; OE1FH; OE7EJ; OH3OI; OK2HX; OZ3J; PK1RL; PK3MP; VK2LW; VK4AP; YM4AA; ZE1SU; ZS1AD; ZS1B; ZS1H; ZT2Q; ZU1C.

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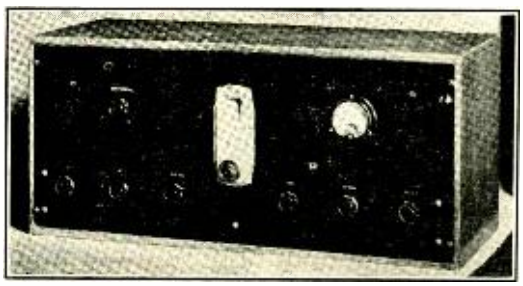
Exports of transmitting apparatus last November were $118,662 as against $89,636 for November, 1935.

A Home-made Phone Receiver That Really Works

By Chas. M. Weagant,* W7GAE
and Lee Campbell,* W7ADH

As we at W7GAE and W7ADH were primarily interested in phone, when the need arose for a new receiver we decided to build one that woud be most effective for phone reception. Consequently it could not be so sharp as to cause serious sideband cutting, with its attendant reduction in intelligibility.



Front Panel Layout of the Receiver

The input to the receiver is designed for use with a double doublet antenna and has a tapped transformer at the set to facilitate matching the feeder impedance. A Faraday screen is interposed between the tapped antenna coil and the grounded link circuit that serves to couple the energy from the antenna to the grid coil on the r.f. stage. The use of this screen effected a pronounced reduction in automobile QRM and other man-made noises by greatly reducing the capacity coupling between the antenna and the input circuit.

It was decided to use only one stage of high gain r.f. amplification. Two stages were not considered as the gain at 14 Mc. and higher is not enough greater than that obtained with one to warrant the extra parts required. Also, a reduction in tube and background noise is obtained through the use of only the one stage. A reserve of gain is available on all the bands used. The r.f. stage and first detector are made with external trimmers brought out to the front panel, enabling the set always to be "trimmed" up for maximum gain. However, each of the oscillator coils has its own self-contained trimmer condenser which is originally adjusted properly to scale the ham bands and then not touched further. In addition, all the coils are tapped to enable better bandspread.

The first detector, a 6C6, is operated with manually-adjustable fixed bias, which is obtained from the power supply. This adjustment on the 6C6 bias allows a screwdriver adjustment to be made for best first detector sensitivity and gain. The 6D6 electron-coupled high-frequency oscillator is coupled into the screen grid of the first detector tube. This latter coupling arrangement was found to give the best conversion efficiency in our particular case.

The two-stage i.f. amplifier uses National air-tuned air-core transformers throughout. The more selective iron-core transformers would probably have been better had the receiver been designed only for c.w. work. A common cathode bias control on the two i.f. stages serves as the main gain control for the set. The rheostat itself is one which has incorporated in it a fixed minimum adjustment of the bias on the i.f. grids.

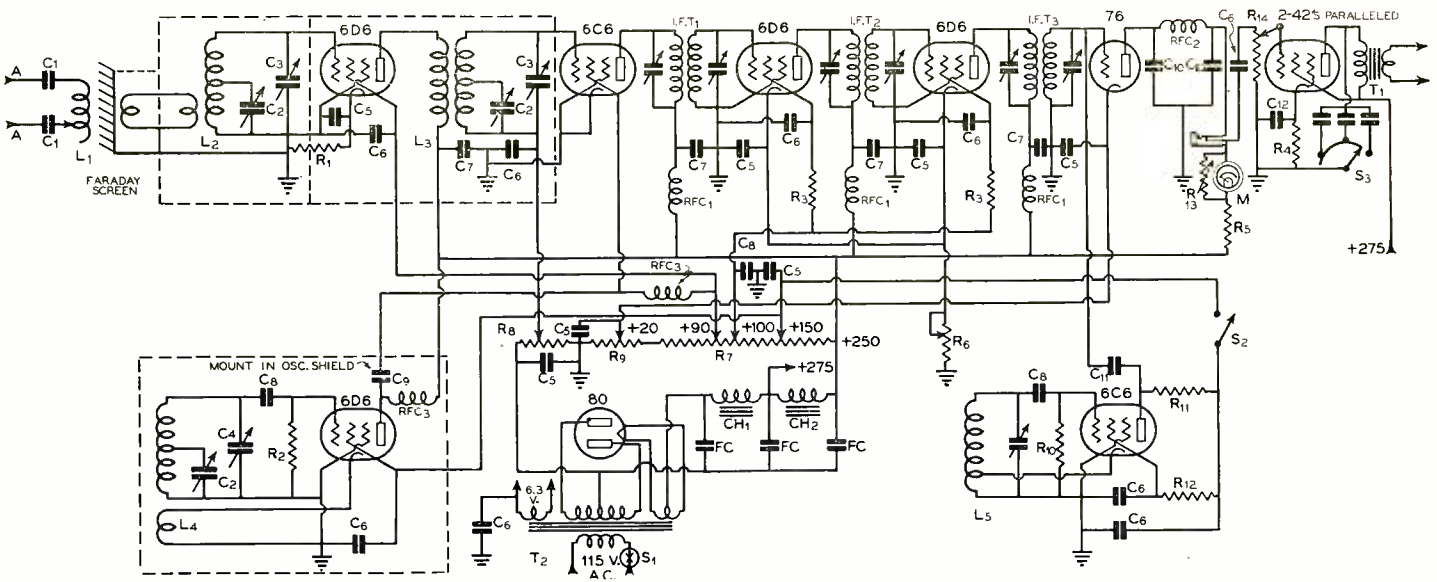
The power second detector utilizes a 76 triode which has manually variable fixed bias, allowing adjustment to be made for best detection action and power handling ability. This adjustment (the same as the *first* detector bias adjustment) is made by means of a screwdriver in a slotted shaft potentiometer mounted on the subpanel. Through the uses of this type second detector, an easy and convenient method of using any type of phones with the receiver is provided. In addition, by hooking an 0-1 ma. meter in series with the detector plate lead, a very active signal strength meter is provided. A variable shunt resistor is connected across the meter's terminals to allow adjustment of its sensitivity.

A 6C6 beat oscillator and a pair of 42 pentodes in parallel to feed the loud speaker complete the lineup of the set proper. The power supply is conventional in using an 80 rectifier, three 8 μfd. electrolytics, and a filter choke and the speaker field.

Mechanical Construction

The majority of the constructional details can be seen from the photographs shown. As can be seen in the under-chassis view, each stage

*4110 No. E. Fremont St., Portland, Ore.



Wiring Diagram of the Receiver

C_1—.0001 µfd. mica
C_2—100 µµfd. midget variable
C_3—75 µµfd. midget variable
C_4—75 µµfd. air padder condenser
C_5—.5 µfd., 400 volt tubular
C_6—.1 µfd., 400 volt tubular
C_7—.1 µfd., 600 volt tubular
C_8—.00025 µfd. mica
C_9—.0001 µfd. mica
C_{10}—.00025 µfd. mica
C_{11}—Very small coupling capacity 2" twisted hookup wire
C_{12}—25 µfd., 50 volt elect.
FC—8 µfd. wet electrolytic
R_1—500 ohms, 1 watt
R_2—40,000 ohms, 1 watt
R_3—50,000 ohms, 1 watt
R_4—250 ohms, 10 watts
R_5—75,000 ohms, 2 watts
R_6—50,000 ohm potentiometer
R_7—25,000 ohm, 50 watt slider type
R_8—500 ohm potentiometer
R_9—500 ohm potentiometer
R_{10}—50,000 ohms, 1 watt
R_{11}—25,000 ohms, 1 watt
R_{12}—50,000 ohms, 1 watt
R_{13}—1500 ohm potentiometer
R_{14}—250,000 ohm potentiometer
L_1—20 turns, 1" dia. tapped every other turn. 5 turns on link
L_2, L_3, L_4—See coil table
L_5—Beat oscillator coil
I.F.T.$_{1, 2, 3}$—465 kc. air-tuned transformers
M—0-1 d.c. milliammeter
T_1—Pentode output transformer
T_2—Power transformer; 350 each side, 125 ma.; 6.3 volts, 3.5 amp.; 5 volts, 2 amp.
RFC_1—5 mh. universal wound chokes
RFC_2—20 mh. universal wound choke
RFC_3—2½ mh. pie-wound chokes
CH_1—6 hy., 125 ma. power choke
CH_2—2000 ohm speaker field
S_1—SPST sw. on r.f. gain control
S_2—SPST b.f.o. sw.
S_3—Philco tone control

COIL TABLE

Band	Ant. - R.F.	Detector	Oscillator
80 meters	pri. 9 t. sec. 28 t. tap 12 t.	pri. 16 t. sec. 23 t. tap 12 t.	17 t. total 11 t. to tap 6 t. tickler
20 meters	pri. 5 t. sec. 11 t. tap 6 t.	pri. 7 t. sec. 10 t. tap 8 t.	6 t. total 5 t. to tap 4 t. tickler

with its associated resistors, condensers, and component parts is individually shielded in a sheet-aluminum-walled compartment. By thus confining each section of the receiver, any tendency toward instability and feedback was eliminated. Also, when it was required to run an r.f. lead from one compartment through another to a third, the lead was very carefully shielded throughout its length where it passed through the center compartment. This also contributes to the overall stability of the set.

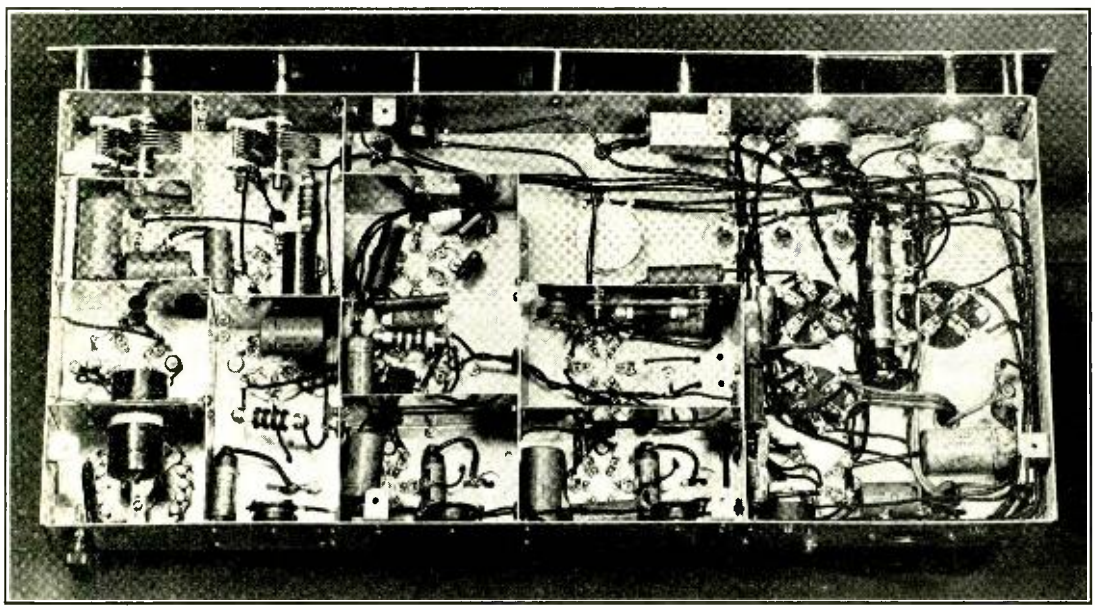
The Faraday shield, along with the antenna impedance matching switch and coil, can be seen in the extreme lower left-hand corner of the under-chassis view. A convenient way of making the actual screen part of the shield is as follows:

On a flat piece of thin sheet-celluloid about 3 inches square, space wind some no. 24 or 26 bare copper wire, spaced slightly greater than the diameter of the wire. Solder a piece of bus bar or no. 12 or 14 bare or tinned copper wire along one edge. Apply a coat of Duco cement to *one side* of the celluloid. When dry (it dries quickly) take a pair of scissors and cut along the edge of the celluloid opposite the soldered end. Adjacent wires should not make contact at this end if it is to act as a satisfactory static shield. The wire on the uncemented side may be laid back and cut off at the base with the scissors. Better use tin-snips if the x.y.l. is around.

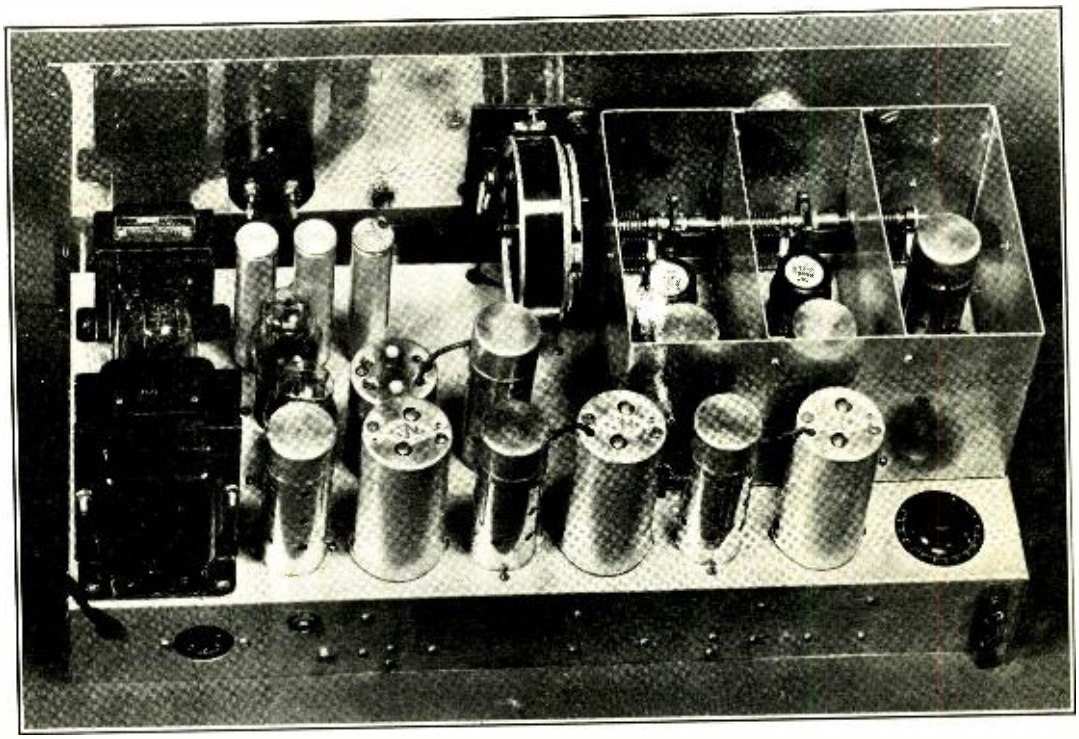
The I.F. Transformers

Another distinguishing feature of the receiver is the manner in which each i.f. transformer is individually shielded. A disc, slightly larger than the diameter of the transformer can, is cut from sheet aluminum and mounted on the bottom of each transformer. Then the whole unit is spaced from the chassis by means of a pair of insulating washers slipped on the spade bolts before they are put through the chassis. In this way the field of each i.f. transformer is completely self-contained and does not cut into the sub-chassis where it can cause interstage coupling. Through this expedient and the fact that each cathode has an unusually large by-pass condenser, quite high i.f. gain is available without any tendency toward self-oscillation.

All coils are plug-in and are wound on Iso-



Under Chassis View. Note Shield Partitions and Many By-pass Condensers, Resulting in Good Circuit Isolation.



The Design Is Simple and Straightforward, But Efficient

lantite coil forms. Specifications are given for the 4 and 14 Mc. bands; other bands are in proportion. All primary windings are interwound from the bottom of the secondary turns to give closer coupling between the stages.

Results as far as operation goes have been very gratifying. The internal set noise is very low; in fact it is almost inaudible under ordinary conditions. No difficulty has been had in hearing all continents on phone under average fair conditions.

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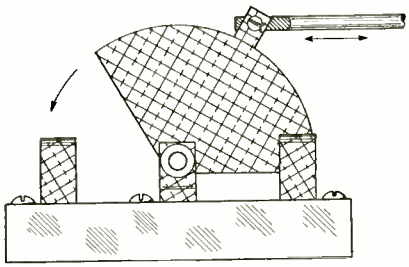
REMOTE CONTROLLED "S.R." SWITCH

The illustration (right) shows a method of remotely controlling a double-throw switch for the purpose of switching the antenna from receiver to transmitter and back. Usually it is desirable to place the antenna switch up on the wall or in some place not readily accessible from the operating position. Due to the short swing necessary to change switch position, the adaption shown will permit operation by means of a wooden dowel of suitable length. The regular switch blade is replaced with a "pie-cut" segment of same thickness copper or brass of suitable dimensions. Of course, for each additional pole another segment is required. If similar switches of a suitable number of poles



are at each end of the dowel, a cheap means of simultaneously switching antenna, receiver B voltage, and transmitter plate voltage can be had. The blade can be made in a variety of shapes to suit the mounting position or throw length wanted, but the above is satisfactory for most uses. The idea is not new, being used quite extensively back in the spark days when the transmitting antenna was always used for the receiver as well.—*W6FFF.*

A Small But Effective "Flat Top" Beam

By JOHN D. KRAUS,* W8JK

A compact, bi-directional array, simple but highly effective. Besides "pulling down" the vertical angle of radiation, it offers more gain in both directions than a single half-wave director and reflector in one direction. It may be fed either with tuned feeder or by an untuned line and matching stub.

In the days of spark, galena crystals, and catwhiskers, the "T" antenna was a common form of sky-wire. Its horizontal flat top with wooden spreaders at each end and vertical downlead at the center were a familiar sight at "wireless stations". To see a "T" antenna nowadays is unusual. Recently, however, we put up an antenna which bears a great resemblance to one of the old "T" types, as may readily be seen from the photograph. It has the flat top, the wooden spreaders, and the vertical downlead. Although its appearance may be similar to the "T", its operation is quite different.

It is actually a beam antenna of very compact design. The antenna in the photograph is less than 60 feet long overall and operates on 14 megacycles with a substantial gain in both directions broadside to the "flat top". The wires in the flat top are two in number, each one wavelength long, and crossed at the middle. The parallel wires are spaced *one-eighth* of a wavelength. A two-wire tuned feeder line (zepp. type) feeds power to the middle of the "flat top", driving the parallel wires in opposite phase. The antenna is bi-directional so that it can be used for sending and receiving equally well in both directions broadside to the flat top. It is a compact little "beamer" and can be conveniently supported by two poles of moderate height. The system in the photograph is one-half wavelength or about 35 feet above the ground. More height, up to a wavelength or so, would undoubtedly help.

The plan of the antenna with dimensions is given in figure 1. This antenna is cut for fundamental operation at the middle of the 20 meter band (14,200 kc.). In figure 1A the dimensions for one of the flat top wires are given. The insulators 1, 2, 3, and 4 are fastened at the distances shown, and this wire is then placed with the insulators in the position shown in figure 1B. A second wire and insulators are adjusted to the same dimensions and form the remainder of the flat top wiring. A two-wire zepp. or tuned feeder line is connected at the points F, F. Due to the one-eighth wave spacing the radio frequency impedance of the wires in the flat top is small and the currents are correspondingly very large. The spreaders are 1 x 2 inch strips. The detail of the center wooden spreader is given in figure 1C.

Some years ago Foster[1] and more recently Brown[2] published data showing the radiation from two antennas spaced one-eighth of a wavelength and fed with equal currents in opposite phase as in figure 2A. The arrows on the wires indicate the direction of the currents at a given instant. The radiation pattern in the plane at right angles to the wires is shown in figure 2B. It is a "figure eight" pattern with maximum radiation in line with the antennas. In the plane of the antennas the radiation is maximum broadside to the antennas and minimum off the ends. It is interesting to note that, according to the data of Brown, the gain in *both* directions from this arrangement is a bit more than that obtained in *one* direction by the use of a reflector spaced one-quarter wavelength from an antenna, the two being fed with equal currents 90° out of phase. One can shorten the antennas to seven-sixteenths of a wavelength and fold over the remaining one-sixteenth so that the feeders may be conveniently attached as in figure 2C, thus exciting the antennas 180° out of phase. Each antenna acts both as a director and as reflector for the other. This antenna can be used either vertically or horizontally. In either case, it has the desired action for dx of favoring the low angles of radiation. By adding another set of antennas co-linear with the first two, the arrangement of figure 2D is obtained. This is the arrangement of the antenna in figure 1. More sections may be added as in figure 2E. In each case, the currents in the wires on each side of the "flat top" are 180° out of phase.

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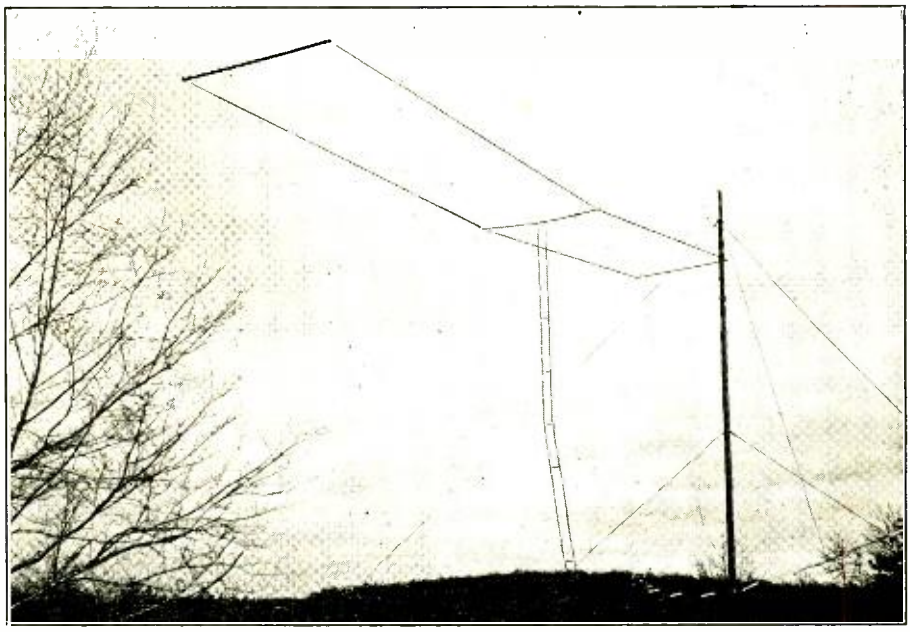
[1]R. M. Foster, "Directive Diagrams of Antenna Arrays", *Bell System Technical Journal*, April, 1926.

[2]G. H. Brown, "Directional Antennas", *Proceedings I.R.E.*, Jan., 1937, p. 94.



The "flat top" beam at W8JK. Used on 14 Mc., it is less than 60 feet long. Photo retouched to show detail.

Instead of using zepp. feeders the flat top can, of course, be fed in a number of other ways. A quarter-wave stub may be suspended at the points F, F, and a matched impedance line connected near the shorted end of the stub. The antenna in the photograph is actually fed by a zepp. line or "stub" three-quarters of a wavelength long (52 feet from the flat top to the short) which is connected to a 600 ohm line a few feet from the shorted end. The arrangement is indicated in figure 2F. The distance "X" is adjusted for a maximum of current near the center of the 28½ foot flat top sections as indicated by a flash bulb shunted across an inch

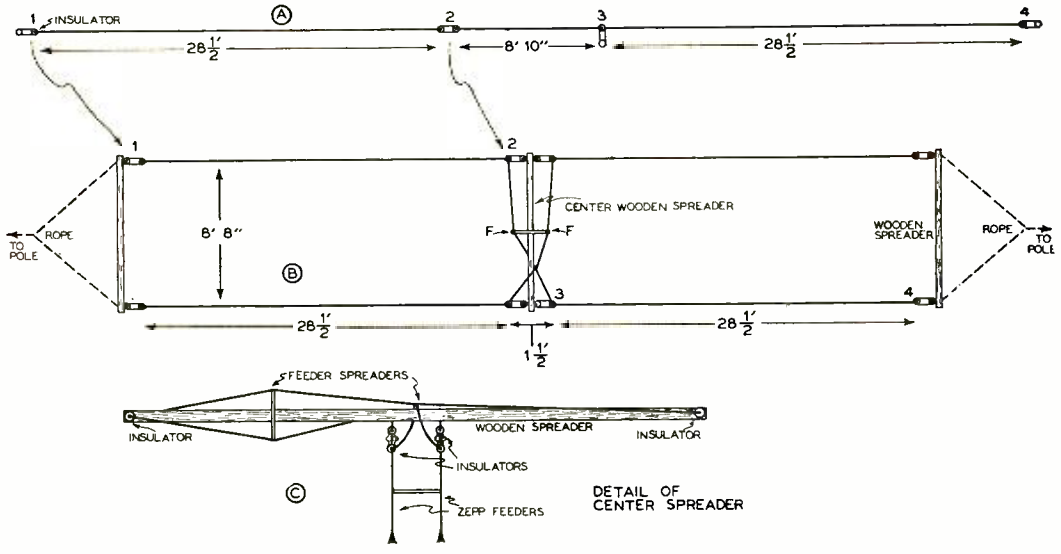


Figure 1: Dimensions of the Flat Top at W8JK. For Ten Meters Divide by 2, for 40 Multiply by 2, Etc.

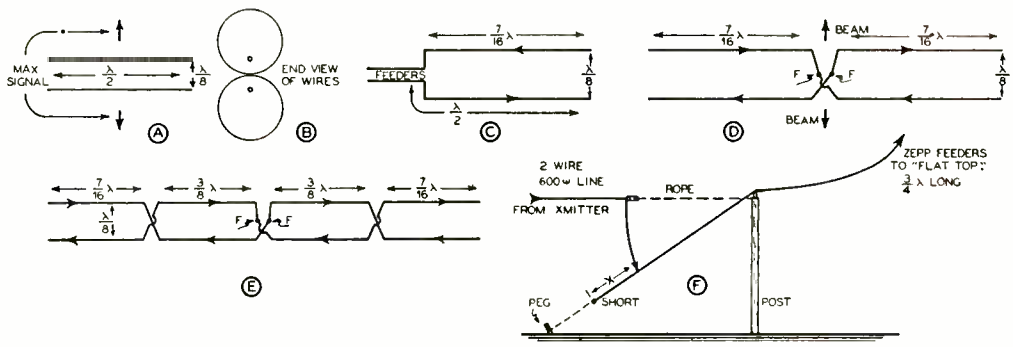


Figure 2

or two of the antenna wire. As a first trial, "X" may be made 4 or 5 feet.

The one-eighth wavelength spacing used is not critical and may be varied. It was chosen because it is effective and also a very convenient spacing for 14 Mc.

An antenna with the dimensions given in figure 1 was erected at W8JK. Folded arrays of the Mesny-Bruce type have been used at this station for a couple of years[1]. Although its gain may not equal that of some of the larger folded types at W8JK, the operation of the "flat top beam" has been a revelation. No direct comparison was made with the folded beams since they all point in different directions. To obtain an approximate check on the antenna, a calibrated field strength meter with horizontal antenna was set up at a distance of about 5 wavelengths in a direction broadside to the flat top and a reading taken. The flat top beam was let down and two horizontal half-wave antennas (co-linear and fed in phase by a zepp. feeder at the middle) were pulled up between the same poles in its place. For the same power input to the double half-wave antenna the field strength reading was about 3 decibels down. Although the two systems may possess different vertical radiation characteristics, the field strength check indicates that the addition of the antennas at one-eighth wavelength spacing has the desired effect. The gain of the flat top beam of figure 1 probably approaches 6 decibels over that from a single, half-wave horizontal antenna. The four-section arrangement of figure 2E would have still more gain but on a narrower beam. "Great circle" maps, such as have been published in RADIO (January, 1937) and in the RADIO "Antenna Handbook" should be used for orienting the beam. Although the beam is quite well defined it is, of course, possible to send and receive signals in directions well off the beam.

In a few hours of operating time during the days immediately after the flat top beam was erected, phone contacts were made with stations in India, Egypt, England, Mexico, and New Zealand. All were on two-way phone except with New Zealand. The localities contacted all lie well on the beam. Signal strength reports were very good.

The antenna of figure 1 can also be operated on its second harmonic on 10 meters, but the horizontal radiation pattern will then not be the same. For fundamental operation on 10 meters the dimensions should be one-half those in figure 1, and on 5 meters approximately one-quarter. Such a flat top beam would not be too bulky for 40 meter fundamental operation, but, if the one-eighth wavelength spacing is used, 18 foot spreaders would be necessary.

The "flat-topper" may not bore a hole through the ether like a rhombic array, but it is very effective for such a small and simple system. With its simplicity and compactness there is much to recommend it.

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Foreigners who want something very special and fancy in the way of a QSL should lay for W6FDO (the "Scotch wave" station). For dx stations he has a special QSL of red, white, and blue silk, with gold fringe and braid. The banner has his call and other data overprinted on the white silk portion. It measures approximately 7 by 10 inches and makes a very decorative addition to a wall covered with QSL cards from the U.S.A.

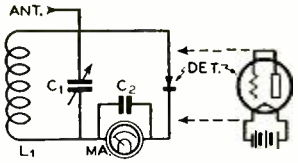
[1]J. D. Kraus, "Directive Antenna Systems", *R/9*, June, 1935, p. 14.

Handy Neutralizer and Field Indicator

By Joseph L. McGrath,* W1CT

Most frequently we neutralize a tube to make it free from any desire to oscillate or regenerate. However, when non-linearity can be tolerated in the amplifier, it may be desirable to throw the amplifier slightly out of neutralization. This tendency toward regeneration is sometimes desirable in an amplifier where unusually high power gain is needed. In either case, however, we should first neutralize the stage to the "dead" adjustment and then proceed from there.

There are a number of permanent and temporary indicators that can be used during the process of neutralization. The man who has a meter provision in the grid circuit of each amplifier tube is in a class by himself, and more than likely he will have little or no use for the gadget to be described. However, for the majority of hams, who have a limited supply of meters available, this arrangement may afford a convenient solution to the problem of accurately neutralizing the transmitter.



Field strength meter circuit used at W1CT for neutralizing and presetting circuits of high power stages

In the diagram, L_1 C_1 is a resonant circuit that tunes to the frequency of the stage being neutralized. A small condenser and coil from the junk box are required for this circuit. If desired, a good dial can be placed on the tuning condenser and the circuit calibrated to give a rough idea of the operating frequency. Many times in tuning up a multi-stage transmitter with a number of frequency multipliers a wavemeter is very helpful in telling whether a stage is doubling or operating on the third harmonic.

The meter MA can be almost any low-range milliammeter (0-5 ma. or less) found around the shack. A good many hams have an analyzer or set tester with a low-scale meter in it. It does not necessarily have to be operating as a milliammeter; a low-range voltmeter of 0-5 volts or less will be satisfactory. The by-pass condenser C_2 should be at the coil-condenser unit; ordinary leads may then be run to the analyzer where the meter is located.

The amount of current the detector will pass without "burning up" will limit the current available for working the meter MA. Those who haven't been in the game long enough to have a crystal detector kicking around in the junk box should get a piece of carborundum crystal. If you have a rectifier type meter, you don't need the detector. If you wish, a tube (type 30 with flashlight cells for filament supply for instance) with connections as shown may be used in place of the crystal.

The rig is nothing more than the ordinary field-strength meter. I did not build the parts into a unit, as the meter I use is the one in my volt-ammeter. The crystal detector avoids the bothering with filament batteries.

To neutralize a tube, connect an "antenna", as indicated at A, to one side of the tuned circuit. I have used a 5 foot antenna when it was not convenient to set the meter near the transmitter, but as a rule the pick-up lead should be shorter. Couple to the amplifier circuit by bringing the lead close to it. With the r.f. driver feeding into the amplifier, the plate supply to the amplifier broken, but with all amplifier connections otherwise as they are to be permanently, tune the L_1 C_1 circuit until a substantial reading on meter MA is obtained.

With the neutralizing condenser at zero, vary the amplifier tank condenser. As it goes through resonance the meter MA will indicate. Advance the neutralizing condenser a little at a time and tune the tank condenser through resonance until the neutralizing value is reached where the meter needle does not flicker. Advancing the neutralizing condenser still further will cause the needle to flicker again as the tank is tuned through resonance, showing that the tube is again unneutralized.

The best part of this method is the speed with which several stages can be lined up, the shift from stage to stage being accomplished by simply shifting the coupling lead. In my transmitter, with a 2000 volt supply for the last two stages, I neutralize, set two grid, two plate, and one antenna tank right on the nose before turning on the 2000 volt supply at all. I touch an insulated pick-up lead to one side of a tank circuit where necessary. The '10 stage preceding provides the necessary power.

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Improving Weak Signal Response in Superhets

By Morton E. Moore,* W6AUX

We often wondered how the W6AUX-W6CNX team was able to hear signals never before heard on the west coast. W6AUX explained that it was largely due to the receiver, which did not exactly follow conventional practice in a good many respects. Some of the revelations he made were quite startling; so we prevailed upon him to give you the dope in an article. Read it before you start your receiver.

In the article to follow I have attempted to set forth and explain certain principles which I have found to be of the utmost importance in the design and construction of a super-heterodyne receiver for amateur use. While it may be true that each item in itself may not represent any sensational improvement over some of the more common methods of design and construction, yet the sum total of the incorporation of all of the features together in one receiver will mean just the difference between a satisfactory receiver and "just another receiver".

Further, I have limited my discussion to those features which may be readily incorporated without great cost, thus making it possible for practically everyone to derive some benefit from what is to follow.

The problem of the design of a receiver for the specific purpose of weak signal reception is materially different from the problem of designing a receiver for any other use whatsoever. The design of a receiver for weak signal reception is a problem which is not to be treated in the manner usually accorded the design of receivers for other purposes, and unless the particular problems encountered are carefully studied and their solution carefully considered, there can be no hope of obtaining a satisfactory receiver for weak signals when the job is finally finished. It is safe to say that the majority of sets used by the amateur do not satisfactorily meet the requirements for a receiver for the reception of weak signals. There are certain fundamental principles in the design of circuits, the construction of coils, the choice of tubes, and many other things which lead to the satisfactory operation of the finished receiver, and it should be well worth the time of any amateur to consider these points carefully.

Weak Signal Response

In the beginning it may safely be said that the problem at hand does not concern the amplification of strong signals for they are already strong enough to take care of themselves. What is required is that truly weak signals shall be sufficiently amplified to the point that they may be heard, and that they shall be heard with as little accompanying interference as possible.

We are therefore interested in the design of *weak* signal amplifiers as opposed to the design of high level amplifiers. We are interested primarily in the detection of weak signals and not in the linear detection of high-level signals, since in general we need only to be able to understand the intelligence of a radiophone signal, without regard to the problem of high fidelity reception, and since the reception of c.w. signals will permit of all the distortion within the receiver which would arise from *any* system of detection or amplification.

"Low C" Tuned Circuits

Starting with the tuned circuit, it has been repeatedly demonstrated that the best results, as regards amplification, are to be had when circuits having a high L-C ratio are employed. When low L circuits are employed, the impedance of the parallel-tuned circuit is considerably lower than when high L circuits are employed, which simply means that the induced voltage across the grid of the tube is correspondingly lower and the gain of the amplifier correspondingly less than when high L circuits are employed (also low C, obviously). The writer has made calculations of the L-C ratios of the tuned circuits employed in the r.f. and detector circuits of amateur receivers manufactured by several nationally known manufacturers, the above mentioned circuits supposedly having very high L-C ratios. The writer has also made calculations of the L-C ratios which it is *possible* to use on the basis of a reasonable allowance for minimum capacity. The possible L-C ratios are usually several times greater than the L-C ratios employed by the manufacturer. It is sufficient to say that the highest possible L-C ratios will be obtained only when the minimum capacity of the circuit is kept very low, and the coil wound so that it tunes to the highest required frequency with this value of capacity. This means that there shall be no padding condensers used

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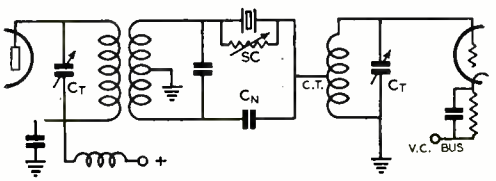


The Most Successful Crystal Filter Circuit Tried

C_T—Tuning condenser
C_N—Neutralizing condenser
SC—Variable selectivity control (see text)

for band spreading; the use of padding condensers can be obviated by the use of small condensers of fixed capacity in series with the tuning condensers, adjusted so that the total variation of capacity effected by varying the tuning capacity is sufficient to give the required band spreading.

Circuit Resistance

The L-C ratio is, however, not the only thing which affects the performance of the tuned circuit. The effective resistance of the circuit has a very large bearing upon the performance of the circuit. Both the impedance and "Q" of a tank circuit are inversely proportional to the circuit resistance R, and the highest values of impedance and circuit Q will result when R is at a minimum. Now it so happens that the presence of a conducting material in the field of a coil increases the effective resistance of the coil through losses in the material as induced eddy currents, and if the material should have a permeability greater than unity, then also through hysteresis.

Coil Shielding

Until recently it has not been feasible to manufacture i.f. transformers with iron cores because with materials formerly used the core loss was so great that the performance of the circuit would not equal the performance obtained with air cores. The moral of this is to keep the shielding well away from the coils, especially at the ends of the coils. From the theory of electricity and magnetism it is possible to calculate the effect upon a given coil by the introduction of a conducting material within its field, but unless certain simplifying assumptions are made, the calculations are quite involved, and for practical application to the design of shielding are rather without value, since they are very laborious to make, and since the simplifying assumptions usually only approximate the actual case to begin with. However, a few simple suggestions are in order.

Have the coil removed from the shielding at least two coil diameters at the ends and at least one coil diameter at the sides with normal shapes of coils such as the National SW-3 coils. For very long coils of small diameter, more space should be left at the ends, while for coils of large diameter and short length, more space should be left at the sides. The difference between proper and improper shielding can hardly be appreciated without actually comparing the two.

I have in mind a certain pre-selector which I constructed in one of my weaker moments. The pre-selector was housed in a very small can, coil and all, and fitted inside the cabinet of an FB7 receiver. I was hardly able to notice any change in the performance of the receiver after installing the pre-selector. There was no image suppression, and the signal-to-noise ratio of the receiver was still the same. I later took the pre-selector from inside the cabinet and tacked it onto the outside, putting the coil in the very center of a spacious shield can. The images completely disappeared, the signal-to-noise ratio was immensely improved, and the pre-selector now was really a worthwhile addition. And the only change was to put the coil in the center of a large can where it could really get down to business. Please, fellows, pull those padding condensers out from inside your pre-selector and first detector coil forms at least!

Coil Construction

As to coils themselves, there is not much information available on form factors, wire sizes, etc. The design of coils for high frequency work seems to be a moot question, and as to the best design there is not much which can be definitely said. However, again a few generalities are in order. Small coils, wound with small wire, are out. Coils should be of a reasonable diameter. Further, if the turns are spaced some distance apart the performance will be improved. The National SW-3 coils furnish an example of construction embodying the above principles.

Vacuum Tube Choice

Having disposed of the tuned circuit, let us now consider the other element in the circuit which requires attention, the vacuum tube itself. The function of a vacuum tube in an amplifier is to amplify the signal as much as possible, or as much as is required. There are many different types of tubes available for amplification, but for the purpose of r.f. amplification the tetrode and the pentode seem the only likely ones since they require no neutralization and

give greater amplification than do other types. The pentode is generally conceded to be superior to the tetrode in point of amplification. There are two distinct classes of pentodes available for r.f. amplification. The first class is intended for use in the i.f. stages of broadcast receivers for use with a.v.c. This class is commonly known as the variable μ tube, and is represented by the '58 and 6D6. When driven over the whole range of grid swing possible, this type of tube gives the greatest amplification obtainable. However, this pre-supposes a high signal level. It is perfectly ridiculous to expect a weak incoming signal to swing the grid of the first tube over a range of from 10 to 30 volts as is required with this type of tube before it really gets down to business. The advantage claimed for this type of extended (remote) cut-off tube for use in i.f. channels is the reduction of cross talk at high levels, the cross talk resulting from a grid going beyond cut-off and the amplifier acting as class "C". It is apparent that when working at low levels with the bias near zero, we are well away from cut-off bias, and therefore the broad cut-off tube has absolutely no preference over the sharp cut-off tube as regards cross modulation (when working at low bias with weak signals). The gain of a broad cut-off tube when working at very low signal levels is poor, and such tubes should *never* be used for the purpose of weak signal amplification when maximum weak signal response is desired, the fact that such tubes are commonly employed in commercially made receivers for this purpose notwithstanding.

The other type, known as the sharp cut-off type, is highly desirable for weak signal amplification, and will give excellent results when used for this purpose.* Pentodes of this class are the '57 and 6C6. Though these tubes will give excellent gain when operated under rated conditions, the gain at low signal levels may be considerably improved by reducing the bias from the rated value to from 1 to 1.5 volts, and increasing the screen voltage to from 125 to 150 volts. The emission from the filament in this type of tube is sufficient to handle the above conditions while still giving reasonable life.

Metal Tubes

It will be noted that so far nothing has been said of the metal tube. We shall now issue a word of caution about the use of metal tubes. Owing to the fact that most, if not practically all, pre-r.f. amplifiers are coupled to the detector through an *untuned* primary which is inductively coupled to the tuned circuit of the detector, and owing to the fact that the plate-to-filament capacity of the tube is directly across the primary of the coupling transformer above mentioned, it will immediately be apparent that at high frequencies it is desirable to keep the plate-to-filament capacity of the tube as low as possible. This is one of the reasons for the use of acorn tubes at ultra-high frequencies. Since metal tubes in general have from 2 to 2½ times the output capacity of glass tubes, and since they differ but little from glass tubes in operating characteristics, they will not produce as satisfactory results as glass tubes at high frequencies such as 14 and 28 Mc. In the i.f. stages where the plate-to-filament capacity becomes a part of the tuning capacity of the primary circuit, the above statements do not apply, and metal tubes may be used to advantage because of their small size.

Let us consider the remaining requirements for weak signal amplifiers. The pre-r.f. amplifier is the most important one to consider. It should employ a sharp cut-off tube as previously explained. It should be run wide open at all times (1 volt bias for a 57 or 6C6), and no gain control of any kind whatsoever should ever be used on this stage. Further, though the introduction of regeneration will bring about more amplification, and in cases of receivers lacking in gain, will enable weak signals never before heard to be heard, it *should not be employed since, though amplification is increased, the noise is increased all out of proportion to the increase in gain.*

If a receiver is incapable of bringing in weak signals without regeneration, then there is something sadly lacking in the receiver, and said receiver is in serious need of attention, and the solution does *not* lie in the addition of regenerative pre-r.f. I cannot too strongly emphasize this point. Ever notice how with the old "detector and one step" the noise of the detector increased

*The mutual conductance of a type 58 at 1 volt bias and 150 volts screen voltage (normal plate voltage) is approximately the same as for a 57 under the same conditions. However, the plate current on the 58 will be excessive under these conditions. To bring the plate current down to a safe value, it will be necessary to increase the bias to a value that cuts the mutual conductance to less than half that of the 57 operating under the first mentioned conditions. In other words, the mutual conductance of a 57, *for a given plate current,* is higher than that of its variable μ cousin, the 58. If we run both tubes at the maximum safe plate current, the 57 will have the higher gain.—EDITOR.

as the point of oscillation of the detector was approached? Ever notice the loud hiss just before the detector broke into oscillation? Well, to be effective, a regenerative r.f. stage must be operated just below the point of oscillation in order to get gain, and the resulting noise is thus amplified by the receiver, which absolutely ruins the signal-to-noise ratio. The r.f. can never be operated under the condition of oscillation, and if it is not operated *just below* the point of oscillation, then it is not regenerative in the true sense of the word. Therefore, regenerative r.f. is "out".*

The output signal level from the first detector, even though a good stage of high-gain pre-r.f. precedes it, will not be high when considering weak signals, and the *first* i.f. stage should therefore employ a sharp cut-off tube, or at the very worst, nothing with a more remote cut-off than the 6L7 used in the control position of noise silencer circuits in the first i.f. stage. It has been recently demonstrated by Western Electric that the sharp cut-off tube is in every way superior to the broad cut-off type, and such tubes are employed in the Western Electric 10-A receiver, the last word in high fidelity broadcast receivers. The ham might well learn a lesson from this and use such tubes as the '57, 6C6, and 6J7 in his receiver, since their superior weak signal amplification is unquestioned.

The other important item having to do with weak signal response of the receiver is the system of detection employed. Diode detection is linear when operated at high level. At low levels the output is very, very low, and there is a certain threshold level below which it will not operate, and this threshold level is sufficiently high to class it as absolutely worthless for weak signal detection. And this goes for the second detector! When signals after having passed through the i.f. amplifier are so weak that they can just be heard, then the second detector must be a weak signal detector. This is preferable to adding regeneration to the pre-selector.

What may be said of the second detector goes doubly strong for the first detector, for here we are *really* dealing with weak signals. By the way, did you ever notice anyone using a diode for a first detector? No! Why not? Must be because they aren't so good for weak signals, as they have surely tried about everything else. Plate circuit detection is considerably more sensitive at low levels than diode detection, has more distortion, is somewhat suitable for weak signal detection, but is not nearly so sensitive as grid leak detection. Grid leak detection, when used with a small grid blocking condenser and high value of grid leak, is extremely sensitive to weak signals and is the finest weak signal detector for general use known. It has more distortion than does plate detection, but it must be pointed out that it was used for broadcast reception with good results long before plate detection made its appearance. Grid leak detection should by all means be used for weak signal detection, and that goes for both first and second detectors. To this there will always be those who will say that after going through the i.f. channel the level should be high (and in this they miss the very point of weak signal reception, for weak signals are very weak) and that "anyway, you can always add audio amplification". Now it is obvious that 10,000 times zero is still zero, and if there is no signal except noise to amplify, then no amount of audio amplification will make the signal appear. Further, what is wanted is a weak signal detector, in order that the strong signals shall not obtain unholy preference over the weak signals when vying for the operator's attention.

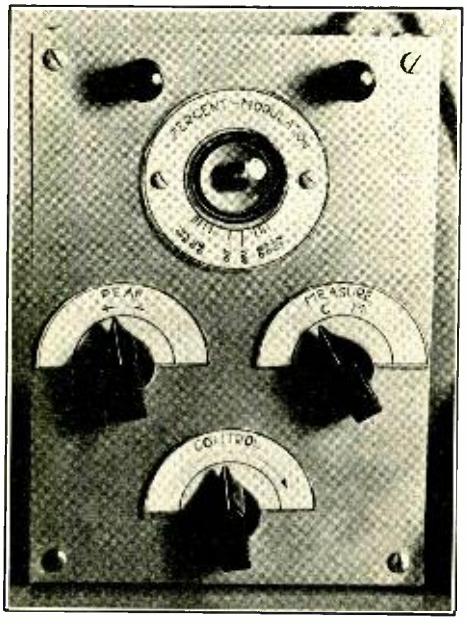
So far we have considered only the matter of obtaining sensitivity within the receiver, and to the reader it might appear that we had forgotten all about the noise which accompanies the signal and which we wish to do away with if possible. But in obtaining weak signal sensitivity, we have done the very things which must be done to meet the requirements of a high signal-to-noise ratio. We have utilized high "Q" circuits, tubes especially designed for weak signal amplification, and employed special weak signal detectors. By utilizing high "Q" circuits, while leaving the noise voltage of the tube constant, we have increased the signal voltage over what it would be with a low "Q" circuit and have therefore improved the signal-to-noise ratio. By utilizing sharp cut-off tubes we have obtained the maximum weak signal amplification, and have reduced the tube noise from what it would be had broad cut-off tubes been employed, since sharp cut-off tubes have less shot effect (in proportion to signal) than broad cut-off tubes. By utilizing detectors designed for weak signals we have made it possible to obtain greater response to weak signals while leaving

[*Continued on Page 80*]

*This contention was made also in "Intermediate Amplifier Design", C.F.Bane, RADIO for March, 1936.

The "Tell All" Meter, the Phone Man's Friend

By H. HARRISON*



Panel View of the Meter, Showing the Calibrated "Eye" Indicator

The amateur is usually somewhat reluctant to tie up very much money in measuring or test equipment, excepting perhaps the meters integral with his transmitter. He usually prefers to spend the money on the transmitter itself. The wisdom of this is very questionable, but nevertheless that is the case. He buys everything else first, and then if he can still afford it, he buys perhaps an oscilloscope, over-modulation meter, etc. He may buy the parts for these instruments and build them himself, but the procedure is the same: he buys them last.

The instrument to be described, while comparatively simple and inexpensive, will perform numerous functions around the station that make it quite valuable to the amateur who refuses to tie up money in more expensive measuring equipment. It will measure percentage modulation due to voice. It will measure r.f. harmonic content. It can be used to measure gain per stage in arbitrary units. And it may be used as a general voltage indicator.

*1063 Columbia Ave., Chicago, Ill.

As a percentage modulation indicator, the meter measures the r.f. carrier, measures the individual loops of the a.f. wave, and responds instantaneously to a.f. changes.

The tube line-up of the "tell-all" meter consists of a 6H6 as a double diode, a 6E5 as an indicator, and a 25Z5 as a rectifier. The unit works from 115 volts a.c. and fits in a cabinet only 7 x 5 x 5 inches.

Figure 1 shows a block diagram of the modulation meter. To reproduce the actual conditions existing within the envelope of the emitted wave, it is necessary that the modulation meter introduce no wave distortion or harmonics. This requires the use of a linear rectifier in the carrier and a.f. circuits.

The device indicates the amplitude of the r.f. and the a.f. By calibrating the "eye" in terms of the carrier, we have a meter sufficiently accurate for our purposes.

As may be seen from the wiring diagram of figure 4, the r.f. is obtained by coupling the pick-up coil to the tank coil of the last r.f.

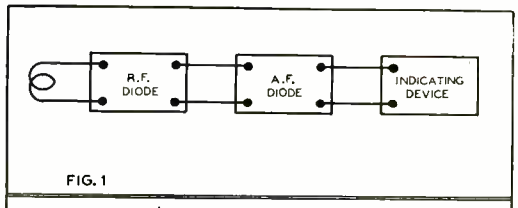


FIG. 1

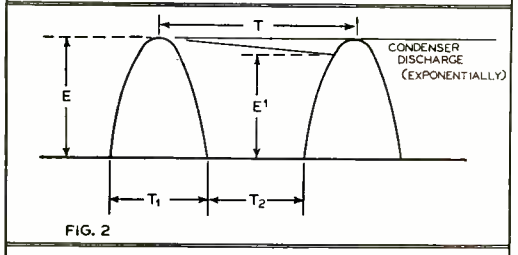


FIG. 2

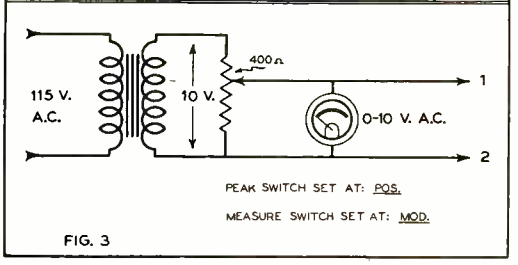
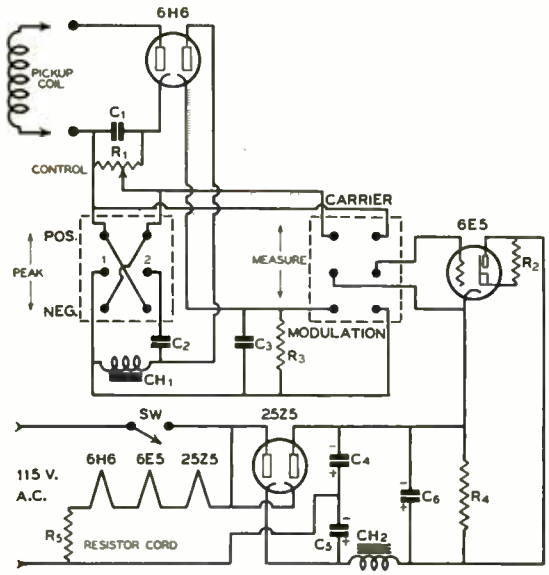


FIG. 3



General Wiring Diagram

C_1—.006 µfd. mica
C_2—0.5 µfd. tubular
C_3—0.2 µfd. tubular
C_4, C_5—8-8 µfd., 150 volt elect.
C_6—4 µfd., 350 volt electrolytic
R_1—50.000 ohm potentiometer
R_2—1 megohm ¼ watt resistor
R_3—250.000 ohms, 1 watt
R_4—20.000 ohms, 10 watts
R_5—258 ohm line cord
CH_1—100 hy. audio choke
CH_2—30 hy. 25-50 ma. choke
SW—Line switch on back of R_1

stage. The rectified r.f. is present across the 50,000 ohm control. This control regulates the amplitude of the r.f. voltage impressed on the 6E5 indicator tube.

When the r.f. contains a modulating wave, the a.f. is impressed across the 100 hy. choke coil. It is then rectified by the second section of the 6H6. The rectified voltage across the time circuit C_3R_3 is then switched to the 6E5. The arc on the fluorescent screen will close an amount dependent upon the amplitude of the rectified a.f. voltage. The opening of the arc can be calibrated in percentage modulation as is shown in the illustration of the front panel of the device.

The "peak" switch permits either loop of the a.f. wave to be rectified, thereby giving a means of measuring each peak value. The "measure" switch connects the 6E5 input to either the rectified r.f. or the rectified a.f. The timing circuit C_3R_3 performs the duty of controlling the speed of the arc amplitude change. The disadvantage of meter type indicators is that a meter cannot follow the actual change in voice amplitude. The fluorescent screen of the 6E5 can follow the change provided the C_3R_3 circuit does not act as a damping circuit.

Referring for the moment to figure 2, the operation of the timing circuit is as follows: During the period of conduction (T_1), the rectified voltage of maximum value E appears across R. During T_2, no voltage is across R. The arc on the 6E5 will respond to E, and during T_2 will open. This will give to the human eye an average closure which will *not* be equal to the arc closure produced by E. To cause the arc on the fluorescent screen to maintain the closure due to E during the time T_2, a condenser C_3 is connected across R_3. The condenser is discharged during T_2 to the value of E^1. The value of E^1 is made as conveniently close to E as is practicable. A ratio of E^1 to E between 0.90 and 0.95 will give values for C_3 and R_3 that are easily obtained. Let the ratio of

$$\frac{e^1}{e} = 0.90$$

For a 200 cycle wave the period

$$t = \frac{1}{200} = 0.005$$

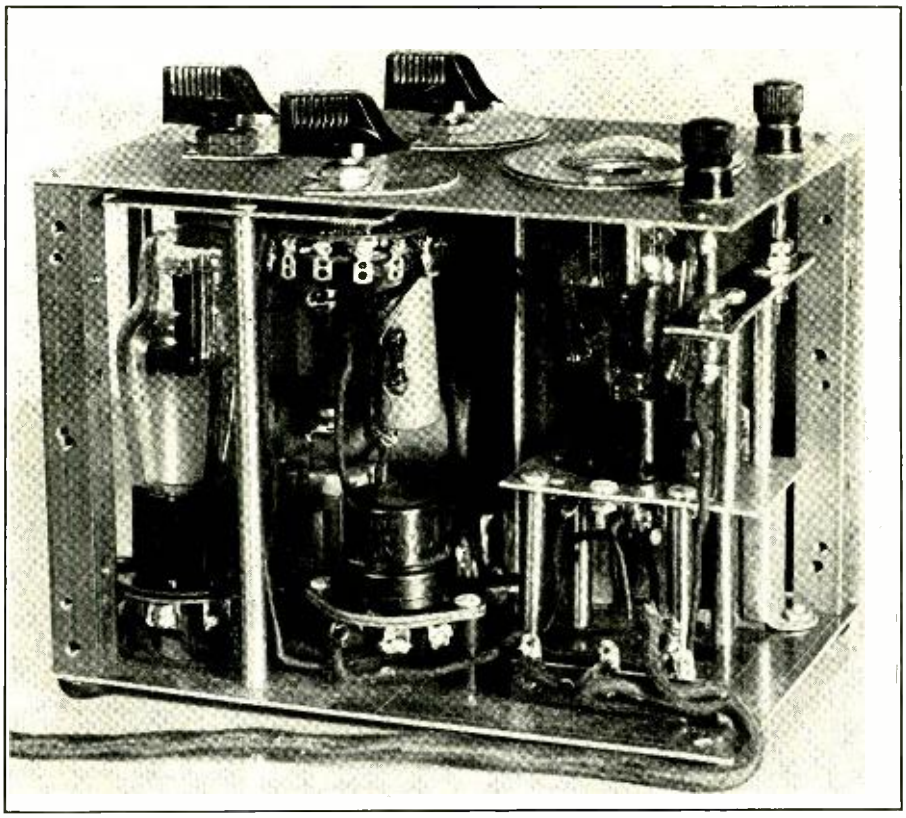
Select R_3 as 250,000 ohms. Then

1) $e^1 = e\left(\epsilon - \frac{t}{CR}\right)$
2) $\frac{e^1}{e} = \epsilon^{-\frac{t}{CR}}$
3) $0.90 = \epsilon^{-\frac{0.005}{C \cdot 250{,}000 \cdot 10^{-6}}}$
4) $0.90 = \epsilon^{-\frac{0.02}{C}}$
5) $\text{LOG}_\epsilon\ 0.90 = -\frac{0.02}{C}$
6) $-\text{LOG}_\epsilon\ 0.90 = \text{LOG}_\epsilon \frac{1}{0.90} = \text{LOG}_\epsilon\ 1.11$
7) $\text{LOG}_\epsilon\ 1.11 = \frac{0.02}{C} = 0.1042$
8) $C = \frac{0.02}{0.1042} = 0.192\ \mu FD$

Calibration of the instrument to indicate percentage modulation may be made in a very simple and accurate manner. Figure 3 illustrates the method. Amplitude modulation deals with the relation of peak voltage amplitudes. Percentage modulation may be expressed as the ratio of a.f. voltage divided by r.f. voltage.

We are dealing here with voltage regardless of the source. In the calibration, the voltage necessary to close the arc is recorded. Let this voltage represent 120% modulation. 100% modulation will then be at a lesser voltage. If we calibrate the closure of the arc in terms of percentage modulation, we have a simple and easy way of calibrating the indicator.

For example, suppose the arc of the 6E5 closes when V equals 7 volts. We select the percentage modulation points as 120%, 110%, 100%, etc., down to . . . 0%. 7 volts is represented by 120%. To determine what



Side View with Cover Removed, Showing Compact Construction

voltage represents each of the other points we compute as follows:

$$\frac{120}{7} = \frac{110}{x}, \quad x = \frac{110 \cdot 7}{120} = 6.42 \text{ VOLTS FOR } 110\%$$

$$x = \frac{100 \cdot 7}{120} = 5.83 \text{ VOLTS FOR } 100\%, \text{ETC.}$$

When the arc due to carrier alone is set at the 100% mark, any a.f. voltage above or below that point will close the arc proportionately. The calibration is marked on a paper form placed about the circumference of the 6E5, as shown in the photo.

The following procedure is used in measuring percentage modulation. First, couple the pick-up coil to the output r.f. coil of the transmitter. Set the "measure" switch to "carrier", and the "peak" switch to "pos." Then vary the control to the 100% mark. Set the "measure" switch to "modulation". Read the percentage modulation on the scale around the 6E5 "eye". To read negative peaks, set the "peak" switch to "negative".

Measurement of Filter Ripple

The procedure for measuring filter ripple is exactly the same except that no voice modulation is used. Whatever a.f. is present comes from power supply modulation.

The r.f. harmonic content may be measured by using a tuned circuit at the binding post terminals. Tune the circuit to the fundamental. Regulate the arc to the 100% point. Tune the tank to the harmonic frequencies, in, each case reading the arc calibration in per cent. Once the control dial is set for the fundamental, it should not thereafter be varied. Switch positions should be as follows while taking the readings:

Peak—"Positive"

Measure—"Carrier"

Control—Vary till arc reads 100% at fundamental

[*Continued on Page 84*]

Postscripts and Announcements

Reduced Mortality: Men and Crystals

We received a postcard asking why the 2200 volts in the 100TH transmitter shown in the February issue was any more dangerous than any other 2200 volts. It isn't; that was just the first drawing to appear with the inscription.

Hoping that a constant reminder will do something in the way of reducing the burns and deaths in the ranks of the radio amateur due to accidental electrical shock, we instructed our drafting department to include the inscription *"Danger—High Voltage"* on drawings of all circuits utilizing 500 volts or more.

Also started last month was the policy of showing, wherever practicable, a low-current 6.3 volt dial light as a warning indicator in series with the crystal of any crystal oscillator. We have shown these at various times in the past, but now are going to show them whenever one can be used without upsetting the circuit, in the hope that you will remember to incorporate one when building the rig described.

Saving human lives is of the greatest importance, but saving the lives of crystals is of importance too.

Schedule of 56 Mc. Transmissions from G6DH — 1937

Automatically keyed, stabilized, *unmodulated* c.w. transmission sending "Test 56 de G6DH" 50 watts input, non-directional horizontal antenna. Frequency 56,000-56,500 kc.

Daily including Sundays, commencing February 1st. Times are G.m.t.

February and March

10.00 - 10.30	13.00 - 13.30
11.00 - 11.30	14.30 - 15.00
12.00 - 12.30	15.30 - 16.00

April, May and June

09.00 - 09.30	13.30 - 14.00
10.00 - 10.30	14.30 - 15.00
11.00 - 11.30	15.30 - 16.00
12.00 - 12.30	16.30 - 17.00

During May and June transmissions will also be made between 17.00 and 19.00 (when conditions warrant them).

On days when conditions are good and there is a possibility of contact with other stations, the above schedule may be subject to slight variation.

A daily watch will be kept for other signals (using a receiver that is capable of receiving weak c.w. signals).

SCOOP
Coming Next Month

Just what you have been waiting for in a low-powered transmitter or high-power high-frequency exciter

40 to 45 watts output on 10, 20, and 40 meters

•

One crystal and only 3 single-winding coils cover all three bands

•

Less than 20 seconds to change bands

•

May be used either as an exciter or c.w. rig

•

May be high-level modulated for 10 or 20 meter phone

•

No neutralization, no shielding, no coupling adjustments

•

Only three variable tuning condensers, no more

•

Four inexpensive, receiving-type tubes

The simplest, most economical, most inexpensive, most efficient 10-20-40 meter rig you have ever seen

Still 30 Cents

A number of subscribers have written in regarding the 50c price on the cover of the February issue. This was an accidental "hangover" from the previous issue, the Yearbook number. Subscribers should ignore the 50c price; it does not indicate that the price has been advanced on regular issues. All newsstand copies were corrected before being shipped.

◆

Calls Heard

When sending in lists of calls heard, please list band, type of emission, and approximate date. Usually one of the three is lacking. Many lists make no distinction between phone and c.w., and as many 14 Mc. and 28 Mc. amateurs work both, this information is of great help.

"QROP"

Regularly we get letters asking why we show so many 1 kilowatt c.w. rigs, and beseeching us to show lower powered rigs instead, as but relatively small percentage of amateurs can afford a kilowatt transmitter.

The reason for this is that by leaving off the final stage, an excellent 50-150 watt transmitter results. There is no law that says a certain amplifier circuit must work into another tube and not into an antenna. Then, in the future if one should desire to increase power, a matched and perfectly adapted amplifier may be added by merely "completing" the transmitter.

Perhaps the best way to show a high-powered c.w. transmitter circuit would be to describe it as a "hundred watt transmitter with optional one-kilowatt amplifier for those who want more power".

Because driving requirements and modulator requirements enter into the picture in a phone transmitter, the same line of reasoning does not hold true. For that reason it is very seldom that a kilowatt phone transmitter is shown in RADIO.

NAME CONTEST

To the amateurs who submit what our judges consider the best names for the following departments, RADIO will present each a 2 μfd., 2000 working volt oil-impregnated filter condenser of nationally-known make.

(*Present Department Heading*)

1) "What's New"
2) "Postscripts and Announcements"
3) "The Question Box"
4) "Calls Heard and Dx Department"

To enter, merely jot down your entry on a postcard and mail to RADIO, Contest Editor. You may send in a suggestion for each of the four departments, but only one name for each department. More than one name for each department will disqualify you. In case of any ties, duplicate awards will be made. The condensers will be awarded regardless of whether or not we see fit to use the winning entries. All entries must be postmarked by March 25, 1937.

The titles now used are reasonably descriptive except perhaps the "What's New" heading. In this department are included all semi-commercial announcements and apparatus descriptions, whether pertaining to a new item or one that has been on the market for some time.

A good idea of what goes in each department may be had by referring to back issues of the magazine.

Oddity Contest

For the most unusual radio experience, submitted with proof, or for the most unusual photograph of odd radio equipment which really works, RADIO will present the winning entrant with a pair of T-20 transmitting tubes.

The facts submitted must not have appeared as "radioddities" in any other paper or magazine, nor in any "Believe-It-or-Not" cartoon, but may be based on bona fide news articles.

Any fact must be accompanied with proof, which of course will vary in requirement with the circumstances. A news article or reference to a standard textbook might suffice in one case; in another an affidavit might be made, or signatures of well-known, qualified observers might be appended.

All entries must be mailed to the Contest Editor, RADIO, before April 25.

◆

Correction

In the percentage modulation meter circuit diagram appearing on page 59 of the February issue, the indicating meter should replace the jumper between SW_2 and SW_3. Connections for the meter were not shown.

◆

Mid-America Convention

On May 21st, 22d, and 23d, 1937, will be held the Mid-America A. R. R. L. Convention in the Hotel Lowry, St. Paul, Minn.

This convention, which will culminate in a gigantic dinner at which more than 1500 northwestern "hams" will be seated, will be an important milestone on the march of amateur radio through 1937. There will be few larger conventions in the United States and none better equipped, promise the sponsors.

◆

Maywood "Smoker"

On April 3 the second annual smoker of the West Towns Club will be held in Maywood, Illinois. Fred C. Booty, W9VH, chairman of the shindig, expects that last year's attendance mark of 600 will be exceeded, since this time the committee has arranged for a place large enough to hold a thousand and none need be turned from the doors.

Souvenir programs will follow a "Paris Nights" motif.

VU7FY, SOUTH INDIA

The above photograph would lead one to think that it was taken of a very modern and complete station in London or New York. Such was not the case, however, as it happens to be that of VU7FY, situated in tropical South India, 11 degrees from the equator, and on the Kolar Gold Field in Mysore State. The owner of VU7FY, Mr. O. A. F. Spindler, an Englishman, claims the climate is very fine at his particular location (3000 feet above sea level) and electric fans are absolutely unnecessary.

Mr. Spindler was first licensed in 1925 and received the call, 2FY, subsequently adding the VU after the Washington Radio Convention.

On the right of the picture may be seen the t.p.t.g. push-pull transmitter which is used as a stand-by, and on the left of this is the crystal-controlled rig. It is a conventional three-stage job using LS5B tubes for the crystal oscillator, buffer, and power amplifier. The modulator is an LS6A, while for the rectifiers he uses two G.U.1 mercury vapor tubes. The bottom tier in the transmitter houses the power supply; the center tier contains the modulator; and the top has the h.f. and the antenna tuning unit. Many of the parts in Spindler's rig are of 1924 vintage, most of them being made locally. The only reason VU7FY never attempted to make his own tubes was the absence of a vacuum tube pump.

The present transmitter was completed and put on the air in December, 1933, and in the space of three years 93 countries in six continents have been contacted. North America is not considered an elusive continent to work; as a matter of fact it is quite local to 7FY. 300 QSO's have been made with North America, and the best time for contacting W stations appears to be from 1230 G.m.t. to 1330 G.m.t. W4DBC kept a daily schedule with VU7FY for 31 days and had all 100% QSO's but one, that being one Sunday morning when just about everybody and his brother in the U.S.A. was on the air.

The antenna at VU7FY is a voltage-fed half

wave zepp., and is the result of much experimenting by Spindler. The flat-top was carefully adjusted for the best omni-directional results. He maintains a consistent report of RST 569 from all points of the compass, and this is all done with an input of 10 watts or less. In India, power on the short waves is strictly limited to ten watts; therefore efficiency in the antenna and transmitter are of major importance.

VU7FY lays claim to being the first station in the world outside of U.S.A., and the first in the British Empire, to work all continents on *two-way* phone. The honor of being the first in the world goes to a W station.

VU7FY is always anxious to stand by for a sked, or to help some other ham contact Asia. Keep an ear open for him on the high frequency end of the 14 Mc. band (14,384 kc. to be exact) on either phone or c.w.

◆

QRR WHAS

"A boat is needed . . . A boat is needed . . . 536 W. St. Catherine . . . four need a boat . 112 S. 43d St. . . . boat needed for ten people, three are children . . . one man sick . . ."

"Boat to 2516 W. Chestnut, six people . . . Boat to 3502 W. Market . . . four adults, and one child . . . This boat urgent . . . Boat needed 292 Bank St., two people on roof . . . Truck in vicinity of Third and Breckenridge, go to 22 W. Breckenridge, six people . . . If you wait too long a boat will be needed . . . 1392 S. Second St., ambulance needed immediately."

"Boats needed at once, Kentucky Colored Children's Home, 825 S. Sixth St., must be removed next 45 minutes . . ."

And so these desperate calls continued far into the night—in fact all night—January 24th-25th. It was broadcast station WHAS at Louisville, Ky., performing emergency service in directing rescue work. And the story of WHAS is the story of many other broadcast stations dotting the map along the Ohio Valley from Pittsburgh down, and even at far away Memphis down on the Mississippi, when the flood struck or was fearfully awaited. And as the rest of America sat at home, the drama unfolded in the form of calls for help, directions to rescues, pleas for food, clothing, bedding for the countless thousands who were made homeless and forced to evacuate inundated territory.

How many hearing these cryptic calls were able to envision the announcer, huddled in a blanket in a heatless and powerless studio, reading by flickering candle-light these scribbled notes on torn bits of paper? How many appreciated the struggle of engineers and technicians who helped keep this precious link with the outside world in operation?

As in Louisville, broadcast transmitters in Pittsburgh, Cincinnati, Huntington, and Memphis immediately became central communication headquarters delivering 24-hour service, in some cases energized by gasoline-driven generators after the local power supply failed. In other cases, power cut-offs forced the transmitters off the air, but the studio equipment was quickly connected through improvised telephone circuits to the transmitters of other stations, remotely located, so that operations could continue. Typical of the response by outside radio stations to the broadcast plea for more radio men and extra portable apparatus was that of WOR at Newark, N.J., whose staff immediately dispatched operators and announcers to the flood zone, carrying with them an array of microphones and portable speech input equipment.

The police radio installations at Pittsburgh, Wheeling, Louisville, Evansville, and Memphis played worthy roles during the emergency, furnishing the means of swift communication between the scattered activities of the departments and enabling them to work with the utmost speed and efficiency in evacuating threatened areas and effecting rescues.

Teletypewriter equipment, too, carried a heavy load of dispatches between flood points and the outside world, and the U.S. Army subsequently ordered additional teletype equipment to be rushed to Jackson, Miss., far down the flood valley, to be ready in advance of the inevitable emergency's arrival.

American Airlines dispatched one of their radio equipped planes from Chicago to Louisville, where it was expertly set down on a "squishy" field in the outskirts of the inundated area, to there furnish radio communication with "outside". Other planes were then flown in with serums and other sorely needed supplies for the flood sufferers.

Probably harder hit by the flood than any of the other stricken cities was Louisville, and there the Red Cross established local headquarters right in the studios of WHAS, so as to expedite their relief operations.

With WSM in Nashville, Tenn., broadcasting the program received over a telephone connection from the studios of WHAS during the

The Perfect Amateur
CLASS "B" TUBE
Distortionless Zero Bias Amplifier
NEW AMPEREX ZB 120

Never before in the history of radio has a tube with the ideal characteristics and excellent performance capabilities of the new Amperex ZB 120 been made available to the amateur. It is a high current low voltage tube with the following general characteristics and ratings:

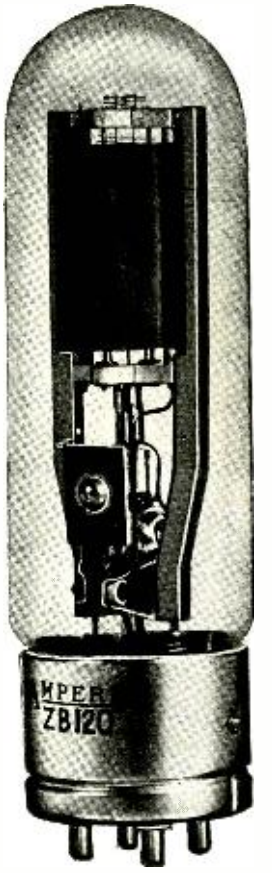
Amplification Factor	**90**
Grid to Plate Transconductance at 100 ma.	**5,000**
Filament Voltage	**10 volts**
Filament Current	**2 amps**
Maximum Allowable Plate Dissipation	**75 watts**

The combination of an amplification factor of 90 and a transconductance of 5000 is only approached in one or two of the larger transmitting tubes. This combination of characteristics in a low cost tube is only made possible by exclusive Amperex design features (covered by pending patents). It is these design elements which invest the ZB 120 with the properties that enable it to deliver, under similar operating conditions, at zero bias, power outputs of an amplitude equivalent to the much larger and costlier tubes, with such a greatly reduced distortion factor that the tube may be truly termed "DISTORTIONLESS".

The excellence of its performance in various classes of service can be judged from the following paragraphs.

PERFORMANCE AS CLASS B AUDIO AMPLIFIER-MODULATOR

Zero Bias for Plate Voltages up to 1250 volts. Power output up to 300 watts per pair of tubes. Straight line dynamic transfer characteristics, and practically constant and high input resistance, minimize circuit requirements and make possible practically distortionless operation with exceptionally low driving power.



PERFORMANCE AS LINEAR RF POWER AMPLIFIER

The special characteristics of this tube that result in its ideal operation as a Class B Audio amplifier, also afford superior performance with minimized circuit requirements in Class B RF amplifier service. Carrier output in the order of 40 to 50 watts per tube are readily attainable in this service.

CLASS C — RF POWER AMPLIFIER

In this class of service the ZB 120 will deliver up to 150 watts of r.f. power with lower driving power requirements than any triode heretofore available, and at economical plate voltages.

FREQUENCY MULTIPLYING POWER AMPLIFIER

The exceptionally high mu coupled with a high r.f. grid voltage tolerance, makes practical the use of the ZB 120 as a frequency multiplying final amplifier, with consequent savings in total tube costs and elimination of neutralization requirements.

GRID MODULATED POWER AMPLIFIERS

The characteristics of the ZB 120, ideally adapt it for use as a grid or bias modulated class C amplifier, or doubler amplifier. In this class of service, fully modulated carrier outputs of the order of 40 to 50 watts may be obtained even while doubling, with exceptionally low modulation distortion.

$10

Additional engineering information and typical performance data may be obtained by writing to our engineering department.

AMPEREX ELECTRONIC PRODUCTS, Inc.
79 WASHINGTON STREET • BROOKLYN, NEW YORK

power interruption, the station staff in Louisville was enabled to carry on. Other radio stations from coast to coast "picked off the air" the program carried from the marooned WHAS studio over that one slender telephone line rigged up for the occasion above the rushing torrent to the nearest A.T.&T. line on high ground, and thence to Nashville—and the ears of the nation heard.

◆

Scenic QSL Cards

In most drug stores of any town large enough to boast a public library and postoffice, one may purchase colored "penny picture postcards" depicting something of unusual interest or great scenic beauty in that locality.

When bought in lots of 100, these may be purchased for about a half cent apiece. By picking a view which has a good hunk of blue sky or water, one may print his call letters in red against the water or sky. Thus one has a very striking, multi-colored QSL card for about a cent a card, depending upon the cost of overprinting.

—*W7IFKN.*

◆

Standard I.F. Frequency

Assignment of the frequency of 455 kc. as an intermediate frequency standard for the radio industry has been requested of the F.C.C. by the Radio Manufacturers Association.

A protected frequency on 455 kc. would insure against interference from "riding in" on the i.f. frequency. It would be to each manufacturer's interest to adopt the "protected" frequency, and therefore the frequency would soon become standardized. It would also make it possible, in the case of amateur or communications receivers, to standardize on quartz crystal filter units, making any 455 kc. filter crystal usable in any standard superheterodyne.

◆

A velocity microphone is a sure means of putting a fine wrist watch out of the running. Care should be used when working around these mike heads. While the magnetic field does not extend a very great distance outside of the metal case, it does reach far enough to do an appreciable job on a watch hairspring in close proximity.

Taylor HEAVY CUSTOM BUILT DUTY Tubes

Two NEW Record-Breaking Values for Amateur Radio!

866 Jr.

HALF WAVE

Mercury Vapor

Rectifier Tube

$1.00

GENERAL CHARACTERISTICS

Fil. Volts.....2.5V
Fil. Current.....2.5A
Max. RMS A.C. Volts.....1250
Max. D.C. Current per pair (Choke input).....250 M.A.

T-20

20 Watts Plate Dissipation
Ceramic Base

$2.45

GENERAL CHARACTERISTICS

Fil. Volt.....7.5
Fil. Current.....1.75A
Plate Volts Max.....750
MA Max. 75
Amp. Factor..... 20
Grid to Plate.....4 mmf.
Max. D.C. grid. Curr.....25 MA

Class B audio—output..70 watts
Plate to plate load..12,000 ohms

Ask to See These NEW Taylor Tubes at Your Dealer's or Write for Full Details NOW!

"More Watts per Dollar"

TAYLOR TUBES, INC. 2341 WABANSIA AVENUE **CHICAGO, ILL.**

Amplifier Design

[*Continued from Page 35*]

rule may be helpful: When the lines of centers of two symmetrical coils (the line of center of a coil is the line that passes through the exact center of the coil longitudinally) intersect at a right angle in the center of one of the coils, there will be no mutual inductance or inductive coupling between them. Or, more broadly, when the line of center of one coil falls in a plane that passes through the center of the second coil and this plane is perpendicular to the line of centers of the second coil, there will be no coupling between them. The above rules may seem too complicated to some. If they do, sit down with a pencil and paper and draw a couple of coils and lines of centers and so forth and prove the rules to yourself. If these rules are once proven to you, it will be a very much simpler task to reduce the undesired intercoupling in the next transmitter you build. Merely putting two coils at "right angles" does not necessarily eliminate inductive coupling.

One other thing: remember that the above rules still apply to coils mounted on different shelves in a rack unless, of course, they are quite far removed from one another or they are shielded from one another.

Link Circuits

Use heavy gauge, untinned copper wire in your link circuits. EO-1 cable or a similar product makes excellent links for the higher level stages or for coupling from the final stage to the antenna. Heavy enameled wire, insulated with lengths of spaghetti and twisted, works very well for short distances or for the lower power stages. No. 10 untinned copper wire, spaced about a half inch on stand-off insulators, is advisable for frequencies above 28,000 kc.

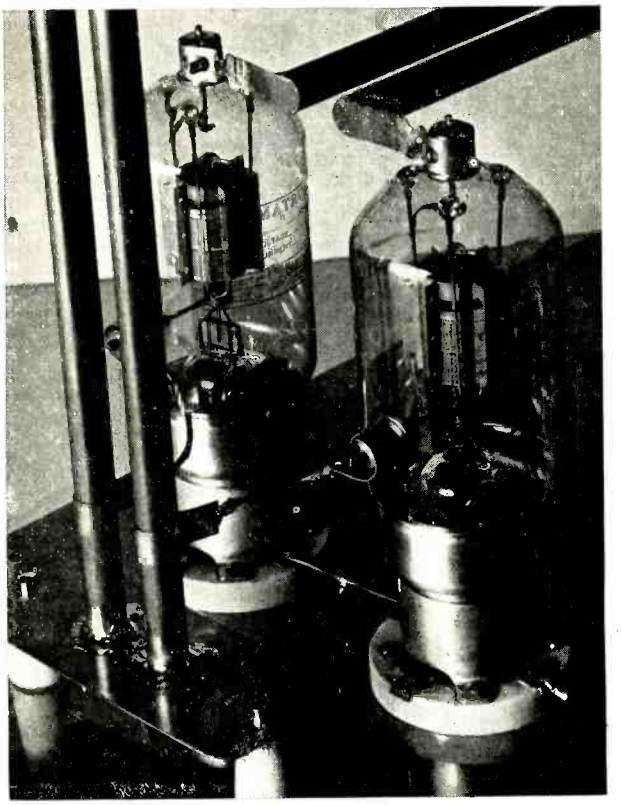
◆

Television Future

[*Continued from Page 37*]

ranks of radio engineers, physicists are making valuable contributions to television in the electronic field and no group is complete without researchers in the field of chemistry, because one of the greatest problems is to obtain a more efficient light source, as the subject of fluorescence still withholds many of its secrets from mankind.

Other things that have to be accomplished before commercial television becomes a reality are: (1) Endorsement by the Federal Communications Commission of television standards and the issuance of commercial licenses for transmission in the ultra-high frequency band suitable for television; (2) more complete coverage of the United States than is obtained by a few transmitters having limited ranges averaging 25 miles. Cities such as San Francisco,



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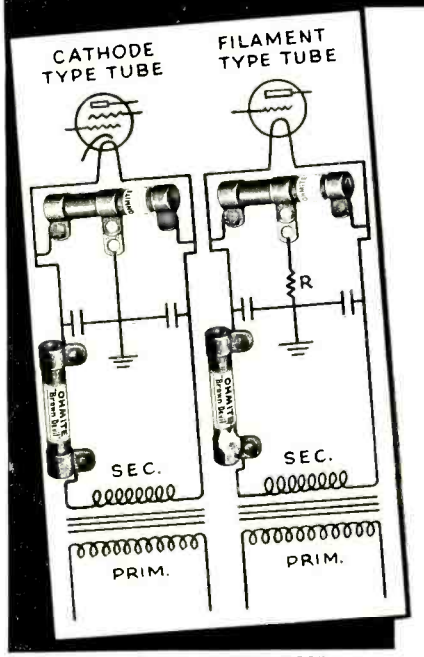

SEND FOR BULLETIN 107
Complete data covering use of resistors as outlined above. Tables show exactly what size and value to use. Check the coupon!

Here's Simple Method to Adapt Your Transmitter

ARE you planning to operate the newer type of transmitting tubes from your 7.5 volt filament supply? There's no need to scrap costly equipment already in use. The diagrams herewith show how an adaptation of equipment now in use may be easily accomplished with OHMITE Filament Dropping Resistors. Applications are shown for use with both the heater or cathode type of tube and for the filament type of tube. These diagrams also show the use of OHMITE Center-Tapped Resistors to secure electrical centers of the tube filament circuits. In the right hand diagram a grid bias resistor is also indicated.

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Los Angeles, New York, Philadelphia, Washington, Boston, etc., will have television first; (3) sources of programs—interesting programs will have to be developed. Television requires more in the way of costumes, rehearsals and properties than any other known form of entertainment. The problem of giving the American people satisfactory television programs 365 days a year assumes staggering proportions; (4) a reduction in the cost of television receivers. Home receivers producing pictures of a quality equal to home movies and much smaller in size will probably cost more than most of us care to pay. In England there is no rush to buy television receivers now selling for from $500 to $600.

As a forecast of what 1937 holds for television, Mr. Murray stated, "Field tests will continue. The peculiarities of ultra-high frequency waves will be further explored and service areas more definitely determined. Leading experimenters will change their transmitting equipment to conform with the RMA Television Standards. This means 441 lines. Experimental receivers will be improved, simplified: costs will be somewhat reduced, making the price nearer what the man-in-the-street can pay when commercial television arrives. Some improvement in picture size and brightness may be expected. Experiments in television relaying will be initiated, that is, images from the athletic field will be relayed to the main broadcasting station for rebroadcast. Research will continue in the various laboratories with unabated vigor. The search for new and better ways of flashing pictures into the home will be broadened and intensified. The result might be an entirely new method of producing this modern miracle."

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Open Forum

[Continued from Page 45]

He claims that 95% of the messages are of no importance, but what about average QSO's; they are not very important either, and handling the non-important messages greatly facilitates handling the important ones. Since the flood in the Ohio and Mississippi valleys I think it is very nice to be able to handle traffic in a way that is efficient and fast.

Even those messages that do not seem important tend to bring the amateur closer to the public and show it that the amateurs can be useful and that all their time spent on the air is not spent in telling about their rigs and saying, "That's the dope on that."

Some hams are too selfish to burn watts for anything that does not benefit themselves, and they are the ones who let traffic die on the hook. I would rather spend an hour getting through a message of no benefit to myself than to work a dozen stations to get the same reports and time of day from each of them—that's the dope on that.

I truly hope more stations will take to handling the messages of no importance, so that when the time comes to handle the important traffic they can do so with the least QRM and in the quickest way possible. This can come from only one thing and that is practice. The ham that handles traffic has my deepest respect.

C. L. PATERSON, W9GDC.

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NO MORE TOWERS?

Los Angeles, Calif.

Sirs:

I am an amateur radio operator, W6MJK. About six months ago, I erected a lattice-work tower about 67 feet in height on a piece of residential property within the city limits of

Los Angeles for the support of one end of an antenna.

I am recently in receipt of a letter from the City Planning Commission of the City of Los Angeles, which I believe you will be interested in as it raises a question of interest to all radio amateurs, as well as others interested in radio. The letter reads in part as follows:

> "This property is in zone 'R-1' and is limited to a single family residence, together with the usual accessories incident thereto, and as provided in Sec. 12.04 of the Los Angeles municipal code.
>
> "Question is raised as to whether this radio tower comes under the category of the usual accessories under the above section. In order to clarify this point, we referred the matter to the City Attorney's office for an opinion.
>
> "This opinion is now on file and states in effect that your radio tower is not an accessory structure in the sense which the zoning ordinance intends, and its erection and maintenance is therefore unlawful."

From the contents above-quoted, it will be seen that this ruling makes the erection or maintenance of a tower as part of an antenna system within a residential district unlawful. Perhaps, also, the erection of a pole for the same purpose would be unlawful.

I believe this ruling is entirely erroneous and that the erection of towers, poles, and the like for the support of an antenna is a normal and usual accessory in a dwelling district.

Have you any information or statistics which could be used to show the extent to which towers and poles, or the like, have been erected and used in residential districts?

RICHARD F. LYON.

•

ON THE ONE HAND

Cleveland Heights, Ohio.

Sirs:

We are interested readers and supporters of RADIO, but—we also are members and earnest supporters of the A.R.R.L. We think it is about time we stick in our two cents' worth.

Why is it that RADIO is always knocking the league? What has RADIO done to gain amateur rights?

There has to be some organization to protect amateur rights. Since there is only one such organization, why not help build it up, improve it and so on, instead of doing a lot of harmful knocking that does no one any good?

The league has definitely helped the hams obtain and keep the privileges we now have. In fact, if there were no league there would be no amateur radio. The league has done everything that has been done for the good of amateur radio in this respect. RADIO has done nothing like this. Then why the big noise?

We think RADIO is a vy f.b. mag. But we believe it can continue to exist without the aid of some dirty cracks for the league. It won't hurt the circulation any.

KARL M. POHLMAN, W8PMB.
JAMES B. BAMBERG, W8OPX.

•

AND ON THE OTHER

New York, N.Y.

Sirs:

Why is it that so many hams accuse you of "running down the A.R.R.L."? I haven't my ticket yet, but have read every issue of *QST* and RADIO for the last year. Whenever an argument starts at the local club regarding your "persecution" of the league, I try to get in my little say so by pointing out that RADIO merely criticises certain of the administration, but I talk to deaf ears. Once I defied anyone to show me anything in RADIO during the last year that directly or indirectly tried to undermine the league itself. No one could. But the fact that your efforts are being misconstrued would indicate it wise to soft-pedal mention of the league administration and their affairs.

HOWARD W. HAYES.

•

SECOND THE MOTION

Milwaukee, Wisconsin.

Sirs:

Your last two exceptionally fine numbers of RADIO compel me to write and offer my commendation for the excellent job you are doing.

In the open forum section, Mr. Pyle's letter strikes me as a very worthwhile suggestion that merits serious consideration by us all. It is at least a sound start in the right direction. I can vouch for his right to claim at least the 28 years background that he speaks of. I, for one, cut my eye teeth in commercial radio out here on the Great Lakes under Pyle's watchful eye (and the little red book) way back there when Pyle held down WGO. His logic and reasoning are plainly the fruits of many long watches and struggling efforts, fighting the odds of QRM and lid operating.

Let me add one further suggestion to Pyle's: that of also increasing the requirements to qualify for class "A" privileges. This is only fair and will further the cause of better amateur engineering practice. We cannot continue this

endless recruiting of new members to our ranks without finding a way and means of handling the increased numbers and of keeping them within bounds. No better example of this fact is found than the present flood emergency that, through cause of too many amateur stations working at one time, forced the F.C.C. to call a temporary ban on any but emergency traffic on frequencies below 4000 kc.

In limited numbers we play a very important part in the economic and social structure of this country, but when our numbers swell to the point where we become a burden, the public soon learns to look down upon us as a definite unnecessary evil. When that day arrives, amateur radio will relegate itself back to the listening era and the commercials will shut down their "V" wheels — their objective reached, the battle won.

C. C. RICHELIEU, W9ARE.

•

"197 COUNTRIES"

Cleveland Heights, Ohio.

Sirs:

I just thought I would write you to tell you that I think your magazine is FB! Also, referring to your article, "Hammanners" in the January issue, the article was very good but you left out some very important characters.

The first of these is the Hon. (?) Hiam A. Frawde. Hiam considers himself as one of the big dx boys of the community. Every time he meets any other ham on the street he fills him full of his exhorbitant claims of dx. In Hiam's way of thinking, the wilder his dx claims are, the better. His tales run something as follows:

"I got R9 from a ZL this morning; I worked 6 XU's, also worked VS, VQ, VK9, etc., etc., etc." This would be very fine indeed if Hiam did work them, but alas, Hiam does not use a receiver and transmitter to do this "marvelous" achievement. He uses a call book and a good imagination.

I am sure that every big town has its pests like Hiam and the less we hear of them the better. I haven't got time to mention the other Ham Personalities, but one just can't leave out Isham Stuff, Esq. He calls "CQ flood area."

LLOYD W. FROHRING, W8PMJ.

The Golden Egg

There is a persistent rumor going the rounds that a large number of radio parts manufacturers recently got together and agreed to refuse to donate prizes for amateur conventions. It seems they became disgusted with attempts of amateurs to work a good thing to death, and became antagonistic at attempts of certain prize committees to "wheedle" by innuendo and left-handed blackmail more prizes each year.

It looks as if we didn't know when we were well off. Feeding the goose an overdose of Golden-Egg-Layer Stimulator has been known to kill the goose.

Clean Primary Keying

[Continued from Page 47]

the filter did not improve the keying when using the bias pack.

In conclusion, we offer the method as an easy way to please the F.C.C. with a T9 plus signal, cleanly keyed, and still retain the old favorite, primary keying.

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Improving the Superhet

[Continued from Page 63]

the noise inherent in the circuit approximately the same as it would otherwise be had other detectors been employed.

The Mixer Circuit

There is yet another principle which I wish to advocate which will lead to an improved signal-to-noise ratio of the receiver itself. It has to do with the mixer circuit. The output of the mixer (modulated detector to you) is proportional to the product of the oscillator and signal voltages. Therefore, with a given signal voltage, the greatest output will ensue with the largest permissible value of oscillator voltage. However, though the output increases with increase in oscillator voltage, when the oscillator voltage is greater than the signal voltage, the increase in noise is out of proportion to the increase in signal output. Therefore, it is desirable to provide some means of controlling oscillator output to match the signal level. This can be done by varying the screen and plate voltages through a potentiometer. There is much more to this story than the above explanation indicates, and we have not the time to go into the details here.

There are a few other tricks to the obtaining of a high signal-to-noise ratio. So far we have considered only the inherent noise within the receiver. Now it is perfectly obvious that the addition of a crystal filter, whereby the selectivity of the receiver is increased greatly, will reduce to a great extent interference arising from outside sources. Such a filter is a most worthwhile addition to any set for amateur use. The installation of a system of "delayed" instantaneous automatic volume control (noise silencing) is also highly worthwhile, and the system developed by Lamb is undoubtedly a worthwhile adjunct to any receiver. There is, however, little if any sense in operating the receiver with a.v.c. and noise silencing in use at the same time. Therefore, the a.v.c. being in use only when the "silencer" is not in use, the best results will be had if a switch is incorporated in the circuit of the noise silencer to throw

it from noise silencing to a.v.c. by inserting the proper sized condenser across the diode resistor of the noise detector. This system has the advantage that it does not pass the signal from which the a.v.c. voltage is obtained through the crystal filter, and therefore the a.v.c. will be more sensitive in its action than had the signal been passed through the filter and then used to obtain a.v.c. in the usual way.

The Crystal Filter

As regards crystal filter circuits, I have used the accompanying circuit for some time and find it superior to any of the other circuits which I have tried, for with this circuit variable selectivity is had *without* sacrifice of amplification as is the case with circuits which obtain their selectivity control by detuning of the secondary of the i.f. transformer. The selectivity control is made of an 11-point Yaxley switch and a group of small ½ watt carbon resistors. The resistors are mounted around the switch in order of increasing resistance. They should start with a value of approximately 5000 ohms and proceed in increasing size, the idea being to have the total resistance after the addition of each resistor increase in somewhat near geometric progression, the final total value being a few megohms.

It is safe to say that all the various methods of noise suppression, such as audio filters, peaked audio, and many others will give results which justify their inclusion in the receiver, and are to be recommended. But they should be used with caution. When all is said and done, much may be made of the following point.

There are many times when it is necessary to have the signal appear with as natural a tone as it is possible to have it appear. The reason for this is that many times the crystal filter is a hindrance in point of selectivity instead of a help. And it must not be forgotten that the human equation, aural selectivity of the human ear, is a very great weapon in dealing with QRM, the ear being able to distinguish between two signals in close proximity by simply distinguishing between the pitch of the signals.

Many times this form of selectivity will do the trick when the crystal filter is absolutely useless. For the ear to function satisfactorily in this respect we must at least be able to remove or cut in our audio filters from the circuit at the flip of a switch in order that we may be able to determine if they are of any help under the given conditions. They may be either, depending upon conditions. It is for this very reason that I prefer to run the headphones directly out of the second detector, as in this way it is possible to obtain a perfectly natural tone to the signal, and because I have found aural selectivity to be very useful on a number of occasions. I have yet to see the audio amplifier which did not to some extent change the character of the

signal and introduce noise in the low frequency region of the audio range.

The Operator

Having disposed of the receiver itself, a word of caution to the operator himself is highly in order. It is obvious that there is no point in obtaining a fine signal-to-noise ratio in the receiver itself if the operator is going to ruin it by improper operating. By this I mean that one should not use a loud speaker, since the external noises within the room are then competing with the signal for the operator's attention, and the *effective* signal-to-noise ratio of the receiver and operator together will be low. To this let me add my condemnation of the practice of wearing earphones on the cheek bones, a practice which must have originated in the stone age and should have died many years ago. For the same reason that a loudspeaker is to be thrown out, the earphones should not be worn on the cheek bones. Wear the phones directly over the ears, and have them fit as tightly as it is comfortable to have them fit in order to keep out extraneous noises within the room. The merit of this suggestion can hardly be appreciated unless one has had considerable experience with the two methods, and I cannot too strongly emphasize its importance.

Results

While incorporating any one of the items expounded in this article may not make a particularly noticeable difference in the weak signal response of the receiver, when taken as a whole the improvement is readily apparent. Each contributes its bit, and when all the miscellaneous db improvements are added up the results are most gratifying.

As an example of what weak signal sensitivity will do in the way of dragging in elusive dx that other stations cannot hear, let me cite the following:

The author's receiver and a well-known commercially manufactured receiver of excellent reputation were compared in a good location. A single good antenna was used, being switched from one receiver to the other.

An R5 signal on the author's receiver was R5 on the test receiver. But one never has trouble in hearing R5 signals anyhow. The difference is not yet apparent.

We dig out an R4 signal. On the test receiver it is R3. Now we are getting somewhere.

Finally we drag in an R3 signal—weak but

perfectly readable. On the test receiver the signal not only was not readable, but was not even audible above the noise.

Similar tests run since have shown that the above results hold for the majority of sets in use today.

Location

It must be realized, of course, that in a noisy location, where the man-made noise is of such intensity that it masks weak signals to a much greater extent than the inherent set noise even in a noisy receiver, the improvement will not be noticeable. But in a good location and with a good, tuned, "anti-noise" receiving antenna the difference is remarkable. The signals below R5 that you are able to hear will be increased 100%.

The nicest part of it is that the new stations you will be able to hear will be the ones that most other fellows are unable to hear. That gives you a tremendous "edge" in working dx.

◆

Dx Department

[*Continued from Page 34*]

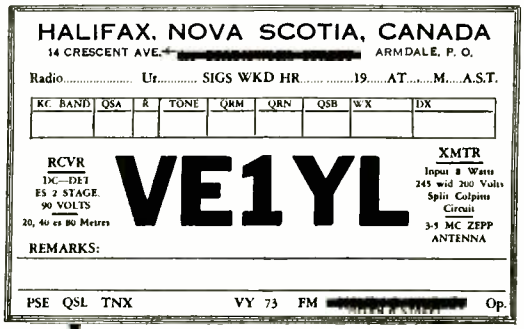
coming through when he went to bed. Reg would rather work VK's on a Saturday night than take a bath. One a.m. he managed to yank himself out of bed as early as 7.30 and got into a three-way QSO with G5ML, VS6AB, KA1BH . . . and naturally with 6ITH in there it was four-way from that point on. Reg delivered a message over the telephone in Berkeley for VS6AB as 6AB was giving it to him . . . and the speed in which ITH handled it so pleased VS6AB that he is sending a card to him via the China Clipper. Almost forgot to mention . . . all of the above was on 20 meter phone.

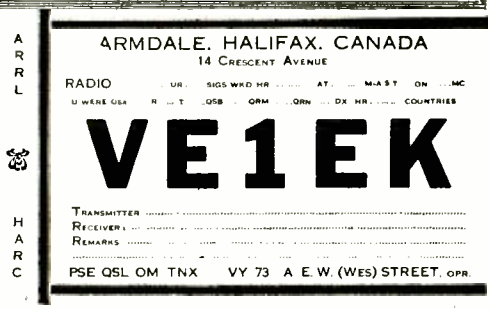
W6CXW sends some new ones . . . FK1AC 7100 kc., VP8B 14,435 kc., in Falkland Islands . . . FY8C 14,000 kc., French Guiana.

W3EDP says dx hasn't been too hot but has hopes that it will pick up next month. I don't know what he wants for dx because the list he sent in includes a swell assortment of stuff on 3.5 Mc., 7 Mc., 14 Mc., and 28 Mc. Hy gives the QRA of FY8C as: Narolles Constant, 91 Chr. Colomb St., Cayenne, French Guiana . . . and also gives P.O. Box 43, same city. Burt Waldron, W9ZT, gives forth: I1IR says Italian QSL cards can be sent to S. Nicolao N. 1 Milano, Italy. Burt says the only way that ES4D gets W QSO's is as 2d op at ES5C. ES4D has a little rig using a 33, 19, and a 2xTC 03/5 with 10 watts input. He is a teacher, 26 years old, 185 cm. in height (??) and his QRA is Porkuni P. Ag., Estonia. W9ZT adds two zones by working TF5C and VP2AT. You guys don't realize what a pal TF5C is to ya.

W2AAL has worked 29 zones and 75 countries and says that dx in general is pretty good. He has been a ham since 1927. Says that U9AC in zone 18 is just outside the high freq. end of the 14 Mc. band. W2AAL wants to know why it is that a W6 will always answer his CQ dx. Here's the answer: "For the same reason a W2 will always answer a CQ dx from a W6."

G6NJ has just been presented with the R.S.G.B. R.O.T.A.B. trophy for 1936-37. The R.O.T.A.B. was presented by the old timer G2NM, and you may well





"Two QSL Cards", a Short Short Story

imagine that 6NJ is mighty proud of it, as the former holders of the trophy include G5ML, G2ZQ, and G6WY. R.O.T.A.B. is the Royal Order of Trans-Atlantic Brasspounders. In the DJDC contest G6NJ rolled up about 106,000 points, which should land him among the first three. New contacts for him are VQ8AB, FM8AD, VP7AA, OA4J, VQ2CJB, VQ3FAR, XU1FK, XU8AL, HH1L, CR9AB, PK4YY, HP1A, MX2B, and VR6M, which is a pip for a G to snag. G6NJ has 37 zones and 103 countries, according to the new list, but thinks it is a long way from being complete.

Speaking of the country list, it was never thought possible to get a list to please everyone in the world, and as far as we are concerned we wanted to get a list so that everyone would have some common basis upon which to compare their number of countries. I'm quite sure that A.R.R.L. had the same thought in mind. However, as time goes on and it is brought out that a few corrections should be made, they will be published so that all will have a chance to check their lists accordingly. So far most of the fellows have had to cut off a few countries from their previous list, but when the whole thing is summed up we are all on the same basis now. It might be rather hard saying you have 100 countries now, when before you might have had 115 or so, but I feel sure that you will forget about the lure of the huge country totals. In the future when a fellow ham says he has 95 countries, you will know what the devil he is talking about.

More About VS8AA

This department has received a number of cards from W hams giving the right QTH of VS8AA. Apparently Mr. J. A. Faithful, who is the owner of VS8AA, has been flooded with mail addressed to Roy Fleming, W6DQD, who has been operating the rig for the past few months. Here goes for the mailing dope:

J. A. Faithful, VS8AA, (ex-VU2BX),
Cable and Wireless, Ltd.,
Bahrein Island,
Persian Gulf.

[*Continued on Next Page*]

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The "Tell All" Meter

[*Continued from Page 66*]

The meter may act simply as an indicator of a.f. or r.f. voltage. Its use in neutralization work is readily apparent. Where a tuned circuit is calibrated, the meter can act as a resonance indicator. Transmission lines or leads may conveniently be tested for r.f. fields. The effect of various metallic shields may be directly compared, as the meter is quite sensitive.

◆

Station CU2L

[*Continued from Page 18*]

come back with, "Same to you." Politeness over the air brings politeness in return; one ham actually sent 88's.

Hams are not now welcomed at the shack, because of the many hundreds of ham stations visited over a period of years by the writer, all complained of the loss of gear and stated that he was not welcome in the future. Therefore the writer has been forced to retaliate. This is indeed a pity and against the spirit of ham radio. Invitations to visit ham shacks wll be welcomed by CU2L.

Wth best wishes, CU2L with very 73

Non-member RSGB, BERU, ARRL, WIA, REF, ETC.

P.S. Owing to the photographer demanding payment in advance, it is regretted that a photograph could not accompany this station description.

Dx News

[*Continued from Last Page*]

Even Mr. Rensch, editor of the Call Book, takes me to task for the former QRA listing, and adds that it should be Bahrain and not Bahrein. I only know what is printed on the QSL cards and given in other correspondence, although the postmark may be Bahrain. We never think of spelling Denmark as "Danmark" . . . but their postage stamps say so. Anyway, Roy Fleming was still operating there a short time ago, as I don't believe he has his own call yet.

•

Mr. and Mrs. W6CUH are still galivanting around the East. He is visiting many factories while there, and in the p.m. you can hear ol' Charlie at some familiar ham station QSO some of the boys back here. He has visited W8DHC, VE3WA, W8LEC, W3ANH, and at present is supposed to be checking up on those "No Yawk KW's". Says there isn't much diff between a "Penna kw." and an "N.J. kw." and the apparently (in)famous "California kw." OH . . . youse guys back there!

Just heard the boss yelling for this copy so guess I had better shut off this mill. Before I do, however, I'm gonna talk about myself for a change. Never mind what change. Remember, last month I promised to let you know if I thought two could live as cheaply as one? Well, it can't be done. Anyway, it's fun trying. Another thing . . . The gang said I was through with ham radio for a year or so, and I swore I would be on within a month. On January 24th . . . a little over three weeks . . . QD was having its first QSO at Manhattan Beach, and yes sir, it was with a W9 . . . in fact W9VOX to be exact. That proved to me mebbe this ol' QRA wasn't so bad after all. The x.y.l. is making strides with the code, having learned a lot of the abbreviations and some of the numerals. I'm glad she knows what "9" is, as now we can't miss on those W9's.

•

In answer to those that have been wanting to know what is being used at the "jernt" in the way of rig, receiver, etc., here it is: Xmtr, still using the "corn-fed kw." with two HF-300's in the final; the receiver is a homemade 10 tube super with xtal filter, built through the efforts of W6VB, W6DOB, W4DHZ. Nothing fancy in it . . . just darn good parts . . . stable, selective, and sensitive. Only have one antenna so far, a 20 meter Johnson Q which is just nine feet above the roof. Considering the height, it works swell, but you can imagine my troubles in trying to get this antenna to work when hooked to my 40 meter final. Incidentally, on 40 the amplifier consists of three 852's in parallel. The "shack" overlooks the Pacific, and is about 300 yards from the water's edge. Going to have a "pole raising" day soon; then will be able to throw some new wire up in the air.

Have a good time in the contest, and remember that I'll be anxious to get information from all of you "the minute it's over". Good luck.

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New R.C.A. Receiving Tube Manual

R.C.A. has recently released a new edition of the ever useful Manual of Receiving Tubes. With numerous revisions and additions it covers the field of receiving tubes and their applications very completely.

The material relating to the all-metal types and the glass bulb types is arranged in numerical-alphabetical sequence throughout its 192 pages, making it easy to look up the individual types. It is amply illustrated with characteristics charts and application circuit diagrams. Several pages are devoted to very complete listing of conditions for the operation of resistance coupled amplifiers.

This manual, Technical Series RC-13, is very useful to amateurs, radio service men, experimenters, and others interested in the technical data on radio receiving tubes and may be secured by sending 25 cents to the Commercial Engineering Section, R.C.A. Radiotron Division, R.C.A. Manufacturing Co., Inc., Harrison, New Jersey.

What's New

New Type Crystal Pickup

The Astatic Microphone Laboratory, Inc., of Youngstown, Ohio, has released a new crystal pickup featuring better reproduction and longer record life.

This new crystal pickup is known as the Tru-Tan Model B and is constructed with a unique, scientifically designed off-set head which holds the needle, throughout the entire playing surface of a 12″ record, practically true to tangent of the circle at all points—maximum error never exceeding 1.5° from true tangency.

Every engineer will immediately appreciate the value of this off-set design that holds tracking error within 1.5°. It is common knowledge that the average 8″ straight-arm pickup will track off tangency as high as 15° and the average 12″ arm as high as 10°. It would take a straight pickup arm approximately 6 feet long to accomplish the same perfection in tracking as the new Tru-Tan Model B.

A test of the Tru-Tan Model B also shows that it is free from mechanical resonance throughout the audible frequency range.

In addition to its performance features of better reproduction and minimum wear on records, it also has a full double row ball bearing base swivel, with hardened steel pivot trunnion.

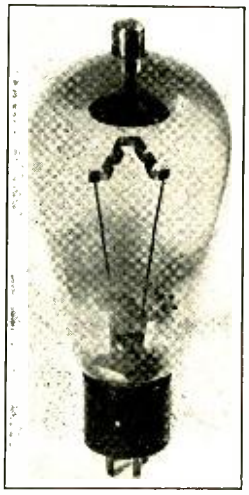
Another outstanding feature is the provision for needle loading—which consists of a reversible head, permitting the needle to be dropped in from the top.

Units are beautifully finished in plain telephone black wtih chromium trimmings. Special finishes on request.

◆

Heavy Duty Rectifier

Langrick Radio Engineering Service has released a heavy duty type 866 known as the 866-B. It has a 2.5 volt 7.5 ampere filament and is rated at 1200 ma. peak current and 10,000 volts max. inverse peak voltage. A pair in a full wave circuit will deliver 1 ampere when swinging choke input is used. The tube fills the gap between the type 866 and 872 rectifiers, being ideal for plate supply where one power supply feeds both the driver stage and a 1 kw. amplifier.



A standard four-prong UX type socket is used for filament connections. The tube measures 7¼ inches over-all in height.

◆

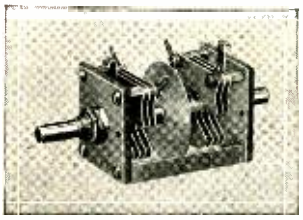
P.P.P. 6L6 Amplifier

A high power amplifier for PA service has just been released by the United Transformer Corp. This unit uses four 6L6's in the output stage providing 70 watts self-bias or 110 watts fixed bias. A total of 4 stages are used to obtain 110 db gain. The unit includes separate chassis for power and audio with dimensions suitable for rack mounting. The input is high impedance and the output universal line and voice coil impedances. This unit can also be obtained for amateur service with a UTC Varimatch Modulation Transformer.

◆

New Dual "Trim-Air" Midgets

The Allen D. Cardwell Mfg. Corp., 81 Prospect Street, Brooklyn, N.Y., has made available a new complete line of 10 standard double-section equivalents of stock Trim Airs. These condensers are constructed with sturdy, over-size double bearings and are selling for less than the cost of two individual units. They can be furnished either with a circular shield as illustrated in this ER-25-AD or with a square shield that is removable from the nickled



brass tie rods. A ¼ inch shaft extends at the rear for additional ganging. This midget is so constructed as to allow for any of four convenient methods of mounting. Isolantite insulation.

◆

New Zero Bias Triode

Recently released by Amperex is a new high-μ, high current, zero bias triode designated as the ZB-120. In spite of the very high μ (90) the transconductance is quite high, being 5000 μMhos at 100 ma. It has a 10 volt, 2 amp. filament and is rated at 75 watts plate dissipation.

As a class B audio amplifier it may be operated zero bias up to 1250 volts. Power outputs up to 300 watts per pair are obtainable with low distortion and low driving power requirements.

The very high μ and the high insulation of the grid structure and lead make the tube an excellent frequency doubler for r.f. work.

The tube will also give a good account of itself in other common applications such as a linear r.f. amplifier, class C r.f. amplifier, grid bias modulated power amplifier, etc.

◆

New Hammarlund Catalog

"Streamlined" for efficiency and attractiveness, Hammarlund's latest catalog gives the engineer, serviceman, and consumer details about its products in a concise but complete fashion.

The ham can flip through the pages quickly, locate the desired item easily, discover specifications of the product in short order.

Copies of this new catalog can be secured, gratis, from the Hammarlund Mfg. Co., 424 West 33d Street, New York City.

◆

"Fish Rod" Car Antenna

Two new car antennas designed to meet all automotive-radio requirements are announced by Insuline. The first is the "Poletenna", which is of the telescopic type, opening to a maximum height of 8 ft. It is intended to clamp to the rear bumper, and fits any make or model of car. It is also suitable for transmitting purposes and can be tuned for 5- and 10-meter amateur operation.

The second new antenna is the "Airflow", especially designed for new cars of the streamline and all-steel body types. It consists of a length of rust-proof metal tubing supported on the top of the car by means of rubber suction cups, and is installed quickly and easily without requiring drilling of the top. It provides maximum signal pick-up with minimum ignition noise and wheel static, and is not affected by rain, snow, dirt or mud. In addition, it is attractive in appearance.

◆

Test Instrument Manual

The Supreme Instruments Corp., Greenwood, Miss., has compiled a 60-page manual on tube and radio test instrument design that describes the technical design of meters and circuits used in these instruments. The manual, containing much valuable data of great interest to amateurs and servicemen, is available upon request by using your letterhead or, in the case of amateurs, by making the request on a QSL card.

◆

Knock Down Cabinets

A line of black crystallized-finished steel cabinets, supplied in knock-down form for easy assembly by amateurs, experimenters and service men, has been brought out by the Insuline Corporation of America, 25 Park Place, New York, N.Y. There are seven sizes, the smallest measuring 9 inches long, 5 inches wide and 6 inches high, and the largest 18 by 12 by 9 inches.

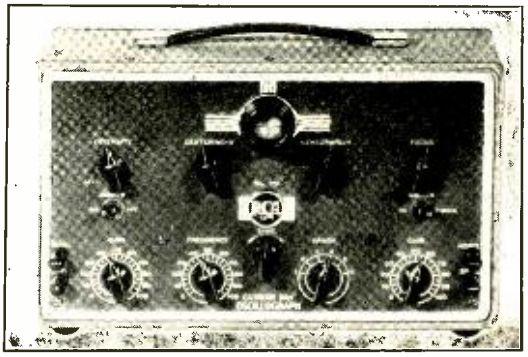
The sections of these cabinets are held together by self-tapping screws. The front and back panels, and also the bottom, can be removed without disturbing the rest of the box. This arrangement allows inspection or revision of the circuit or the changing of a part. The top of the cabinet is a hinged lid.

These cabinets are suitable for a wide variety of purposes. They are ideal for receivers, transmitters, power supplies, amplifiers, test oscillators, oscilloscopes using the new 913 cathode ray tube, etc.

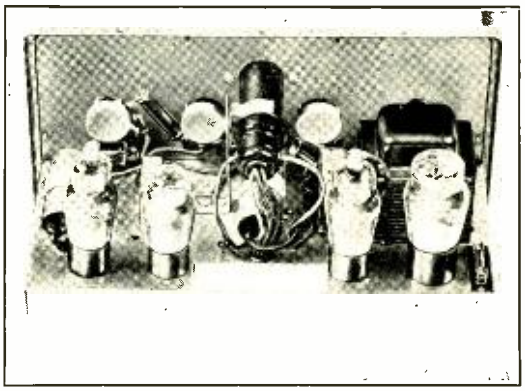
Cadmium-plated steel chassis to fit inside the cabinets are also available.

◆

R.C.A. Midget 'Scope



Introduced by the R.C.A. parts division is a new low-cost cathode ray oscillograph. The introduction of this new oscillograph, with a one-inch screen that meets every requirement and more of the serviceman and amateur, places this valuable instrument within the reach of additional thousands of service engineers and amateurs at half the cost of the larger, more



elaborate oscillographs. Its development was only recently made possible by using the new R.C.A. 913 simplified cathode ray tube, and further simplification of the associated apparatus. With it, circuits may be accurately aligned, visually; all forms of distortion and hum checked, and modulation measured. Among its outstanding features are high sensitivity, providing a full visual image while using only 1.75 volts (r.m.s.); vertical and horizontal amplifiers, with in-

dividual controls, in a flat range of from 30 to 10,000 cycles; linear timing axis in the same range; small spot diameter for sharp focusing, and individual centering controls.

◆

New T-20 Transmitting Triode

A general purpose triode, an extremely fine amplifier on all frequencies up to and including 56 Mc., efficient as a doubler or buffer and giving real power output in class B audio work.

General Characteristics

Filament voltage, volts	7.50
Filament current, amps	1.75
Plate resistance, ohms	8000
Mutual conductance, μMhos	2500
Amplification factor	20

Physical Characteristics

Max. length, inches	6½
Max. diameter, inches	2½

UX Ceramic Base

Interelectrode Capacities

Plate to grid, μμfd	1

Class "C" Osc. and Power Amp.

Max. operating plate volts	
Unmodulated d.c. volts	750
Modulated d.c. volts	750
Max. d.c. plate current, ma.	75
Max. d.c. grid current, ma.	25
Max. plate dissipation, watts	20
Max. r.f. grid current, amps.	2.5
R.f. output, watts	42
Percentage of efficiency	75%

Class "B" A.f. Modulator

Push-pull Operation

Typical Operating Cond.

Filament, volts	7.5	7.5
D.c. plate voltage	800	600
Grid voltage, approx.	—40	—30
Load resistance P.P.	12,000	8100
Av. d.c. plate current per tube, ma.	68	70
Static plate current	10	10
Power output, watts (2 tubes)	70	50

◆

Compact Oil Condensers

With the rapidly increasing trend toward higher power and better fidelity in high grade receivers, transmitters, and amplifiers, there has been a correspondingly increasing demand for high capacity, high voltage condensers combining the excellent dependable characteristics of the bulkier types with the compactness and assembly simplicity of the can-type electrolytics. This demand has culminated in the development of the Cornell-Dubilier type TL dykanol capacitors.

These new, hermetically-sealed condensers will prove the ideal solution where reduced size, weight, and cost are desired in conjunction with extremely high voltage ratings and negligible power factor. Manufactured by the Cornell-Dubilier Corporation, South Plainfield, New Jersey. Full descriptive catalog, no. 135A, sent free upon request.

◆

"Outboard" Pre-amplifier

United Transformer Corp., New York, has just brought out a new innovation in pre-amplifiers with a unit which obtains its power supply directly from the main amplifier. It incorporates a 6F5 resistance coupled to a 6C5 providing 60 db of gain. The input is high impedance and the output universal line impedances. Filtering is provided in the pre-amplifier to assure low hum level. If desired, a separate power supply can also be obtained for this unit.

WARNING TO MANUFACTURERS

A number of writers have been soliciting radio parts from manufacturers on the ground that description of the finished piece of equipment is to appear in some radio magazine. In some cases "Radio" has been mentioned.

The editors of "Radio" do not obligate themselves to accept any article until the finished manuscript has been submitted and approved; such half-promises cannot apply to "Radio".

For its own laboratory, "Radio" neither "promotes" nor accepts free parts or apparatus.

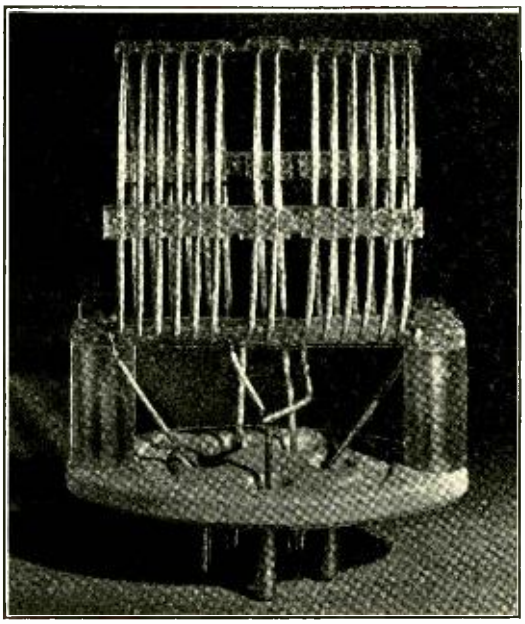
Versatile Meter

The new compact voltohmmeter, milliammeter and output meter illustrated should find wide use in the hands of radio service, laboratory, amateur radio, and production men. Fitting conveniently into the pocket, this instrument may be used for practically all receiver chassis measurements right on the job. As a laboratory or shop tool it will be in constant use, checking bench work. It is invaluable for testing transmitter and public address systems, and is ideal for experimental or routine measurements.

It has a large three-inch meter with two-color scale and accurate D'Arsonval movement with knife-edge pointer and zero adjuster. The d.c. milliampere scale reads 0-1, 0-10, and 0-250. Two output scales are provided, one for the voice coil circuit, the other has a blocking condenser. The two-ohm scales are direct reading: "lo-ohms" from ½ to 500, "hi-ohms" from 200 to 500,000. The instrument is manufactured by Burton Rogers Co. (Hoyt).

◆

Low Stage Plug-in Coils



The Decker Mfg. Co. is now supplying a series "L" coil which is available for all bands from 10 to 160 meters and fits a standard 5 prong tube socket. Supporting ribs are of a fire-resistant low-loss celluloid, while the mounting base is composed of a special low-loss ceramic material. Windings are of silver plated phosphor bronze wire, giving mechanical rigidity with low r.f. resistance. The coils are available with any combination of center tap and link, the link being connected to the filament prongs and the center tap to the grid prong in every case.

Because of their orientation, the coils may be mounted at right angles when the mounting sockets are in the same plane. It also cuts down the amount of extraneous material in the concentrated part of the field of the coil.

The coils are suitable for use in tank circuits handling 25 watts or less.

"The Knights Are Getting Bolder"

W4DLH was not content with his record-breaking half hour phone W.A.C.; so he proceeded to get his "Knights of the All-Continent Round Table" to "rev it up a bit" and after several tries finally got it down to *less than 10 minutes.* Bill Burkhart has the c.w. boys sorta worried; they are wondering if it is practically possible for a c. w. station to work all continents in less than 10 minutes.

Someone has raised the question that if W4DLH was hooked up with all these stations at the same time, then why is it not an "instantaneous" W.A.C.? Bill counts the total time that it takes for each of the stations to "report in" and does not count the circuit complete unless each station copies satisfactorily each of the other stations on that round. On January 19, he got this time down to 8 minutes and 10 seconds. With a U.S.A. station standing by to give him the 6th contact, the 10 minute W.A.C. was a "cinch."

◆

Sunspots and Radio

Although sunspots have been observed for years, and have been said to cause nearly everything in the category of human disasters, about the only thing that seems to be fairly certain as to their effect on earthly affairs is the effects on radio reception. It has been generally observed that radio reception as a whole is more troubled with static than in ordinary conditions of calmness on the sun's surface, but observations by the U. S. Bureau of Standards tend to show that the increase of ultraviolet radiations which comes with sunspot activity tends to increase the range of ultra short wave signals. This is probably the reason for the extra-ordinary range noticeable during the past year by services which are not intended to get out over 30 or 40 miles, such as the high frequency police stations.

In the earlier days of radio, only one layer was generally regarded as existing, although of variable density, and was referred to as the Kennelly-Heaviside layer after the two scientists who first propounded the theory. It was generally agreed that skip effects were caused by this layer due to refracting the radio waves and caused them to follow the contour of the earth but with variations due to the angles resulting from the varying height of the layer at different seasons of the year and times of the day.

The Bureau of Standards has made numerous tests by directing radio waves of different frequencies and measuring the time lapses before their return to earth, and from these tests have come much data as to the heights and densities of the different layers of ionization. The ionization by the way, is caused by ultraviolet radiation knocking electrons off molecules in the extremely high atmosphere and creating electrified particles which are called ions. During extreme sunspot activity the density of ions in the upper regions is greatly increased due to this bombardment.

Of the three major layers, the lowest averages about 65 miles above the earth, the next one about 130 miles high, and the third about 190 miles. Not all the ionization seems to be directly due to the ulta violet radiation, but the upper layers seem to have their ion density increased by direct radiation of ions from the sun. The lower band seems to be ionized mainly by the ultra violet radiation. In density the lower layer is the more highly ionized, with the second main layer less ionized and the upper still less. During periods of extreme sunspot activity as at present, the upper layers of the ionospere increase greatly in ionization as compared to the lower ones.

The height of the layers varies differently in the northern and southern hemispheres as also does the separation between them, particularly as regards the separation between the upper two layers. In the summer, the upper layers over the northern hemisphere are widely separated during the middle of the day but at that time they are merged over the southern hemisphere. The opposite is true during the middle of the winter.

It is to be expected that with the increase in knowledge that will result from such study that predictions can be made as regards sunspot activity, which seems to follow approximately eleven year cycles, and its effect on radio reception in the short wave spectrum. At the present time, sunspot activity is increasing, with the maximum activity and ultraviolet radiation expected in 1939.

◆

OPEN FORUM

Sirs:

Mr. Rus Sakkers' article in the February issue of "Radio" has brought to light a subject much in need of revision. That is, entirely too much space in our amateur bands is devoted to traffic work.

It should be remembered that amateur radiograms are not to be considered on a par with commercial telegrams and radiograms. Thus when one considers the importance that an amateur radiogram should have attached to it, 50 per cent of the messages are important. I do not feel as qualified in saying as Mr. Sakkers has that only 5 per cent of the messages are important. His greater experience is appreciated; but his figures are to be questioned by any traffic man. I do feel qualified in saying that messages, with the possible exception of 15 per cent, never reach their destination. But why should a message be delivered if it is 15 days late arriving within delivering distance? The relaying of messages is too slow to be of any use to the public or to the amateurs.

A logical summary then is that traffic work lacks three things: importance, deliveries, and all-around proficiency. The best way to keep traffic going is to clear these difficulties, and then decide who shall handle the bulk of the traffic.

Probably the best group to handle traffic is an organized net. Yet how is Mr. Average Ham able to place his traffic in trunk line Z when it operates on 3860 kcs. and he calls them all night on 3525 kcs.? The average ham will admit he does not know what frequencies the trunk lines use. The AARS and the ARRL nets are to be considered, but the same condition holds true for them.

After a study of the frequencies used by the trunk lines, AARS nets, and the ARRL nets has been made, it is seen that the frequencies used by them begin on one end of the amateur band and terminate on the opposite end. This may seem the logical ar-

rangement for such nets, but it is a fact that the easiest way for a group to accomplish a task is to do it together.

So let's gather these birds of a feather and flock them together. They are going to operate somewhere within our bands and they may as well be together. It will aid the present QRM problem if we present them with a choice hundred kilocycle channel. They then can work together in an organized manner.

True, a number of stations will be forced from the frequencies they have grown up with, but the change will be worth it. There will be plenty of room for those forced out if they take advantage of the frequencies left vacant by the traffic men.

Now when Mr. Ham has a message, he knows exactly where he can place it so that he can depend upon good service. If he has any reason to expect to have a volume of traffic it will be well worth the money spent for a crystal within the traffic band.

When occasion arises for emergency amateur work, there will be a channel very easily cleared in a short time. There will be no need for the F.C.C. to step in and order the rag chewers off the air as was the case in this past emergency. A little thought will bring to light other advantages of having this distinct channel within our bands. Anyone not interested in traffic could swap his crystal with some traffic man who wanted to get into the traffic band instead of out of it.

I should like to see more developments along this line; so sweat along with W8DED and me. Some solution must be reached.

DEL RAIRIGH, W9YXD.

◆

160 METER DX

Upon reading the Open Forum letter by Howard Pyle in the February issue of RADIO, a member of our staff, Bill Conklin, was prompted to dig into his old records for cards and reports received in the "200 meter" days when amateurs were usually found from 200 to 250 meters. Maxwell Howden of (VK) 3BQ reported 9DBF on 185 meters calling 4FZ and 6VD on March 2, 1934; (ZL) 3CA heard him call 4AF and 6AOL on March 23rd; (ZL) 3AL also heard the contact with 4AF;

[Continued on Page 94]

NOTICE
to
New Zealand Customers

The Te Aro Book Depot, Ltd., of 64 Courtenay Place, Wellington, has been appointed exclusive subscription and wholesale agents for the sale of "Radio" in the Dominion.

New Zealand subscribers should henceforth send subscription orders to Te Aro, **not** to our Los Angeles office. The rate is 18/6 per annum, post free.

Bookstalls and radio dealers wishing a supply of copies for resale will be allowed a small trade discount.

Osockme, Japan.

Radio Magazeen, Los Angeles
Dear gentlemen and ed.:

What you know, hon ed.? Scratchi are big shots now. He are called upon to making talk at local 5 Meter Bootleg Club. This are the club which Scratchi are try to join a few months ago and are turn down because he have a license. But even if not allowing me as member are welcome as speaker, especials if pay admission same as members. They calling it "dues", but are all the same, as will not let members inside dore until are paying dues for that weak.

Looking around I see my old pal Hamafisti, who are rescently get his license provoked for outside band operations. He are now member in good standing in this very select groop, even if he are too dumb to know how it are all about. I look around some more and see my brother Itchi sitting in regular members section. This are shock to me, as he are having a license, and it are making me soar on acct. because they are turn me down. I rise to make question to hon. sec. why my dear dear bro. Itchi are admitted to memberships, when he are have a perfectly legal license. Sec. make toothsome smile and explane that dear bro. Itchi are really a bootlegger at heart, as he are cheat on his license examinashions, and that after all, it are really the spirit of the thing that count. This do not sounding just rite to me, hon. ed., and I are giving Itchi a dirty look, which he return with a horsy laff, and add that I are just jealous.

Well hon. ed., I are then giving them talk on what hot stuffs are eccentric feeders for feeding 5 meter antenna, and are do good job convincing them that it are reely the berries. When I get all through wise guy in back gets up and make ask dum question whether I are meaning off-center single-wire-feed or are meaning co-axial low-impedance cable. But as I were saying, hon. ed., one can always figger on certain amount of dumb remarks in bunch of dopes like that.

Next sec. present a letter he are writing the R. I. on behalf of club asking that something be done about certain amateurs with irradiating receivers, listing calls, as they are bothering hole 5 meter band, and as ops are having govt. license should really knowing better sense. Are written on offishal 5 Meter Bootleg Club stationary, so should making a real impression on the R. I.

Meeting wind up with serving of stail coffee and doughnuts which are purchased at reduced rate from "Day Old Bake Goods Mart". It are really a nifty club and nice bunch of fellow, and I are serious thinking of getting pink ticket so can getting license provoked so he can be regular member. Incidentals, hon. ed., they are making you honorary president of vice at last meating.

Respectively yours,
HASHAFISTI SCRATCHI.

◆

160 METER DX

[*Continued from Page 93*]

and (ZL) 3AF provided a report dated May 28, 1924.

These were the days when eastern stations had to get up in the early mornings to hear the sixth and seventh districts; when 201A type tubes were new and wonderful. The transmitter at 9DBF used three western Electric type 211 "50 watters" which, if carefully handled, would take 2 kw. input without getting too red (we said *carefully*), and put ten amperes into the antenna. With one 70 foot mast, the antenna system consisted of a pair of "cages" forty feet long slanting downward, with a lead-in to the basement. A fan-shaped counterpoise filled the backyard.

By 1924 many spark and c.w. stations had spanned the Atlantic and the Pacific on 200 meters. Receiving was often done with a single tube in a regenerative receiver, while the transmitters used anything from 25 watts on

"5 watters" to kilowatts on spark. High masts were more often than not used for transmitting and receiving antennas. Bell of New Zealand 4AA said that there was a bedlam of Yankee signals including some from the east coast during the 1923 200 meter tests. His list of calls showed over 500 stations heard from February 1923 to March 1924, between 200 and 400 meters. Some of the transmitting stations used tubes of the "5 watt" variety.

Also in 1923, 7HG hooked up with the first "J", also on 200 meters. The transmitter had an input of 100 watts, using a six-wire flat-top antenna 50 feet long, 65 and 40 feet high at the ends. A counterpoise was used. The receiver was a two tube affair.

One station much in the dx news then was 6CGW, who was reported in all states plus Australia, England, Samoa, Holland, New Zealand, Porto Rico, Alaska, Panama, Tonga Islands, Hawaii, Mexico, Canada, Cuba, and by ships off Spain, Cape Horn and Peru. Although a 250 watt tube (204) was owned, 6CGW got more out of a "50 watt" type 203 (not 203A) with close to one-half kilowatt input, putting 6 amperes into the antenna on 200 meters, and 4 amperes on 150 meters.

The antenna, supported on two 80 foot masts, was a 40-foot six-wire cage with the down-lead brought from the center, "T" fashion. The counterpoise, suspended directly beneath the antenna, was a six-wire T flat top 60 feet long with 15 foot spreaders.

These antennas don't sound much like the 270 foot zepps now in demand on 160 meters, do they?

BUYER'S GUIDE

Where to Buy It

CALIFORNIA — Los Angeles

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.

ILLINOIS — Chicago

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

MARYLAND—Baltimore

Radio Electric Service Co.
3 North Howard Street
Baltimore, Md.

MICHIGAN — Flint

Shand Radio Specialties
203 West Kearsley Street
Flint, Mich.

MISSOURI — St. Louis

WALTER ASHE RADIO CO.
11th and Pine Streets
St. Louis, Mo.

PENNSYLVANIA — Pittsburgh

Tri-State Radio Equipment Company
403 Penn Avenue
Pittsburgh, Pa.
W8FQ and W8MYM ready to serve you

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.

●

C_1, C_4, C_9, C_{12}, C_{13}—Aerovox type 1467

C_2, C_6, C_{10}, C_{11}—Hammarlund "Star"

C_5—Aerovox type 1450

C_3, C_8—Bud type 833

R_5—Yaxley type M3R

R_4, R_8, R_9—Ohmite "Wirewatt"

R_{10}—Yaxley type M10R

S_1—Centralab two gang bandswitch

S_2—Federal "anti-capacity" switch

CH, T_1, T_2, T_3—United transformer midget, "UM" type

Cabinet — Bud portable type

INDEX OF ADVERTISERS

The Marketplace

(a) Commercial rate: 10c per word, cash with order; minimum, $1.00. Capitals: 13c per word. For consecutive advertising, 15% discount for 3d, 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.

(c) Closing date (for classified forms only): 25th of month; e.g., forms for March issue, published in February, close January 25th.

(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 therefor. Rates and conditions are subject to change without notice.

TRADE: Brand-new Hallicrafter Skychief and cash for 1936 Super Skyrider. William Martin, 13 Prince St., Marblehead, Mass.

CRYSTALS, 80 and 160 meter bands, 95c. 40 meters, $2.00. Holders, 60c. Special AT-cut, $2.35 mounted. White Radio Laboratory, Sandpoint, Idaho.

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

SELL: Brand-new RCA 803, $20. Slightly-used Sylvania O3A, $6.00. W7DTJ, Clarkston, Washington.

BETTER QSL cards! Samples! Fritz, 203 Mason Avenue, Joliet, Illinois.

CRYSTALS: Eidson "T9" fracture resisting 40, 80, 160 meters, $1.50. Dependable, powerful X-cut. Close frequency always supplied. Fully guaranteed, accurately calibrated. Fast, increasing popularity, they are unbeatable, say users. "T9" ceramic plugin holders, $1.10 postpaid. COD orders OK. "Eidson's", Temple, Texas.

ATTENTION—Selling out. Receivers, transmitters, large assortment. Make offer. W2DBF.

MOVING—must sacrifice RK20, 802, 204, tubes, condensers, coils, transformers. W6BEJ McCullough, 3817 Girard, Culver City, Calif.

CONSULT us with your shield can, cabinet, and rack problems. We have built hundreds of them. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

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WRITE us for trade-in price on your old receiver. We buy meters. Walter Ashe Radio Co., St. Louis, Mo.

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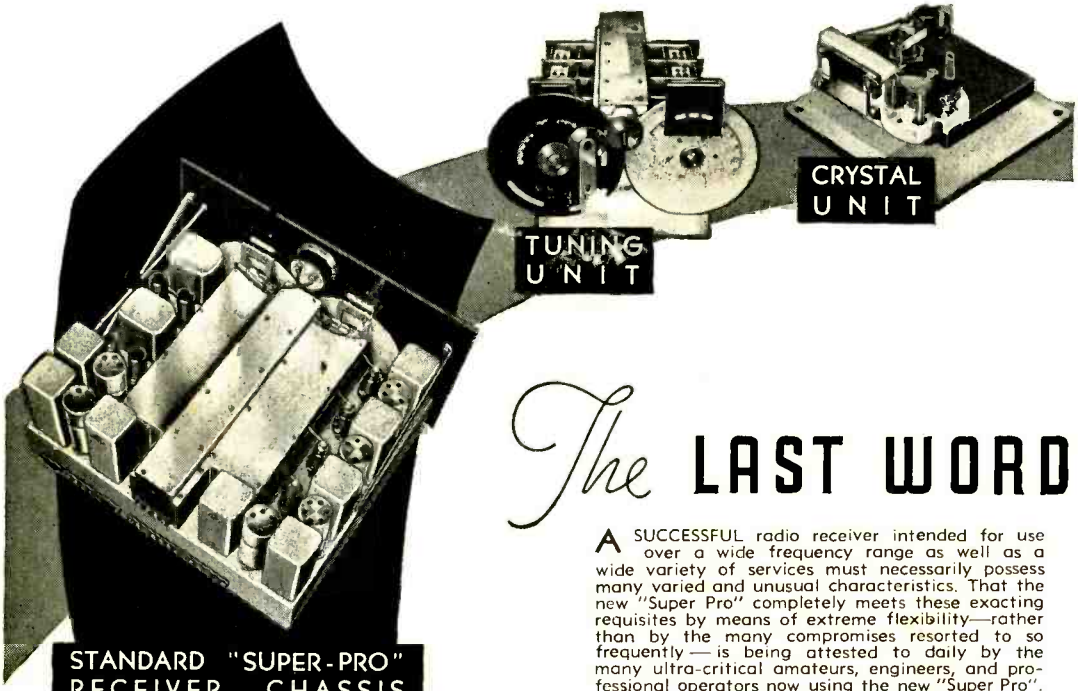
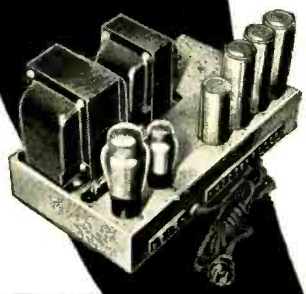
EMERGENCY power 700-watt, 110-volt a.c. generator. W6JXJ. Phone OLympia 3063, Los Angeles.





The LAST WORD

A SUCCESSFUL radio receiver intended for use over a wide frequency range as well as a wide variety of services must necessarily possess many varied and unusual characteristics. That the new "Super Pro" completely meets these exacting requisites by means of extreme flexibility—rather than by the many compromises resorted to so frequently — is being attested to daily by the many ultra-critical amateurs, engineers, and professional operators now using the new "Super Pro".

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"As I was tellin' da late Light Fingered Larry, da oney way ta put up a sparkler is ta do da job rite.

"How long ya makin' da gams? Three C's on a side? Say, if ya really wannut ta woik right, it otter be four hunnert feet on a side for dat freakency. Anodder C on a side wud raise youse purty near an 'R'.

"What berg youse puttin' da squeeze on; Yurrup? Or ya gonna draw a bead on da VK's? Better get a "RADIO" ANTENNA HANDBOOK and use da great circle maps ta make sure she's aimed dead on da schnoz.

"Better turn ta da chapter on feeders, too. No use havin' a good sky hook if ya can't pour da soup ta her widout wastin' haff a it.

"How much input ya runnin'? A grand? Say, wid all dat soup da savvy ting ta do would be ta break down and spend a few potatoes on a **good** feeder. Feeders is very important.

"I spotted a nifty pair of concentric feeders on a knoll on my way out here. Also a sloppy lookin' twisted pair. I said **knoll,** not moll. Instead of da kind a stuff rekommended in da R.H.B., da dope was usin' some corny inside house wire twisted together. And at stuff ain't worth a nickel on 20 meters. Gess I'll drop in on him on my way back ta da lights. He sure has a location what is a nifty.

"Well, so long. Tink I'll blow. Don't forget to buy a "RADIO" ANTENNA HANDBOOK. It's da nuts."

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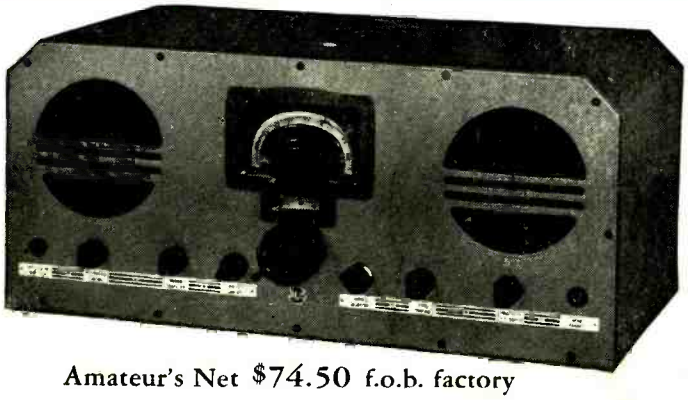

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12 Antenna rejection filter reduces interference.
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15 A. V. C. at will.
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