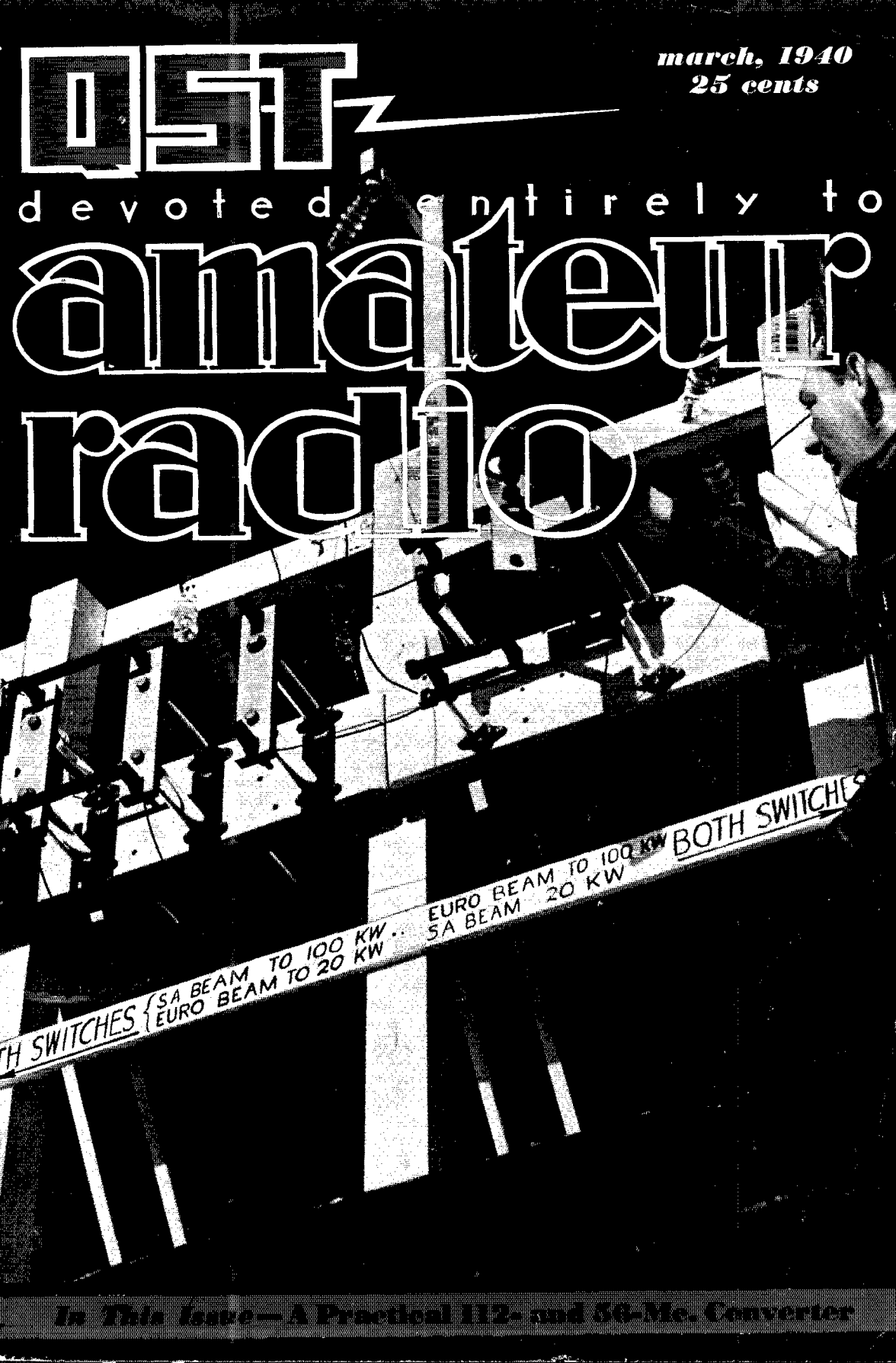
march, 1940
25 cents

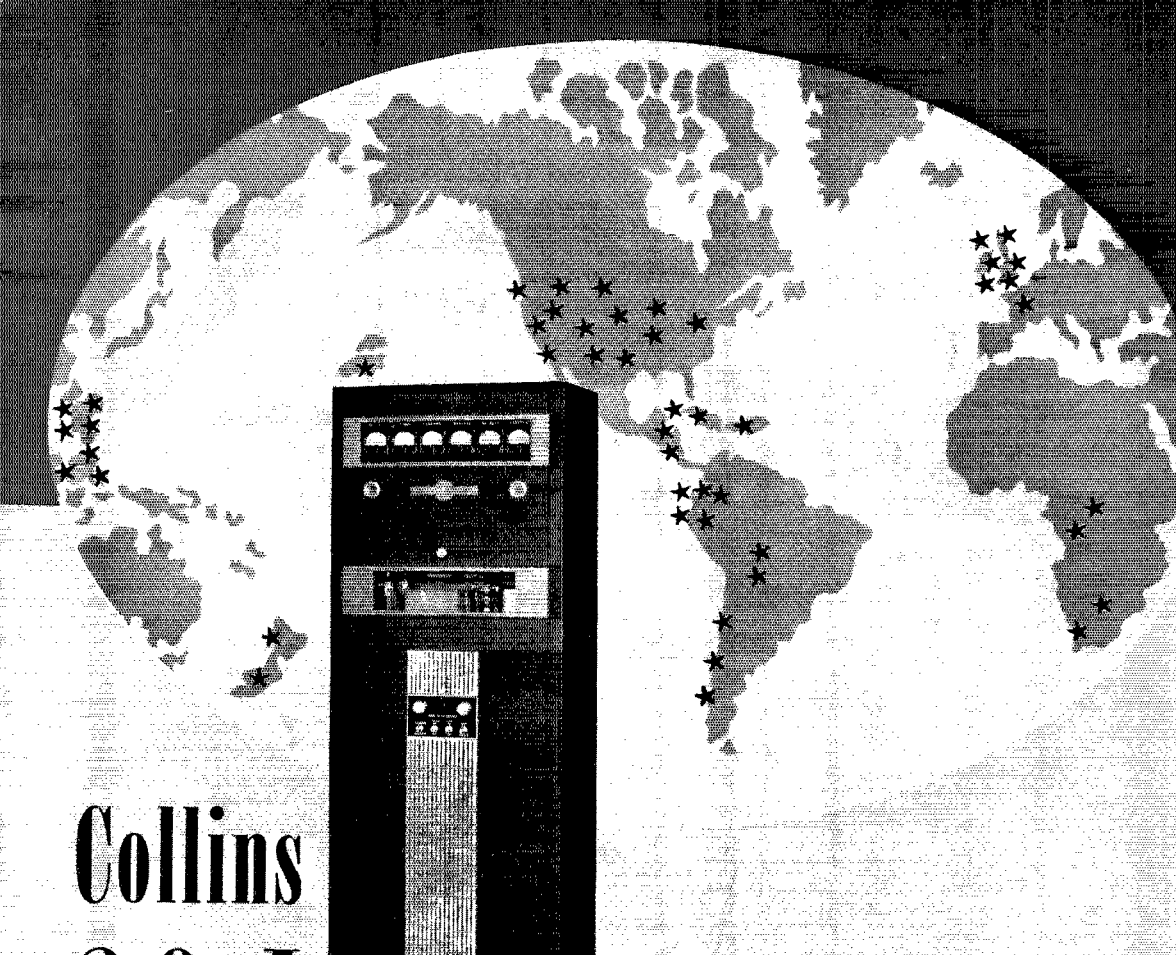
QST

devoted entirely to

amateur radio



In This Issue—A Practical 112- and 56-Mc. Converter



Collins 30J wins world-wide acclaim

Collins 30J, as far as we know, is the only transmitter with a rated power output of 250 watts and a frequency range of 1.5 mc to 60 mc.

At frequencies up to 30 mc the output is actually 300 watts cw and 250 watts phone, dropping off to about 200 watts phone and cw at 60 mc.

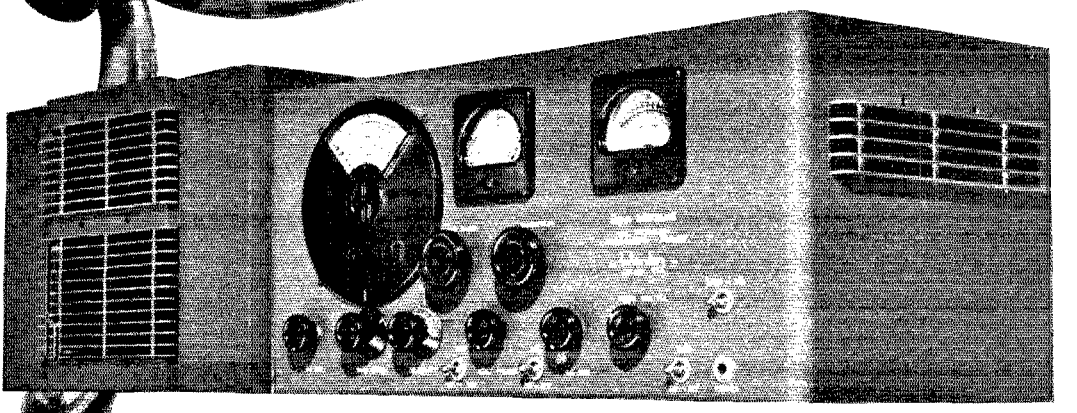
Where government license restricts power the 30J can be operated with as low as 50 watts output with full efficiency.

Handling airline traffic, u.h.f. police dispatching and commercial point-to-point use are some of the services the 30J performs throughout the world.

As a deluxe amateur transmitter, Collins 30J is hard to beat.

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA · NEW YORK, 11 West 42nd Street



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HERE'S WHAT'S BACK OF THE

SUPER DEFIANT SX-25

This story began a long time ago. But not until now could it be told. For not until now did we have the overwhelming proof for the final chapter . . . proof that the new SUPER DEFIANT is one of the finest amateur receivers ever developed at the price.

After months in the hands of our engineers . . . designing, experimenting, testing, developing, perfecting . . . it was finally completed. But that was not enough. We wanted to KNOW what the SUPER DEFIANT would do in the hands of amateurs. No experimenting by customers. No selling it on faith alone. So a large number were placed with amateurs and key distributors for operation under almost every conceivable condition. Opinions were weighed, comparisons made, results checked.

These practical tests proved that it met every demand made of it. Distributors were notified . . . told about its performance . . . told that here is a receiver amateurs were waiting for . . . told that at its low price the demand would hit a new high. They believed us. They ordered. They had SUPER DEFIANTS in stock, ready to make their announcements *at the same time* Hallicrafters did. And their confidence was justified.

"First one sold within five minutes," writes one. "The hottest receiver and biggest receiver value in my radio experience," wires another. "Showed it to a group of hams and they were so enthusiastic that they sent a telegram of congratulations to the factory," reports a third. "Sold five in one day." "Sold out first three days." "Rush two by express."

These are typical of the expressions in scores of wires and letters that have been pouring in from Distributors. If you haven't yet seen it, call upon your Distributor at once. He'll give you the facts . . . why it is making such a hit with amateurs Everywhere . . . why it may be just the receiver for you.

the hallicrafters inc.

CHICAGO, U. S. A.

WORLD'S LARGEST BUILDERS OF AMATEUR COMMUNICATIONS EQUIPMENT

the HT-9

A NEW 100 WATT TRANSMITTER

at Less Than You Could Build It Yourself

It is only natural that the "largest builders of amateur communications equipment," with unlimited engineering and production facilities, should develop such a transmitter. You could not build one like it yourself except at a cost far in excess of its price. Even THEN you might not have a transmitter which would equal the performance of the new HT-9. Note some of its special features:

The HT-9 is a five-frequency phone and CW unit, rated at 100 watts on CW and 75 watts on phone (carrier *output*.) Coils are available for all bands from 1.7 to 30 megacycles. Exciter coils for five bands can be plugged in, pretuned, and left in the transmitter. Band-switch, controls and meters, governing every function of the transmitter, are all on the front panel.

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The new HT-9, with all these advantages, sells for $199.50 less only coils and crystals. And you may have it from your Distributor on TIME PAYMENTS if you wish.

the hallicrafters inc.
CHICAGO, U. S. A.

WORLD'S LARGEST BUILDERS OF AMATEUR COMMUNICATIONS EQUIPMENT

MARCH 1940

VOLUME XXIV

NUMBER 3

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OFFICES

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QST *devoted entirely to*

AMATEUR RADIO

PUBLISHED, MONTHLY, AS ITS OFFICIAL ORGAN, BY THE AMERICAN RADIO RELAY LEAGUE, INC., AT WEST HARTFORD, CONN., U. S. A.; OFFICIAL ORGAN OF THE INTERNATIONAL AMATEUR RADIO UNION

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Section Communications Managers of the A.R.R.L. Communications Department

All appointments in the League's field organization are made by the proper S.C.M., elected by members in each Section listed. Mail your S.C.M. (on the 16th of each month) a postal covering your radio activities for the previous 30 days. Tell him your DX, plans for experimenting, results in 'phone and traffic. He is interested, whether you are an A.R.R.L. member or get your *QST* at the newsstands; he wants a report from every active ham. If interested and qualified for O.R.S., O.P.S. or other appointments he can tell you about them, too.

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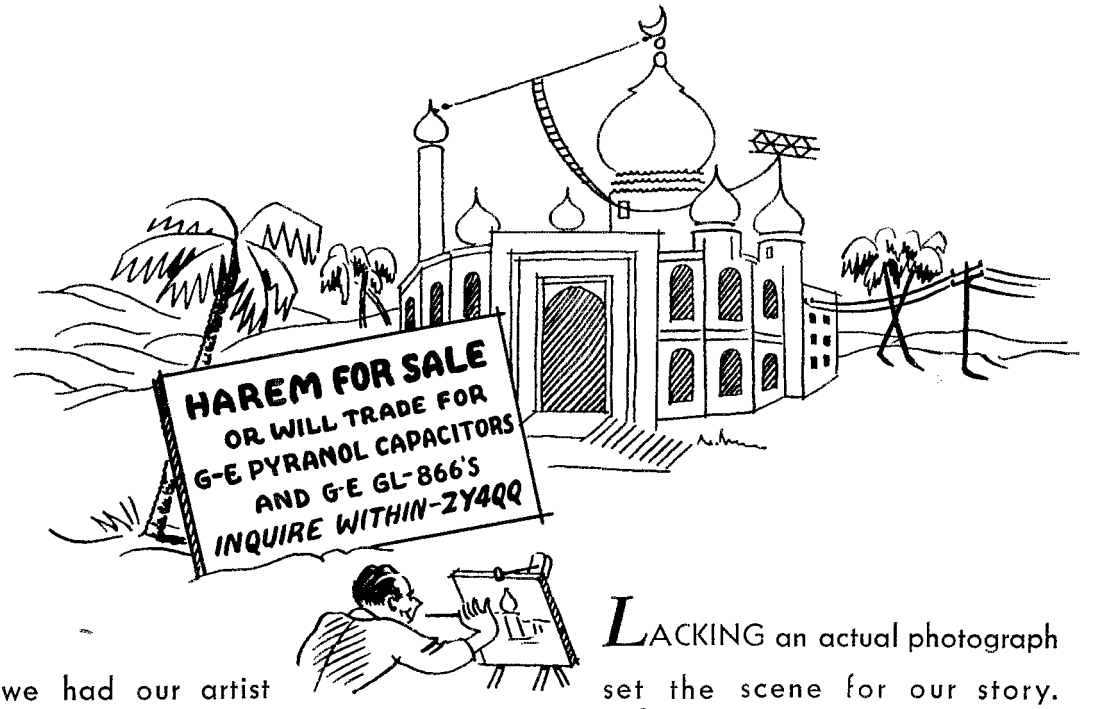


LACKING an actual photograph we had our artist set the scene for our story. ZY4QQ, you see, found so many OW's a bit hard on the budget. So he mail-ordered (by camel express) a pair of cut-rate filter condensers. He installed them, but before the caravan was out of sight, they blew, taking out a pair of good 866's as well.

• ZY4QQ knows he can depend on G-E products. He's now playing safe by turning to Pyranol capacitors and GL-866's—if he has to trade off some of the OW's to do it. He'll save, of course.

G-E Pyranol capacitors are built to exacting standards to assure long, dependable service. They'll operate continuously at 10% above rated voltage. And their compactness will save ZY4QQ some express costs, because space is at a premium on camel-back just as it is in your transmitter.

OM ZY4QQ wants GL-866's because he knows that G-E research scientists were the first to develop hot-cathode mercury-vapor rectifiers and that the name *General Electric* means he will get top performance from all G-E transmitting tubes. You can prove he's right in your own transmitter!

Bulletin GEA-2021-B covers G-E Pyranol capacitors; GEA-3315, G-E transmitting tubes. Get them from your dealer or from General Electric, Radio and Television Dept., Schenectady, New York.

GENERAL ELECTRIC

900-30

THE AMERICAN RADIO RELAY LEAGUE

THE AMERICAN RADIO RELAY LEAGUE, INC., is a non-commercial association of radio amateurs, bonded for the promotion of interest in amateur radio communication and experimentation, for the relaying of messages by radio, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

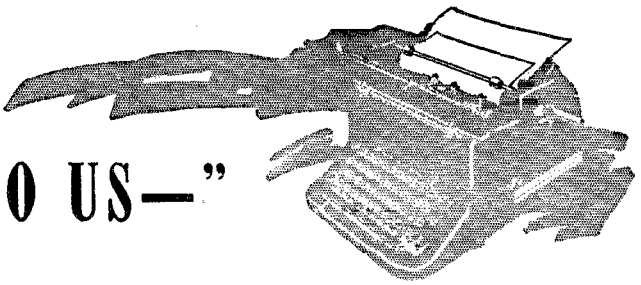
It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a Board of Directors, elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its board.

"Of, by and for the amateur," it numbers within its ranks practically every worth-while amateur in the nation and has a history of glorious achievement as the standard-bearer in amateur affairs.

Inquiries regarding membership are solicited. A bona fide interest in amateur radio is the only essential qualification; ownership of a transmitting station and knowledge of the code are not prerequisite. Correspondence should be addressed to the Secretary.

HIRAM PERCY MAXIM, FIRST PRESIDENT

Address all general correspondence to the administrative headquarters at West Hartford, Connecticut.



"IT SEEMS TO US—"

THERE is an old and dog-eared manila folder in our desk with the title "Editorial Suggestions." It has been there for years and is torn and spotted and faded. It could be replaced for two cents but we like it the way it is because we can always put our hand right on it. Throughout each month it receives notes and ideas and letters that suggest a topic for this page. Each month, come this time, we bring it up to the top of the madhouse we call our desk and look through its contents to see what we ought to write about.

We were rather impressed to find in the old folder this month two letters complaining of an appalling lack of sportsmanship by established amateurs towards newcomers or would-be amateurs. That is happily an uncommon thing in ham radio. We don't often have such cases. Generally we can find reason to be mighty proud both of amateur accomplishments and of the splendid spirit of brotherhood that characterizes the participants in our art. But when we review these two letters at the same time they combine to leave so bad a taste in our mouth that we believe something deserves to be said on the subject.

The first letter is from a large city in the near southwest. Like every large city, it has numerous amateurs and a considerable group of would-be amateurs on their way to licenses. The latter group, with the assistance of a local club, is getting up code speed by listening to the A.R.R.L. code-practice lessons sent out by a few public-spirited amateurs on the 160-meter 'phone band. Some of the local amateurs seem to have decided that the bands are crowded enough already and that they are not in favor of any new amateurs. So, it is reported, they have deliberately organized themselves into a network on the exact frequency used for the code practice, with the specific intention of preventing its reception. They admit it. Pleas, threats and plain honest begging so far have not been able to move them.

This is a sickening violation of common decency and of the creed of the amateur. These fellows forget that they themselves were once beginners who had to look to others for help. They are reversing the usual rule of the amateur to be as helpful as possible to others, particularly to beginners. They show a saddening lack of sportsmanship and of the traditional amateur spirit. We are ashamed of them.

They are also violating communications law. The interference that happens accidentally in amateur radio (and that is always with us) is legitimate. No one can complain about it. But interference that is deliberately created by moving onto a particular frequency with the purpose in mind of preventing the reception of other signals on that frequency is unlawful. It is precisely what is meant by the term "malicious interference" in the Communications Act. Heavy penalties are provided for it, including loss of license and fine or imprisonment.

We now call upon these fellows to cease and desist. We believe they will know exactly what we mean.

Our other letter is from a professional man, licensed for something over a year, who has been taken for several rides by mercenary amateurs. When he first received his ticket he didn't know much more radio theory and practice than the law required, and he felt obliged to seek assistance in the design and construction of his transmitter. A number of local amateurs wanted to help him for a fee. He eventually selected one, highly recommended by a local supply house, who for a hundred dollars agreed to design the transmitter, list the parts, help in the wiring, explain the theory and see that the rig worked properly. It never did work properly, apparently because it wasn't a sound design. Its father fiddled with it for months. He never could find the trouble but he kept his "fee" and he seemed to think he ought to have more because of the length of time he was spending looking for trouble. Other amateurs heard of the difficulty and offered to help but our friend says that their invariable story was, "Well, I can fix it up for fifty dollars." He began to think all amateurs were like that. Then he had the good fortune to meet a real amateur, one who painstakingly checked through the whole transmitter, found the trouble, showed how it could be overcome at a cost of less than five dollars,

and who didn't want a fee. But meanwhile our correspondent had almost decided that every amateur wanted money before he would help, and he has a pretty low opinion of our tribe generally from what he has seen of us.

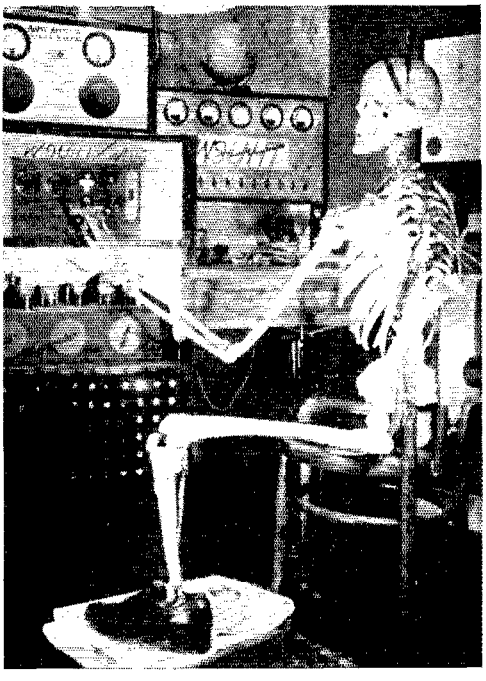
He is disgusted, but we are amazed. We admit that in all our years we have never heard of anything like this in amateur radio. Building a complete rig for a novice for a fee is one thing, and may be all right if value is given, but trying to charge a brother amateur fifty fish for spotting trouble — well, we're disgusted too.

As we've pointed out before, amateur radio dies out from the top. It is the amateur of skill and proficiency, gained by experience, who for some compelling personal reason is obliged to give up the game. We must have fresh blood coming up, if we are to hold our numbers and our position in the art. The new people must succeed the old-timers, themselves to become the skilled old-timers. We have never aimed at great growth and in fact we have assiduously avoided too-great growth. But we must have constant *replacement* to hold our own against our losses from the top, and these people must start as we all did — from scratch. It is therefore plainly up to us to encourage beginners. It is part of the amateur's code to be friendly. The amateur spirit is marked by kindly advice and counsel to the beginner, friendly assistance when needed, slow and patient sending when requested. These have been our standards for over a generation. Let's maintain them!

K. B. W.

★ SPLATTER ★

The mail produced "one for the books" the other day from "Doc" Gainsforth, W9UHP. We are reproducing the photo with "Mike" sitting in the driver's seat.



—•••—

Dr. Walter Lemke, W8RLB, criticizes *QST*'s lack of interest in the communication problem for the amateur yachtsman. He would like to see some dope on antenna systems for the small craft, ideas on waterproofing equipment as it may be called on for a drenching, or even at best, salt spray is going to take its toll. And there is the power supply problem.

This sounds like a "must" to us and we shall do something about it if we can gather together any information on the subject. What say ham yachtsmen — let's have the dope on how you licked the problems and let the rest of the brethren benefit from your experiences.

—•••—

Our Cover

This shot was taken at South Schenectady by G.E.'s Photographer Burns. Emile Nickle, W2EGN is in the process of manning the switches. This is just the temporary antenna switching arrangement for WGEO at the moment, while the new one is under construction.

—•••—

Maybe the old worm, "Necessity is the Mother of invention" wasn't coined expressly with the ham in mind, but we have certainly adopted it as an apt phrase time on end. The latest "necessity" is the kink on eliminating the bugaboo of flashover in neutralizing condensers. Hansen, W9KNZ of Denver, who has many times before "done something about it" has written this up for *QST* and appears on page 28.

—•••—

Deserving of careful study by every amateur is the unusually clear presentation and explanation of just what happens in the Ionosphere, which originally appeared as a Bureau of Standards Circular and we judged worthy of reprint in *QST*. As we continue to explore the high frequencies it behooves us to grasp the basic fundamentals that we may more readily understand and appreciate these theories that have proven to be fact, not fancy.

The phrase "The House of Magic" has become synonymous with the General Electric plant at Schenectady. That phrase, connoting the synthetic lightning bolts and the talking robots and the other stunts displayed for visitors, is largely window dressing. Behind the window dressing, though, in the laboratories and workshops strewn through the massive, sprawling plant there is genuine magic being done — the magic both of basic research and of practical engineering. Three members of *QST*'s editorial staff — Grammer, Rodimon and Goodman — recently had the opportunity of exploring the plant and examining this work in detail. When they came down to earth (in other words, back to 38 LaSalle Road), they sat down and let us have the adjoining account of what they saw.

QST Visits G.E.

The Editors Explore the "House of Magic" and Report on Latest Radio Developments

If you asked an average individual, ham or otherwise, to name the first s.w. broadcasting station that came to his mind, the chances are he'd say "2XAF" or "2XAD." For these stations were not only real pioneers in the business (15 years or so in the game and still going strong) but always were outstanding in pushing real hefty signals around the world. The days of experimental calls seem to be over (2XAD is now WGEA and 2XAF is WGEO), but changing calls does not mean a change in the policy of the station management. For the G.E. short-wave broadcast transmitters are still experimental and probably always will be — the laboratory for transmitter developments which sooner or later will be incorporated in other stations whose prime purpose is sending out program material. Even now WGEO is in the throes of transition into the most powerful short-wave BC transmitter in the U. S., using a new kind of power tube which bears little external resemblance to the kind of tube we see in more conventional stations.

The desire to have a squint at this newest rig attracted us to the 65-acre plot of land two miles southwest of Schenectady that is the QTH of WGEO, WGEA and WGY, and numerous other experimental layouts. Too, G.E.'s rapidly-maturing television broadcasting developments aroused their share of interest — and anticipation. And we had a warm invitation to come and have a look so, showing remarkable astuteness in preselecting one of the coldest days in January to make the trip, off we went. We timed ourselves to be at the reception building outside the main gates promptly at opening time, and on getting there found E. H. Fritschel, W2DC, already waiting for us. On "Fritz" had fallen the job of getting things lined up so we could see as much as was physically possible in one day, and his was the not-too-easy task of keeping us moving fast enough to meet the schedule. There are always so many things to examine, to ask questions about — and, when practically everybody you meet is a ham or ex-ham, a community of spirit that doesn't make for short QSO's!

Right at hand, and therefore the first stopping place, was Building 36 which houses the television and short-wave broadcasting studios. The television end was our first objective, because we had heard that there was some pretty snappy u.h.f. equipment installed there. And we found that the reports were not exaggerated.

Visualize a large room, perhaps 25 by 40 feet, with a 10 by 15 "island" at one end. The island is the control room, glass-fronted towards the "studio" so the control operator can watch the action and monitor the picture at the same time, 'phoning instructions to the cameraman, who wears a headset and rides the movie-type dolly carrying the television camera. The other three walls of the control room are formed by relay

All photos courtesy of G.E.

When good hams get together — it's all in fun! *L.-R.* (standing): Fritschel, W2DC; Grammer, W1DF; Goodman, W1JPE; Darlington, W2ALP; (kneeling) Rodimon, W1SZ; Fritschel, W2MCL.

racks full of sweep circuits, high- and low-frequency pulse generators, blanking circuits, phase-correction circuits, audio, video and radio amplifiers, monitoring equipment — enough tubes and parts to satisfy an indefatigable ham builder for years and years. Unlike most television studios, this one does not simply handle audio and video circuits but includes actual radio transmitting equipment as well, for the signal generated here in Schenectady is relayed by a radio link to the actual broadcast transmitter some 12 miles away in the Helderberg mountains.

The studio itself is set up much along the lines of what we imagine an ordinary movie set to be like. Since the television camera requires more illumination than a movie camera, batteries of lights are very much in evidence — not ordinary lights, but G.E.'s new "capillary-type" *water-cooled* mercury-vapor units. Ordinary "takes" require 12 of these 1-kw. lamps — four batteries of each. This grouping permits 3-phase operation to avoid flicker. The light is about 3 times as intense as that from the same wattage in incandescent lamps, but 90% or more of the heat is taken away by the cooling system in much the same fashion as in water-cooled transmitting tubes. Occasionally extra illumination is required for a scene, and then a dozen or two 300-watt incandescents with internally silvered reflectors are brought into service. The heat from these is practically unbearable, and between the heat and the glare we have a lot of respect for the actor who can behave naturally in front of a television camera.

In this maze of complicated circuits and non-microphone technique the thing that catches the ham's eye is the relay transmitter. Working on a carrier frequency of 157.25 Mc., this is a sweet job of u.h.f. construction, with lots of little kinks worth adapting to amateur use. The front end of this set can't be told, in appearance, from an ordinary i.f. amplifier chassis; it has a crystal os-

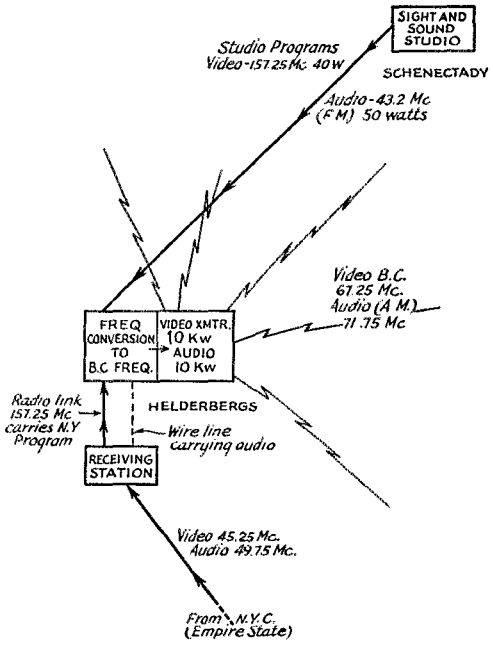
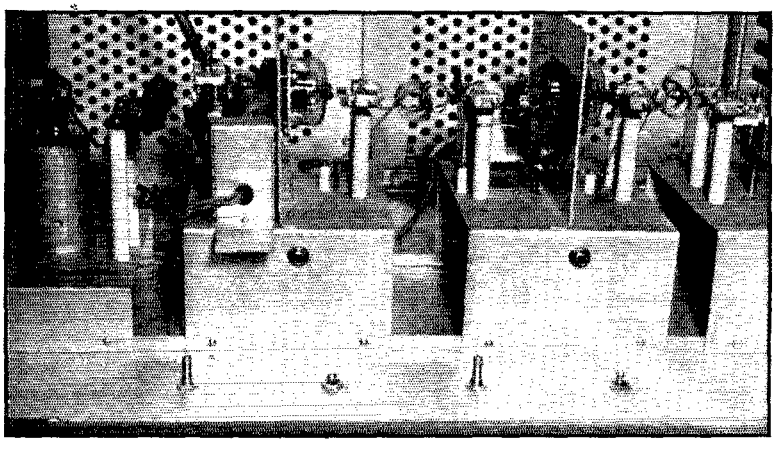


Fig. 1 — This "schematic" shows the television broadcasting setup, involving relayed programs from two separate sources. FM sound programs also will be relayed in similar fashion.

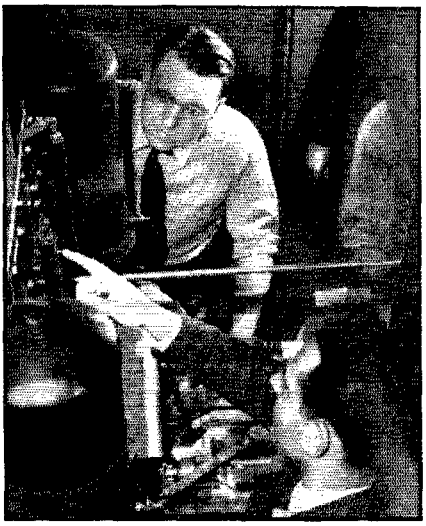
cillator, frequency multipliers, and a couple of 1852 amplifiers working on a frequency of 22.75 Mc. The video signal is introduced into a balanced modulator at 22.75 Mc.; one side-band is selected, amplified, and mixed with a local oscillator frequency of 134.5 Mc. to give a beat at 157.25 Mc., which is then fed through a line to the first stage of the transmitter shown in the photographs. Each of the stages in this outfit is a linear amplifier, using 832's (the u.h.f. double beam tube) to build up the power level to the point where it will



The television relay transmitter at the Schenectady studio has unit-style construction for each stage. For short leads and symmetry, tuning condensers are discs mounted on standoffs which bring the plates right at the tube terminals. Stages are coupled inductively, with coupling varied by moving the stage along the "track" at the bottom.

excite the final push-pull 834's. The output is about 40 watts, which is ample to do the job for which the transmitter is intended.

Each stage is built on an aluminum chassis in the shape of an inverted U, with all tuned circuits lined up so that inductive coupling can be used between stages. The bottom edges of the chassis fasten to aluminum-angle "rails" running the length of the transmitter; interstage coupling is adjusted by moving the whole stage back and forth until the loading is right; then the stage is fastened permanently to the rails. Obviously it is easy to take out a stage should anything go wrong. The r.f. is fed to the antenna through a double concentric line, which is simply two ordinary copper-tubing lines soldered together. The tubing is grounded and the inner conductors carry the r.f. The method of coupling to the line is shown in Fig. 2. All four condensers resonate the circuit, while the loading is adjusted by varying the ratio of C_1C_1 to C_2C_2, identical settings being used on corresponding condensers. The use of balanced circuits throughout avoids much of the difficulty often experienced with u.h.f. transmitters.



These metal cylinders are rated at 50 kw. apiece.

W1JPE pointing, with Towlson figuring out the answer. Whatever it was all about, the fact remains they are alongside the final amplifier at WGEO.

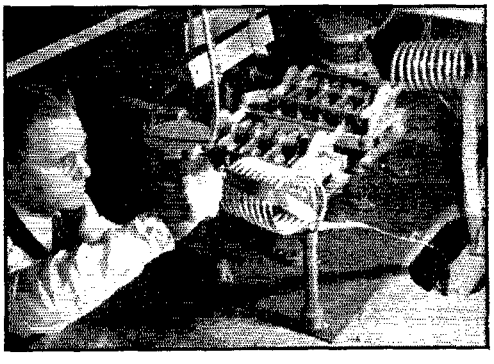
A miniature rhombic on top of the building directs the 157-Mc. signal to the Helderbergs. The sound program for the broadcasts goes out from a 50-watt frequency-modulated transmitter which is small enough to be (and is) tucked away in an odd corner on a window-sill. It operates on 43.2 Mc. at present, but probably will be moved to a higher frequency in the near future.

We almost forgot to mention one thing which seems to be done as matter of course throughout the r.f. end of a television transmitter. On every stage, from the smallest up to the largest, a 955 acorn sits somewhere on the chassis. It's connected as a diode and is provided with a pickup loop so that some of the r.f. can be rectified for monitoring purposes. Thus the picture can be checked at every point in the transmitter, and should a broadcast suddenly develop one of the many faults which can appear in a television picture the guilty stage can be located in a hurry.

During the hour or so spent in looking over equipment and asking questions of Mr. D. E. Norgaard, W2KUJ, in charge of the experimental work in the television studio, a couple more of the G.E. ham contingent joined the party: Gene Darlington, W2ALP, in charge of short-wave broadcasting, Paul Fritschel, W2MCL, who is with the frequency-modulation crew, Bill Green, W9FWB, of the publicity department, and George Burns, ex-W2HON, of the photographic staff. Through the good offices of the publicity department George had his camera along to shoot anything we thought might interest hams, and you can be sure we had him use up quite a lot of film and flash-bulbs.

Next stop, South Schenectady! WGY, WGEA, WGEO, buildings full of transmitters, acres of beam antennas. A matter of a ten-minute drive from the River Road main plant, it would be ahard job to miss this place, spotted as it is by WGY's new 625-foot vertical radiator, visible for many miles over the surrounding country.

Externally, things looked rather natural as we approached the station grounds. Several 300-foot steel towers and many 100-foot poles with all sorts of dizzy-looking arrays stretched between them are very much in evidence. The famous Byrd antenna pointed at Little America, which several years ago was so effective, is still up and even now is beginning once again its schedule of weekly "mail-bag" broadcasts to the colonization crew digging in at Little America. Most of the short-wave antennas are of the type known

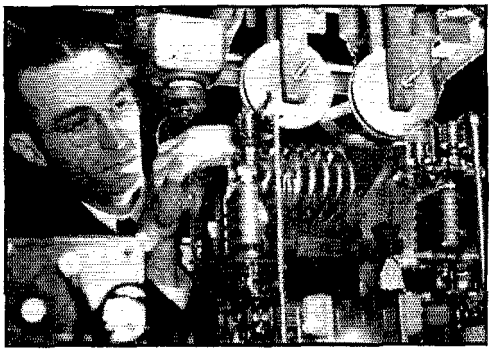


Power is off and it's safe to tangle with the antenna network of 100-kw. WGEO.

W2ALP gingerly adjusts a tap on one of the network inductances.

as the "Alexanderson panel antenna," consisting of stacks of horizontal collinear half-wave elements, with a corresponding reflector when unilateral transmission is desired. The size of the antenna depends upon the amount of directivity that can be tolerated; the bigger the antenna the greater the gain, but the narrower the beam and hence the smaller the region which can be given good service. Generally there are three stacks of elements, since a good deal of vertical directivity can be used, with from three to five horizontal elements in each row. Each element is individually trimmed to insure peak performance. All the short-wave antennas are fed by 600-ohm lines, tapped to ¾-wave matching stubs. The closed ends of the stubs are inherently at ground potential and are directly grounded for lightning protection.

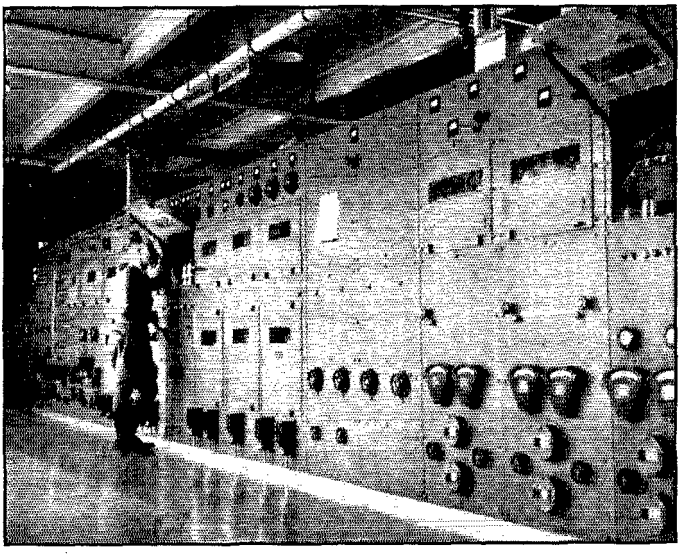
Approaching the entrance of the main building the photograph you see on the cover looked like a "natural" so it was snapped with the coöperation of Emil G. Nickle, W2EGN, who was aloft to switch antennas. (Another shot that may not look so "natural" is the one of the G.E. and HQ combination in front of the building.) Our visit to South Schenectady was concentrated in the main building, where WGEO, WGEA and WGY are housed. WGEO was the center of interest, with its new high power final amplifier (a Class-B linear) soon to be pushing out 100 kw. on regular programs. This is the outfit which incorporates tubes more resembling 50-gallon water tanks than r.f. bottles. These tubes (so far as we know they have no numbers) constitute a radical departure from conventional practice, especially in mechanical features. For one thing, they can be taken apart — no discarding a whole tube here should one of the filament wires burn out! One of the photos shows the metal top of the tube; this simply is bolted to the rest of the assembly and can be taken off with the aid of an Allen wrench. One touch we liked a lot was the spigot on the plate to let out the trapped water when the tube is demounted! Each tube is mounted on a sort of truck which rides on a track running through a door in the front of the amplifier unit, and when any work is to be done on the tube it is



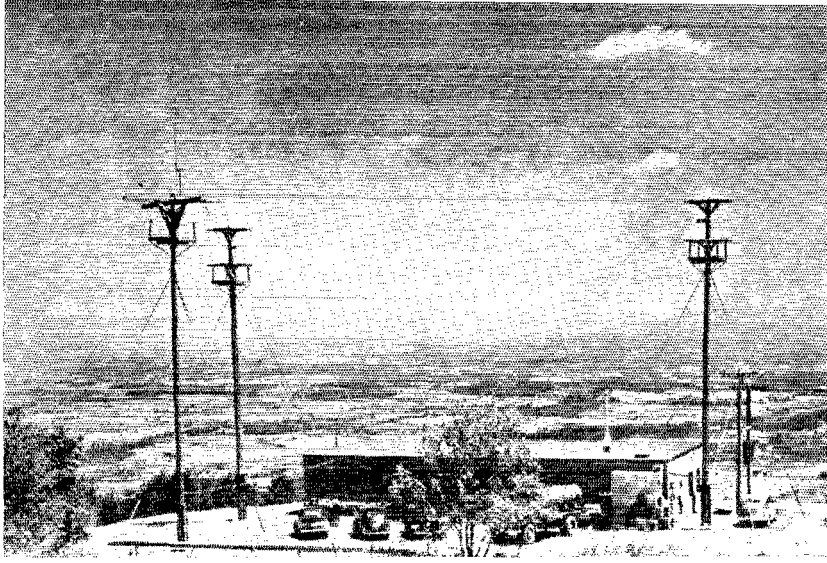
Among the driver stage of WGEA, W2DC appears to be inspecting the terminals of an 833.

disconnected and pulled out into the room on its truck. They are not evacuated and sealed off as are normal tubes, but are continuously pumped to maintain the vacuum; the vacuum pumps run day and night whether the transmitter is on the air or not. In addition to the familiar meters normally associated with a power amplifier, the control panel has vacuum gauges to show the gas pressure in each tube.

Electrically, the tubes are in the low-voltage high-current class — comparatively speaking,



Behind this panel — 10 kilowatts of sight and 10 of sound, on television channel No. 3 (67.25 Mc.). At this transmitting plant at the Helderbergs there is no video equipment — the signal comes in at r.f. and goes out the same way, but on a different frequency. All linear amplifiers from the receiving antenna to the transmitting antenna. Larry Leeds is taking a squint inside one of the high-power stages.



Here's a site to make an ultra-high-frequency man's mouth water! Looking out over the valley from behind the transmitting station in the Helderbergs. The hundred-footers carrying the antennas don't hurt any, either.

since they are intended to be operated at 9000 volts when full power goes on. During this experimental period they have been running at about 6000, with a plate current of 10 *amperes* per tube; eventually the input will be upped to 40 amps total at 9000 volts, which it is expected will give around 100-kw. actual output to the antenna after deducting tank losses.

One might expect something terrific in the way of a plate tank circuit for a high-frequency transmitter of this size, but actually it is not too formidable. The circuit is rather high-*C* judged by ham standards, but the plate current/plate voltage ratio also is high. The tank coil is two turns of about 1-inch copper tubing wound to a diameter of about a foot, and it is tuned by vacuum condensers. At least that was the arrangement when we saw it; several other tanks had been tried before (including one "coil" consisting of one large turn of four-inch busbar) and plans for trying a new scheme were already under way. The copper tubing coil is water-cooled, a practical necessity when tank currents run in the hundreds of amperes.

The neutralizing method is an interesting one, although probably not generally applicable to amateur transmitters. The circuit arrangement is shown in Fig. 3. Although one of the very early neutralizing circuits proposed, it is only recently that it has been finding favor in commercial transmitters, and we were told that a good many modern broadcast transmitters are using it. The inductance of the coil is adjusted so that its reactance is equal to that of the grid-plate capacity of the tube so that the feedback through the tube is cancelled by an opposite feedback through the coil. This system of neutralization avoids the parasitic oscillations usually associated with cross-neutralized circuits, and has the advantage that since there are no neutralizing condensers there is no increase in the effective capacity shunting the tank circuit. Unfortunately, the neutralization does not hold over much of a frequency range, so it is necessary to readjust the neutralizing circuit when the frequency is shifted.

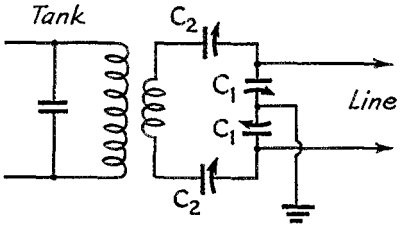


Fig. 2 — Coupling circuit used in the u.h.f. transmitters for working into a balanced concentric line.

We amateurs aren't the only ones who have difficulty with harmonics. A troublesome third here was cleared up by the linear trap shown in Fig. 4, the trap being a shorted section of transmission line, ⅛ wavelength long, bridged across the main 600-ohm line to the antennas. The condenser across the end cancels out the stub reactance at the fundamental frequency so that the stub or trap has no effect on the fundamental, but on the harmonic the trap is a short-circuit. "Before and after" measurements showed that installation of the trap reduced the third harmonic by 18 db, and another 2 db suppression was obtained by enclosing the stub line in a sheet-aluminum shield.

At its present output of 50 kw. the rig is just coasting along, but if too many new troubles don't develop as the power is increased it won't be long before the full 100 kw. is on the air. According to the fellows at the station, you never can tell what's going to pop next when the power is doubled — the only sure thing is that something always does! Including burning out one of the wires in a directive array when the output was running around 100 kw. It must have been fun while it lasted!

Let us straighten out a point for those of our readers who assume that high-power experi-

mental transmitters are all dolled up with chromium plating and polished brass rails for visitors to walk around and gaze at with awe. It will perhaps be something of a shock to learn that the fact is actually the antithesis. These transmitters are real guinea pigs; in them apparatus, circuits and ideas must go through the most exhaustive workouts. Perhaps it is the lack of frills, coupled with thoroughness of testing and elimination of "bugs" of all descriptions, that makes an amateur feel so much at home in this plant.

Before leaving we walked into that part of the station housing WGY's famous 50-kw. broadcaster on 790 kc. since 1926. Passing along to the control desk to sign the visitors' log, our attention was caught by something familiar-looking on the bulletin board. We just couldn't resist taking a shot to bring back to the C.D. An ORS/OPS Bulletin was prominently displayed on the board. Did anyone ever say that hams don't work at BC stations? As an example, here's the roster of the gang now working at South Schenectady: Emil G. Nickle, W2EGN; Donald McIlwain, W2KOZ (ex-W5ABD); George M. Hoffer, W2AVG; Robb Millham, W2EZ; Ralph Yeandle, W2ETY; Robert Lingle, W2KWF; Harold G. Towlson, W2BDE; Ty Schumacker, W2AIX; Roy Stigberg, W2AUJ; William Spencer, W2CEM; Fred Vert, W2JWA.

Time out for lunch, then off to the Helderbergs and the television BC transmitter. This site is 20-odd miles southwest of Schenectady by road and at the highest point in the vicinity — 1520 feet above sea level. As this trip was being made in the middle of winter it was understood we should not be able to go all the way by car — road conditions would make it necessary to climb the final hill on foot as driving was an impossibility up the last stretch. Arriving at the spot after a gradual climb up a winding slippery road, we saw readily that there had been no exaggeration whatsoever. Directly in front of us,

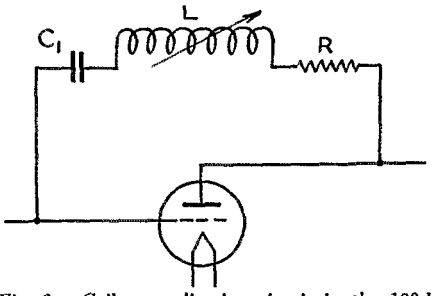
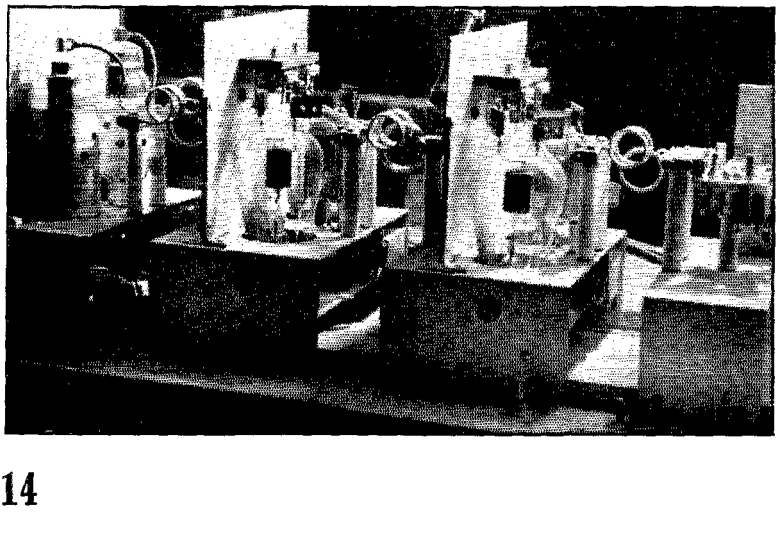


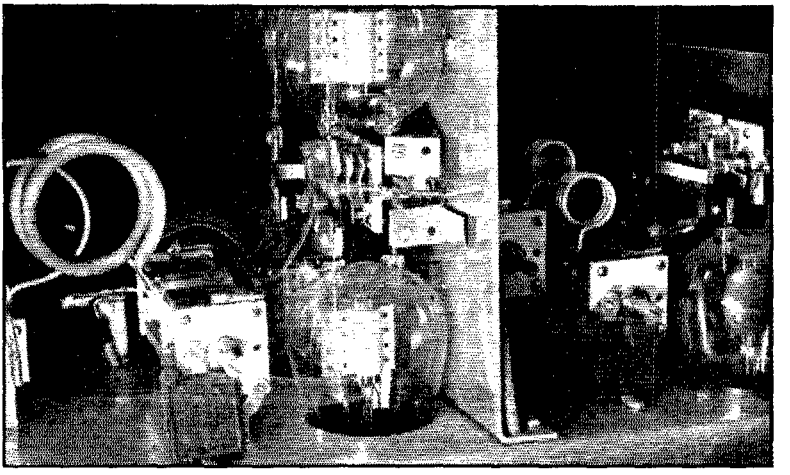
Fig. 3 — Coil neutralization circuit in the 100-kw. linear amplifier for WGEO (ex-W2XAF). The blocking condenser *C* is to isolate the plate d.c. from the grid and resistor *R* is an oscillation suppressor. The coil reactance is made equal to the reactance of the grid-plate capacity of the tube.

up a 30-degree slope, was our destination and it was either hug the road of sheet ice or take to the drifts. The less agile members of the party were about ready to call out the St. Bernards by the time the top was reached!

There are really two stations at this location, one for receiving and one for transmitting. The transmitting end is situated on the side of the mountain facing Albany and Schenectady, on a little plateau which seems like a balcony overlooking a vast expanse of Hudson River valley. It is said that on a clear day one can see into Massachusetts and Vermont from there, and we can readily believe it. But in zero weather with a small gale blowing the scenery is best appreciated from indoors! The receiving station is on the other side of the peak where there is a clear shot down the valley toward New York City and the Empire State building. This station is used for picking up the New York television and frequency-modulation programs and relaying them to the transmitter. The whole system is a bit complicated, but can be straightened out with the aid of Fig. 1. Empire State programs on television channel No. 1 (45.25 Mc.) are picked



Part of the front end of the 67.25-Mc. television transmitter. Similar construction to the lower-power job at Schenectady, but using different tubes. At the extreme right is an output coupling circuit of the type shown in Fig. 2, feeding into a balanced concentric line which runs to the input end of the main transmitter shown in another photograph.



In the 71.75-Mc. sound transmitter, the exciter has one stage with four tubes in push-pull parallel. This unconventional arrangement uses ordinary tank circuits, and fairly good-sized ones at that! Particular care has been taken to make the circuit perfectly symmetrical.

up here, converted into audio and video outputs in the usual receiver fashion, and the audio is then passed on to the transmitting station over a wire line. The video signal, however, is used to modulate a low-power transmitter on 157.25 Mc., the same frequency as that used in the relay transmitter at Schenectady, and sent by radio to the transmitting station. At the transmitting end, therefore, we find something of a novelty — a television transmitter entirely devoid of video circuits, pulse generators, blanking-signal generators, and the usual accompaniment of auxiliary circuits. The whole sight transmitter is made up of linear amplifiers and a frequency-changing circuit or two. But if it sounds simple, one glance at the control panel will bring quick disillusionment on that point!

Basically, the sight signal comes in on 157.25 Mc. and is rebroadcast at a 10-kilowatt level on 67.25 Mc. A rather complicated system of frequency conversion is used to get the signal to the latter frequency without running into "birdies" from mixing of various oscillator harmonics. After conversion, the signal is passed through linear

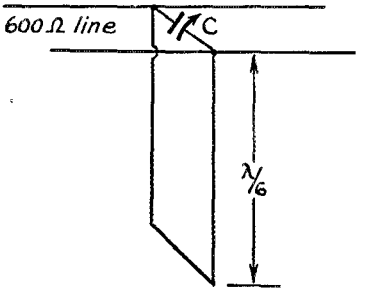


Fig. 4 — Linear harmonic suppressor, using a $\frac{1}{6}$-wave line. The line is resonanted by the condenser C to the fundamental frequency to avoid loss of power, but acts as a short-circuit to the third harmonic.

amplifiers, all on the same frequency, starting out with the small unit shown in one of the photographs. Its construction is a good deal like that of the relay transmitter at Schenectady, but more conventional tubes can be used because the frequency is lower. In the main transmitter unit the power is built up in successive stages, using in some cases small water-cooled tubes of the 888 type; larger stages incorporate tubes — GL-889 and GL-880 — developed especially for the purpose. The perennial u.h.f. problem of tube capacities is acute here, because a tube has to be fairly big physically to handle the power. Add on the fact that the amplifier frequency characteristic has to be flat over a band of five megacycles and you have a real job on your hands to get any kind of efficiency, especially in a linear amplifier. It may be of interest to note that 10 kw. of television transmitter takes up more space than five times that power of ordinary broadcast transmitter.

Linear tank circuits are used in the larger stages, with inductive coupling between the plate tank of one stage and the grid tank of the next. Tube capacities and inductance of internal leads make it necessary in many instances to use trick circuits with half- and three-quarter-wave lines, with the tube leads forming most of the line. The coupling usually is varied by swinging one tank through an arc with respect to the other, and some neat mechanical arrangements have been developed for the purpose. One feature of the high-power stages that caught our eye was the use of carbon-rod type resistors (100-watt size) of the order of 2 or 3 ohms as filament "by-pass condensers." The rods have low impedance to both radio and video frequencies, which would not be the case with ordinary condensers. Draining a few more amps from the filament transformer is of no particular consequence. Conven-

(*Continued on page 116*)

A Practical 112-Mc. Converter

Using Loktal Tubes for the U.H.F. Mixer and Oscillator

BY BYRON GOODMAN,* WIJPE

A 112-Mc. CONVERTER is nothing new, of course, but the one to be described started out with a different angle from most. As far as we know, all of the available designs for 2½-meter converters use acorn tubes. Acorn tubes are designed for the u.h.f. picture and are expected to do a good job in that range, but we wanted to see if some less expensive tubes might not turn in a fair performance. We weren't at all sure that anything could be made to work, but we didn't run into any serious trouble and now we're quite keen about the possibilities of more fellows getting on 2½ meters with good but less expensive gear. With 2½-meter f.m. looming as the big interest for the serious u.h.f. man, perhaps the knowledge that he doesn't have to go to acorn tubes will induce him down to the band faster.

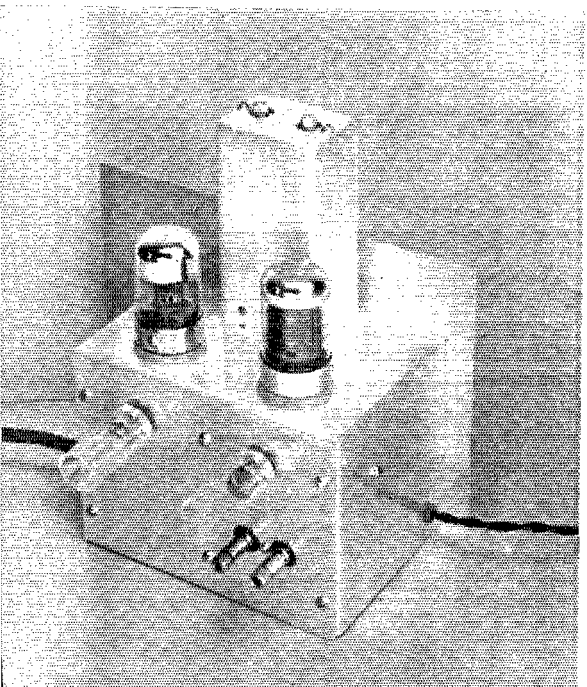
It might be well to start out by admitting that we're an old fuss when it comes to the u.h.f. stuff. Every time we see a lead over an inch long in a piece of u.h.f. gear we think, "My, what a lovely choke," because, actually, it doesn't take much inductance to have considerable reactance above 60 Mc., and even a straight piece of wire has inductance. Further, we're a nut on dielectrics, and we're always visualizing the losses introduced by a piece of inferior insulation in u.h.f. gear. With all this as a background we were rather up against it when we started to look around for tubes and gear to use in a 112-Mc. converter that *wasn't* to use acorn tubes. Acorn tubes weren't considered for the job because it was felt that their use already had been covered quite thoroughly, and we wanted to see what other tubes might work. After looking over the available tubes, the loktal series showed up as the most logical. They are available with the necessary characteristics, they have good insulation (glass throughout) and the leads are a half-inch shorter than their nearest rivals (the bantam series) and, what's better, the leads are made of heavier wire with, consequently, less inductance. Unfortunately, after all the excellent arguments for the loktal-type base, the only available sockets were of "low-loss" natural-colored bakelite but (just to prove we worry too much) the sockets didn't seem to keep the converter from working. We did manage to find polystyrene coil sockets and forms but had to be content with isolantite for insulation on the tuning condensers.

We ended up with what we feel is a fairly reasonable starting point for the serious but impecunious 2½-meter experimenter. The converter, for simplicity, uses only a mixer and oscillator, with separate tuning controls to avoid ganging worries. The thing is flexible enough so that by simply changing the output coupling transformer it can be made to work into a 3- or 5-Mc. i.f. or, if one wishes, into the i.f. amplifier of a 43-Mc. f.m. broadcast receiver.

The oscillator stability turned out to be better than we had dared to expect, comparing favorably on 2½ meters with any acorn oscillator using coil-and-condenser tuning that we have seen. The sensitivity of the converter seems to be quite good, and it brings in any signal a t.r.f. superregenerative acorn job will, which is the only standard of comparison we have available.

Let's itemize the variations, to keep them straight. With the 3-Mc. (or 5-Mc.) output coupling transformer, the converter can work into an f.m. amplifier and detector for 2½-meter amateur reception and 43 Mc. f.m. broadcast reception. Coupling the output to a regular receiver tuned to 3 (or 5) Mc., the converter can be used for the reception of stable amplitude-modulated signals in the 2½-, 5- and 7-meter ranges. The converter can work directly into your present f.m. broad-

* Assistant Technical Editor.



A rear view of the converter shows the two plug-in coils and the antenna terminals. The wire leading off at the left is the battery cable; the twisted pair on the right carries the output to the i.f. amplifier.

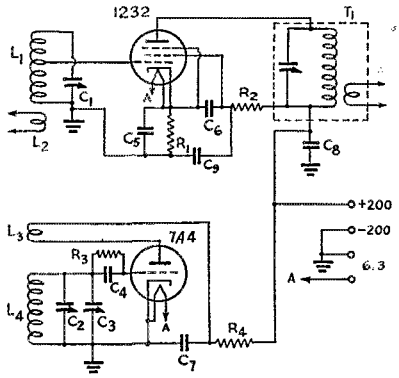
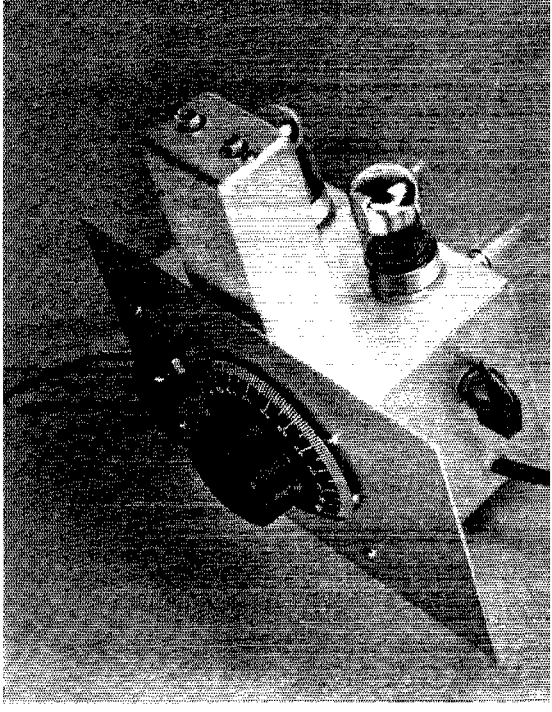


Fig. 1 — Wiring diagram of the u.h.f. converter

C_1 — 15-$\mu\mu$fd. midget variable (Hammarlund HF-15)
C_2 — 35-$\mu\mu$fd. midget variable (Hammarlund HF-35)
C_3 — 10-$\mu\mu$fd. midget variable (Hammarlund HF-15 with one stator and one rotor plate removed)
C_4 — 100-$\mu\mu$fd. midget mica
C_5, C_6, C_7 — 500-$\mu\mu$fd. midget mica
C_8, C_9 — 0.01-μfd. 600-volt paper
R_1 — 500 ohms, ½-watt carbon
R_2 — 125,000 ohms, 1-watt carbon
R_3 — 20,000 ohms, ½-watt carbon
R_4 — 10,000 ohms, 1-watt carbon
T_1 — 3 Mc.: 75 turns No. 30 d.s.c. closewound; coupling coil is 20 turns No. 30 d.s.c. closewound ⅛-inch from ground end of coil.
5 Mc.: 45 turns No. 30 d.s.c. closewound; coupling coil is 14 turns No. 30 d.s.c. closewound ⅛ inch from ground end of coil.
The transformers are built in the Hammarlund ETU units. Both sections of the condenser are used.
L_1 — 112 Mc.: 2¼ turns No. 20 enam., ⅜-inch diam., spaced diam. of wire. Grid tap at ¾ turn from top.
56 Mc.: 4½ turns No. 20 enam., ¾-inch diam., spacewound to occupy ½ inch. Grid tap at 1½ turns from top.
43 Mc.: 5½ turns No. 20 enam., ¾-inch diam., spacewound to occupy ½ inch. Grid tap 2 turns from top.
L_2 — 112 Mc.: 3 turns No. 20 enam., ¼-inch diam., closewound one wire diameter below cold end of L_1.
56 Mc.: 3 turns No. 24 enam. closewound ⅛-inch below L_1.
43 Mc.: Same as for 56 Mc.
L_3 — 112 Mc.: 1 turn No. 20 enam. ¼-inch diam., 3 wire-diameters below L_4.
56 Mc.: 1½ turns No. 24 enam. closewound ⅛ inch below L_4.
43 Mc.: 2½ turns No. 24 enam. closewound ⅛ inch below L_4.
L_4 — 112 Mc.: ⅞ turn No. 20 enam., ⅜-inch diam.
56 Mc.: 1¾ turns No. 20 enam. spaced to occupy ¼ inch.
43 Mc.: 2¾ turns No. 20 enam. spaced to occupy ¼ inch.



The 112-Mc. converter uses a 7A4 oscillator and a 1232 mixer. The panel dial is the oscillator tuning dial; the panel knob is the mixer tuning control. The knob on the side adjusts the oscillator band-set condenser.

cast receiver for the reception of amateur 112-Mc. f.m. signals, by cutting in at the h.f. mixer grid.

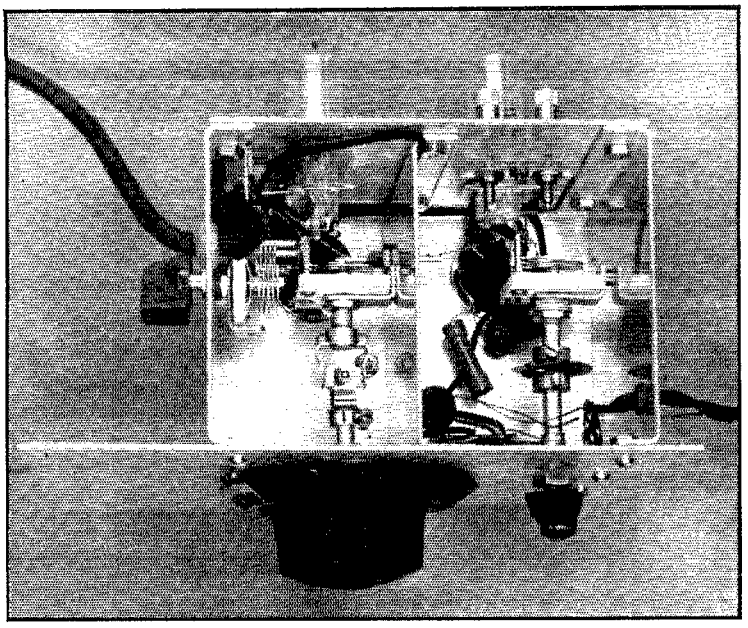
The Circuit

A 1232 is used for the mixer tube. Although it has a slightly lower mutual conductance than the 1231, the 1232 showed up better in this particular case. This is a bit of luck, since the 1232 is less expensive and is more readily available. In an effort to cut down the loading of the tuned circuit by the tube, the grid is tapped down on the coil, and it results in better gain and a much more decided tuning peak to the circuit. The grid is capacity-coupled to the oscillator rather loosely but apparently plenty for good conversion.

The oscillator is a 7A4, the loktal version of the 6J5. The old "plate tickler" circuit was used so that the cathode could be grounded. On 56-Mc., the stability and lack of hum on the oscillator is such that c.w. signals can be copied and made to sound as they do on a low-frequency band, but on 112 Mc. some hum does creep in and it is not possible to tune in a c.w. signal and have it sound "T9". This is a trouble we ran into

It isn't much of a trick to build a 112-Mc. converter with regular tubes if you take care with a few details. The converter described here will help to get you started on 2½-meter amateur f.m., since it can work into a 3- or 5-Mc. i.f. amplifier, or your 43-Mc. f.m. broadcast receiver. It also makes a nice converter for 56-Mc. a.m. signals by working it into your communications or all-wave b.c. receiver.

In case you don't own an f.m. receiver or i.f. amplifier, you can get started with the converter now and *QST* will soon carry a description of a suitable i.f. amplifier for f.m. to go with this converter.



A shot underneath the converter illustrates the arrangement of the parts. Note that in the oscillator section (on the left) the band-set and tuning condensers butt into each other for short leads. The band-set condenser is insulated from the side panel by an insulated washer, and the oscillator circuit grounds to the chassis at only one point, through the tuning condenser. The victron through-bushing which serves as coupling between mixer and oscillator can be seen on the partition just above the oscillator tuning condenser. The bushing connects to the 1232 grid on one side and to nothing on the other.

in the acorn-tube front end of our first f.m. receiver,[1] and we must confess we don't quite know how to lick it without going to battery-operated h.f. oscillators. The drift is quite low on 112 Mc., but the hum is just enough to superimpose ripple on any signal that is tuned in. It isn't objectionable, and is completely missing on the lower frequencies, but it does present a problem that has us slowed down to less than a walk.

The oscillator tuning condenser is a 15-$\mu\mu$fd. condenser from which several plates have been removed, and this is paralleled by a 35-$\mu\mu$fd. band-set condenser. With this old familiar type of band-spread system, the converter can be set to the desired frequency band, the mixer condenser turned to the point where the noise is greatest, and then the tuning is all done with the small oscillator condenser. When a signal has been tuned in, the mixer can be peaked again, but it is not usually necessary over the range of the band-spread condenser. The pulling of the oscillator by adjustment of the mixer tuning condenser is very slight, doubtless because of the loose coupling.

Construction

The only trouble that may be encountered in the construction of the converter will be brought about by the lack of a soldering iron with a sharp point. We were a bit apprehensive about the wiring of the converter, but found it to be much simpler than had been expected, through the simple expedient of deciding beforehand just where the wires went and which ones would prevent our getting at certain terminals. But that's getting ahead of the story.

As can be gathered from the photographs, the prime objective was to keep the r.f. leads in the circuits as short as possible. The arrangement that was finally worked out gives leads that are short and direct by mounting the coil sockets at the rear of the chassis, the tuning condenser in front of the coil sockets and the tube sockets directly above the condensers.

All of the metal is $\frac{1}{16}$-inch thick aluminum. The panel is $5\frac{1}{2}$ by 8 inches, but it is longer than is absolutely necessary and could be trimmed to be only 6 inches long. We included the extra length to put the dial in the center of the panel and also to provide room for possible future switches for shifting to various i.f. amplifiers. The chassis itself is built from a piece of $5\frac{1}{4}$-inch wide metal bent to form a $3\frac{7}{8}$-inch wide top and 4-inch deep back. A $\frac{1}{2}$-inch lip is bent down from the top to fasten the chassis to the panel. Two sides were made by forming shallow U's (with $\frac{1}{2}$-inch sides) to fit between the panel and the back of the chassis. A shield was made and fitted under the chassis, making the oscillator compartment $2\frac{1}{2}$ inches wide. This shield mounts the oscillator tuning condenser and also takes the National TPB victron through-bushing which serves as a coupling condenser between oscillator and mixer.

The coil forms are the small $\frac{3}{4}$-inch diameter Amphenol ones made of polystyrene, and the coil sockets are also of polystyrene. The coil sockets mount simply by drilling a suitable hole

[1] Grammer and Goodman, "F. M. in Amateur Communication," *QST*, January, 1940.

and sliding the retainer rings over the sockets. The tube sockets are also made by Amphenol and mount in much the same fashion. For short leads, the oscillator socket should be mounted with the slot towards the rear of the set, and the mixer socket should be mounted with the slot towards the left-hand side of the set.

As mentioned before, the oscillator tuning condenser, C_3, is mounted on the shield partition, and the band-set condenser, C_2, is mounted on the right-hand side of the chassis. The band-set condenser is insulated from the metal by fiber washers so that there is only one ground point to the chassis for the oscillator circuit, that through the oscillator tuning condenser. The mixer tuning condenser, C_1, is mounted on the right-hand side of the chassis and grounds the mixer circuit at that point.

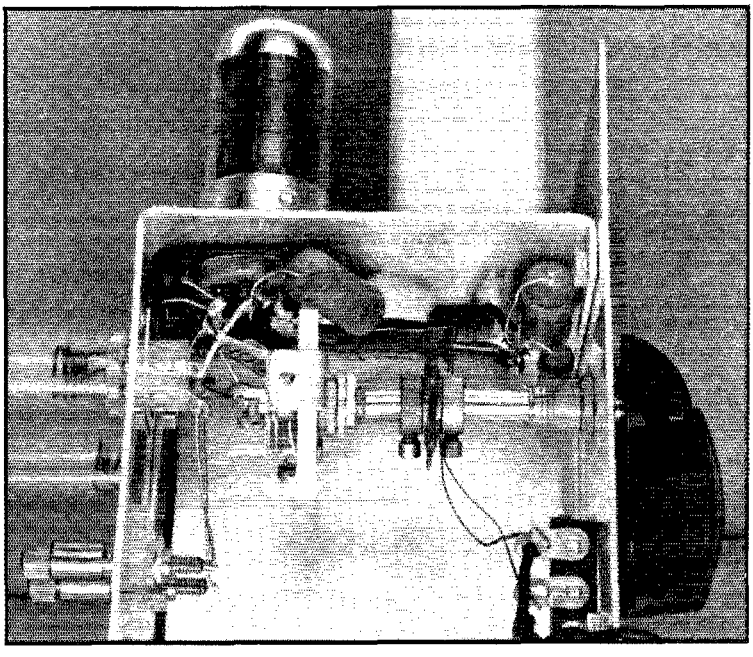
The oscillator tuning condenser and the mixer tuning condenser are fastened to their respective panel controls through insulated couplings, to avoid duplication of grounds.

One of the mounting screws for the tuning dial also serves to hold the top of the chassis to the panel, and another one holds the partition to the panel.

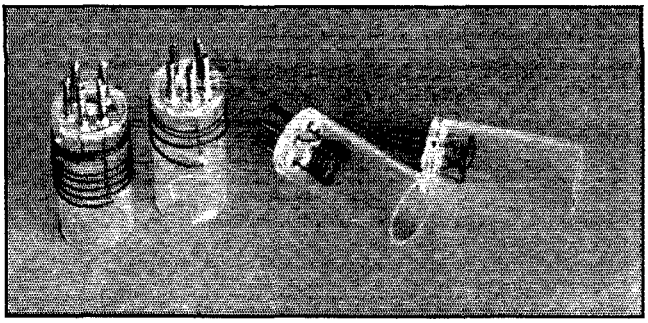
It isn't as difficult to wire the converter as one might expect. The panel and sides should be left off until all of the wiring that can be done without them has been finished. Heater leads, ground connections, by-pass condensers, and resistors can all be put in before the sides and panel are fastened. One should be a bit careful not to hold the soldering iron on the polystyrene coil sockets for any longer than is necessary to start the solder flowing, or else the socket contacts will loosen from the heat's effect on the polystyrene. That small, pointed soldering iron comes in very handy here. A lead is run from the grid of the 1232 to the through-bushing on the partition but no connection is made on the oscillator side, since the capacity between the bushing and the oscillator leads is sufficient for coupling. All r.f. leads and leads from by-pass condensers carrying u.h.f. current are kept as short and direct as possible.

Coils

The coils for the 5- and 7-meter ranges are wound in the usual manner on the outsides of the coil forms. No trouble should be had in finding the 5-meter amateur band and the 43-Mc. broadcast band, since the tolerances on these ranges of coils are fairly wide. The only care necessary is to prevent the pins from loosening up in the forms because of the heat when soldering. The wire should be well cleaned and a spot of flux used on the tip of the pin. No attempt should be made to flow solder on the pin and wire, but a drop of solder picked up by the iron can be held against the pin for just an instant, long enough to solder wire and pin together. If the pin loosens up or moves out of place, it can be heated again slightly (by holding the soldering iron against it) and held in the proper position with long-nosed pliers. When the metal (and coil form) cools, it should be as solid as ever. If it isn't, it doesn't matter too much, since the form can still be plugged in the socket without too much difficulty.



The mixer circuit can be seen when the side panel is removed, giving an idea of the placement of the parts. The tie strip at the lower right takes the output leads from the transformer. The through-bushing can be seen just to the left of the tuning condenser, with a wire from it running to the 1232 grid.



The 112-Mc. coils (right) are self-supporting inside the coil forms, while the 56-Mc. coils are wound in the usual manner.

The coils for the 2½-meter band are wound *inside* the coil forms and require a little more care, since too much wire means you won't be able to get down to the wavelength you want. The coils are wound around a rod to get the proper shape and then placed in the forms and soldered, observing the same precautions about getting the pins too hot.

The usual rule must be followed for the oscillator coil, i.e., if both grid and plate coil are wound in the same direction, the grid and plate connections come off opposite ends (in our case the outside ends).

The connections on the oscillator coil, looking at it from the bottom are (starting with the oddly-spaced pin and going clockwise): plate, ground, B plus, grid and blank. In the same manner, the mixer-coil connections are grid, tuning condenser, antenna, antenna and ground. Both mixer and oscillator coil sockets are mounted with the odd pin at the top.

If the connections have been made correctly and kept short enough, no trouble should be experienced in making the oscillator oscillate in any of the ranges. For the 112-Mc. band, the oscillator band-set condenser will be at minimum capacity, but will set at about mid scale for the other two ranges, varying slightly with the i.f. used.

The converter is coupled into the i.f. amplifier through a low-impedance link, and this requires that the input transformer in the i.f. amplifier be modified by winding a number of turns about the grid coil and connecting the link to this coil. Alternatively a duplicate of the output transformer T_1 can be built and substituted for the first transformer in the i.f. amplifier. If a receiver is used for the i.f. amplifier, the output leads connect to ground and the grid cap of the mixer tube in the receiver, after the regular grid lead has been removed.

Antennas for use with the converter present the same problem that they do with any u.h.f. receiver, and your particular favorite is the one to use. A little experimenting with the antenna coil L_2 may help in giving a better match to the antenna system — the dimensions given are average values that were about right for our low-impedance line input.

If signals are weak the trouble probably can be accounted for by too much or too little oscillator voltage reaching the mixer, and this can be adjusted over considerable range by moving the tickler coil L_3 closer to or farther away from L_4. However, the adjustment does not seem to be too critical.

For maximum performance, it is suggested that a stabilized power supply be used with the converter. Ours is one of the jobs that uses a series 2A3 and control 6J7 (described in the *Handbook*), but a simple VR-150 should help considerably.

Strays

W8SEA belongs to the Naval Reserve. — *W8FU.*

—•••—

Assistant: "Professor! Professor! I just contacted Mars."

Professor: "Huh! That's nothing. I just completed a 100% QSO on 160." — *W9DZR.*

—•••—

A neighboring b.c.l. called me in recently to look over his ten-year-old set which had suddenly ceased functioning. Noticing that two or three of the tubes had burned out, I yanked one out and said, "This tube is no good."

"Oh, that's all right," he replied, "that tube is for WABC, and we don't listen to that station." — *W2KZT.*

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Here is an idea for quick reference when working another ham of previous acquaintance. If you have the other fellow's QSL, make a notation on the back of the card as to the date, name and other interesting information. This saves the trouble of thumbing back over old log books. — *W4DTV.*

—•••—

"While my antenna was down, I got a *weak* R9 from Kearny (N. J.), but now that it's fixed, I get a *loud* R9 again." — Heard by W2GHI on 160 'phone.

★ WHAT THE LEAGUE IS DOING ★

SANTIAGO CONFERENCE

THE Second Inter-American Radio Conference convened in Santiago de Chile on January 18th with about sixty delegates present from the various American administrations, and concluded its labors on January 25th except for the signing of the final documents, done a day or two later. Amateur radio was represented by A. L. Budlong, assistant secretary of A.R.R.L.

We shall expect a *QST* yarn on the conference from Bud when he returns. Meanwhile the highlights, as we learn them from him by amateur radio: All the amateur bands through 60 Mc. are specified as exclusively amateur in the Americas. (We don't know where allocation left off but apparently above about 100 Mc. is regarded as only national in effect.) The third-party message arrangement has been retained. No agreement could be reached on a uniform subdivision of bands for 'phone use, so no mention of this subject occurs in the final treaty. It is recommended that the 14-Mc. 'phone privilege be confined to operators of adequate experience. Amateur stations may not be used for broadcasting or for other services than amateur. The U. S. delegation, as usual, supported us splendidly.

Look for Budlong's article in the next issue.

HEADQUARTERS NOTES

DID you notice that new title in the masthead? We are happy to report that Jim Lamb, our former technical editor, has returned to headquarters duty after an illness of two years. Under the new title of Research Engineer, A.R.R.L., Jim will work primarily on special laboratory development problems that will provide play for his rabbit-pulling abilities. He will also serve as technical advisor to the Board of Directors and will participate in the technical aspects of our representation at Washington and the preparation for international conferences, as well as representing the League in the technical committees of the radio industry in which A.R.R.L. participates. You'll also be hearing from him in *QST* soon.

Washington has been quiet on amateur matters while the Santiago Conference was in course. The next big item on the program there is a hearing on the future of frequency-modulation broadcasting, opening on February 28th. While the question is largely f.m. versus a.m. broadcasting in the u.h.f., the League will be represented at the conference and will keep an eye on the interests of amateurs.

Despite the European w-r and its inevitable reduction in our Canadian and foreign membership, we closed 1939 with a net increase of over 2000 in membership and the highest figure ever attained. Most pleasing of all, our United States membership increased 11.25% in the year!

Strays

"The Bureau of Standards has a number of publications on the ionosphere and transmission phenomena which should be of interest to amateurs. They are liberally filled with curves and cover work in this field for the last seven or eight years. The cost of these is only five or ten cents each. Interested parties should write to Superintendent of Documents, Government Printing Office, Washington, D. C., and ask for price list 64, Standards of Weight and Measure and the List of Radio Publications." — *W3EZJ.*

WWV Schedules

EXCEPT for the special broadcasts of WWV using 20 kw. as described below, WWV is now running a continuous schedule (day and night) on 5000 kc. with a power output of 1 kw. This continuous transmission is modulated with the standard pitch in music, 440 cycles per second.

Each Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station, WWV, transmits with a power of 20 kw. on three carrier frequencies as follows: 10:00 to 11:30 A.M., E.S.T., on 5000 kc.; noon to 1:30 P.M., E.S.T., on 10,000 kc.; 2:00 to 3:30 P.M., E.S.T., on 20,000 kc. The Tuesday and Friday transmissions are unmodulated c.w. except for 1-second standard-time intervals consisting of short pulses with 1000-cycle modulation. On the Wednesday transmissions, the carrier is modulated 30% with a standard audio frequency of 1000 c.p.s. The accuracy of the frequencies of the WWV transmissions is better than 1 part in 5,000,000.

EXPERIENCE SPEAKS

When it becomes necessary to do a soldering job too delicate for the regular-size electric iron, make up a small iron from a small piece of copper rod, fit a handle to it and heat it in the regular iron after its tip has been removed. Such an iron can be used for meter or speaker repairs and other tight-place jobs. — *Frank Pray.*

A "Modified" Dickert Noise Limiter

A Circuit Particularly Adapted to Mobile Applications

BY J. L. HILL,* W9ZWW

WITHIN the past few years noise limiters have appeared by the dozen for application to almost any amateur receiver to relieve that curse of the high frequencies, auto-ignition QRM, but each of these has had some limitation which makes its installation in a particular receiver either a large job or of questionable value.

The subject of limiters to be applied to the audio end of the receiver (since other types of silencers usually require too much of a major operation for most amateurs to apply them to a commercially-built receiver) can be divided into two main classifications: series and shunt. Of these two, the series limiter as described by Bacon [1] is probably the most effective except for

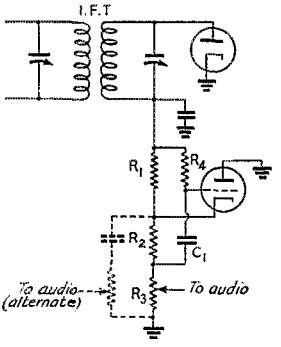

Fig. 1 — **The original Dickert limiter circuit can be modified to put the plate of the limiter tube at ground potential without changing the effectiveness of the circuit.**

the fact that it cannot easily be adapted to provide automatic threshold control. This deficiency can be most irritating when trying to copy a deeply fading signal or when tuning onto a loud carrier and having all the modulation suppressed until the threshold control can be reset.

Of the shunt type, the most effective to appear is that described by Dickert.[2] This has an inherent automatic-threshold control, but possesses one regrettable characteristic in that a major portion of the audio voltage developed on the diode resistor "stick" must be *wasted* to provide plate voltage for the suppressing triode. Of course this can be restored by additional audio amplification, but in a good many communications receivers the audio portion of the set is often delivering about all it is capable of and has very little reserve gain.

Another crying need is for a limiter possessing these features which may be applied to receivers using duo-diode-triode and duo-diode-pentode tube types for the second detector. This type of detector circuit is usually used in auto receivers where there is a need for a noise limiter which requires no attention. Some of the various single-diode limiters are the only circuits which can be used in sets where the cathode of the second detector is grounded or connected to ground through a cathode biasing resistor. These circuits achieve automatic threshold control but leave considerable to be desired in their limiting properties. The limiter to be described is particularly adapted to this service, possessing automatic threshold, effective limiting and requiring a minimum of space-consuming components.

The following described "Modified Dickert" system was applied to one of the original [3] HQ-120 receivers which came equipped with a 6H6 diode "limiter," and the modified version has proved extremely satisfactory. It provides a limiter which may be easily applied to any receiver using a diode second detector without introducing any of the difficulties enumerated above. The circuit (Fig. 1) is fundamentally identical to that shown by Dickert in Fig. 3F of his story,[2] with the exception that the grounded elements of that circuit have been connected together and disconnected from ground and the ground has been transferred to a new point in the circuit, namely, the diode cathode and the triode plate. The operation of the circuit may be analyzed in much the same manner as the original Dickert circuit, except that it is somewhat complicated by the fact that the grid of the triode, instead of standing at a d.c. potential proportional to the mean carrier level for the duration of the time constant of the grid filter, now has an additional audio component impressed on it. Nevertheless, since one element of the triode (the plate) is held at ground potential, the analysis can be started there and carried on backwards through the other tube elements, remembering that the d.c. voltage is becoming increasingly negative as we move away from ground. But as Dickert so aptly put it, a

* 1138 Fauquier St., St. Paul, Minn.

[1] Bacon, "The Series-Valve Noise Limiter," *QST*, Oct. 1939.

[2] Dickert, "A New Automatic Noise Limiter," *QST*, Nov. 1938.

[3] The first one-hundred-or-so HQ120's used the diode limiter instead of the original Dickert circuit the present ones use. — ED.

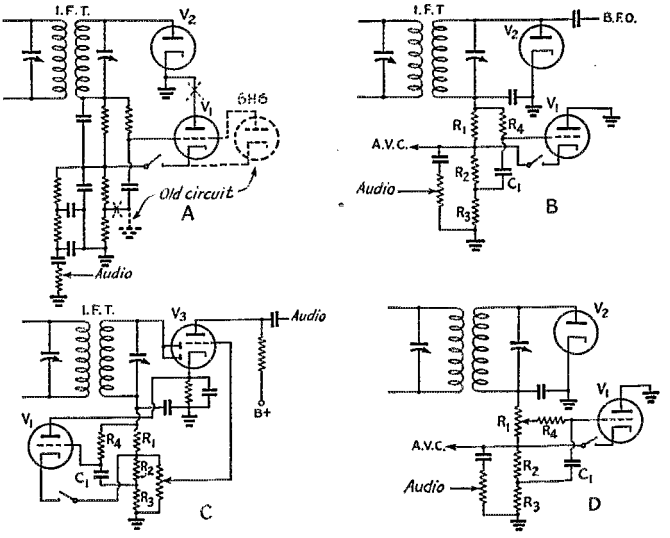

Fig. 2 — Practical applications of the modified limiter circuit. The one at A shows how the diode limiter circuit used in the first models of the HQ120 can be changed, while B shows how it would be applied to the average receiver. C is for use with duo-diode-triode second detectors, and D includes an additional refinement for adapting the limiter to various percentage-of-modulation levels.
C_1 — 0.05-μfd. low-voltage paper.
R_1, R_2, R_3 — See text.
R_4 — 1 megohm.
V_1 — High-μ triode.
V_2 — Diode.
V_3 — Duo-diode triode or pentode.

rigid circuit analysis is in a sense futile — the proof of the pudding is in the listening!

Obviously the circuit is no more effective than Dickert's, but the universality of its application makes it of interest to all amateurs searching for a limiter for their particular receiver. Fig. 2A illustrates the circuit as applied to the original model of the HQ-120. It should be noted that these components are already in the receiver, making a new tube and minor wiring modifications the only changes necessary. Fig. 2B shows the application of the system to the average receiver. The actual values of the resistors in the circuit are not critical, provided the resistance load on the i.f. transformer does not depart radically from the original design value. However, the proportions of the resistors to each other determine the effectiveness of the limiter. R_1 should be equal to R_2, for cutoff at 100 per cent modulation, but for more effective limiting the circuit should be designed for cutoff at about 70 per cent modulation,[4] for which R_1 will be 0.7 times R_2. R_3 should be about twice R_2, but may vary either way without impairing the action. As was previously stated, the sum of the values of R_1, R_2 and R_3 should approximately equal the original load resistance which they replace. R_4 in all cases should be 1 megohm and C_1 0.05 μfd. The tube can be any high-mu triode, preferably one of the 6A6, 6N7, 6Y7, 53 and 79 series of double triodes designed for low-power Class-B service, connected with its elements in parallel.

Fig. 2C shows the circuit applied to receivers of the auto-radio class with duo-diode triode or pentode second detector-audio stages, where the cathode is at or near ground potential and is common to the other tube in the same envelope. The same explanation as was made for Fig. 2B applies to this application. Fig. 2D illustrates an additional refinement which may be used in compensating for low percentages of modulation on the received signal. (Yes, some amateurs do actually *under*modulate!) By providing adjustment of the d.c. grid voltage of the triode through a potentiometer substituted for R_1, cutoff at any percentage modulation can be controlled.

The same precautions regarding short leads and the switch for removing the limiter from the circuit as outlined by Dickert are equally applicable to this version of his circuit which can make operation on the higher frequencies on the highway a pleasure, despite the heavy traffic just under the antenna! As is characteristic of all noise limiters, this one will cease to be useful when the noise pulses occupy too great a portion of the time.

[4] Limiting is obtained at less than 100% modulation when $R_1 = R_2$ if R_1 is partially or completely by-passed for audio. This is what was done in the first HQ-120's. Ed.

Strays

Those who are familiar with the Mallory-Yaxley Encyclopedia will be interested to know that a supplemental service has been established. These supplements, which have much of interest to the amateur, are obtainable from P. R. Mallory & Co., Inc., Indianapolis, Ind., at cost.

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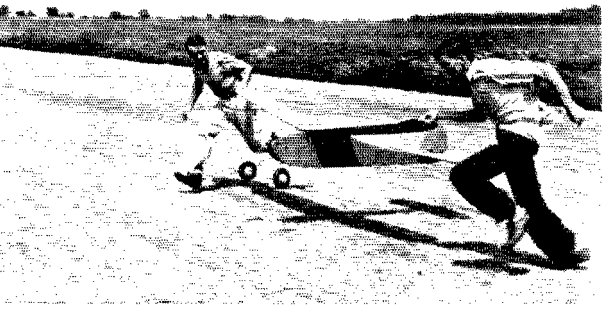
RCA has just published a new edition of their well-known receiving-tube manual (R-14). Aside from the tube characteristics, the book contains much additional valuable information on principles of tube design and application. Copies may be obtained from your RCA dealer or by sending 25 cents to the Commercial Engineering Section, RCA Mfg. Co., Inc., Harrison, N. J.



The take-off! Practically all flights are made in this manner to ensure good take-offs despite the man at the controls. The plane is being guided, not lifted.

Winning the National Radio Control Meet

Details of a Radio-Controlled Model Airplane That Has Made Over One Hundred Successful Flights

BY WM. E. GOOD,* W8IFD

ONE of the most interesting by-products of ham radio is that of radio control of gasoline-powered model airplanes. Here is one sport where your signals must be QSA 5 or you may have to start on a cross-country jaunt, praying that those two ounces of gasoline will hurry up and run out. If your signals are "getting through," you find yourself landing the radio-controlled plane right in the middle of the runway. Exciting? I'll say! Every flight is just like that memorable first QSO!

Radio control of model planes began with the advent of small gasoline motors and has been progressing slowly ever since. Most of the development has been done by hams in coöperation with the gas model enthusiasts. [1]

Our equipment is the result of over four years' experimentation and of late has proved rather successful. The control consists of two frequency channels — one for the rudder and the other for the elevator. For each channel there is a modified five-meter superregenerative receiver. In its plate circuit is a sensitive relay which is connected to an electromagnetically-operated rubber-powered escapement in the tail which moves the controlling surface in the fashion desired.

The plane, designed and built by my twin brother Walter, has an 8-foot wing span and weighs slightly over eight pounds, including its two pounds of radio gear. Its gasoline motor is of the one-fifth horsepower variety and does a good job of flying this stable ship. The cruising speed is about 20 miles per hour and the ship glides very well, insuring excellent landings if reasonable skill

* 934 Hillcrest St., Kalamazoo, Mich.

[1] *QST*, Oct. 1937 and June, Sept. and Oct. 1938; *Model Airplane News*, January and August, 1938; *Air Trails*, August 1938, January and May, 1939.

Four years ago a radio-control event was added to the program of the annual National Model Aircraft Championship Meet. But it was not until last year that a wholly successful demonstration of radio-controlled flight under a variety of conditions was finally achieved. The Good brothers of Kalamazoo were responsible, their triumph climaxing years of experimentation. Here is the story of their success.

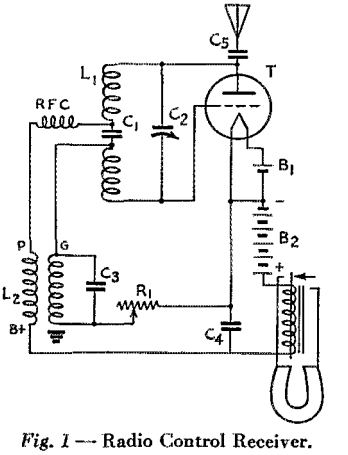


Fig. 1 — Radio Control Receiver.

T — RK42 (*not* RK-62).
C_1 — 250-$\mu\mu$fd. midget mica.
C_2 — 15-$\mu\mu$fd. midget variable.
C_3 — 0.002-μfd. midget mica.
C_4 — 0.005-μfd. midget mica.
C_5 — 30-$\mu\mu$fd. mica trimmer.
L_1 — Each half 5 turns No. 14 or smaller wound on 3/8" diameter form, spaced wire diameter.
L_2 — Interruption-frequency oscillator coil (National OSR).
B_1 — 1.5-volt flashlight cell.
B_2 — 45-volt midget 10-oz. "B" battery.
R_1 — 10,000-ohm midget variable.
Relay — See text and Fig. 3.

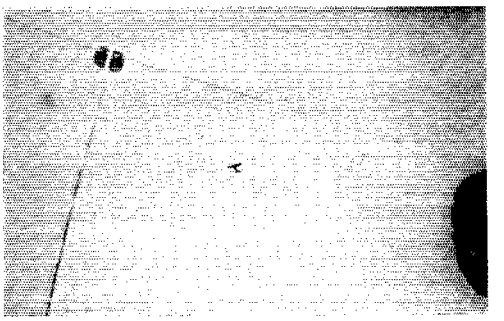
is used at the controls. The plane banks automatically when the rudder is turned, due to the dihedral in the main wing.

Before a flight the receiver in each channel in the plane is adjusted so that its sensitive relay closes when the carrier from the five-meter transmitter is turned on. The sensitive-relay contacts actuate the small electromagnet (in the tail) which allows the rubber-powered escapement wheel to go through one position or one-quarter of a revolution at a time (i.e., for each dash sent). The controlling surface is connected directly by a small steel-wire arm to a pin on the escapement wheel. The power used to move the surface through its positions is taken from the wound-up rubber band. Our control surfaces have three main positions, e.g., the rudder has left, neutral and right, plus two half or intermediate positions, making five in all. Naturally, the movements take place in a cyclic fashion. Each pulse or dash from the transmitter causes the surface to move from one main position to the next.

Walter has done practically all of the design and detail work on the escapements and the sensitive relays, although he's not even a ham. We did have him in the RI's office one Saturday morning to take his exam — but he sneaked out and made the rounds of the model airplane shops in Chicago!

Escapements Located in Tail

The escapement units in their present state weigh just a half-ounce each and are mounted permanently in the tail surfaces, so that direct mechanical connection can be made to the moving elements (rudder and elevator). This makes for extreme reliability in addition to the fact that the units boast almost instantaneous response, which has been shown to be practically a necessity under actual flying conditions. A control stick or "joy stick" (one for each control) which adapts itself very well to the escapements is a Western Electric



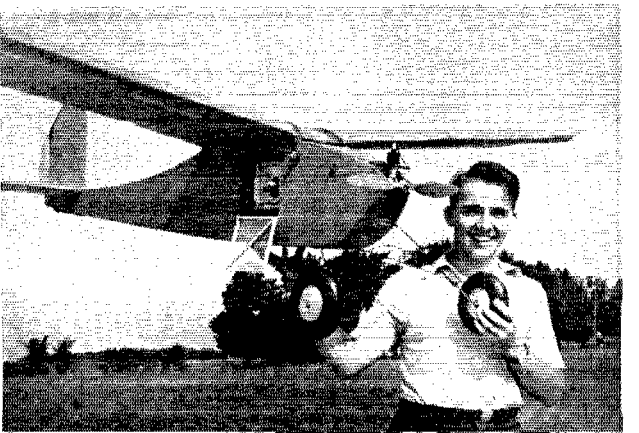
In flight! Framed by the center-fed doublet atop a bamboo mast, the ship is but a speck in the sky. The radio controls operate as far as the ship can be seen.

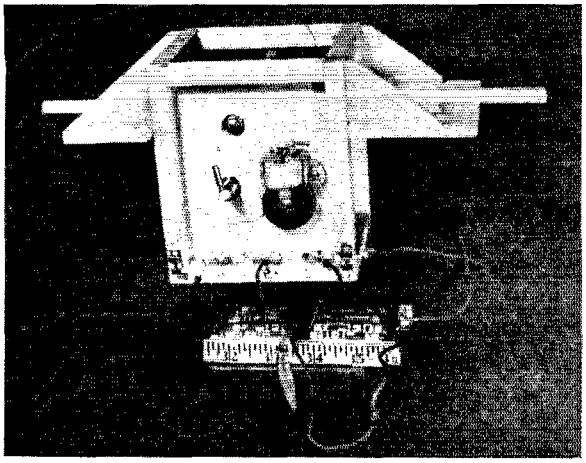
telephone switch which was rebuilt so that contact is made and broken (sending a dash) as the switch is moved from neutral to either extreme position. Thus the rudder or elevator will be in the same position as its corresponding control "stick," and this synchronization will be maintained as long as the control switches are moved through complete cycles. The moving elements will follow the motions of the switches even though they are jerked back and forth as fast as four or five times a second. Thus the surface may be moved to any desired position with such rapidity that the motion of the plane is not affected while so doing. Due to the arrangement of the switches and the tail escapements, the corresponding moving element will be in a half or intermediate position when its control switch is in a half position. This system allows the operator to know exactly where the rudder and elevator are positioned at any instant. Actual flying has shown this to be a natural method of control.

The sensitive relays have been the result of a generous mixture of theory and experiment on the ground and in the air. In all, six relays have been developed. The one that has proved the

Top — Bill Good, W8IFD, with the fuselage and ground control set-up. *Left*, the genemotor and its battery box; *center*, the two-frequency transmitter in its travelling case; *lower right*, the control box with two telephone-type switches as joy sticks.

Bottom — Ready to fly! Walter Good, national radio-contro champion, holding his winning ship. The receiver is accessible through the open doorway in the side of the cabin.





The receiver in its balsa-wood container, with the battery supply underneath. The miniature polarized relay can be seen in detail. Batteries are attached rigidly to the fuselage, but the receiver is mounted in sponge rubber and suspended by rubber bands.

most satisfactory and the one that we have been using for the past two years we call the DG-6. (It can be duplicated for fifty cents.) It is a polarized balanced-armature type (no springs), weighing two ounces, and operates on less than one milliwatt. For vibrating motors and airplanes in flight we believe this is the Good answer to the maiden's prayer!

The receivers have also had their share of attention, and considerable research has been done to find the best operating conditions. Essentially they are one-tube superregenerative jobs in the self-quenching circuit using quench coils, but the conditions of operation have been changed so that a maximum change in plate current takes place when a signal is received. A Type 30 tube will give a plate current change of as much as three milliamperes, while an RK42 (a 1.5-volt version of the 30) will give about two milliamperes change (through 2500 ohms). Besides the tuning condenser, the antenna padder and the grid bias resistor are adjusted to obtain maximum plate current change. On the field it is only occasionally necessary to adjust the variable grid resistor. Experimenting has been done with various circuit constants and different makes of quench coils in addition to different quench frequencies and quench voltages. By extending the recently developed superregeneration theory, it is not difficult to explain the theoretical basis for the required adjustments.

The Two-Frequency Transmitter

The transmitter is unique in several ways besides portability — if you call lugging a six-volt storage battery portability! It utilizes two separate electron-coupled oscillators (one frequency for each channel) and only one final amplifier. The two 6V6G e.c.o.'s have a common plate tank — which, by the way, works very well — broadly tuned and capacity coupled to the 807 doubler-final. The half-wave horizontal center fed Hertz antenna is furnished r.f. by a tuned line which is inductively coupled to the final. A switch is incor-

C_1, C_2, C_7 — 100-$\mu\mu$fd. midget mica.
C_3 — 35-$\mu\mu$fd. midget variable.
C_4, C_5, C_6, C_8, C_9 — 0.002-μfd. midget mica.
C_{10} — 15-$\mu\mu$fd. midget variable.
R_1 — 0.1-megohm, ½-watt.
R_2 — 50,000 ohms, 2-watt.
R_3 — 150,000 ohms, 1 watt.
R_4 — 25,000 ohms, 1 watt.
R_5 — 25,000 ohms, 10 watts.
—C — 45-volt midget "B" battery.
M_1 — 100 ma.
M_2 — 0.5 ma.
L_1 — 9 turns No. 14, tapped 1 turn from ground.
L_2 — 8 turns No. 14.
L_3 — 6 turns No. 12.
All coils ¾" dia., windings spaced wire diameter. L_2 is tuned by squeezing or pulling out the winding.

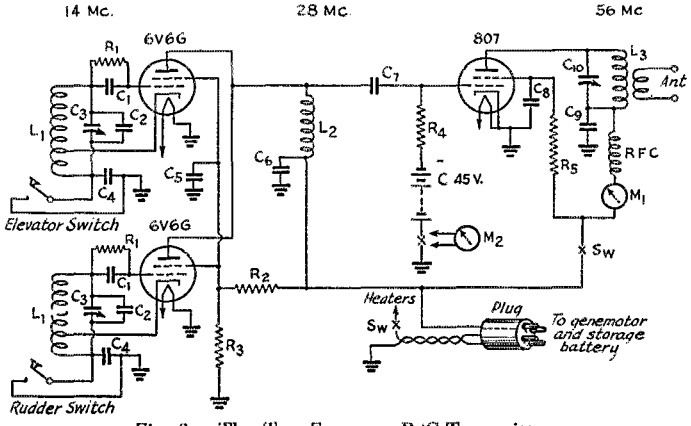


Fig. 2 — The Two-Frequency R/C Transmitter.

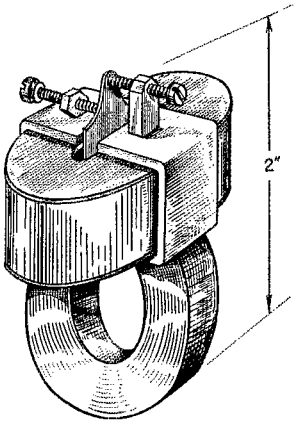


Fig. 3 — The DG-6 Sensitive Relay.

This polarized relay, designed and built by Walter Good, is of the balanced armature type, having no springs on the armature. A small Alnico horseshoe magnet holds the thin iron armature against the back contact until the coil and its surrounding soft-iron magnetic circuit is energized. With a 2500-ohm coil the reliable sensitivity is 1 milliwatt. The weight is slightly over 2 oz.

porated to remove the power from the 807, leaving just the weak five-meter harmonics from the e.c.o.'s for tuning the receivers when the plane is near the transmitter. The genemotor mounted on top of the storage battery is a 400-volt 125-ma. job. Nevertheless, only 20 to 30 watts of the fifty available is the accustomed power input.

When the plane is properly adjusted it flies and glides straight with the neutral rudder position and gives the same size circles to the right or left for the extreme positions. This is true both under power and in the glide because of proper power and wing loading. A great deal of flying is done with the rudder alone. For this, the elevator is adjusted for a good climb and then it maintains level flight in the turns. Theoretically, the gyroscopic effect of the motor should cause the nose of the plane to come up when the plane is turned left and down when turned right, but practically this effect is not noticeable.

When the rudder is turned to either right or left maximum position, the plane banks automatically and proceeds to execute a beautiful right or left circle. If the control is kept in this position for more than one turn or so, the bank gradually becomes steeper and the turn develops into a large spiral. It is not difficult to lose any amount of altitude in short order by spiralling the ship down in this manner, even if it is only for the gratifying sensation of pushing the control stick neutral to watch the plane straighten out and start into a fast climb, using up the speed just acquired by the descent.

One question that always arises in radio control discussions is, "Is it necessary to have such speedy snap-action controls?" In our flying we have found that fast control has been more than convenient, especially in take-offs and landings. Many times in coming in for a landing it has been imperative to give opposite rudder to straighten out the glide when the ship was only four or five feet from the ground. A second of time in such a predicament is precious. Take-offs call for more precision and speed of control, because the controls are more sensitive and the operator really has to have the "feel" of the controls to keep the plane right-side up. The picture shows the usual take-off procedure of running the wing tips until the plane is well off the ground. We've found it's much safer to learn how to "fly" after the plane is up in the air! Lately, however, we have been merely starting the plane down the runway (tail

(Continued on page 86)

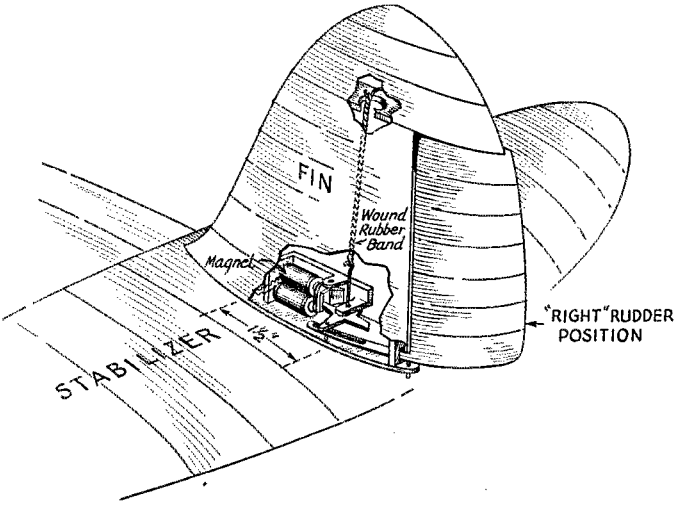


Fig. 4 — Isometric View of the Tail Assembly in the Good Championship Plane.

The small control escapement is considerably exaggerated in size to show detail. Actually the small magnet coils are about ¼" diameter and each escapement weighs about ½ oz. The elevator control escapement is similar, being located in the stabilizer just to the right of the fin juncture.

Neutralizing Economy

Taking the d.c. off the Neutralizing Condenser

BY B. P. HANSEN,* W9KNZ

T. M. FERRILL'S article in *QST* for December, 1938,[1] suggested a sensible means of effecting improved performance and economy in the plate tank tuning condenser in any final amplifier stage. There is no good reason why the same principles cannot be applied to the neutralizing condensers in the same amplifier. Many times, when the power input to a final amplifier is increased, it is found that the old neutralizing condensers are just a little too small, with the result that flashovers occur. Replacement with larger condensers is the obvious solution but not the only one — unless the increases in plate voltage and bias are considerable.

It is highly desirable that the physical dimensions of the neutralizing condensers be small from the standpoint of reducing stray capacitive coupling to parts of the circuit where it is not wanted.

Referring to Fig. 1, it will be seen that in the normal setup, the neutralizing condenser has a pretty heavy cross to bear. Across it, in series

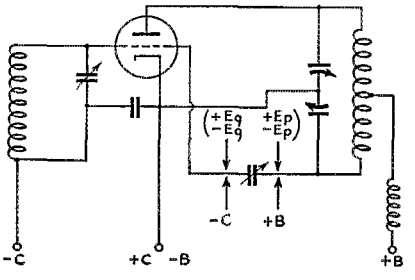


Fig. 1 — Voltages pile up across the neutralizing condenser in conventional circuits, as shown in this drawing.

adding, are the bias and d.c. plate voltages. Also across it in phase, are the grid excitation voltage and the r.f. voltage across the tank coil. If we can remove the d.c. voltages across this condenser, two things are accomplished; the r.f. voltage which can be applied across its terminals becomes much higher, and the damage that might result through the d.c. arc that usually holds after a flashover in a "mixed" circuit is prevented.

First, let's consider how to accomplish this improvement, then we'll see why it works.

Fig. 2 shows a more or less typical final amplifier using Ferrill's suggestion for the plate tank and employing d.c. isolation for the neutralizing condensers. C_x is a well-insulated mica condenser whose capacity is much larger than the capacity of the neutralizing condenser. If, for example, C_n is about 15 $\mu\mu$fd., a common value, then C_x might well be 0.001 μfd. rated at 5000 volts d.c. working voltage. Remember that the ratings of by-pass or blocking condensers depend to a great extent upon the voltage *drop* across them, not necessarily upon the values of the voltages impressed upon the circuits in which they are used. Because most of the r.f. drop in this circuit is across the neutralizing condenser, C_x has little work to do insofar as r.f. is concerned. Its purpose is to prevent the plate voltage from reaching the grids of the tubes. R_n, the value of which can be about one-half megohm, rated at one or two watts, effectively short circuits the neutralizing condenser insofar as d.c. is concerned, but has negligible effect upon the r.f. constants of the circuit.

Well, that's all there is to it. The effectiveness of the scheme is shown by the example of the W9KNZ transmitter. Economy dictated the choice of neutralizing condensers . . . economy and availability. In the conventional circuit, 1000 volts was the maximum that could be plate-modulated without their flashing. Now the old 242A's have to take 1750 and like it because

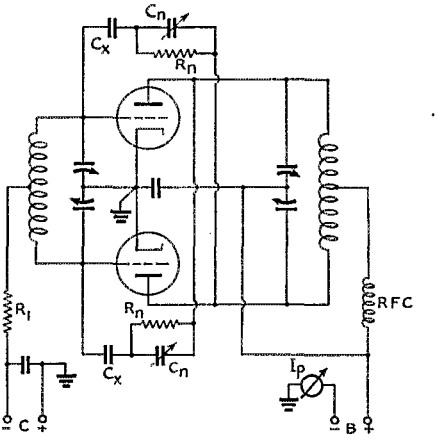


Fig. 2 — The circuit arrangement used by W9KNZ brings both sides of the neutralizing condenser to the same d.c. potential but does not disturb r.f. conditions. C_n handles the r.f.; C_x the d.c.

* 3800 East Colfax, Denver, Colo.

[1] Ferrill, "How Much Condenser Spacing?" *QST*, December, 1938.

the neutralizing condensers no longer flash over. This is good, sound (!) typical ham reasoning. If the amount of soup that can be poured into the old rig is limited by any single circuit component, fix that one thing up and pile on the soup till something else breaks down. HI! This stunt is finding application in at least one broadcast station and several others have inquired about it. Since new regulations have called for power reductions in some stations, changed operating conditions have, in occasional cases, resulted in increased peak voltages, believe it or not, and the first place that trouble seems to occur is in the neutralizing condensers. Something has to give!

Here's the why: Condensers are often connected in series in order to increase the breakdown voltage rating of a given filter setup. Now, the d.c. voltages across condensers in series do not divide inversely as the capacities, the laws of physics to the contrary. This is because the d.c. voltage drop across a condenser tends to be proportional to the leakage resistance of that

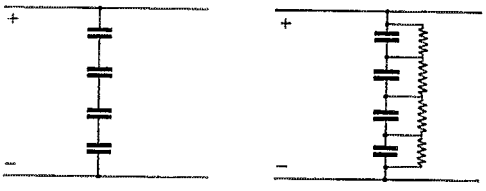


Fig. 3 — Equalizing voltages across series-connected filter condensers by means of high resistances.

particular condenser. To prevent disaster in filter setups where condensers are used in series, small bleeder resistors of equal value are placed across each condenser as shown in Fig. 3B. These resistors are of low enough value to swamp out variations in leakage resistance and thus the actual d.c. voltage across each condenser is made the same. C_a is an air condenser and thus its leakage resistance is extremely high. C_z, in series with C_a, is a mica condenser whose leakage resistance is also very high but not as high as that of C_a. Therefore, although the d.c. path through C_a is apparently broken by C_z, really the CHARGE across C_a is practically the same as before and the mere insertion of C_z does not prevent flashover. Now we place R_a across C_a, thus bringing its leakage resistance to a low value compared to that of C_z. This places the full sum of bias and plate d.c. voltages across C_z.

This suggestion may not appeal to the fellow who can spend all he wants to on his rig. But to the fellow who has to pull most of his stuff out of the junk box, it should prove interesting. As a cure for an existing case of trouble it is much more economical than the purchase and installation of larger neutralizing condensers. Because the physical dimensions of the condensers are smaller than those that would otherwise be required, the scheme possesses technical merit aside from its economy. The reader is referred to Ferrill's article for examples of plate spacings for given operating voltages. Keep in mind that the excitation voltages and r.f. plate voltages at any instant are across the neutralizing condenser

Neutralizing condensers have a tendency to flash over? Here's a simple way to isolate the d.c. and thereby lower the peak voltage the condenser must handle. Inexpensive, too.

William H. Smith, Ex-9ZF, 9KOA

AMATEUR radio lost one of its beloved old timers with the death on November 18, 1939 of William H. Smith, of Denver, Colo., undoubtedly the most enthusiastic "wireless" pioneer in what is now the Rocky Mountain Division.

One of the organizers and charter members of the Colorado Wireless Association, Denver's first radio club, "Pop" Smith was chief operator during its entire existence, 1912 to 1922. He used the familiar letter "S" as his call from his beginning in amateur radio until about 1915, when the limited commercial call "KIX" was assigned to him as the Denver communications office of a Colorado mining company. During the war he taught code classes at the Y.M.C.A., and afterwards he again became active with a 1-kw. rotary quenched spark outfit using the call 9KOA which was issued to him at that time. From that station he broadcast time signals nightly, and many amateurs will remember the astonishing accuracy with which they were sent, even though transmitted manually. Confirmations of reception were received from listeners more than 2000 miles distant. All of his apparatus was home-made — exact duplicates of the best manufactured equipment of the day.

"Pop" Smith was the first amateur in Colorado to make out-of-state contacts, quite an achievement back in the 1916 spark days. One of the first League members, and for several post-war years a director, he was active in organizing the A.R.R.L. trunk lines. Operating 9ZF in the first transcontinental relays, he successfully bridged the long gap between 6EA, Los Angeles, and 9ABD, Jefferson City, Mo. He remained active until spark was outlawed and never operated c.w., but was a constant listener to all branches of radio services up to the time of his death.

ON THE ULTRA HIGHS

CONDUCTED BY E. P. TILTON,* W1HDQ

As might be expected, reports of five-meter activity reached a new low during January. We believe that this is partly due to the fact that most of the gang are saving up reports until time to submit the monthly resumé of activity for Marathon credit. From our own observation it appears that 56 Mc. is showing much more in the way of consistent nightly activity, in this part of the country, than during the same period last year; but for the fellows who, because of lack of local activity, must depend on skip DX for five-meter contacts, January was a pretty quiet month.

One "open day" in December was reported too late for inclusion in last month's column. On Dec. 21st, at 8:47 P.M., W5AJG, Dallas, was heard by W9IZQ of Wauwatosa, Wis. No other reports were received for this date, and Leroy was testing with a station in Ft. Worth at the time, so no DX was worked. On Jan. 11th, W5AJG worked W4AUU, Macon, Ga., and again, this was the only report received for this date. We would like to commend to other u.h.f. enthusiasts the reporting system of W5AJG. Whenever anything interesting occurs, Leroy jots it down briefly on a postcard and sends it in immediately. If more of the gang would follow his example he would be able to present a much more complete and interesting story of u.h.f. conditions each month.

The second week in January produced a series of exceptional nights for extended local work. During this period, mild temperatures and high humidity prevailed generally in the North Atlantic states and on several occasions, notably Tuesday, Saturday, and Sunday, a considerable amount of lower-atmospheric bending was in evidence. Signals of better-than-average strength were noted also on the 23rd, 29th and 30th.

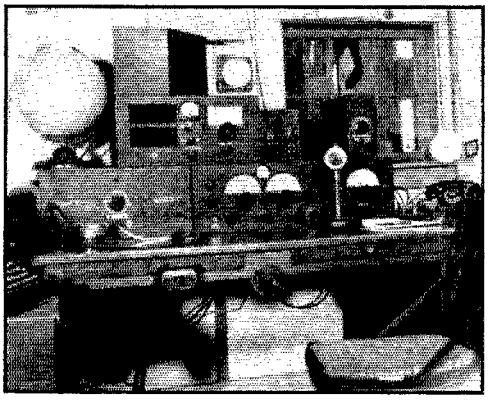
All afternoon and evening of Saturday, Jan. 13th, signals from distances up to 200 miles came through at Wilbraham with surprising strength and steadiness. The maximum strength attained was not equal to summer peaks but the steady character of the signals for long periods (in contrast to the fluctuation generally noticed during spring and summer) made possible many very satisfactory contacts over fairly long paths.

W1DEI, Natick, Mass., worked W1HDF, Elmwood, Conn., late Saturday afternoon, with signals equal to the best that summer might have offered. This is a 100-mile jump from low elevations at each end, with 1200-foot ranges of hills intervening at a number of points. W2LRE, Rahway, N. J., well over 100 miles, was worked at Wilbraham when he was using a 15-watt portable rig and a two-tube super-regen. W3HOH maintained a steady signal close to S9 for several hours, while W3BZJ averaged S6-7 over a 200-mile distance. W1KLJ, from his vantage point atop Fall Mountain, Bristol, Conn., worked stations all the way from Pennsylvania to New Hampshire during the evening. Television reception from W2XPS, N.B.C. station in the Empire State Building in New York City, was the best ever experienced since the television receiver was installed last July, and all the while the ten-meter band was filled with S9 signals from New York and New Jersey.

Such conditions, while not so frequent in winter as in spring, summer, and early fall, do occur much oftener than most 56-Mc. enthusiasts realize; and we insist that those who drop Five in the late summer and return to it in the spring are missing many interesting evenings. To them, and to all other amateurs whose interest in u.h.f. work is only casual, may we recommend the purchase of a barometer and a subscription to the daily weather-map service (only twenty cents per month from your nearest Weather Bureau office). There are plenty of very readable books on meteorology at your local library — study the weather a bit and then watch for the relationship between atmospheric conditions and u.h.f. DX. Here, you will find, is a phase of amateur radio which has much more to it than calling CQ or fighting QRM!

* 329 Central St., Springfield, Mass.

All time mentioned is local time for the station whose work is reported.



The operating position at W9ARN, Bartonville, Ill. Receivers include an RME HF-10 and a 69-DM36 combination. Note the barometer and thermometer, important items of equipment for the u.h.f. man.

HERE AND THERE:

W1DEI is back on the active list after some heavy work outfitting his new shack. Mel can now operate in comfort (no heat previously) and can be counted upon to be "in there" whenever the band is open for either extended-local or skip DX. Mel is using his buffer stage for contacts at present, and is rebuilding his final and power supplies in accordance with safety principles. Competition for DEI is now supplied by W1JTB, formerly of Ware, Mass., now a near neighbor.

W2MO finds things picking up gradually, with several new calls appearing in his log, which, incidentally, now includes approximately two thousand different stations worked on Five! Earl would hasten to assure you that practically all of these were worked prior to Dec. 1, 1938, however. Our guess is that 2MO will take the January Award for the highest score in the first month of the 1940 U.H.F. Marathon, with close to 100 different stations worked, from what we hear as this is being written. W1KLJ and W3HOH are giving Earl a good run for his money, both fellows piling up new contacts nightly.

W3IDS, Philadelphia, takes issue with those who claim that modern 56-Mc. technique is too costly or too complex for today's beginners. With exactly $15.47 at his disposal when he obtained his ticket, he, with the help of W3HVK, built a "poor man's rig" consisting of a 6K7 e.c.o., 6F6 doubler, and 6L6 final, modulated by a 6L6 with 6F5 speech. The quality of the signal emitted by a rig of this sort can easily equal that of the more costly crystal jobs. All components were purchased new, except for the modulation choke. Says W3IDS: "For the cost of a half-decent modulated oscillator, anyone can build a rig having xtal performance. . . . I hope you can find room for this report to encourage activity, among newcomers, on five meters."

It looks as though the old standbys in Georgia and Florida are going to have some competition this year. W4FKN, Atlanta, reports that he and W4MV, also of Atlanta, are going to give W4FBH a run for his money. This group gets together each Saturday night for a "round-table" and more stations are expected to join in soon. W4FKN also has equipment for 112 and 224 Mc. W4BRB should be on in West Palm Beach, Fla., by the time this appears in print. Gene hopes to work out with W4DRZ and W4EDD.

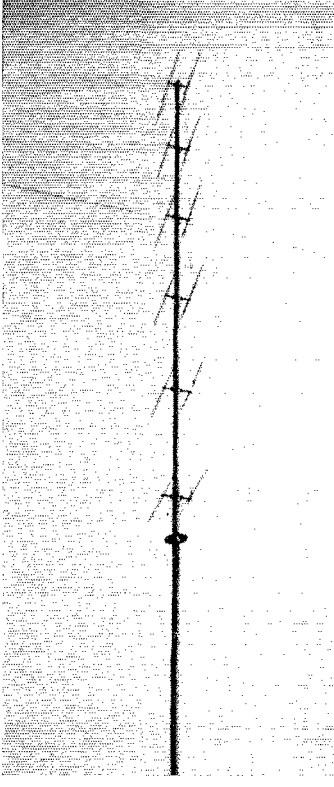
W5FYF, Oklahoma City, heard W5EHD, Del Rio, Texas, on Dec. 15th. This, being that in-between distance so difficult to work, excited our curiosity. We inquired of W5EHD and found that he was on 28 Mc. at the time, working short-skip with a station in Northern Texas, but the dope checks with Vance's log. Some harmonic!

W6QLZ passes along some interesting dope on conditions of Dec. 15th. After working W5AJG at 6:45 P.M. he listened around and heard W6OVK, Tucson, Ariz., calling Leroy on c.w. By this time 5AJG had faded out at Phoenix, and 6OVK was just beginning to get him. Clyde (QLZ) found that the only way he could hear Jim was with his beam pointed several degrees north of east, instead of southeast which is the approximate direction of Tucson. This looks like an extreme example of a rebound from a sharply tilted reflecting layer. Clyde says that the c.w. of W6OVK had "multipath flutter" during this period. According to Clyde's prognostications, Feb. 24th and 25th should be "open." As most of you will be reading this about then, we'll see how well he calls his shots. The log at W6QLZ shows open days around this time each year since 1936.

Here's good news for searchers for new states in 1940: W8TNC, located at Martin Hall, West Virginia University, is active on 56, 112, and 224 Mc. The five-meter rig ends up with a pair of 35T's at 250 watts, while the 112 and 224-Mc. jobs use HK-24's and 316-A's respectively. West Virginia University has been the scene of much enlightening troposphere research in recent years.[1] Other active stations in Morgantown include W8SPY and W8KWL.

From W8NOH, Grand Rapids, Mich., we learn of the formation of the Kent U.H.F. Club, with a charter membership including W8's RKE, QQN, TBN, GRP, OTG, LNW, and NOH. Also included in this group was Errol V. Wells, W8LMP, of Caledonia, Mich., who passed away January 3rd. Always active on the ultra-highs, W8LMP will be sorely missed. Receipt of this sad news struck a particularly responsive chord with your conductor, for it was W8LMP who, in June, 1935, provided us with our first experience in reception of Skip DX. This was one of the first recorded instances of this phenomenon, and as we happened to be the only person in the Springfield area who heard this then unbelievable signal, we had quite a time convincing our skeptical friends that we were entirely sane and sober, until it was reported in *QST* later[2] that W1CBJ, Derry, N. H., had worked W8CYE, Dayton, Ohio, the previous day, June 22, 1935.

A protracted rag-chew with W9ZHB during a splurge of short skip on 28 Mc. in the wee-small hours of the morning of Jan. 21st netted us some interesting facts about 56-Mc. activity in Central Illinois. Ed says that the gang, including W9's ARN, CBJ, CLH, RGH, and many others check the band nightly for signs of DX. Horizontal antennas are practically standard equipment, as the result of numerous tests which have shown horizontal polarization to be most effective, regardless of the polarization at the other end. Thus is fuel added to the fire of controversy already raging over this business of horizontal vs. vertical. It may be only because of the large number of stations using them, or possibly that a wrong impression has been created by the success of a few stations which are fortunately located, but the entire eastern group still favors verticals; and our own tests, both at Wilbraham and former locations in Springfield, give the vertical types preference by a wide margin. The fact that horizontals have proven most effective over the flat country around the Great Lakes, while verticals have seemed to be best in the rugged country of W1, 2, and 3, makes us wonder if the nature of the country has anything to do with this apparent contradiction. Here, indeed, is an interesting field for those who think that the experimental work is all done on 56 Mc.!



The 12-element 224-Mc. array at W8GU, Erie, Pa., is mounted on a steel mast without the use of insulators.

INTERNATIONAL NOTES:

In the November issue of *Break-In*, official N.Z.A.R.T. publication, we found an interesting summary of the results of several years of intensive listening on Five on the part of P. A. Morrison of Wellington, New Zealand. Two W6's have been heard which appear to be authentic examples of long-distance 56-Mc. transmission. W6ENS was heard calling "CQ DX 56 Mc." and W6ITH was heard on an occasion when he was transmitting on 14, 28, and 56 Mc. simultaneously. Three other W's have been heard but these were identified as harmonics of 28-Mc. transmissions.

Several VK's have been heard, with reception of VK2NO (1400 miles across the Tasman Sea) in November, 1937, definitely confirmed. Other DX reports confirmed by

[1] "Heights of the Reflecting Regions in the Troposphere," Friend and Colwell, *I.R.E. Proceedings*, October, 1939.

[2] "Five-Meter Signals Do the Impossible," *QST*, August, 1935.

(Continued on page 106)

The Ionosphere and Radio Transmission

Normal and Irregular Characteristics Which Affect Wave Propagation

As time goes on, the unremitting efforts of physicists in probing the upper atmosphere bear the fruit of continual additions to our knowledge of the things that happen to the signals we launch so hopefully into space. It's helpful, now and then, to take stock of that knowledge. The accompanying article, extracted from the Bureau of Standards' Letter Circular LC-575, is an up-to-date summary of known ionosphere effects. "Must" reading for the chap who wants to keep well informed.

IN THE high atmosphere, above about 50 kilometers (30 miles), the air particles are separated so far that collisions between them are far less frequent than in the lower atmosphere, and when an air particle is ionized by ultraviolet radiation from the sun it remains ionized for a considerable time. Therefore at any given time a large proportion of the air particles are in an ionized condition. This does not occur much below about 50 kilometers (30 miles), because the ionizing radiations from the sun are largely absorbed in the higher regions of the atmosphere. Likewise there is not very great ionization density above about 400 kilometers (250 miles), because the air is so rare at such heights that there are not enough atoms to provide for great ionization density. The region in which the ionization is great, great enough in fact to affect radio wave transmission, is thus between 50 and 400 kilometers (30 and 250 miles) above the earth's surface, and this region is called the "ionosphere".

The ionization in the ionosphere is not uniformly distributed with altitude but is stratified, and there are certain definite layers in which the ionization density is such as to reflect radio waves. These layers do not remain always at the same height but vary diurnally, seasonally, and otherwise, in both height and ionization density. There may be a considerable number of such layers at a given time. There are two principal ones, called the "*E*" and "*F*" layers. The *E* layer is at a height of 90 to 140 kilometers at different times, usually about 110 kilometers. The term *F*-layer is ordinarily reserved for the other layer as it exists at night; in the daytime during most of the year it divides into two layers which are called the "F_1" and "F_2". The night *F* layer is at a height of about 180 to 400 kilometers. The F_1 layer exists in the daytime, at a height of about 140 to 250 kilometers. The F_2 layer also exists in the daytime, at a height of about 250 to 350 or more kilometers in the summer, and about 150 kilometers in the winter day. (The "virtual" heights, defined later, are somewhat higher than these values.) The fourth layer, which is semi-permanent, is the "*D*" layer; it exists only in the daytime, and its height is of the order of 50 to 90 kilometers. Little has been done on the determination of the quantitative characteristics of the *D* layer, its effects being largely inferred rather than directly observed. Existing knowledge covers mainly the *E*, *F*, F_1, and F_2 layers.

The structure of the ionosphere may be visualized in an elementary way from Fig. 1, which is for a typical summer daytime condition, the *E*, F_1, and F_2 layers all being present. This diagram is drawn to scale, so the angles of reflection of radio waves from the layers may be estimated correctly. The three layers are shown as mere thin lines, for simplicity. The layers have in fact a certain thickness, and the density of ionization varies somewhat in this thickness. At the right of the diagram is a rough illustration of a possible distribution of ionization density with height.

Dotted lines indicate two of many possible paths of radio waves from a transmitter to a receiver as transmitted by reflection from the

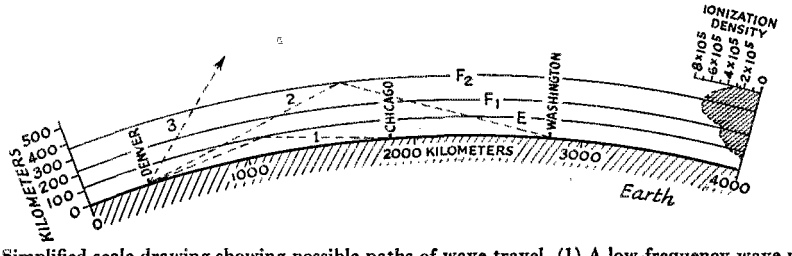


Fig. 1 — Simplified scale drawing showing possible paths of wave travel. (1) A low-frequency-wave reflected by the *E* layer; (2) a wave of higher frequency reflected from the F_2 layer; (3) wave which passes completely through the ionosphere because its frequency is too high to permit reflection.

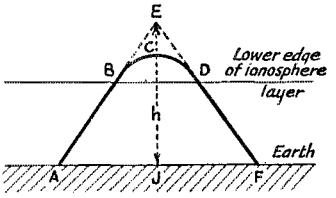


Fig. 2 — Showing the relation of virtual height (h) to the height actually reached by the wave in reflection from the ionosphere.

ionosphere layers. This picture, simple as it is, does in fact represent the basic mechanism of radio wave transmission over long distances. When we consider the variations of ionization and height of the layers with time, and the effects of the ionization upon the received intensity and the limits of transmissible frequency at any particular time, the picture loses its simplicity. However, most of the phenomena of long-distance radio transmission are completely explainable in terms of the ionosphere.

Ionosphere Characteristics

The principal ionosphere characteristics which control or determine long-distance radio transmission are the height and the ionization density of each of the ionosphere layers. Since each layer has a certain thickness it is necessary to define the sense in which the term "height" is used. When a ray or train of waves is reflected by a layer, it is slowed down as soon as it starts to penetrate into the layer. The process of reflection thus goes on from the point at which the waves enter the layer until they have been fully turned down and leave the layer. This is true whether the waves travel vertically or obliquely to the ionosphere. It is illustrated for the oblique case in Fig. 2. The waves follow a curved path in the layer until they emerge at the same vertical angle at which they entered. The time of transmission along the actual path *BCD* in the ionized layer is the same as would be required for transmission along the path *BED* if there were no ionized particles present. The height *h* from the ground to *E*, the intersection of the two projected straight parts of the path, is called the "virtual height" of the layer. This is the important quantity in all measurements and applications.

The virtual height of a layer is measured by transmitting a radio signal from *A*, and receiving at *F* both the signal transmitted along the ground and the echo, or signal reflected by the ionosphere, and measuring the difference in time of arrival of the two. The signal is a special, very short pulse in order that the two may be separated in an oscillograph, as the time differences are mere thousandths of a second. The difference between the distance $(AE + EF)$ and AF is found by multiplying the measured time difference by the velocity of light. From this and the known distance AF, the virtual height h is calculated. It is usual to make AF zero by transmitting the signal vertically upward and receiving it at the same place (and it is for this case that the term "virtual height" rigorously applies). The virtual height varies somewhat with frequency.

The effectiveness of the ions in reflecting the waves back to earth depends on the number of ions present in a unit of volume, i.e., the ionization density. The higher the frequency, the greater is the density of ionization required to reflect the waves back to earth. It has been shown that, for electron ionization, the relation (for the ordinary ray, explained below) is

$$N = 0.0124\, f^2$$

where N is the number of electrons per cubic centimeter and f is the highest frequency, in kilocycles per second, at which waves sent vertically upward are reflected back to earth. Waves of all frequencies higher than this pass on through the ionized layer and are not reflected back to earth, while waves of all lower frequencies are reflected. This frequency is called the "critical frequency," and measurement of it is, with the equation just given, a means of measuring the maximum ionization density in an ionized layer. (Waves of higher frequencies than the critical are sometimes reflected by another mechanism — see discussion of "Sporadic *E*" later.)

Measurements of critical frequency are usually made by means of vertical or nearly vertical transmission (that is, with the transmitter and receiver not far apart). The process is to measure the virtual height, by the method described above, repeating the determination at successively increasing frequencies until the waves are no longer received back from the layer. The highest frequency at which waves sent vertically upward are received back from the layer is the critical frequency of that layer. Typical results of such measurements are illustrated in Figs. 3, 4 and 5, for different times of year, day and night. They show critical frequencies as sharp increases in virtual height.

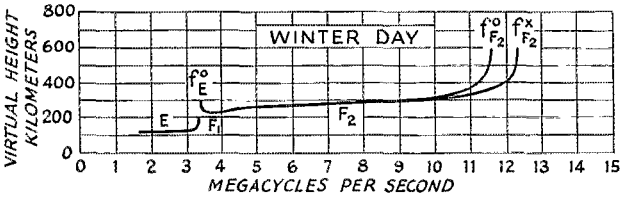


Fig. 3 — Virtual height plotted against frequency for a typical winter day, with critical frequencies indicated.

In Fig 3, starting at a frequency below 2000 kc. the virtual height is found (in this example) to be about 110 kilometers, and remains at about this height until about 3300 kc. The critical frequency of the *E* layer at the time of this measurement is thus 3300 kc.; i.e., this is the highest frequency at which vertically-incident waves are reflected back to earth. All such waves of higher frequency penetrate through the *E* layer and go on up to a higher layer, the F_2. The F_2 layer has a greater ionization density and so it reflects back waves of frequency greater than 3300 kc. It is not until frequencies greater than 11,500 kc. are used that the F_2 layer fails to reflect them, in the case illustrated.

Near the critical frequency the waves are excessively retarded in the ionized layer, which accounts for the rise of the curve at the critical frequency. At the right of the curve appear two critical frequencies for the F_2 layer. This is an indication of double refraction of the waves due to the earth's magnetic field, two components of different polarization being produced. One is called the "ordinary" wave and the other the "extraordinary" wave. The symbols *o* and *x*, respectively, are used for these components. The critical frequency of a layer *n* is represented by the symbol f_n, and to such symbol the *o* or *x* is added as a superscript. Thus the critical frequencies of the F_2 layer for the ordinary and extraordinary waves are indicated by the respective symbols, $f^o_{F_2}$ and $f^x_{F_2}$.

In the case of the *E* layer, the ordinary wave usually predominates and the extraordinary wave is so weak it does not affect radio reception. At Washington the critical frequency for the extraordinary wave is about 750 kc. higher than for the ordinary wave (for frequencies of 4000 kc. or higher). The difference in frequency is proportional to the intensity of the earth's magnetic field at the place of reflection, and is therefore different at different places on the earth. In reporting results of measurements of critical frequency it is now customary to give the values for the ordinary wave; practice varied in the past.

Besides the virtual heights and critical frequencies, the absorption of the energy of radio waves by the ionosphere is an important factor in limiting radio transmission. This absorption exists because the ions set in motion by the radio

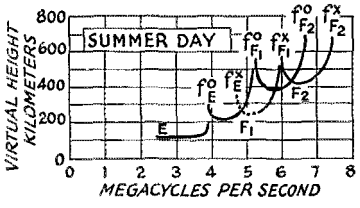


Fig. 4 — Representative summer day conditions. The extraordinary components are clearly indicated.

waves collide with air molecules and dissipate as heat the energy they have taken from the radio waves. Consequently the energy thus absorbed from the radio waves is greater, the greater the distance of penetration of waves into the ionized layer and the greater the density of ions and air molecules in the layer, and hence the greater the number of collisions between ions and air molecules. Absorption is especially great in the daytime, and it occurs chiefly in the low ionosphere, in the *D* or *E* layers. It also occurs in the high ionosphere, near critical frequencies. Much of the low-layer absorption disappears with the decrease of low-layer ionization at night. Higher frequencies are less affected by absorption than are lower frequencies, for waves passing through the same ionized layers.

Regular Variations of Ionosphere Characteristics

There are three principal types of variation of critical frequencies which are fairly regular with time. These are diurnal variations, seasonal variations, and year-to-year variations with the sunspot cycle.

The diurnal and seasonal variations of the critical frequencies of the normal *E* layer are particularly regular. The critical frequencies vary with the altitude of the sun, being highest when the sun is most nearly overhead. Thus the diurnal maximum of the *E* critical frequency (f_E) is at local noon, and the seasonal maximum is in midsummer. At night this layer usually does not reflect waves of frequencies higher than about 1000 kc.

The diurnal and seasonal variations of the critical frequencies of the F_2 layer at Washington are quite different from those of the *E* layer. The winter F_2 critical frequencies exceed any regular critical frequency found during the summer. In the winter a broad diurnal maximum occurs in the daytime, centered around 1:00 P.M. local time. In the summer a broader diurnal maximum centers about sunset. During the night the winter critical frequencies are usually lower than the corresponding summer values. Thus, the highest F_2-layer critical frequencies occur during the winter day, and the lowest *F*-layer critical frequencies occur during the winter night; the summer day and night values are between.

The F_2 virtual heights are much lower during a winter day than during a summer day. The *F* virtual heights at night are about the same in winter as in summer.

The seasonal effects in the ionosphere synchronize with the sun's seasonal position, not lagging a month or two as do the seasons of weather. Winter conditions in the F_2 layer obtain during a period of several months from about October to March, and summer conditions for a period of several months from about April to September. Around the equinoxes, there is a transition period

of a month or two in which the change occurs between winter and summer conditions; in these transition periods the ionosphere characteristics (except for the effects of sporadic E) fluctuate between winter and summer conditions and are thus more erratic than during the rest of the year.

There are important changes in ionosphere characteristics in the 11-year sunspot cycle. From the sunspot minimum in 1933 to the sunspot maximum in 1937 the F- and F_2-layer critical frequencies doubled (for most hours of the day), and the E-layer critical frequencies became 1.25 times as great. A consequence is that the best radio frequencies for long-distance transmission were approximately twice as great in 1937 as in 1933 (except for summer daytime, when they were about 1.5 times as great). In about 1944 they will return to minimum values.

The condition of the ionosphere varies somewhat with latitude. For all latitudes of continental United States the differences from the Washington values appear to be negligible, but the values in Alaska and in the Canal Zone are somewhat different.

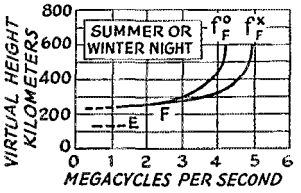


Fig. 5 — **At night, either summer or winter, the E layer is relatively weak, while the F_1 and F_2 layers combine to form a single layer, the F. Critical frequencies are considerably lower at night than during the daytime.**

Applications to Radio Transmission

From the vertical-incidence critical frequencies and virtual heights of the ionosphere layers, at any given time, it is possible to calculate the upper limit of radio frequency that can be transmitted over any distance. The calculated values of maximum usable frequency are found to agree with direct observation of radio transmission over such distances.

When radio waves are transmitted along the earth over any distance, they strike the ionosphere obliquely (Fig. 1). Such obliquely incident waves can be reflected back down with lower ionization densities than can vertically incident waves. It results that the larger the angle of incidence (angle of wave path with the vertical), i.e., the greater the transmission distance, the higher is the upper limit of frequency of waves that can be reflected from a layer of given ionization density or critical frequency. This upper limit of frequency, for transmission via an ionosphere layer, for a particular time and transmission distance, is called the "maximum usable frequency." It may be calculated roughly, to a first approximation,

TABLE I

Typical Average Ratios of Maximum Usable Frequency to Critical Frequency

(For One-Hop Transmission)

	Distance, km				
	500	*1000*	*1500*	*2500*	*3500*
Winter					
Midnight F.....	1.2	1.5	1.8	2.8	2.9
Noon F_2.....	1.2	1.6	2.1	2.9	3.4
Summer					
Midnight F.....	1.2	1.4	1.7	2.4	2.8
Noon F_2.....	1.2	1.5	1.8	2.5	2.9
Noon F_1.....	1.3	2.0	2.7	3.6	—
Noon E.....	2.0	3.4	4.4	—	—
Sporadic E*.....	2.5	4.2	5.1	—	—

* Sporadic E transmission has no critical frequency. The values given are ratios of maximum usable frequency to the approximate upper limit of frequency of the stronger sporadic-E reflections at vertical incidence.

by multiplying the critical frequency of the layer by the secant of the angle of incidence.

The accurate calculation of maximum usable frequencies from vertical-incidence critical frequencies is quite complicated. For convenience, typical values for the conversion are given in Table I.

To obtain the maximum usable frequency for transmission over a given distance by way of a given layer, multiply the critical frequency by the ratio given in the table. Where blanks appear in the table, and for distances over 3500 kilometers, the distance is too great for one-hop transmission, i.e., transmission over such distances requires multiple reflection from the ionosphere with intervening reflection from the ground.

The distance at which a given frequency is the maximum usable frequency is also the minimum distance over which that frequency is receivable. This minimum distance for any frequency is called the skip distance; at any less distance it is impossible to receive on that or higher frequencies, except for sporadic or scattered reflections.

The highest maximum usable frequencies (in north temperate latitudes) occur during the winter day and the lowest during the winter night. The summer values for both night and day lie between these two extremes except as modified by sporadic-E or scattered reflections.

Maximum Usable Frequencies over Long Paths

Since the local time of day, and hence the ionosphere characteristics, may vary a large amount throughout a long transmission path, it is necessary to consider what part of the path determines the conditions of transmission. For single-hop transmission (transmission by a single reflection from the ionosphere), it is the region half-way

(Continued on page 88)

Fitting the Chassis to the Layout

A Compact Medium-Power 20- and 10-Meter Transmitter

BY E. DAVID LITKE,* W1IVY

The relay rack is a straitjacket from which few amateur transmitters seem able to escape. But the r.f. layouts it leads to only too often aren't the best that could be devised. Here's one ham's answer to getting panel construction — without relay-rack panel constriction. Give a thought to tailoring the chassis to your next transmitter.

IN RECENT years most amateur equipment has been designed and built for relay rack mounting, and few rigs have been built in such a way as to contribute to the "eye appeal" of the shack of the fellow who wants to keep his equipment neatly arranged on a table or on his operating desk. The rig herein described is a complete r.f. section of a 10- and 20-meter 'phone transmitter consisting of a push-pull 812 final amplifier with a three-stage exciter (6V6 oscillator, 6V6 doubler, 807 amplifier-doubler) all mounted on a chassis and panel measuring 11¼ inches wide, 12 inches high, and 6¾ inches deep. The complete transmitter therefore occupies just about the cubic space normally used by only one stage.

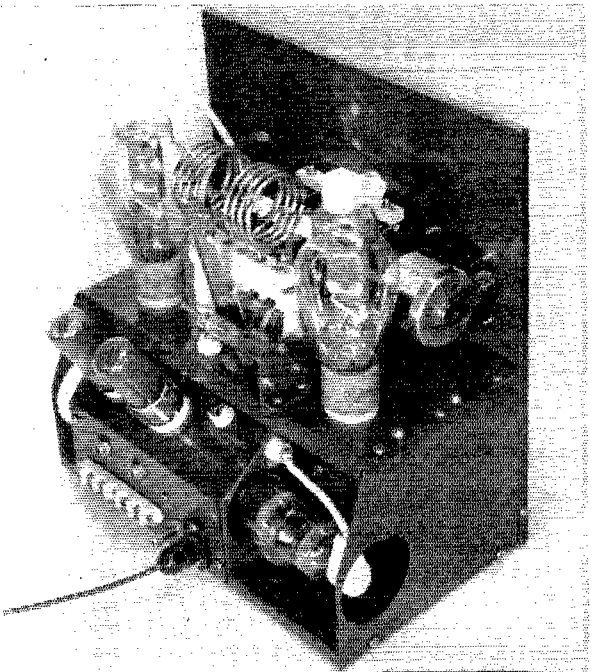
The space is divided into two parts by a shelf mounted from the panel 5¼ inches from the bottom and extending back 5½ inches. The space on this shelf and on the upper half of the panel is taken up by the final amplifier, while the lower compartment houses the exciter stages and the filament transformer.

Mechanical Construction

The compact construction of this transmitter is made possible by following a "bend your own" policy of making the chassis to fit the parts, rather than the customary practice of getting the chassis first and then attempting to fit the parts to it. More rigs could boast the appearance of an instrument instead of merely a conglomeration of parts, if this policy were followed more frequently.

*Millen Mfg. Co., 150 Exchange St., Malden, Mass.

Neutralizing condensers are mounted flat, by means of small metal angles, on either side of the final tank coil to give a symmetrical layout and short connections. This view also shows the way the components for the final are arranged.



The entire chassis and panel assembly is made of 0.040-inch sheet iron, cut and folded to proper dimensions. The panel is a piece of sheet stock 11⅞ inches by 12 5/16 inches folded 5/16 inch on both sides and on top for rigidity. (Regular crackle-finished panel material such as Masonite could be substituted if desired, thus avoiding the necessity for bending the edges of thin metal stock.) The shelf is a piece 12 by 6 inches folded 5/16 inch on the longer sides. The ends are made from pieces 6½ by 5⅝ inches folded ⅜ inch on top. The can enclosing the exciter stages is 6¼ inches long and 4 inches high, with the back vertical to 2½ inches from the bottom and then sloping 30 degrees to the horizontal for the remainder of the height. The bottom is a piece of sheet iron 6¾ by 11 inches, folded down 5/16 inch on each side, with automobile rubber door bumpers inserted in each corner for feet.

The shelf fastens to the panel with three screws through the front lip. The end brackets fasten to the shelf with screws through the lip on top of them and fasten to the side lip of the panel. The can enclosing the exciter extends forward to the panel and fastens to it. The bottom is set in 5/16 inch so it is flush with the panel and side brackets and fastens on all sides with screws.

The metal pieces should first be laid out on the sheet metal itself, then cut out, and then all holes drilled and cut. It is important that as much of the cutting and drilling as possible be done while the pieces are still flat. Next the edges are folded. A neat job of this can be done in a husky vise with a few odd lengths of steel bars. A line is first marked on the sheet metal where it is to be bent, and then the sheet is clamped at the line between

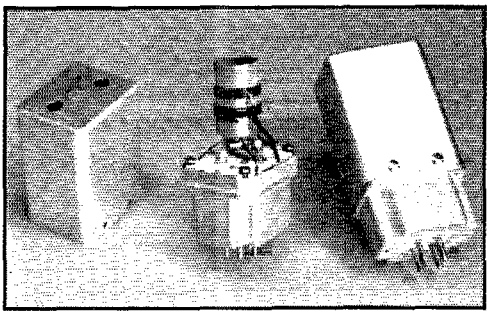
two bars of steel in the vise. The steel bars should be at least as long as the bend. If the bend is a long one, the steel bars should also be clamped together at the ends with "C" clamps. The metal is next gripped with the hands and bent. Then another steel bar is placed over the bend and pounded with a heavy hammer. The result will be a sharp, even bend.

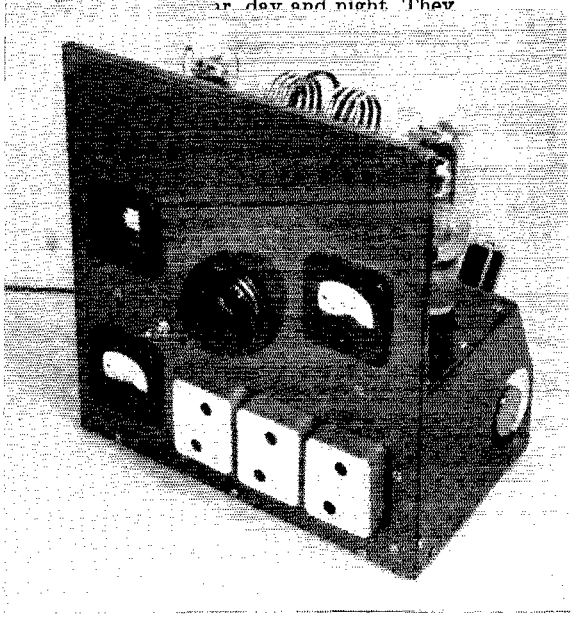
While the only tools really necessary for a good job of cutting and bending the chassis are a husky pair of tin shears and a good-sized vise with a few pieces of steel bars, it is much easier and an even better job is obtained if the pieces are all laid out on a piece of sheet iron and then taken to a local tinsmith, who will shear it up and bend it in his brake for a very nominal sum.

The pieces were prepared for painting by thoroughly cleaning them with a grease solvent. After the solvent had completely evaporated, the dark gray enamel was applied with a brush. The paint was then baked in a large pasteboard box with an electric stove in it so arranged so as to distribute the heat evenly. After the paint was dry, the chassis was reassembled and the parts mounted on it.

The three exciter stages are mounted in the bottom compartment in a can so shaped that the pre-tuned exciter tanks will plug in from the front through a cut-out section of the panel, while the 807 and the 6V6's plug in on the end and on the sloping section of the back, respectively. The crystal is mounted on the end opposite that on which the 807 is mounted. Holes 2¼ inches in diameter are cut into the end brackets to make the crystal and 807 accessible. With this layout the tube socket connections are but a very short distance above and in back of the coil socket terminals, while the terminal strip connections are only a few inches below, all of which permits very short connecting leads. This construction also lends itself well to a busbar ground run through the can to which all of the grounded parts are connected, thereby eliminating the use of the chassis in the ground circuits. Feed-through bushings are used in all high potential

Inside one of the plug-in exciter tanks. Although operated fixed-tune, screwdriver adjustments may readily be made from the front of the panel.





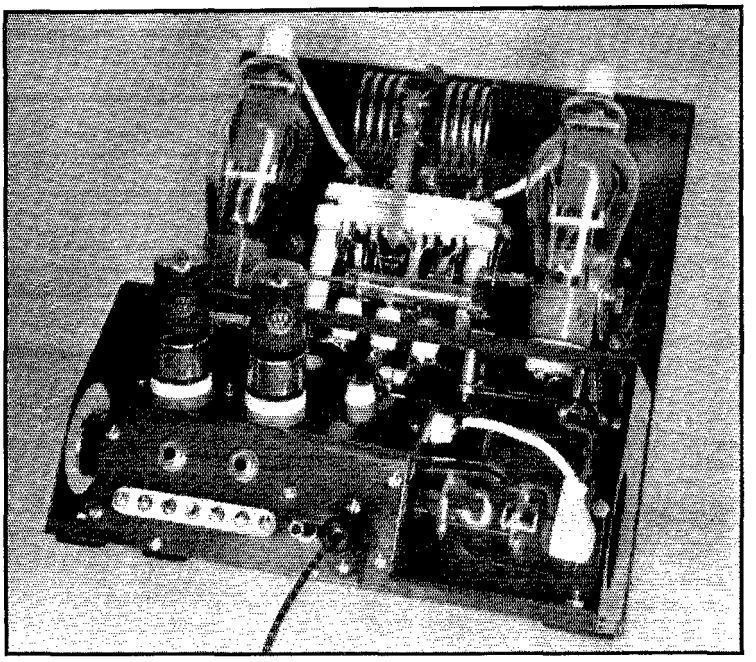
Unusual mechanical construction and fixed-tune units plug-in from front of panel feature this compact transmitter. The fixed-tune units are readily adjustable from the front panel.

leads feeding through the chassis, but for low potential leads such as grid and meter leads, a very satisfactory feed-through insulator was obtained by removing the prong clips from a crystal socket (Millen 33002). This proved very useful in that it permitted feeding the leads directly through the chassis instead of breaking the lead and soldering to the lugs on both ends as is necessary on the regular bushing. The sockets used are the type having the insulating barrier between prongs, thereby eliminating the possibility of shorting or arcing between the socket connections.

All parts are ruggedly mounted and suspension from flexible leads is avoided as much as possible, since in compact construction very little shifting of parts can be tolerated. All r.f. chokes are mounted on stand-off insulators. Small condensers and resistors are mounted with the shortest leads possible. The 3000-ohm voltage dividing resistor is mounted in front of the filament transformer where air can circulate around it more freely, thereby preventing the heat from affecting the exciter stages.

To permit removing the exciter tank cans by gripping the tops, the bases are fastened to the cans with screws, one on one side and two evenly spaced on the other side. This arrangement prevents the screw heads on adjacent cans from getting in each other's way, as would be the case if they were all put in the same respective positions.

In the two 6V6 stages the plug-in tanks require only three connections, so the fourth is used to ground the can. The third can, however, houses the 807 tank circuit and the final grid circuit, and so needs all the prongs furnished by the five-prong plug. To ground the can, an auxiliary clip



The exciter is built in a metal box occupying part of the lower deck, with the 807 driver projecting to the right. Note the filament transformer behind the 807. The plate choke for the final is under the upper deck, back of the right-hand 6V6.

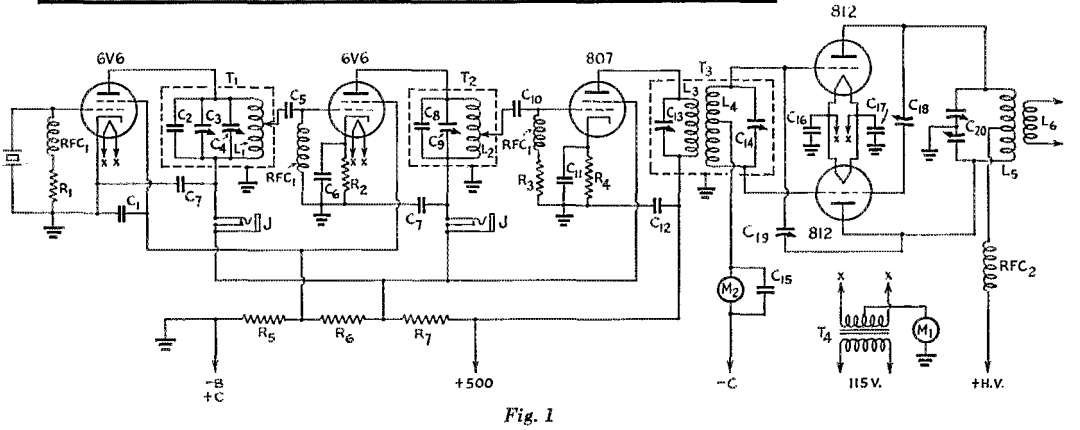


Fig. 1

C_1, C_6, C_7, C_{11}, C_{15}, C_{16}, C_{17} — 0.005-μfd. mica, 500-volt.
C_2 — 25-$\mu\mu$fd. silvered mica (Millen 27025).
C_3, C_4, C_8, C_9, C_{13}, C_{14} — 25-$\mu\mu$fd. air trimmers (in exciter tanks).
C_5, C_{10} — 250-$\mu\mu$fd., 500-volt.
C_{12} — 0.002-μfd. mica, 2500-volt.
C_{18}, C_{19} — 0.5-13.5-$\mu\mu$fd. neutralizing condenser (Millen 15003).
C_{20} — Split-stator transmitting condenser, 35-$\mu\mu$fd. per section, 0.77" spacing (Millen 11035).
R_1 — 25,000 ohms, ½-watt.
R_2 — 500 ohms, 1-watt.
R_3 — 10,000 ohms, 1-watt.
R_4 — 300 ohms, 5-watt.
R_5 — 40,000 ohms, 2-watt.
R_6 — 9000 ohms, 2-watt.
R_7 — 3000-ohm semi-variable, 25-watt.
RFC_1 — 2.5-mh. receiving choke.
RFC_2 — Transmitting choke (Millen 34140).
T_1, T_2, T_3 — Exciter tank assemblies containing dual tuning condenser and coil form (Millen 70225).
T_4 — Filament transformer, 6.3 volts, 10-amp. (Thordarson T-19F99).
M_1 — 0–300 d.c. milliammeter.
M_2 — 0–50 d.c. milliammeter.
L_1 — 18 turns No. 18 enameled, length 1¼ inches, tapped at center.
L_2 — 9½ turns No. 18 enameled, length ¾ inch, tapped one turn from plate end.
L_3, L_4 — 28 Mc.: 4½ turns No. 18 enameled, close-wound, 3/16 inch between coils.
14 Mc.: 11½ turns No. 18 enameled, close-wound, ¼ inch between coils.
L_4 tapped at center.
Note: L_1, L_2, L_3 and L_4 all wound on 1-inch diameter forms.
L_5 — 28 Mc.: 8 turns No. 8 wire, length 3 inches, diameter 2 inches.
14 Mc.: 10 turns No. 12 wire, length 2½ inches, diameter 2½ inches.
Center turns of both coils separated ¾ inch to provide space for L_6.
L_6 — 3 turns No. 14, diameter 2½ inches.

is used which contacts the side of the can when it is plugged in.

In the oscillator tank, a fixed padder is connected in parallel with both variable condensers in the unit. In the 6V6 doubler, both variable condensers paralleled give sufficient capacity. In the third can, one condenser is used in the 807 tank and the other in the balanced grid circuit for the final. The silver-on-mica padder has an ear on it by which it is rigidly mounted to the coil form bracket with a 4-40 screw.

The filament transformer is mounted from the shelf in back of the 807 on ⅞-inch metal stand-offs with 8-32 screws. This clears the socket of the 812 nicely and still keeps the transformer high enough to leave room for the bottom cover plate to be inserted.

The compactness of the final stage was achieved by proper selection and arrangement of parts. The worm-gear-driven condenser is mounted in the center, close to the panel. The drum dial tuning indicator is fastened to the end of the condenser shaft, and in order to simplify the alignment of the condenser and drum dial bearings, the inside bracket of the drum dial was removed. The tank coil is mounted behind the condenser on 1¾-inch stand-offs made by fastening together a 1-inch isolantite stand-off and a ¾-inch cone with a headless 6-32 screw. This gives a long stand-off which will take 6-32 mounting screws, whereas most longer stand-offs are made to take an 8-32 screw.

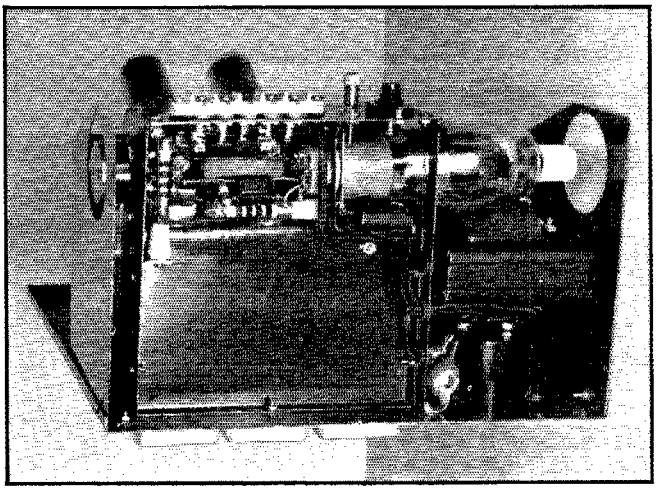
The neutralizing condensers are the new compact polystyrene dielectric type mounted below and on both sides of the tank coil in a horizontal position. The bases are mounted on small angle brackets, and the top connecting lug is soldered to the lug of the feed-through bushing that brings the grid lead through the metal shelf. This placement of the condensers keeps them away from the heat of the tubes and puts them right in line with the shortest neutralizing leads possible. When soldering connections to the neutralizing condensers, care must be exercised to avoid overheating the polystyrene either by direct contact with the soldering iron or by overheating the lugs when soldering to them, since polystyrene has a low softening temperature.

The r.f. choke in the final is mounted on its brackets on the bottom of the shelf under the tank coil in a horizontal position.

The panel controls are arranged in a symmetrical layout. The tuning knob for the final condenser is located in the center of the panel. A little above and to the right of the knob is the plate current meter, and to the left is the tuning indicator dial with a bezel to match the Triplett meter. The bottom left-hand portion of the panel is occupied by the grid current meter for the final, and the exciter tank coils are plugged in through the lower right-hand section of the panel. The filament switch is below and to the left of the condenser knob.

Safety precautions were taken wherever possible. All plate contacts are made with isolantite-insulated plate caps, and the plate leads are covered with isolantite beads which fit into the end of the plate cap, leaving no part of the wire exposed. The new safety terminal is used for the high-voltage connection. A terminal strip with barriers between terminals is used to prevent shorting of terminals by connecting wires. A shield (not shown in photographs) is mounted over the plate circuit jacks and the terminal strip to avoid accidental contact. The plate-current meter is connected in the cathode circuit of the 812 tubes to keep it at low potential, but it must be remembered that it will read the sum of the plate and grid currents.

(Continued on page 112)



By-pass condensers, chokes, resistors and tube sockets fill most of the space in the exciter compartment. The bottom of the set is normally protected by a plate which is fastened by screws to the side pieces and panel.

One Meter for Multi-Stage Transmitters

A Discussion of Meter-Switching Methods

BY D. L. WARNER,* W9IBC

ONE of the most common problems in the design and construction of amateur transmitters is that of providing a satisfactory means of checking the operation of each stage without an expensive array of meters. While we all admire the appearance of a nicely laid out front panel which sports anywhere from one to a dozen meters, there are times when we like to get by with the least possible number of them — undoubtedly because of a desire to put our few nickels into much needed parts and to hold down the total cost as much as possible.

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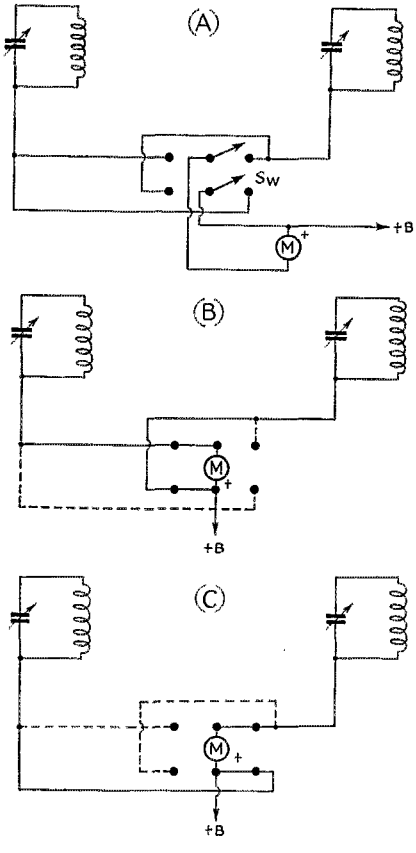


Fig. 1 — Switching a meter between two plate circuits can be accomplished quite simply with a d.p.d.t. switch. An ordinary toggle switch can be used for low-voltage circuits (250 volts or so). The drawings at *B* and *C* show the active circuits with the switch in alternative positions.

Just how serious this multi-meter proposition can be was rather forcibly brought home to the writer recently in attempting to design a new portable rig which would also be called upon to double at the home station as an exciter unit. When all details of the circuit had been included that were absolutely necessary, we discovered that our plans were going to require about twenty-five dollars' worth of parts and, in addition, about twelve dollars for meters, if we placed a meter permanently in each circuit. Needless to say, we voted against an array of meters that would run into any such amount, providing we could dope out a method of making one meter do all the work.

While trying to cover this problem in a satisfactory manner, we asked several dozen amateurs of our acquaintance what they would do in a case of this type and were surprised to find that only one or two had any ideas or even a single idea as to how to approach the subject! And that in spite of the fact that we distinctly remembered seeing various types of meter-switching circuits in previous issues of *QST* and the A.R.R.L. *Handbook* at one time or another.

Since we did go to quite a bit of trouble in gathering together a selection of metering methods for our own use, we feel that many of our brother hams might appreciate a survey of some of the methods that can be used, as outlined here. Let's assume then that our problem is one of making a single meter do several jobs, for the cost of a single meter will seldom add a great deal to the estimated cost of building a new rig or of remodeling an old one.

Simple Methods

Our first method is the simplest, and is based on the necessity for checking plate current in only two stages of a transmitter or exciter unit. In addition to the one meter having a suitable range for the purpose, we'll need only a double-pole double-throw toggle switch (easily extracted from almost any collection of spare parts). Fig. 1A shows the proper connections. This arrangement permits flipping the meter from one circuit to the other without disturbing either circuit. For those who are in the beginner stage, Fig. 1B and Fig. 1C indicate how each circuit is completed, dotted lines showing the portion of the circuit not in use in each switch position.

Next in line is a method that's extremely simple but not often used, whereby a multi-contact switch and one meter will permit plate current checking in three or four stages. It is especially well suited for use where an oscillator and two or three buffer-doubler stages follow each other and where plate current requirements of each stage are of essentially the same value. Outlined in Fig. 2A, the switch can be a single-gang three-pole three-position unit if metering is for three stages, or a four-pole four-position switch if four stages are to be checked with the same meter.

Fig. 2 is self-explanatory as to method of connection. As can readily be seen, tank circuit number 1 connects to the arm of position 1, tank number 2 to the arm of position 2, and so on. One side of the meter goes to positive high voltage; the other side connects to contact 1 of position 1, contact 2 of position 2, etc., with all remaining contacts of each position tied together and connected to the high voltage.

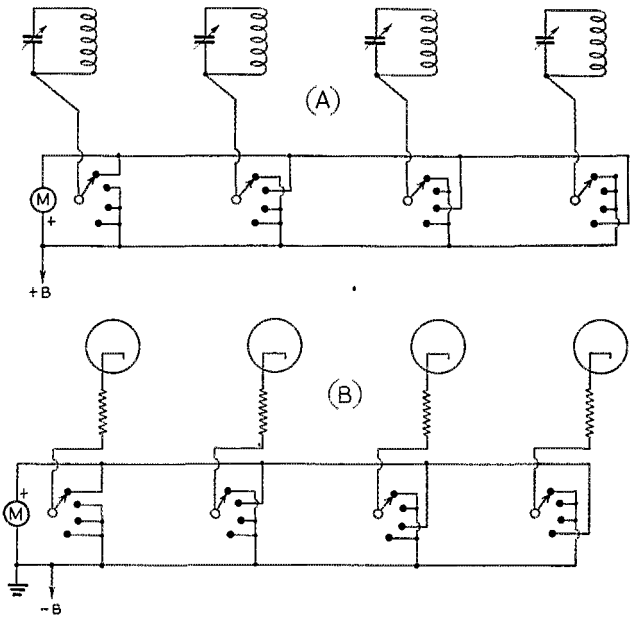


Fig. 2 — **Using a multi-pole multi-contact switch to shift a meter to plate (A) or cathode (B) circuits of several stages.**

Because of the reluctance that some of us feel toward putting our meters in high-voltage leads (even in exciter units the plate voltage is unfriendly to operators) and a desire to eliminate "hot spots" as much as possible, we can use the arrangement of Fig. 2A in an equally satisfactory manner to check stages by putting the meter in the cathode circuits. This is outlined in Fig. 2B and uses the same meter and switch as in Fig. 2A except that the meter is switched in series with the cathode of each stage and ground and provides automatic grounding of each cathode as the meter is switched to another stage.

For the benefit of those who have never tried cathode metering, it is important to note that the current measured in the cathode circuit will be the sum of the plate, screen, and grid currents of that stage. This should, of course, be taken into consideration when tuning stages with cathode metering; otherwise the meter readings will appear to be unduly high, and the unsuspecting operator will start on a "bug-shooting" spree. It might be just as well to point out another confusing point in this type of circuit checking, and that is in regard to screen current in relation to plate load when using 6L6's and similar tubes. With the plate adjusted for proper load and current the screen current will be at a minimum; but if the plate load is removed and the plate circuit tuned to resonance, the screen current will rise to maximum. For this reason alone, the difference in plate current between the resonant and the off-resonance value will not be as pronounced as in plate metering, and the dip in plate currrent will not be as great as it would be if the meter were used directly in the plate circuit. This may deceive the operator as to the true condition of the circuit at first, but once you get used to the idea, it's no cause for worry when retuning.

Collecting in one place the various meter-switching schemes which have been proposed from time to time, this article may remind you of some things you've overlooked — besides providing highly useful information for newcomers.

Individual Stage Shunts

Fig. 3 illustrates another simple method of plate metering which provides for measuring plate current in any number of low-power stages; that is, from four to eleven stages, with a two-gang switch and a single meter. Regular two-gang rotary switches are available having from three to eleven points, with the rotor on each section or gang insulated from the shaft.

In this case the meter can be one with a low-reading scale, such as 0–1, 0–5 or 0–10 milliamperes. The plate voltage is permanently connected to each stage in series with a small shunt resistor, and the meter is simply switched across the shunt in the various circuits. The value of the shunt resistor will, of course, depend upon the

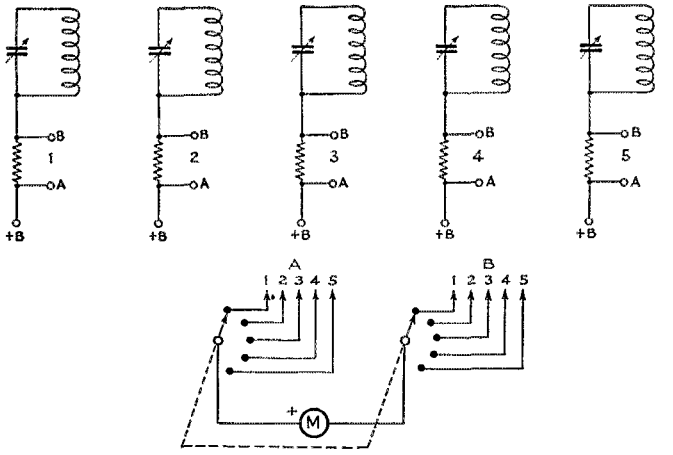


Fig. 3 — The shunt-resistance method of meter switching. A double-pole multi-contact switch is required (a single pole switch can be used if all stages to be metered are operating at the same plate voltage from the same "B" supply, in which case only the set of contacts marked B need be used).

value of the basic movement of the meter and can vary with different circuits in order to provide full-scale readings of 100, 250 or 500 ma., as required. Ordinarily this method would not be used in stages requiring more than 250 ma., and the majority of the circuit requirements in low power stages would not be over 100 ma. Since the gang switches are insulated with fibre or bakelite, it is not recommended that switching of this type be used in circuits where the voltage encountered is in excess of 600 to 750 volts. For circuits in which the operating voltage runs from 750 to 1000 volts one of the ceramic-insulated gang switches designed for amateur transmitting purposes should be used.

When a meter having a basic movement of low current rating, such as 0–1, 0–5, or 0–10 ma., is not available, this same method can be used with a 0–75 or 0–100 ma. meter. In this case the meter shunt which is permanently connected in the circuit can be figured so that when the meter is connected across the shunt, the total current capacity is from 25 per cent to 50 per cent higher than the full scale rating of the meter used. In other words, if a 0–100 ma. meter is used, the addition of the shunt in the circuit will increase the total reading of the meter to 125 or 150 mils. If the range of the instrument is in itself sufficient to handle the maximum current to be drawn by any of the stages to be measured, the shunt resistance may be made high enough so that the readings will represent very nearly the true current in the circuit, so that no correction factor need be applied. For this purpose, the shunt resistance should be such that the reading is of the order of less than 5 per cent below the true value. Since the drop across an ordinary d.c. meter is only a fraction of a volt, the voltage drop through a shunt which fulfills this requirement will be negligible in practically all transmitting circuits. Inasmuch as the elimination of two or three meters represents a worth-while saving, it would, of course, be better to put some of this saving into a low-reading meter rather than to try to use a larger scale meter just because the meter happened to be on hand.

Grid and Plate

In some transmitters the grid and plate circuits of a single stage are checked by one meter by

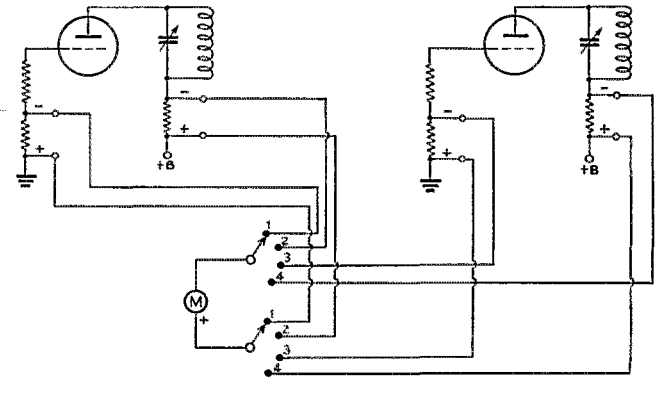


Fig. 4 — By a switching arrangement similar to that of Fig. 3, both grid and plate circuits can be checked with the same milliammeter.

using a plug and jack arrangement to shift the meter from one circuit to the other. While we have no bones to pick with the fellows who use this arrangement, we believe that they're overlooking a bet in not using a multi-contact gang switch to make that meter check both grid and plate circuits of two or three stages instead of using a separate meter for each stage. Another point that is rapidly gaining attention among the safety-conscious owners of equipment is that the plug and jack arrangement usually puts a "hot spot" on the front of the panel by exposing the plate voltage and making accidental contact easy rather than making it difficult as would be the case if a meter switch were used.

Fig. 4 indicates the ease with which a single meter can be used to check both grid and plate circuits of two or three stages, again by using the permanently-installed shunt resistors and then switching the meter in parallel with these shunts. The switch is of the two-gang type with rotor contacts insulated from the shaft. Switches of this type are available with up to eleven contacts to each gang, providing all the flexibility the average transmitter might require. By connecting the meter leads properly to the switch, the meter could be automatically reversed in polarity if necessary. In fact, with this arrangement it would be possible to check a combination of grid circuits, cathode circuits, and plate circuits, thus making a single meter do all the work and providing the maximum of flexibility in observing circuit conditions. In this case we would also suggest one of the ceramic-insulated switches if circuits are carrying from 600 to 1000 volts. Shunts for the meter, assuming a basic movement of 1 mil, could be in the order of 25 to 50 ohms for grid circuits and from 50 to 200 ohms for plate circuits. Exact values of shunts should, of course, be figured using the equation:

$$R_s = \frac{R_m}{\frac{I_t}{I_m} - 1}$$

and based on the maximum current that would be required in each individual circuit. In the formula, for the benefit of those who haven't used it before, R_s is the value of the shunt, R_m the internal resistance of the meter, I_t the total current or the full-scale current reading desired, and I_m the full-scale reading of the meter. If, as is usually the case, the resultant value of R_s, using the above equation, looks a bit dubious, the result can be checked back by using:

$$I_t = I_m \frac{R_m + R_s}{R_s}$$

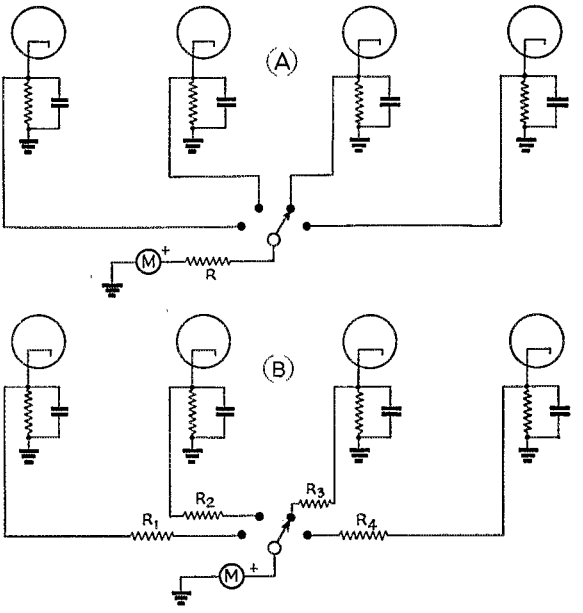


Fig. 5 — A 0-1 milliammeter can be used as a voltmeter across a cathode resistor to indicate total cathode current. The circuit at *A* is suitable for measurements where the cathode-resistor voltage drops are of the same order in all stages. *B* provides for different current ranges where the cathode drops may differ considerably.

wherein the same values are used in substitution for the symbols of the equation as were used originally for figuring the shunt value.

Voltmeter Methods

There is still one more method that can be used in multi-stage exciter units, using our old friend the 0–1 ma. meter. By inserting a suitable multiplier resistor in series with the meter, we can use a single-gang tap switch and measure the cathode voltage developed across the cathode bias resistors as an accurate condition of stage performance.

Fig. 5A tells the story in simplified form. The meter which is, in this case, converted to a low-range voltmeter, is simply switched in parallel with the cathode bias resistor and measures the voltage difference between resonant and non-resonant (or load and no-load) conditions. Of course, this method does not give an accurate reading of plate current but, like the cathode current method of Fig. 2B, will indicate the total of grid, screen and plate current. With plate voltage removed from the stage to be checked, the resultant cathode voltage will be the total of screen- and grid-current drops, of which the grid current will represent only a small portion of the total. Here again, the load-to-no-load condition of the plate circuit will result in rather large changes of screen current. However, it is quite

(Continued on page 98)

A Design for Living—With Television

A High-Voltage Power Supply with Complete Safety Features

BY PHILIP ROSENBLATT,* W2AKF

IN CASTING about for a suitable design for a television receiver power supply, it was discovered that the experimenter could escape oblivion when working around many commercial-, ham- and experimenter-built supplies only by being adroitly alert. Unless an "unconfined high voltage" law is passed before television's mass debut, Johnny Public and Willie Ham are likely to view angelic images when the back cover comes off the receiver.

The limitations of the present supplies were found to be:

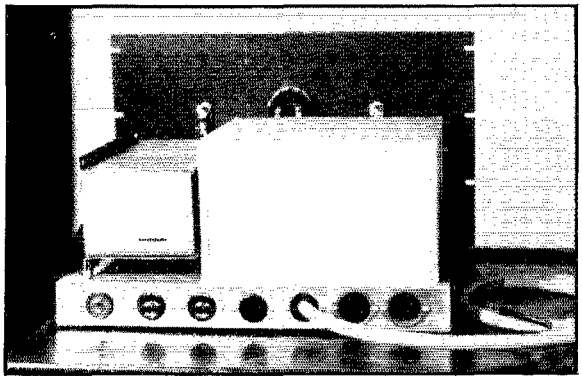
1. Danger of death by either direct contact with the high voltage (exposed high-voltage terminals placed tantalizingly convenient for one to kiss himself into heaven) or by injury contact, caused by the reflex action of the body after feeling the effects of corona from a high-voltage lead. The thought of thousands of volts anxious for liberation will cause almost anyone to spring up like a jack-in-the-box, with a very good chance of his coming in contact with a high-voltage terminal on the way. Some defend the breadboard arrangements of the tuned low-*C* supplies by comparing them to an automobile ignition system but, granting that the h.v. transformer possesses the worst regulation and that the filter condensers discharge rapidly because of their low capacity, the fact remains that high-voltage d.c. is decidedly lethal while the transient-type ignition voltage is not.

2. Severe ripple content above 1 ma. drain. Because most systems use half-wave rectification (which is four times as hard to filter as full-wave, at the same supply frequency), inductance or high resistance is required to complete a tuned filter with the low-capacity condensers used.

3. Poor regulation. Poor regulation results in voltage changes on the Kinescope elements when undergoing varying light excursions and defocusing caused by control-grid (screen intensity) adjustments, necessitating readjustments of the first anode voltage.

4. Fixed voltages. Impossible to adjust for different 'scopes if the filament and plate windings are wound on a single core.

5. Combined with other receiver components on a single chassis. This increases the danger of making adjustments on the less deadly parts.



The television power supply is built on a metal chassis for rack-and-panel mounting. An aluminum box completely houses all of the high-voltage gear, and it is impossible to remove the box without opening one or more of the interlocks. The white cord is the high-voltage cable; the plugs and sockets at the rear of the chassis are for 110-volt circuits.

The features a high-voltage supply should possess to meet present trends and future developments are:

1. Absolute safety under the most extreme absent-mindedness of the operator.

2. Self-contained, and *not* combined with other receiver parts.

3. Good regulation. By increasing the bleeder drain to about 3 ma., voltage flickers and their

Not everyone is going to build a television receiver, but everyone is interested in keeping high voltage where it belongs — away from the operator. That's why you'll find a number of good ideas in this story even if you aren't interested in television. If you *are* interested in television, the story is a "must."

* P.O. Box 905, Hoboken, N. J.

resultant varying screen light changes and control-grid and focusing adjustment interaction are practically eliminated.

4. Variable output. To accommodate tubes of all sizes, the voltage should be variable between 100 and 6000 volts.

5. Negligible ripple up to the rectifier tube current limit. For a full-wave system the d.c. output is twice the limit of a single tube, and for the voltage-doubling system the rectified current cannot exceed that of a single tube. Either method safely supplies 5 ma., and the ripple at this current and 6000 volts is 0.2%.

6. Simple voltage-indicating meter for the entire output range.

These requirements are met by the power supply to be described.

Circuit Details

Reference to Fig. 1 shows that the wiring diagram of the supply is not unusual, except possibly in the inclusion of a large number of interlock switches. These switches are placed at various points throughout the power supply and Kinescope chassis, making it impossible to get at a high-voltage lead without disconnecting the primary of the h.v. transformer. Provision is included for using a G-R 170-watt Variac (Type 200-B) to control the output voltage of the supply. This permits a fine control of the voltage, and is also used to bring the voltage up from zero each time the set is turned on, a good practice which tends to lengthen the life of the rectifier tubes. The Variac is set at zero, Sw_2 is thrown, and the Variac is adjusted until the output voltage is up to the desired value as indicated by the meter M. If the voltage isn't brought up in this manner, the filter condensers appear as practically a direct short when the full voltage is first applied, and the rectifier tubes take quite a licking until the condensers are charged.

The meter M is used as a voltmeter, since the output voltage can readily be determined from the value of current indicated and the value of resistance in series. The effective resistance in series with the milliammeter consists of the series combination of R_1 and R_2 in parallel with the voltage divider used at the Kinescope. The current drawn by the Kinescope is quite small and can be neglected. The resistor R_3 across the milliammeter has no practical effect on the accuracy of the meter, and serves to keep the negative terminal of the supply grounded in the event that the meter opens. There is not much danger of the meter opening, however, since the regulation of the rectifier tubes and the resistance of the transformer secondary limits the current to about 30 ma.

Both sides of the a.c. line are broken by all manual and interlocking switches to insure absolute safety should one of the line leads become grounded accidentally.

Construction

A large partitioned can on the 12- by 17- by 2-inch chassis houses all of the high-voltage accessories, and everything beneath the chassis is at

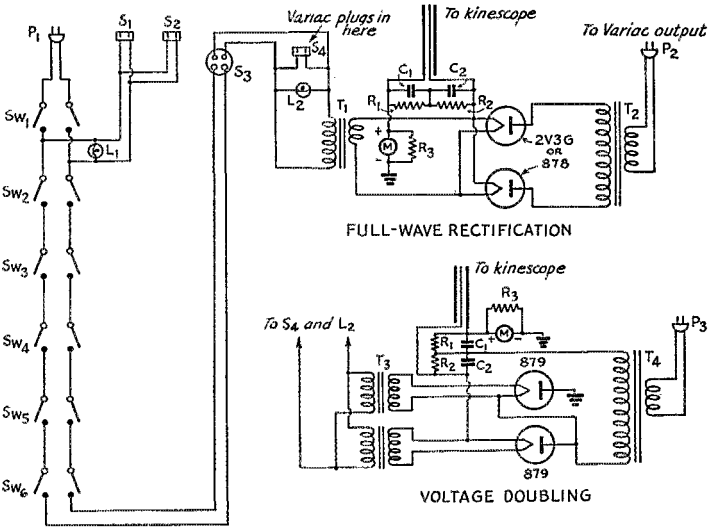
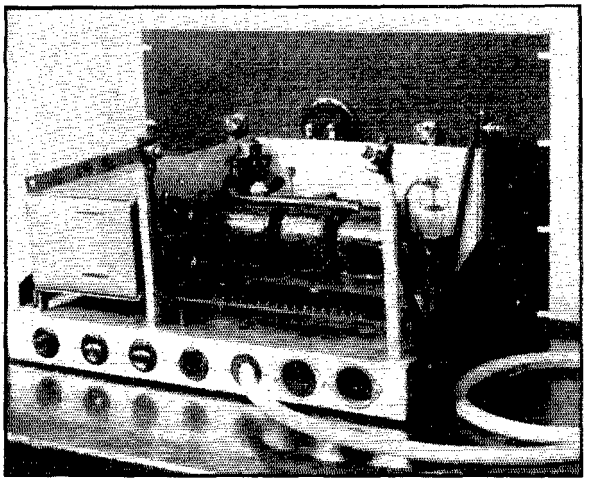


Fig. 1 — Wiring diagram of the h.v. power supply, showing both full-wave and voltage-doubling connections.

C_1, C_2 — 4-μfd., 3000-volt (G.E. 23F44).
P_1, P_2 — Line plug (Amphenol 61-M1).
S_1, S_2, S_4 — Socket (Amphenol 61-F1).
S_3 — 4-prong socket for interlocks on Kinescope chassis (Amphenol RS4-Am).
Sw_1 — D.p.d.t. 15-ampere, 120-volt main switch (Cutler-Hammer).
Sw_2 — D.p.d.t. high-voltage panel-operated primary circuit switch (Cutler-Hammer).
Sw_3, Sw_4, Sw_5, Sw_6 — D.p.d.t. momentary-on button-type depressor switch (H & H).
R_1, R_2 — 6 megohms each, made of eight 0.75-megohm 1-watt resistors (IRC).
R_3 — 150 ohms, 2-watt (IRC BT-2).
T_1 — 2.5-volt, 10-ampere filament transformer, 10,000-volt insulation (UTC S-57).
T_2 — Neon-sign transformer, 4500 volts each side of grounded center tap. Altered (see text and Fig. 3).
T_3 — Two 2.5-volt, 10-ampere filament windings, 10,000-volt insulation (UTC S-71).
T_4 — Neon transformer, 3000 volts total. If winding is grounded to frame at any point, frame must be mounted above chassis on insulators. Altered (see text and Fig. 3).
M — 0–10 ma. milliammeter.
L_1, L_2 — 120-volt, 6-watt candelabra-based pilot lamps (G.E.).

Sockets of all rectifier tubes must be raised above chassis and thoroughly insulated.



A view of the supply with the metal box partially removed shows the interlock switches at the four corners of the box. Note that the filter-condenser terminals project inside the protective box.

line-voltage potential only. The can measures 6 by 8 by 10 inches and is made by sliding the pieces of aluminum into four 6-inch high aluminum corner posts bolted to the chassis. Brass angles might also be used to hold the sides together, if the aluminum corner posts are not available. The cover is made of 18-gauge aluminum which can be fastened to the box by bolts. Push-button type switches are mounted at each of the top four corners of the box so that the minute the cover plate is loosened at least one of the switches opens, cutting the primary voltage from the transformer. By the time the cover plate has been removed, the condensers are completely discharged and there is no chance of shock. The high-voltage filter condensers are mounted outside the can, with their terminals extending inside the can.

The high-voltage cable is homemade and can be handled without corona discharges and fear, since the outer copper braid is at ground potential through the milliammeter. Construction of the cable is shown in Fig. 3 — the necessary length of 7-mm. high-tension ignition cable is slipped into a length of copper braid cut 3 inches shorter than the wire. A length of $\frac{3}{8}$-inch inside diameter rubber tubing is slipped over this assembly to keep the meter from shorting to ground and to improve the cable's appearance. No removable plugs for the cable are provided, because if either end of the cable were withdrawn accidentally the safety features would be partially nullified. Both ends of the cable are firmly attached to terminals by their respective posts with sufficient insulation all around.

The safety features of these supplies derive around the constructional details of the high-voltage cabinet, the bleeder equalizing the load across the two condensers and the momentary-contact power line break switches. A condenser-discharging mechanism was not included because of its bulk and expense, because it was felt that the operator cannot possibly get into the box while the current is on or the condensers charged, but one might be added as a refinement. However, when one tries to get into the box, even under the extreme case of no bleeder load attached to the h.v. lead and the socket to the 'scope chassis (S_3) deliberately shorted, the following occurs: Upon releasing any one of the first top cover screws the momentary-on switch under that corner will spring open and disconnect the a.c. line to the high-voltage transformer. The condensers C_1 and C_2 immediately start discharging through resistors R_1 and R_2 (quite rapidly if the bleeder load is connected), and at least 10 seconds have elapsed after their complete discharge before the other three screws can be taken out and the cover removed. By then, everything is dead — except the operator! Trying to operate the supply by depressing all safety switches simultaneously by hand is rather futile. It is important that the cover be of thin material in order to flex suffi-

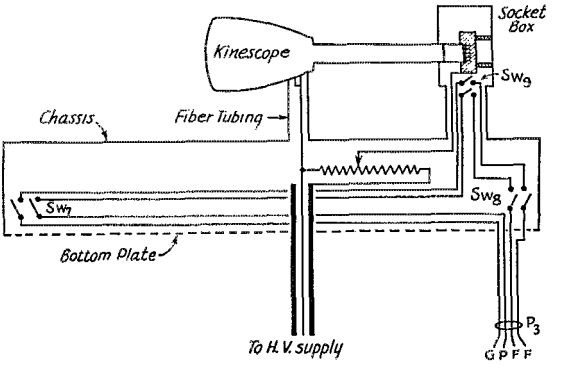


Fig. 2 — Sketch of Kinescope mounting construction. The 'scope socket is housed in a 4-inch by 4-inch by 2-inch steel box (Par-Metal MC-442), and further protection from high voltage is obtained from three interlocks mounted at various points on the chassis (Sw7, Sw8, Sw9).

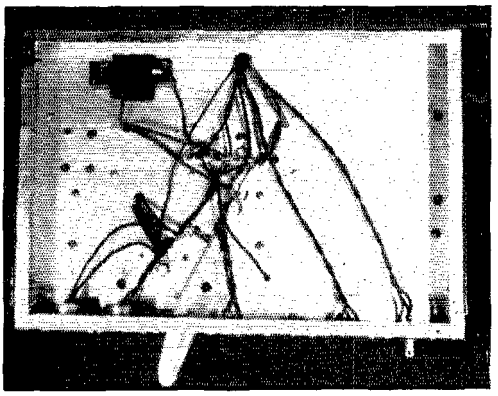
P3 — 4-prong plug for 'scope chassis interlock (Amphenol PM4).

Sw7, Sw8, Sw9 — D.p.d.t. momentary-on button-type depressor switch (H & H).

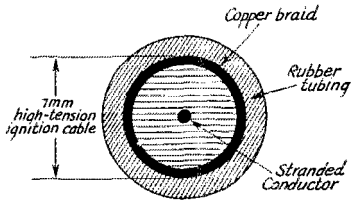
ciently upon the removal of only one screw for the depressor switch to spring up and open. Under no circumstances should the cover be hinged at one end. The time-consuming removal of the four corner screws provides the necessary decay period for the condensers.

The other end of the high-tension lead is protected by line-breaking switches installed diagonally across the bottom of the Kinescope chassis and at the Kinescope tube socket enclosure (Fig. 2). Thus when the bottom plate of the Kinescope chassis or the back cover of the socket enclosure is removed the supply will turn off and protect the operator.

No strict recommendations can be made for protecting oneself from the only other dangerous, although infrequently disturbed, places. These are the second anode nub and the focusing anode connection on the base of the 'scope. On the RCA 1803-P4, 1804-P4, 1800, 1801 and physically-similar tubes of other manufacturers, excellent protection can be obtained by shaping a piece of 1½-inch diameter bakelite or hard rubber tubing to conform with the tube surface at the second-anode nub, with the other end cut flush to lie in the center of the chassis hole through which the h.v. lead is brought to the nub. The focusing anode supply is protected by an interlock switch in the socket enclosure (see Fig. 2). Further to protect the operator, the chassis supporting the 'scope has a steel cabinet fitted over it.



The only wires underneath the chassis are ones carrying the 110-volt current, with the exception of the well-insulated high-voltage cable.



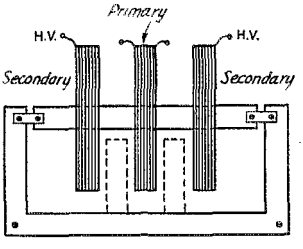


Fig. 3 — A cross-section of the high-voltage cable (at left) shows how it is made by slipping copper braid over a length of 7-mm. ignition cable and then slipping rubber tubing over the copper braid.

A neon-sign transformer is modified for use in the power supply by sawing out the magnetic shunts (shown by dotted lines) as shown at the right. If the secondary is grounded to the frame, the frame must be insulated from the chassis in the voltage-doubling application.

The neon-sign transformer for the full-wave rectifier (T_2) is rated at 9000 volts overall, with a short-circuit current of 18 ma. The transformer used in the voltage-doubling circuit (T_4) is rated at 3000 volts, 18 ma. The secondary on this latter transformer cannot be grounded anywhere but, if the secondary is grounded (usually from center-tap to frame), the entire transformer can be mounted on 1-inch stand-off insulators. The primary is adequately insulated for this service. The transformers can be bought very cheaply from owners of old neon signs and the only modification necessary is to remove the magnetic shunts with a hacksaw (see Fig. 3). Not much can be done with the transformers that are enclosed in compound, but they can be used if the primary voltage is increased about 15%.

A comparison of the full-wave and voltage-doubling systems is given in Table I. Both supplies provide the easily-filtered 120-cycle output but, for all practical purposes, the voltage-doubling system is preferable. Series condensers were used in the output of the full-wave system because a 6000-volt 2-μfd. condenser costs 2½ times as much as the two 3000-volt 4-μfd. units.

During months of trouble-free operation, we have never even felt a corona discharge from the equipment. It's quite a relief to be able to work unafraid around such deadly voltages.

TABLE I

Both methods based on 6000 volts, at 5 ma. output with 0.2% ripple

Advantages	*Disadvantages*
Full Wave	
Single filament winding. Somewhat better regulation above 5-ma. drains. Twice the rectified current available that each single tube alone provides.	High inverse peak voltages. Total secondary voltage impressed across each tube on non-conduction cycles is about 13,000 volts.
Voltage Doubler	
High voltage secondary has to supply only slightly more than one-half the peak a.c. voltage for 2 times the rectified d.c. output.	Two separate filament windings required, insulated from each other and ground for 10,000 volts.
Low inverse-peak voltage of about 4500 volts across tubes on non-conduction cycles.	Rectified current cannot exceed the ratings of a single tube.

Blonde QRM

A Story

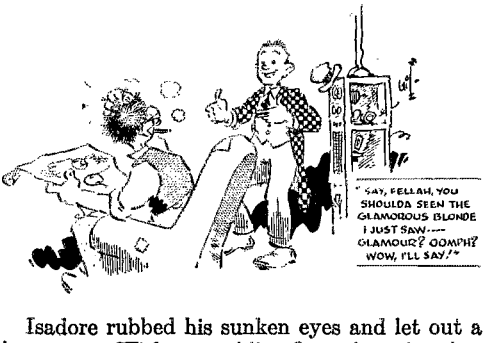
BY HARRY OTIS BRUNN, JR.,* W8MXT

IT WAS one of those cold nights last December when I took a stroll over to the Kerfew Apartments to see my friend Isadore Shapiro, locally known as "the greatest splash on 160." Climbing the squeaky stairway, I arrived at a door with 2B on it and knocked. Not hearing a reply, I walked in and found Isadore in his shack, tearing his hair over a messy diagram of a power supply.

"Hi, Izzy," I said, hanging my hat on his rack-and-panel job. "Say, fellah, you shoulda seen the glamorous blonde I just saw coming up the apartment steps. Glamour? Ooomph? Wow, I'll say!"

Isadore didn't even say hello to me; he just grabbed out a few more fistfuls of hair and mumbled something under his breath about filter condensers.

"Now what the heck's causing all your mental QRM, old timer?" I asked. "You look as though you lost your last r.f. choke or something. I should think you'd be anxious to hear about a blonde with oomph and stuff."



Isadore rubbed his sunken eyes and let out a long moan. With a trembling finger he pointed to the far corner of the room. There was something there I hadn't noticed before. It looked like a final amplifier with a couple of gigantic tubes.

"Well, fer the luvva Pete!" I exclaimed. "Where in the name of Old Betsy did you ever get those things?"

"Won 'em in a c.w. contest," he groaned. "They're SQH-750's. You can run a kw. to a pair of 'em." Then he pulled a junky looking power pack out from under the operating table. Resting his foot on it, he said, "The only power supply I got in the whole joint — exactly 412 volts! Oh, how I wish I wuz dead!"

Poor Isadore! I could see how he felt. Here he got a beautiful pair of r.f. bottles for nothing, and all he had to push them with was 412 volts. And Izzy was a clerk in a "5 and 10"; he really didn't have much excess lucre to spend on ham junk.

"Tell you wot we'll do," I said. "We'll get all the transformers we can lay our hands on and put 'em in series to get about 5000 volts. Then we'll use that old dilapidated pair of 866's I got in my junk box, and your pair, and we'll have a bridge rectifier. Why, we'll have your pair of peach jars percolatin' in no time!"

He looked a little relieved, but not much. "Yeh," he said, "but how about the filter?"

Then I showed him how he could buy a whole pile of paper electrolytics for about three bucks and put them in series, and he was happy.

"Heaven only knows what it'll sound like," he said, "but at least it'll be a kw. You don't know how I've suffered! Imagine having a couple of 500-watt fruit bottles on the pantry shelf and nothing to stuff 'em with. Tsk!"

I laid my hand on his shoulder and said, "Take it easy, old man. I'm not saying you'll have a p.d.c. carrier, but you'll have a kw. and the R.I. doesn't sit up until 3 A.M. anyway!"

Isadore glanced up on the wall where he had a couple of green tickets all dolled up in a gilded picture frame.

"One more of those and I can complete my collection," he said. "Then I'm going after the pink ones they give you for operating out of the band."

So then we threw his twelve watts on the air and chewed the fat with a couple of local boys until about half past one. After that, I went home to bed and dreamed about the glamorous blonde I met on the steps of the Kerfew Apartments.

* * * * *

About a week later Isadore had his kilowatt on the air down on twenty meters in the c.w. band. But then the lady in apartment 3A began to complain about her kitchen lights blinking on and off, and he decided to put the pile of junk on 160 and grid-modulate it. He used his twenty-meter Zepp as a Marconi, and tapped onto the cold-water pipe in his bathroom for a ground. This seemed to work pretty well until one Sunday afternoon when Grampa Schmaltz from apartment 5A came stamping into Isadore's shack with his bathrobe on, dripping wet. It seems Grampa was taking a bath, and when he reached to turn off the cold water an eighteen-inch spark bounced off his index finger and hit him smack in the nose.

* Eggertsville, N. Y.

This trouble was remedied by buying Grampa Schmaltz a good five-cent cigar and using a genuine ground wire instead of the water pipe. But Isadore's troubles were by no means over. Grampa still claimed he could hear him talking every time he went to bed at night. The trouble was found to be resonating bedsprings. That is, the aged gentleman's bedsprings accidentally resonated on Izzy's frequency. This was easily overcome by inserting a wavetrap between his intermediate bedpost and ground; after this, for a while everything looked as though it were lovely.

One Saturday evening, a week or two later, Isadore gave me a ring on the 'phone and invited me to drop over and watch him work Peru on 160. I said I'd be over in about fifteen minutes. So I finished washing the dishes and took a run over to his apartment.

When I arrived, Izzy was busy inspecting his twisted-wire connections to make sure none of them was soldered.

"Well, how is AC KW Shapiro tonight?" I greeted, tossing myself into his easy chair.

"All set to blow the DX fuse," said he, walking over to the rig. First he made sure the filaments were lighted, and then he threw on the plate voltage.

Izzy always used the same method of throwing on the high voltage. First, he'd stick his fingers in his ears and close his eyes, and then he'd kick the knife switch with his right foot. Once when I was there he missed and kicked an 866 clear out of its socket.

"Okay, Izzy," I said. "You can open your eyes now. She didn't blow up."

He plugged in a mike and started calling CQ. Filter chokes boiled and transformers sizzled. Wax from the paper electrolytics melted and dripped down into the cracks in the floor. Rectifiers flashed intermittently as tank condensers sputtered and arced, and audio transformers talked back angrily — but the rig stayed on the air. Izzy finished his CQ and turned the thing off, just as the final milliammeter reached 920 mils. Then he tuned the band for a call on his Super Blooper 16.

"I probably won't get much with a short call like that," commented Izzy, twisting the dial.

But Izzy got more results from that call than he had expected, for less than two minutes later there was a terrific pounding of fists on his apartment door. It was really only two fists, but it sounded like a dozen.

"G-g-gosh!" stammered Izzy, "somebody sure sounds mad!"

The middle panel of the door began to splinter and a hinge popped off, as the pounding became more and more fervent.

"Better let him in before he breaks the door down," I suggested.

Izzy trembled so hard his pivot tooth fell out and a couple of screws came out of his wrist watch. Shakily he walked to the door and opened it. To his amazement, standing there in the doorway was a glamorous blonde with plenty of oomph, and she was waving her fists in the air in a very dangerous manner. To *my* amazement, it was the very same glamorous blonde I had met on the apartment steps the week before!

"Who do you think you are?" she shouted, shaking her fist in front of Izzy's face. "How can a person listen to the sweet, sophisticated strains of Artie Goodman with you fillin' the air with a lot of gibberish!"

Izzy started to open his mouth, but the lady nearly stuck her fist in it. "The nerve of you bustin' up my radio!" she thundered.

Then she reached out and grabbed him by the back of the neck and dragged him out into the hallway. Not being in the mood to watch any bloody murders or become involved myself, I closed the door and went back to the shack. I put Izzy's rig on the air and worked a couple of the local boys. When I thought it was about time for the battle to be finished, I went out and looked in the hallway, expecting to find Izzy's limp body draped over the end of the banister. To my utter astonishment, there was no sign of him!

I stood there and shook my head a few times. Then I went back to his shack and listened to a few guys chew the fat on Izzy's Super Blooper 16. This was about twelve o'clock.

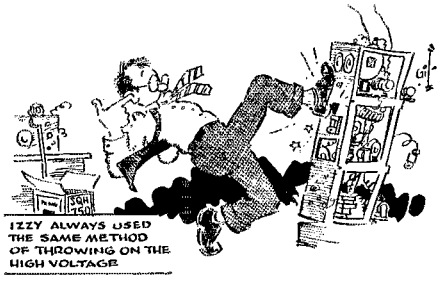
Just as I was getting ready to go home the 'phone rang and I answered it. It was Izzy.

"Say, listen," he said, "I'm 'phoning from the City Hall. I got that woman's b.c.l. trouble all cleared up!"

"Great!" I said. "How did you do it?"

"I married her!" he said.

Well, Izzy and Lizzy do make a swell pair.



Strays

In 1933 Bob Ware received the call letters W4BZD. In 1936 his brother, Lane, received the call W4DZB.

—...—

To owners of the ninth edition of "The Radio Amateur's License Manual": The answer to Question 101 on page 17 is incomplete. To the bands of frequencies there listed, add 56,000 to 60,000 kc.

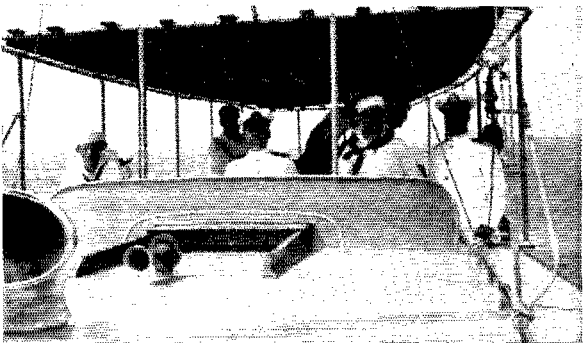
NAVAL COMMUNICATION RESERVE NOTES

THE DISTRICT OF COLUMBIA NCR

BY F. G. CALVERT, RM2C, U.S.N.R.

THE United States Naval Communication Reserve of the District of Columbia was originally organized in 1930. It has grown steadily, until at the present time its personnel consists of 26 officers and 84 enlisted men. Its high efficiency is due to the efforts of Lieut. J. H. Nicholson, previously in command, and Lieut. M. Weinstock, the present commander. Under the leadership of Lieutenant Nicholson, the organization attained first place in 1937 in national competition with all other N.C.R. districts, and we were duly awarded the silver trophy for that year, an honor of which we were all very proud.

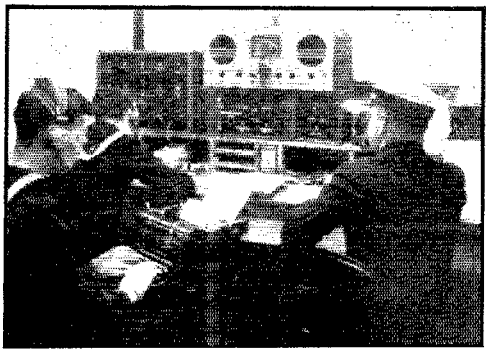
The District N.C.R. has an armory located in the Washington Navy Yard, which is fitted out, as near as possible, in a manner similar to a man-of-war. Each Thursday evening its members hold their weekly drills. Two of these evenings each month are taken up with the national competition drill conducted by Navy Radio NAA as the master control station. Operation of NAA during the national competition drills has been handled exclusively by officers of the Washington, D. C., N.C.R. Three watches are kept at each drill and various members of the organization stand the first watch, thus giving each qualified member a chance to operate the key. The received signals also can be relayed through another channel to eight receiving positions located in a separate room, enabling the newer members a chance to copy the drill and familiarize themselves with the actual naval procedure. The N.C.R. station at Washington, D. C., operates under the call letters of NED and the alternate control station, NEM, is located in Virginia at the home of Lieutenant Nicholson. Station NED has an amateur call of N3BVG and also has an arrangement so that a man operating the key at the armory can actually be the control station operating through NAA. The main transmitter at NED consists of a TAX transmitter with an input of 400 watts. A separate transmitter is set up for the Class B-C-D drills which are conducted on alternate Thursday evenings. Each station has a special naval call assigned to it for these drills and strictly naval procedure is used, as operation is on the navy frequency of 2576 Kcs.



In addition to the various operating duties carried on by the N.C.R., there are classes of instruction in code for the beginners, navigation, naval procedure, signalling by means of lights and semaphore, cryptanalysis, and other activities which are of interest to all.

Each summer, several members are permitted to take an annual cruise with pay, for fourteen days. These cruises are taken with the divisions of the Organized Reserve and give the N.C.R. a chance to get a first-hand knowledge of just what is expected of a radioman when aboard one of Uncle Sam's men-of-war. Some of our members have cruised aboard destroyers such as the *Badger*, *Hopkins*, *Leary* and *Reuben James*. Last year the cruise was aboard the battleship *Texas* to Guantanamo Bay, Cuba. Three of our members were aboard the new aircraft carrier *Enterprise* on its shake-down cruise to Rio de Janiero, a trip which took two months. Two members were also aboard the new destroyer *Jewett*, on its shake-down cruise to Europe, which took six weeks. Several of our members have also seen active duty at the Naval Air Station at Anacostia, D. C. In addition to the annual cruises, a small 50-foot boat which accommodates 3 officers and 12 enlisted men has been put at the disposal of the Naval Reserve. Thus members of the Communications branch, in uniform, are permitted to use the boat for themselves over the week-ends for about three times during the summer. Cruises are generally made about 140 miles down the Potomac River. Activities are carried on during these cruises in accordance with Navy regulations and a lot of information is gained which is very helpful. A larger boat, the *YP47*, is being assigned to the Reserve for these week-end cruises and is expected to be in service very soon. With the use of this new boat, cruises will not be limited to the summer months. This boat will also be equipped with radio. There is quite a lot of pleasure derived from these cruises and in several instances rescues of smaller craft in trouble have been made along the river.

At various times during the year, Navy ships tie up at the Washington Navy Yard for the purpose of drilling the Reserves. During these visits, weekly drills are held aboard the ship



instead of in the armory. We are taken on an inspection tour of the ship from stem to stern, conducted by a competent member of the ship's company. Several times during the year, instructive trips are made to such places as the Naval Observatory, Navy Radio NAA, the Naval Research Laboratories, etc.

On three distinct occasions, the N.C.R. of this district has played an important rôle in the handling of emergency communications during the hurricanes and storms along the Atlantic Coast.

All in all, we believe that we have a highly efficient Communication Reserve here in Washington and we feel mighty proud when we say that we are a part of it. Men living in Washington, D. C., or its vicinity who are interested in joining our organization are invited to come down to the Naval Reserve Armory in the Washington Navy Yard any Thursday evening and see just what fine opportunities we have to offer.

12th A.R.R.L. DX Competition—Warning

Rule 11 (Re Disqualifications) Extended and Explained—No Contacts with Countries on European Continent Permitted

THIS notice is addressed to all United States amateurs interested in participation in the Competition for March 15th–17th and 22nd–24th, which was announced in detail on page 38 of February 1940 *QST*. The paramount consideration of our neutrality responsibilities leads the League to rule that no contacts with stations in the European theater of belligerent activities, or with belligerents, *or colonies of the belligerents* or closed-down neutrals, may be permitted.

Besides reporting on off-frequency stations (all nations), and improper notes, Official Observers this year will report for disqualification, any U.S.A. stations:

(1) that call or contact *any European station;*

(2) that call or contact stations in Australia, Canada, India, New Zealand, the Union of South Africa, any British or French colonies or any countries that may be added to the U. S. proclamation of neutrality by Presidential action on or before the contest;

(3) that call or contact stations in any countries in which amateurs have been temporarily closed down[1] by government edict where amateur licenses were formerly issued in the normal manner.

This self-imposed amateur black-out on Europeans,[2] and others,[2] is a precaution necessary in view of the war. Study of the situation with respect to even the European neutrals indicates that so few Europeans could be counted under the rules published last month, that in the general interest of good conduct, to insure complete understanding of this matter by all participants, it was advisable to leave Europe, including European U.S.S.R., completely out of the contest this year. Not only will no credit be allowed for any European contacts or others per (1), (2), (3) above, but calls intercepted and reported as above indicated, will be used to disqualify contestants, if such are made between March 15th and March 24th. We advise amateurs, not only in contest time, but at all times until war matters are again remote from public attention, to adhere strictly to the A.R.R.L. Neutrality Code, and the above recommendations and rules, in the interest of the unrestricted continuance of our amateur radio. Next year, we hope it will be different, and that fewer restrictions will be necessary.

—*F. E. H.*

[1] Practically every European neutral is such a country, hence blanket prohibition (1).

[2] Participants will be well advised to identify prefixes carefully before doing any calling. See the Country List, pages 441–442, The Radio Amateur's Handbook, 1940, refer to your A.R.R.L. Amateur Radio Map of the World, or consult the tabulations, pages 84–90, Oct. 1939 *QST* which appeared with the report on the 11th A.R.R.L. DX Competition.

★ QUOTE AND UNQUOTE ★

NEUTRALIZATION

THE true criterion of neutralization is not simply absence of self-oscillation in the stage, but complete freedom from reaction of the plate circuit on the grid circuit under operating conditions. With this definition of neutralization as a basis, W. H. Doherty of the Bell Telephone Laboratories in the December issue of *Pick-Ups* [1] examines some of our familiar neutralizing circuits and brings to the surface interesting facts about their performance. The following is a quotation from the part of Mr. Doherty's article dealing with the operation of several neutralizing arrangements in general amateur use:

The author believes that neutralizing circuits have been somewhat neglected in technical radio literature and that many operators and experimenters would feel on much firmer ground with a simple explanation of the theory of these circuits. We are faced with the fact that a current is bound to be fed back from output to input through the interelectrode capacity, and nothing but the interposition of a screen grid will prevent it; so that with a triode our only means of avoiding a reaction on the input is to feed back in some manner an equal and opposite current so that the net current fed back will be zero and the signal on the grid will be entirely unaffected by what goes on in the plate circuit.

One of the earliest experimenters in the power amplifier field was H. W. Nichols of Bell Telephone Laboratories. His solution to this problem was extremely simple and, although subsequently neglected for many years, has turned out to be the most practical method of neutralizing modern high-power broadcast transmitters, particularly the high-efficiency type developed by Bell Telephone Laboratories. It consists of simply connecting between the r.f. plate and grid leads an inductance, as shown in Fig. 1, whose reactance is equal in magnitude to that of C_{pg} at the operating frequency. The current in this coil lags the voltage across it by 90 degrees, while the current in C_{pg} leads the voltage by 90 degrees, so that the total current fed back to the grid is zero. This method, called "coil neutralization," works so well that in the final stage of the Western Electric 407A 50-kilowatt transmitter the coils are simply wound with a number of turns calculated for the frequency and no taps or adjustments of any kind are necessary. In cases where a variation under power is desired a variable condenser (Fig. 2) of small capacity shunting the coil may be used. This condenser in effect varies the plate-grid capacity to make its reactance equal to that of the coil.

When grid-bias modulation is employed a condenser must be inserted in series with the neutralizing coil, as indicated in Fig. 3. The capacity has to

[1] W. H. Doherty, "Neutralization of Radio-Frequency Power Amplifiers," *Pick-Ups* (Western Electric Company), December, 1939.

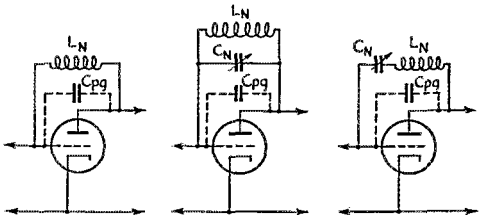


FIG. 1 FIG. 2 FIG. 3

be small to avoid phase shift in the audio voltage across the grid, an important consideration in modern transmitters because of its effect on the feedback. By making this condenser variable the neutralization may be adjusted under power.

The distinguishing feature of the above circuits is that the neutralizing current is fed back from the same point in the plate circuit as the interelectrode current, i.e., from the anode, so that the impedance required is always inductive. The next general type of neutralizing current is fed back from a point having a potential *opposite* to that of the anode, so that the impedance required will be a condenser. The problem in this case is to establish such a point of opposite potential. It is also convenient if this second potential is roughly equal in amplitude to the first, so that a neutralizing capacity approximately equal to the interelectrode capacity can be used. Given a source of potential E_p we can always obtain an equal potential of opposite phase by using a combination of two reactances, $2X$ and $-X$, as shown in Fig. 4. The current through the circuit is E_p/jX, where j indicates a 90-degree phase shift, and so the drop across the condenser is $-jXE_p/jX$ or $-E_p$. Hence we can use the high side of the condenser as a point from which to feed back, through a small condenser C_N, our neutralizing current. And since the series impedance of the combination is jX, the impedance required to parallel-resonate it is another condenser like the first; so the complete circuit assumes the well-known built-out appearance of Fig. 5.

There are three interesting points to be observed in this built-out circuit, all of them important from the design standpoint. One is that under operating conditions the currents in the neutralizing capacity

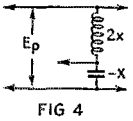


FIG 4

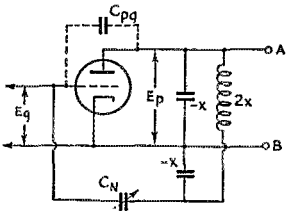


FIG. 5

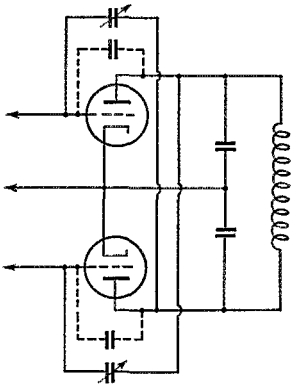


FIG. 6

C_N and tube capacity C_{pg} are not equal, and are not supposed to be. The potential across C_{pg} is the arithmetic sum of E_g and E_p, while the potential across C_N is their difference. The currents that *are* equal and opposite are the *portions* of the two currents that result from E_p. The portions that are due to E_g are actually in phase instead of opposite in phase, so that looking into the input terminals of the amplifier a definite capacity appears; this capacity is, however, independent of E_p, which is what we require for complete neutralization. In the type of circuit shown in Figs. 1, 2 and 3 the currents are actually equal and opposite and no such apparent capacity is presented at the grid terminals.

The second point is that the reactance $-X$ to which we connect the neutralizing condenser C_N is affected by C_N; it can be shown that it is really the parallel combination of the two which constitutes our $-X$. Hence, if for feed-back purposes we were to try broadening the plate circuit by using higher reactances throughout, so that our building-out condenser labelled $-X$ became comparably small in capacity with C_N, we should ultimately reach a point where the former would disappear entirely, whereupon we should find ourselves back to the circuit of Fig. 3. In fact, it was as a result of the careful attention paid to circuit broadening that the method of Fig. 3, in conjunction with grid bias modulation, was evolved as the best possible means of obtaining a wide band in the intermediate stage of the Western Electric 50-kilowatt transmitter.

The third point the author wishes to bring out in regard to Fig. 5 is that if the load is coupled inductively to the coil labelled $2X$, as is often done, complete neutralization can never be obtained, because of the phase shift caused by the introduced resistance. For complete neutralization the load would have to be connected or coupled to some circuit at points A and B of Fig. 5, entirely separate from the neutralizing circuit.

When two tubes are used instead of one, the building-out problem assumes a more favorable aspect. In the push-pull circuit, Fig. 6, familiar to everyone, equal and opposite potentials are sure to exist as long as symmetry in tubes, circuits, and excitation is maintained, and the load may be coupled inductively without affecting the neutralization at all. From a neutralizing standpoint, therefore, a push-pull circuit is ideal.

Figs. 7 and 8 illustrate a type of neutralizing circuit which up until a few years ago was quite widely used. It involves a built-out grid circuit with the input inductively coupled. Most radio engineers are not aware of the fact that this scheme does not give true neutralization at all. When the ordinary neutralizing procedure is followed, of applying excitation with the plate voltage removed and adjusting C_N to give a minimum reading on a small r.f. meter in the plate circuit, a very good null is obtained with C_N equal to C_{pg} and the operator usually feels gratified.

But let us look at the matter more closely. The criterion of neutralization is whether a voltage between plate and ground causes any reaction on the grid potential. If we consider Fig. 7 and imagine an r.f. voltage on the anode, this voltage will cause two currents of equal magnitudes and identical phase to flow back through the capacities C_{pg} and C_N. These currents will not appear in the grid inductance because they balance out in it; their only path to ground is through the grid tuning condensers. The currents produce across these two grid condensers, by a potentiometer effect, two voltages which are in phase with the plate potential, while the normal excitation on the grid side of the circuit is opposite in phase to the plate potential; hence the excitation is reduced and we have a negative

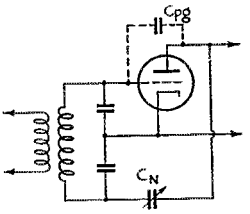


FIG. 7

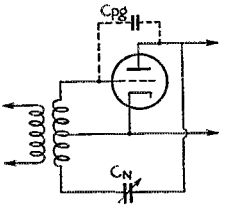


FIG 8

feed-back. On the built-out side of the circuit, where the input voltage is *in* phase with the plate potential, we get an increase in voltage, which has no effect since there is no grid connected at this point.

The author once checked this conclusion by connecting r.f. voltmeters across the two separate sides of the grid input circuit. Before the plate voltage was applied, the voltmeters indicated perfect balance. As soon as the plate supply was thrown on, the voltage on the grid side was seen to drop 10 per cent, while the voltage on the built-out side increased by the same amount.

In the circuit of Fig. 8 these two effects would be reversed, giving a positive feed-back. This is because the currents fed back in this case do go through the grid inductance, reaching ground through the center tap; and since the coupling between the two sides of the coil is usually poor, an inductive drop is set up which gives us a grid potential *opposite* in phase to the plate potential and therefore additive to the excitation. This conclusion has likewise been checked experimentally.

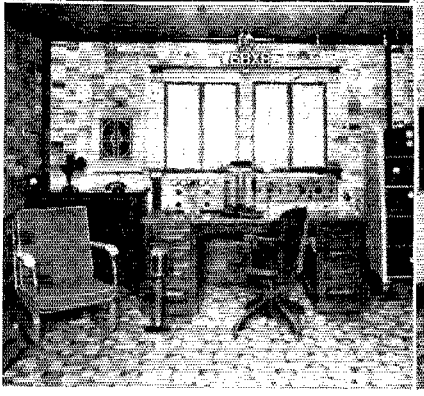
The excellent null obtained in adjusting one of these circuits is therefore very misleading. The fact is that the system actually is neutralized as far as any reaction of the plate potential on the total voltage across the "balanced" input circuit is con-

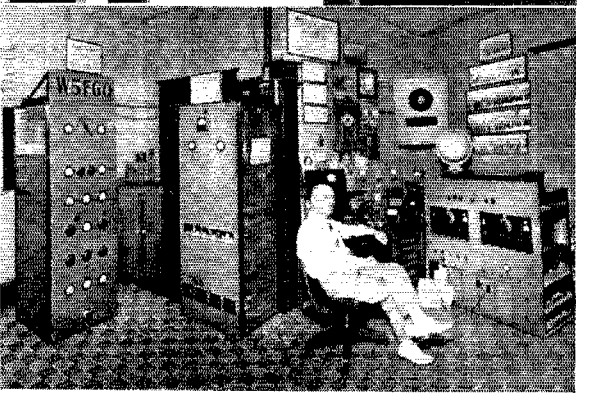
(Continued on page 110)

HAM ☆ ☆ SHACKS

W8STD, Syracuse, N. Y.

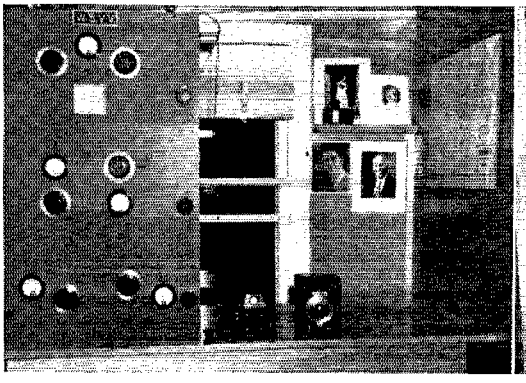
W6BXB Shack and Antenna





W6BXB, Stockton, Calif.

W5FGQ, San Antonio, Texas



Transmitting —— W5VV, Austin, Texas —— Receiving

W8STD

AN UNUSUAL feature of this station is that most of the equipment is built up in portable units. The reason for this is that the OM, Jerome Blaisdell, does appraisal work for the Central New York Power Corporation which requires periodic shifting of headquarters.

On the left is a complete station which fits into a small suitcase when portability is required. In the transmitter portion, use is made of a 6L6 crystal oscillator which may be operated at 20 watts input on 3.5- and 7-Mc. c.w. The receiver in the lower section is a two-tube regenerative. A power pack takes up the remainder of the space. Battery operation is also feasible. Another unusual feature is the use of the 0–1 d.c. milliammeter and a five-point selector switch which makes it possible to check voltages, currents and resistances should any trouble develop in the field. Headphones, key and other accessories fit into the space at the top of the unit. The antenna fits inside the cover of the suitcase.

In the upper right-hand corner is another portable rig arranged for 1.8-Mc. 'phone or c.w. operation. It is a duplicate of the units used by the Norfolk, Va., hams and was described in *QST* for September, 1938. Either the built-in pi-section antenna-coupling network or an external tuning unit may be used.

Directly below is a six-tube superhet (*QST*, Nov. 1938) and, to its left, a regenerative preselector (*QST*, Sept. 1938). The little gadget to the left of the preselector is an antenna tuning unit for receiving purposes. The a.c. power supply, common to both transmitter and receiving equipment, is in a metal enclosure under the operating table.

W8STD finds the portable equipment very handy and effective in keeping in touch with home when he is off on trips.

W6BXB

W6BXB IN Stockton, Calif., solved the problem of where to put the station by building a room over the garage in the back yard. Steel-pipe masts on the roof support a three-element rotary for 28-Mc. work and one end of a Collins multi-band antenna for 14, 7 and 3.5 Mc. The rotary antenna is connected to the Q-bar matching section through a pair of mercury cups which permits continuous rotation. The antenna is rotated by means of a motor connected through a pair of beveled gears to a half-inch diameter pipe running up through the 1½-inch diameter support.

The interior of the shack is sealed off with wallboard, which makes "wall papering easy." On the operating table are a Collins 45-A transmitter and an RME-69 superhet with preselector. To the right is a complete 600-watt transmitter with push-pull 852's in the final and a modulator driven by the audio section of the 45-A. Up above the operating position is the antenna relay for switching the antenna system from the receiver to transmitter.

W6BXB is president of a firm producing metal castings.

W5FGQ

HANK RHODUS, down in San Antonio, believes in building his own and the array of gear shown in the photograph is evidence of his skill in this direction.

On the right is a panelled frame containing two homemade 16-tube superhet receivers, each with three stages of r.f. The lower portion of this unit is devoted to speech-amplifier equipment with power supplies for both receivers and the speech units. Over on the right are two large rack units, one containing a 1-kw. transmitter with push-pull 354C's in the final, and the other a Class-B modulator with 354E's. The final is driven by push-pull RK20's, an 807 doubler and either a 6L6 crystal oscillator or the Meissner unit at the operating position. Checking equipment includes an oscilloscope, G.R. modulation monitor and G.R. frequency-meter-monitor.

Three-element rotary antennas are used for 14 and 28 Mc., while a Collins multi-band antenna with a 250-foot flat-top is used for 4 and 1.8 Mc.

W5VV

TO THE ham with serious DX intentions, a band-hopping transmitter has an advantage, providing it doesn't run into too many complications. We think that Wilmer Allison, W5VV, has solved the problem in a sensible way. To start out with, he has a National NTE exciter unit on the operating table with his HRO receiver. The exciter unit has push-button band switching as well as crystal switching. The output of this unit may be switched to any one of the three driver-final combinations in the panel unit to the left. The lower unit is for 7 Mc., the middle unit for 28 Mc. and the top unit for 14 Mc. Each section has the same tube complement — 35T driver and push-pull 100TH final. The tuning of the driver grid circuits is fixed and the driver plate tank coils are interwound with the grid coils of the finals so that tuning controls are reduced to a minimum in shifting from one part of the band to another.

The small knob in the lower left-hand corner of the transmitter panel controls a ganged switch which shifts the output of the exciter unit and turns on the filament of the amplifier in use. All three output units operate from a common power supply, and a single set of meters is connected permanently in common grid and plate circuits. The idle stages do not draw current, of course, because the filaments are switched off.

The exciter unit is placed on top of a 3-inch chassis into which has been built a 100-kc. fre-

(Continued on page 58)

A Stationary Reversible Beam

Two Directions With a Fixed Three-Element Vertical Array

BY WALTER J. STILES, JR.,* W8DPY

The beam antenna pictured in Fig. 1 consists of a vertical dipole with reflector and director. The gain in any one preferred direction is about 4.5 db, and the lobe has a vertical angle under 25 degrees. The operator has the choice of either of two directions by simply pulling up the desired director and reflector. Further, it can be used as a simple dipole, a great help for local contacts in the evening.

The array is supported on an inverted Y mast consisting of three 18-foot 2 by 4's bolted together with the bottom spread out as a support. Only two guy wires are necessary if this spread is at least 6 feet, but they can be eliminated if property conditions allow the mast to be leaned against a garage and bolted tight. A 16-foot 2 by 2 is bolted on top of the tower so that it points along the desired line of transmission. A small shelf bracket is attached to the top of the mast, to support the antenna about 6 inches away from the pole.

The operating frequency in the 28-megacycle band is selected, and the length of the antenna and director wires is computed by the following formulas:

$$\text{Antenna length} = \frac{492}{\text{Freq. in Mc.}} \times 0.96$$

$$\text{Director length} = \frac{492}{\text{Freq. in Mc.}} \times 0.87$$

One antenna wire and two director wires are cut from No. 14 enameled wire.

A matching section can be constructed from two 8-foot 6-inch pieces of the No. 14 wire spaced by 6-inch spreaders. This section is connected to one end of the antenna wire as shown in Fig. 1, and the antenna is fastened in place on the shelf bracket. A 60-foot piece of heavy binding twine is fastened to one end of each of the directors and this twine is placed through the "eye" hooks as shown. A sash weight or other object weighing about three to five pounds is then attached to the end of the twine, and the directors can be pulled in place by simply letting out twine. You now have a vertical dipole antenna with two directors spaced ¼ wave from it.

Next compute the length of the reflector from the formula:

$$\text{Reflector length} = \frac{492}{\text{Freq. in Mc.}} \times 0.98$$

Subtracting the director length from the reflector length will give the length of wire to be added to either director to make it serve as a reflector. This done, cut such a wire and fasten a small battery clip to one end. By lowering one of the director wires and clipping on the short piece of wire at the lower end, it will act as a reflector when raised again. If transmission is desired in the opposite direction, simply lower the reflector wire, remove the lengthening piece, add it to the other director, and raise the two elements back into place.

Let's consider a specific example: Assuming our operating frequency to be 30 Mc. we find, from the above formulas, the director length to be 14 feet 3.3 inches and the reflector length 16 feet 2.6 inches. By subtracting the director length from the reflector length we find the length of the clipping wire to be 1 foot 11.3 inches.

The array also works well on 20 meters and is still well within the space limits of the average

(*Continued on page 102*)

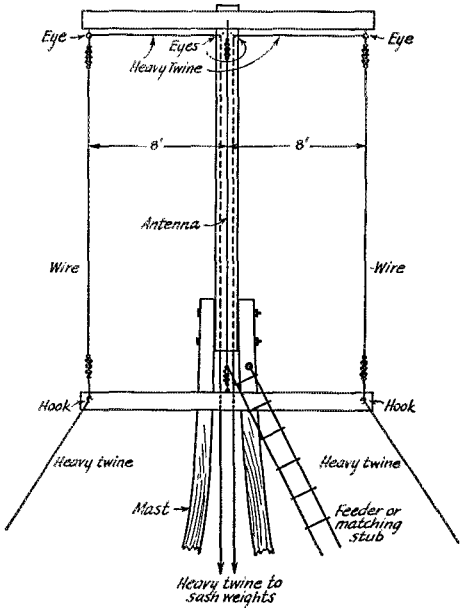


Fig. 1 — A simple uni-directional beam that can be used for either of two directions. One of the outside wires is changed from director to reflector by lowering the wire and clipping on an additional length. Lowering of the wire is facilitated by supporting the elements with heavy twine run through screw-eyes and counter-balanced by suitable weights. The antenna and feeder remain fixed under all conditions.

* 19 Beechwood Drive, Packanack Lake, N. J.

★ I. A. R. U. NEWS ★

Devoted to the interests and activities of the

INTERNATIONAL AMATEUR RADIO UNION

Headquarters Society: THE AMERICAN RADIO RELAY LEAGUE, West Hartford, Conn.

CALENDAR

THE December issue of the Union Calendar reports the admission to membership of two new societies, bringing the present total to thirty-five. We bid welcome and extend our good wishes to the *Burma Amateur Radio Society* and the *Lietuvos Trumpuju Bangu Radio Megeju Draugija* (Lithuania).

In addition, there are two other societies proposed for membership: *The Manchoukuo Amateur Radio League* and the *Radio Club Argentino*. Each has been found by the Headquarters to comply with the requirements of the Constitution and a vote of present member-societies is now being taken on their acceptance.

After summarizing the status of amateur radio in nations represented in the Union, the Calendar points out that, since the resumption of amateur activity after hostilities in countries now off the air will not necessarily be automatic, it is vitally important that there be maintained in each nation at least a skeleton structure of organization in order that there may be a nucleus around which the scattered ex-amateurs of individual nations can group. Close association and coöperation with the proper authorities in all branches of the government, using every opportunity to show that amateur radio should be continued because of its public service value, is urged.

HARTFORD-SANTIAGO SCHEDULES

THROUGH the coöperation of CE3AG, CE3DG and other Chilean hams, Assistant Secretary A. L. Budlong of the *American Radio Relay League*, representing the United States society at the Inter-American Radio Conference at Santiago, Chile, in January, kept in daily touch with *League* officials by amateur radio. In addition, members of the United States delegation were enabled to send personal messages to families and friends via similar circuits.

Secretary Warner scheduled CE3AG direct on 20-meter 'phone from W1EH for daily chats with Budlong as to the progress made by the conference and the outlook for the following day. Although "skip" effects were bothersome, signals were good for the most part, and all together over 30 contacts were made. Many messages were handled in addition to the direct conversation. The A.R.R.L. headquarters station, W1AW, held daily schedules with CE3DG on 20-meter c.w. and routed a number of messages from the U. S. delegates direct to their Washington destinations the same day received.

The conference itself is reported in another section of this issue.

CE3AG, Santiago, king-pin in the amateur "net" which kept U. S. conference representatives in touch with home.

SWITZERLAND

DESPITE the fact that mobilization called practically every officer and member of the U.S.K.A. into military service, it has been decided to continue the activities of the organization to a lesser extent with the staff doing the work in spare time off-duty, according to Dr. Stuber, HB9T. The society expects to make progress with receiving equipment and similar lines and to continue the publication, in condensed form, of the journal, "Old Man." Its main purpose, of course, is to keep a strong and financially sound group to protect amateur radio activity when the war is over.

Contrary to our listing in a previous issue, the QSL Bureau is still operating, with the same address: U.S.K.A., Postbox, Berne.

NOTES

THE W.I.A. has made application for reissuance of experimental licenses throughout Australia for the employment of frequencies of 112 Mc. and above, with a power limit of 25 watts. Its New South Wales division has proposed an emergency communications system with 5-meter stations every 30 miles to provide interstate relay. . . . It is reported that new licenses will be issued to South African amateurs whose reliability and patriotism are beyond all question, after individual approval by a government board consisting of communications, military and civil authorities. . . . It is welcome news to learn that the *Rede dos Emissores Portugueses* at a recent general meeting voted unanimously to continue the activities of the society. The staff has been moved to smaller quarters at Rua de S. Juliano 41–3° Esq., Lisbon. . . . In late December each PA amateur received from the Minister of the Interior a letter informing him that his amateur license had been cancelled. . . . Argentina recently inadvertently gave notice to the Berne Bureau that it did not permit its amateurs to engage in two-way communication, evidently intending to report the usual third-party traffic restriction, whereas technically the notification prohibited amateurs from working foreign stations. Secretary Warner took the matter up with the *Radio Club Argentino*, and the notification has now been modified to permit such communication, except with belligerent countries. . . . At the annual general meeting of the *Reseau Luxembourgeois* in December, F. Scholtes, LX1OB, was elected president and J. Kesseler, LX1AI, secretary. Ironically enough, LX amateurs were preparing to celebrate the tenth anniversary of amateur operation in their country when the shut-down order came. . . . The North Manchester (England) Radio and Television Society uses the medium of the Department of State to send greetings for 1940 to radio amateurs, enthusiasts and short-wave listeners in the United States.

W5VV

(*Continued from page 55*)

quency standard. A similar chassis underneath the receiver contains switches and relays for a push-to-talk system. The unit on top of the receiver is a frequency-meter-monitor which is automatically switched from band to band with the transmitter.

Mims rotaries are used on 14 and 28 Mc., while a full-wave Zepp is used on 7 Mc. The direction indicator is to the right of the receiver and this may be switched between either of the two rotary antennas.

The modulator, which is not shown in the photographs, is built up underneath the r.f. output section. Class-B 203Z's are driven by the audio section of the NTE.

W5VV has been the c.w. winner for the South Texas Section in the International DX tests for the past three years. He has worked 139 countries and made WAC on 7, 14 and 28 Mc. Aside from his prowess in DX matters, most of us will remember Wilmer as star member of several Davis Cup teams, and only recently has he retired from active big-time tennis competition.

—•••—

New Transmitting Triode

HYTRONIC Laboratories announces a new low-price carbon-plate triode — the HY3OZ. Of construction identical to the HY40 and HY51, its internal structure permits operation at full ratings to 60 Mc. and at reduced ratings up to 116 Mc.

Typical operating data follow:

Filament voltage	6.3
Filament current	2.25 amp.
Mutual conductance	3600 μmhos.
Average amplification factor	90
Max. plate dissipation	25 watts
Capacity, G-P	5.1 μμfd.
G-F	5.1 μμfd.
P-F	1.7 μμfd.
Class-B Audio Amplifier (Two Tubes)	
Plate voltage	850
D.c. grid voltage	0
Zero-signal d.c. plate current	30 ma.
Max.-signal d.c. plate current	180 ma.
Plate-to-plate load resistance	8400 ohms
Max. signal grid driving power	2 watts
Max. signal power output	100 watts
Plate-Modulated Class-C Telephony	
Plate voltage	700
D.c. grid voltage	−75
D.c. plate current	75 ma.
D.c. grid current	20 ma.
Grid resistor	3750 ohms
Driving power (approx.)	5 watts
Power output (approx.)	40 watts
Class-C Telegraphy	
Plate voltage	850
D.c. plate current	90 ma.
D.c. grid current	25 ma.
Grid resistor	3000 ohms
D.c. grid voltage	−75
Driving power (approx)	2 watts
Power output (approx.)	58 watts

HINTS AND KINKS FOR THE EXPERIMENTER

FIXED-POSITION THREE-ELEMENT DIRECTIVE ANTENNA

EXPENSIVE three-element rotatable beams are enjoying widespread use on the 10- and 20-meter bands, but it doesn't seem to be generally realized that a three-element *fixed* beam can be built for little more than an ordinary half-wave antenna. As a matter of fact, the one that was used at W5CXH for more than six months cost only $2.00 complete, including the 50-foot feed

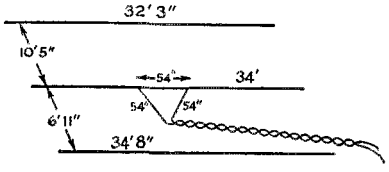


Fig. 1 — Fixed-position three-element directional antenna used by W5CXH.

line. Since, by checking back in the log, it was found that about 80% of the contacts with the old half-wave antenna were in one general direction, the logical thing to do was to replace the half-wave with a unidirectional beam of definite gain for that direction.

The elements were made of regular No. 12 antenna wire, and fishpoles were used to separate the elements. A twisted pair made of No. 12 house wire was used to feed the radiator, and a delta match was used between the radiator and the line. The dimensions of the system are shown in Fig. 1. An open line, delta-matched to the radiator, might have had less loss, but would have increased the cost. If a better match is desired, the system shown in the December, 1939, *QST* [1] might be substituted.

Tilting this three-element fixed antenna brought several interesting facts to light. First, with the antenna at a height of ¾-wavelength, tilting the antenna system about 35 degrees above the horizontal seemed to give maximum field strength at distances less than 1200 miles, on 20 meters. At this distance, tilting usually increased the signal about two S points. The signal seemed to be little affected at a distance of about 1600 miles, but tilting resulted in a decrease in strength at greater distances. Several stations have reported increased signal strength at distant points (greater than 5000 miles) by dipping the beam below the horizontal about 5 degrees or so, but the writer has been unable to notice this effect with the present setup.

A duplicate of the beam was used at VP1WB in British Honduras, and he also had excellent results with it.

— *Dawkins Espey, W5CXH*

[1] Page 50.

PREVENTING TANGLING OF OPEN-WIRE FEEDERS WITH ROTATABLE ANTENNAS

HAROLD ULMER, W6EPM, author of the article on a rotatable antenna with open-wire feeders and a delta-matching system which appeared in *QST* for February, describes a device he has worked out to prevent tangling of the feeder wires as the antenna is rotated. A sketch is shown in Fig. 2. An iron bracket made from a piece of ¼-inch by 2-inch strip is fastened to the pole with lag screws. This bracket is about 9 inches long on each side. A U-shaped piece of the same material is loosely bolted to the outer end of the bracket to form a joint permitting horizontal motion. One side of a large hinge is bolted to the U-shaped piece, and to the other end a 3½-foot length of "1 by 4" is fastened. This arm is fitted with a pair of stand-off insulators to which the feeders are attached. The bracket is fastened about halfway up the mast.

Now as the antenna is rotated, the arm will swing around the mast to the point where the arm

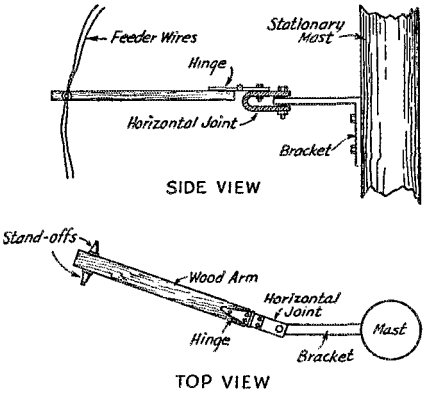


Fig. 2 — Arrangement used by W6EPM to prevent tangling of open-wire feeders when used with rotatable antenna.

is stopped by the mast. When the antenna is turned the last few degrees to complete the rotation, the hinge comes into play. The arm rises in an upward direction to release any strain which may be imposed on the feeders.

RECTIFIER BALANCING CONNECTION

LEWIS KOHLER, W2HRM, reports that the simple arrangement shown in Fig. 3 works out successfully in balancing the load with Type

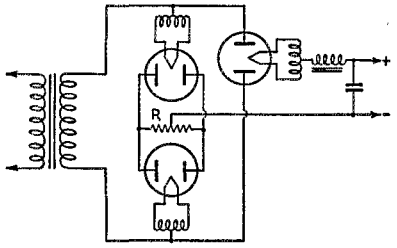


Fig. 3 — Simple arrangement for balancing load of four rectifier elements in bridge circuit using Type 83's.

83's in a bridge rectifier circuit. Only a single center-tapped resistance is required. This should have a value of 50 to 100 ohms.

A PLUG-IN OSCILLATOR UNIT

QUITE often it is desirable to be able to add an additional stage to one's transmitter without a major rebuilding. The simplest way of doing this is to utilize a small oscillator unit that will plug into the 5-prong socket that holds the crystal of the original transmitter. The former oscillator tube now becomes a doubler, enabling

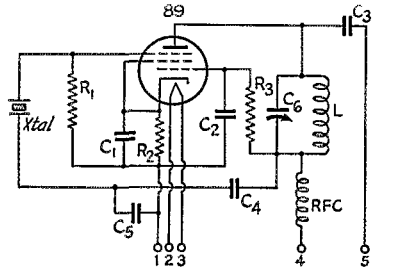


Fig. 4 — Circuit diagram of plug-in crystal oscillator circuit.

C_1 — 0.006 μfd.
C_2 — 0.006 μμfd.
C_3 — 0.0001 μfd.
C_4 — 0.00025 μfd.
C_5 — 0.006 μfd.
C_6 — 0.00005 μfd.
R_1 — 100,000 ohms, 1-watt.
R_2 — 300 ohms, 1-watt.
R_3 — 100,000 ohms, 1-watt.
RFC — 2½ mh.
L — (for 7 Mc.) 26 turns No. 22 enam., ¾ inch diameter, close-wound.

the transmitter to be operated on the next higher frequency band.

The unit in use at W9EHC is built on a 2-inch by 2¾-inch platform, which is bolted to a 5-prong tube base by means of two small angle brackets. Two more such brackets support a 1-inch by 3-inch strip vertically. Upon this strip are mounted a 50-μμfd. variable condenser and a 5-prong socket for the crystal. Upon the base is the 6-prong socket for the 89 oscillator. The self-supporting coil is soldered directly across the terminals of the variable condenser, and the various resistors, condensers, and r.f. choke are supported by their own leads, being assembled on the shortest-path-between-two-points-is-a-direct-line theory. It looks like a rat's nest, but it is very compact and works perfectly.

Referring to the diagram of Fig. 4, point "1" goes to the prong of the tube base that engages the terminal of your ex-crystal socket that connects to ground. Points "2" and "3" go to the terminals that are normally filament connections, and these two terminals on your ex-crystal socket should be connected to a 6.3-volt source. Point "4" goes to the prong that is usually the grid terminal (Type 56, 76, etc.), and about 200 volts should be fed to this terminal of the ex-crystal socket. Usually the screen voltage of the former oscillator is of the correct value for this. Point "5" goes to the terminal of the ex-crystal socket that connects to the grid of the ex-oscillator tube. As a rule, the grid leak is already connected between this point and ground.

Tuning is very simple. Drape a pick-up loop around the coil and turn the variable condenser until the 2-volt dial light bulb glows brightest; then tune the plate circuit of your ex-oscillator tube in the customary manner. As a rule, this tube should now be used only as a doubler.

Should you wish to use your transmitter without the extra unit, it is but a few seconds' job to yank out the unit, shift the rock from it to the original crystal socket, and be back on the air.

— *Carl C. Drumeller, W9EHC*

A "LIGHT-BEAM" TRANSMITTER AND RECEIVER

SEVERAL years have passed since the writer first became interested in the possibilities of "talking" over a beam of light, but nothing was done about it until the XYL persuaded me, against my better judgment, to give a talk before the local women's clubs, on the general subject of radio.

It was while digging up things to amuse the ladies that the old interest was revived, and we decided to give it a try. A bit of experimenting gave results far better than expected, and distances up to 100 feet were covered without any noticeable decrease in volume. Excellent results were obtained even in broad daylight.

In building the outfit, our first consideration

was that of cost. Discarded radio parts had to be used whenever possible, and the final rig contained nothing in the way of new equipment except the photocell in the receiver. Even if all the parts were to be purchased, the costs should not run too high.

The neon-tube and light-sensitive-cell circuits are shown in Fig. 5.

The receiver is simply a high-gain amplifier with about 5 watts output. Your preamplifier

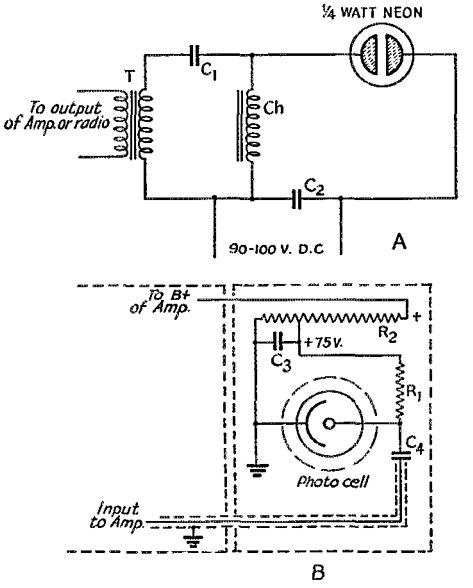
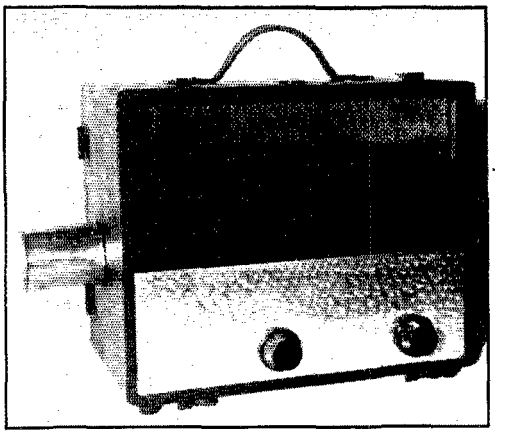


Fig. 5 — A — Circuit of neon-bulb generator on transmitting end fed by microphone, phono-pick-up or radio through suitable audio amplifier. C_1 should be 0.5 to 2 μfd., C_2, 8 μfd. Ch is a 30-henry audio choke.

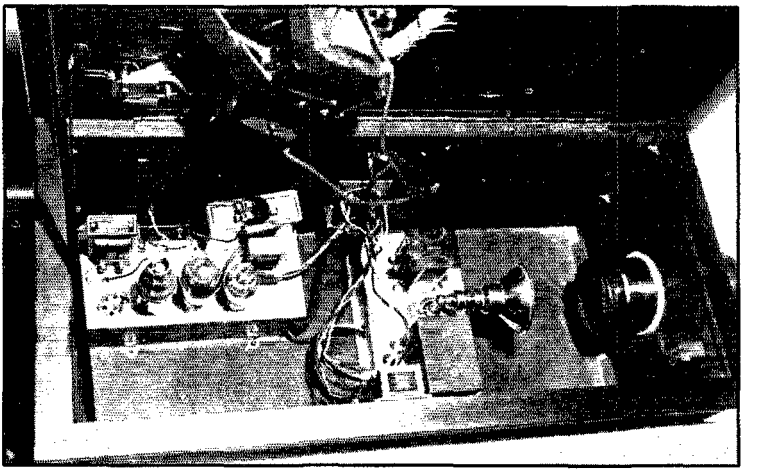
B — Photocell pick-up on receiving end feeding loudspeaker through suitable audio amplifier. R_1 is a 500,000-ohm resistor, C_3, 8 μfd. and C_4, 0.5 μfd. R_2 is a voltage divider of usual value.



Front view of receiver showing pick-up tube which shields light-sensitive cell from indirect light.

should do the trick nicely. We found it convenient to mount the amplifier, speaker and photocell in an old portable radio case. This made it necessary to shield carefully the photocell and first tube in the amplifier with double shield cans. The space between the cans was painted black and a half-inch hole cut in one side to admit the light. In order that the rig could be used in anything but total darkness, a tube about 5 inches long, painted black inside, was mounted so that the light to the cell must pass through it.

The photocell and its own voltage divider were mounted in and on a separate chassis, so they were shielded from the rest of the amplifier, and a shielded lead (as short as possible) was run to the control grid of the first tube. The voltage on the cell is not critical and may be anything from 45 to 90 (we used about 75), but this must be as nearly pure d.c. as possible. Batteries were first used, but the arrangement shown in the drawing gave good results without hum.



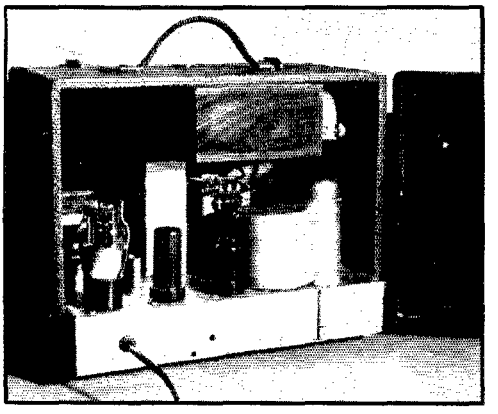
♦

Transmitter mounted in cabinet with phonograph motor in cover. The neon bulb is mounted inside the reflector. The other two components on the bread-pan chassis are the audio choke and input transformer. The audio amplifier is to the left. The focusing lens is set in the end of the cabinet.

♦

The cell itself, a Cetron Type CE-2, selling at $5.40, was chosen for its small size. However, any cell of the type used in movietone work should work as well.

The transmitter consists of a source of light and a method of modulating that light. It was here that we were stumped for a time. Millen and Kruse, in their booklet "Below Ten Meters," gives a circuit for such a device, but we didn't have a "Zetka" recording lamp and did not know where to get one. However, after considerable experimenting we found that a 35¢ ¼-watt neon lamp, such as those used in tube testers and other service equipment, would do very nicely. This may seem low power, but its small size makes it possible to focus the beam and get almost perfectly parallel rays. A reflector, such as those used in automobile spot lights (from the nearest junk yard), and a double-lens system obtained from an old postcard projector made the system complete. A large reading glass at the receiver serves to focus the rays on the photocell.



Rear view of receiver. The light-sensitive cell is in the shield can to the right mounted on separate small chassis.

The modulator is practically the same as that shown in "Below Ten Meters," but the input transformer is an old 3-to-1 audio, and the choke is a 30-henry model from an old radio. Also, the ignition voltage for the lamp was obtained directly from the "B" supply of the amplifier. The polarity of this ignition voltage does not seem to matter, but the condenser should be poled right if it is of the electrolytic variety.

The modulator may be fed from a radio receiver for experimental work, but since we wanted to talk over the light beam ourselves, an amplifier was made from the audio portion of a discarded four-tube t.r.f. a.c.-d.c. midget. The tuning condenser, r.f. coils and r.f. tube were removed and the detector revamped to act as first audio. This was connected to input transformers to match a single-button mike and phonograph pickup and a switch was mounted so that either could be used at will.

The rig will work as far as you can shine the light, so it simply becomes necessary to concentrate the beam into parallel rays to duplicate our results. Only a small amount of light is necessary and, if you have as good luck, you will have to turn down the volume to prevent overloading the receiver. — *L. W. Floorman, W8RWP*

Advanced Radio Course Over WRUL

SUPPLEMENTING the regular and special courses recently announced in *QST*, on Monday, March 4th, at 8 P.M. E.S.T., Dr. C. Davis Belcher will begin a series of lectures on advanced modern radio technique over the World-Wide Broadcasting Foundation station in Boston, WRUL, 6.04 and 11.73 Mc.

In choosing subjects for the lectures a poll of five hundred regular listeners was conducted. As a result the following material will be included: I. Radio Mathematics (three lectures covering trigonometry, complex numbers and vector-analysis). II. Impedance matching (two lectures). III. Frequency doubling. IV. Frequency modulation (three lectures thoroughly explaining basic principles). V. Single sideband transmission (two lectures).

As usual, a large illustrated booklet has been prepared to serve as a text for those following the course. Its forty pages continue much new and some hitherto unpublished material. The price is $1.00 postpaid. This book and additional enrollment cards can be obtained by writing WRUL, University Club, Boston, Mass.

In addition to the 8:00 P.M. period, the advanced radio courses will be repeated by transcription over WRUL at 11:30 P.M., Tuesday nights, on both 6.04 and 11.73 Mc.

Silent Keys

IT IS with deep regret that we record the passing of these amateurs:

Floyd L. Arrick, W6DXQ, Tracy, Calif.
Thomas F. Duffy, W9RHD, Deerfield, Ill.
Joseph E. Hamilton, W2IZ, Port Chester, N. Y.
Frank O. Lowe, Jr., W2EHP, Newburgh, N. Y.
Byron E. McGhee, W8HLB, Brookfield, Ohio.
Lawrence Nelson, W9MCC, Evanston, Ill.
Edward A. Rouscher, W8NOI, Hornell, N. Y.
Capt. William H. ("Pop") Smith, ex-"S," 9ZF, 9KOA

CORRESPONDENCE FROM MEMBERS

The Publishers of *QST* assume no responsibility for statements made herein by correspondents.

NEUTRAL

Devon, Pa

Editor, *QST:*

That picture in last month's issue, page 62, sure did look gruesome. It would just be my luck if and when I get my ticket for such a thing to happen to us in America. So I'm asking a favor of all amateurs. Please keep your yaps closed about the — the game of tiddly-winks they are playing over there.

— *Edwin J. Bush*

NO E.C.O.'S ON KC4USC

Room 57B, Ryerson Physical Labs.,
University of Chicago

Editor, *QST:*

Last night when the usual three score and ninety e.c.o.'s cranked up atop KC4USC and shot holes in his traffic I mentioned the matter to him. He answered, "I will not answer any calls on my frequency or close enough to cause QRM — pse pass this dope around."

I hope this will be the beginning of the end of this nefarious practice which has become so widespread since the inception of e.c.o. popularity.

— *John Kaye, W9YWQ*

ABOUT THE "S"-SCALE

North Hollywood, Calif.

Editor, *QST:*

I've just been reading the letter about the use of the "S" scale by Mr. Jonathan Eddy, W1LAU, and all I've got to say is amen. Boy, many are the times when I wonder "Shall I give him 569 or 579?" or "Is it going to be 558 or 568?" To me, although maybe it's just me (and 1LAU), 9 units of signal strength are a bit too many. There are a few fellas who try to follow 'em, and most of the time I do, but when a guy 2500 miles away gives you 589, you know he thinks you're 579 so by the books your sig is really only 569, and you or I give him a good report if he is even readable. You see, a report like this is really meaningless, as Mr. Eddy states. Five strength units are plenty and are easy to use.

While we're at it, I think the tone scale could be chopped off a bit. Who gives anyone a T1 or T2 report? Why I've even heard guys giving a certain CX who inhabits the frequencies around 14,425 T7 and T8, but when I put a crystal filter on him, he all but disappears except for a funny rasp. My suggestion is to make the "S" and "T" reports go from 1 to 5 instead of from 1 to 9. Let the "S" scale be as he (W1LAU) said, and revise the T scale like so:

T1 — RAC.
T2 — Bad, rough.
T3 — Strong ripple.
T4 — Slight ripple (like most 10 meter cw stations).
T5 — Pure DC, crystal-controlled.

A "c" or a "k" could be added after the report to indicate chirps or clicks. Most of the boys who have had their tickets more than about 4½ years have seen the change from "T9 QSA5, R8" to "RST 589x," so now, how about "RST 544?",Think it over, fellows. Some of what I've said may be bull, but there's sumpin in some of it.

— *Al Faries, W6OOU*

7404 Bennett Ave., Chicago, Ill

Editor, *QST:*

I read the letter from W1LAU in the current issue on the use of the "S" scale. I think in general he has something there.

I am primarily interested in 'phone transmission, and unless I am asked for a report on the other fellow's signal he doesn't get it. I personally don't give a hoot if I am "Q2R3" or R5 or S9. The thing that I am interested in is simply this: "Am I being received well enough by the man on the other end so that he can copy me?" If I am, then it is fine; if not, shall I ask him if he wants to carry on, or shall I move in frequency? I don't do the deciding, I leave it up to him. If he wants to try to copy me through some of the signals that are at 3955 kc., it is OK with me.

Now that I am started in this thing, I shall stick my neck out a little farther and let the fellows swing at it. I am of the opinion that many of us who are on 'phone are probably doing more harm to amateur radio than good. Why? Because the 'phone amateur is the one who is heard by the BCL, either through shock excitation, interference, short-wave receivers or telephone line pick-up. We, the 'phone men, are the ones by whom amateur radio is judged. There is not one BCL in a thousand who would copy code, even if he were able to do so. I have on several occasions had friends who have stopped in to see what goes on in an amateur station. They listen to 75-meter 'phone, and ask what there is to talk about. It is to these people that I try to show what can go on. If I am successful, I find some station who will talk my language, not "*QST* English" (no reflection on the stuff for c.w. where it was intended to be used) and try to talk in general enough terms so that my guests will go away with a good taste in their mouths and know that there is some one on the air besides "this guy CQ." . .

— *John G. Nardin, W9DRA*

Route 1, Box 389, Port Orchard, Wash.

Editor, *QST:*

In regard to W1LAU's discussion on the revision of the S-scale . . . Mr. Eddy hit the nail on the head. . . .

The best common denominator that I can see presently is Mr. Eddy's point that the signal strength should correspond to the conditions on the band, not nine different divisions in the S-scale.

— *Jack Riggs, W7HAD*

91 Grove St., North Attleboro, Mass.

Editor, *QST:*

The idea for reporting signal strength proposed by Jonathan Eddy, W1LAU, seems to me to have much merit. . .

The "T" part of the system should also be revised. Probably more fellows are misled by the tone report than anything else. Under the present conditions, a fellow getting a T8 report should start worrying about his signal, because it probably is a T4 note. In my work as an Official Observer, I have seen this happen more than once.

The "T" part should be more like this: T1 — raw a.c.; T2 — rather rough a.c., prominent ripple; T3* — modulated; T4 — good, but not quite T5; T5 — pure d.c. (the X being added in any case that warrants it).

*Musically-modulated c.w.

The R part could be: R1 — readable with some difficulty; R2 — readable with no difficulty. The S portion now seems to have too many numbers to choose from, and for reasons given by W1LAU, it should be reduced to 5 choices.

(Continued on page 116)

OPERATING NEWS

F. E. HANDY, W1BDI, Communications Mgr. **E. L. BATTEY,** W1UE, Asst. Communications Mgr.

A.R.R.L. Emergency Corps Members: During January every registered member of our Corps was sent blanks for re-registration. Most of those blanks will have been returned to A.R.R.L. by the time you receive this *QST*. The 1939 records are completely replaced. However, we don't want to retire anyone from the active to the inactive list, by inadvertence. If you have *not* returned the blue re-registration forms that carry the 1940 date, rush them to us. Or if the mailman missed you for any reason, and you are one of those amateurs that carries an EMERGENCY CORPS card, kindly advise us at once. The Emergency Corps needs every member, and we'll be glad to duplicate our mailing promptly, if we hear from you.

All Other Amateurs: If you are licensed, but as yet haven't had the pleasure and experience of holding one of our Emergency Corps cards, may we remind you to take steps to identify yourself with this program for the interest of the whole amateur service. You do not have to be a member of any organization to register in the Corps. Every licensee familiar with communicating procedure and subscribing to the special emergency policies adds that much more to the weight of organized amateur radio. The individual standing as a citizen as well as an amateur is enhanced. The extent of our readiness for public service is one measure of the respect of the F.C.C. and other agencies for the fact that amateur communication is something more than a plaything or a novelty. Get identified to-day with the group to whom "public interest, convenience, and necessity" is more than a phrase.

Every licensee is needed. At this time that marks the season of melting snows, high winds, and floods and disrupted wire service in some places, it is particularly fitting that we renew our invitation to all amateurs not previously lined up *to register NOW in the A.R.R.L. Emergency Corps.* Get your A.E.C. card now. Know how best to work with fellow amateurs when communications emergencies arise. A special bulletin of emergency instructions goes to every A.E.C. member with his identifying card. Ask your S.C.M. (address up front in *QST*), or your Emergency Coördinator, or A.R.R.L. Hq., or the nearest Western Union Telegraph office. At each spot application-registration blanks for the Emergency Corps are being held for you.

Use A.R.R.L. Net Service: Heartiest congratulations are due all participating stations and operators listed in the directory of nets that we publish this month. A fine communication job is being done by all concerned. The listing is in three sections, (1) state, club and Section Nets, (2) general coverage nets for larger or special areas, (3) A.R.R.L. Trunk Lines giving fast east-west and north-south service. The information in nearly all cases was collected responsive *to radio requests.* It is no paper organization but stands ready to do your bidding. The larger part of the stations listed hold Official Relay Station appointments (100% in case of the Trunkliners). Every amateur licensed, who handles traffic expeditiously and right, aims to hold down O.R.S. appointment. S.C.M.s will gladly send application and report forms to all amateurs asking for O.R.S. information. Use organized amateur routes for best speed and service. All amateurs are invited to keep in touch by radio with acquaintances beyond contact at the moment, by filing messages through any of the stations listed in the A.R.R.L. Net Directory.

Neutrality Recommendations Again: Many will remember our report in November *QST*, that some legitimate sounding D's and F's were on the air in amateur bands, the former asking public reactions to the war and seeking other information. It was in that issue that we quoted the text of an important F.C.C. warning to all of us, which was emphasized by the loss of privileges of two U. S. A. amateurs for COMMUNICATING WITH AN UNLICENSED STATION and for PERMITTING UNLICENSED OPERATORS to use equipment. It was recommended in that issue that U. S. amateur contact with European and especially *belligerent nations' amateurs* be avoided scrupulously. This will avoid possible suspicion falling on amateurs or amateur radio as a medium, that might call for restrictions of an unpleasant character for all of us. In last *QST* we gave more examples of government surveillance of amateur practices in connection with maintenance of neutrality.

D4BIU, YM2 — (Danzig?), OK — (equally questionable) and others have been heard on January 30th and subsequent dates, trying to contact W's. S.C.M. — W8OXO, W8YA, and W8JQE report that one of the Europeans had some success. From time to time scattered reports on other belligerent, or unlicensed, or questionable amateur stations operating in the European theater of war are forthcoming. We urgently renew our recommendation that W's *avoid work with any such stations.* In a time of war neutrality those who value continued rights will use their

heads and use discretion. A.R.R.L. does not question the legal right or harmless intent, but perceives that others may. Individual desire and irresponsibility should be tempered with due restraint for reasons of group safety. Activity between U. S. amateurs and European stations at this time can only pave the way to investigation and perhaps broad restrictions. Note elsewhere in *QST* that the League, mindful of the importance of continued use of all our bands for all amateurs, has felt it necessary in connection with *the 12th A.R.R.L. DX Competition* to proclaim a complete voluntary blackout on all European and certain other contacts, to insure that we are inviting no trouble. To the few legitimate European neutrals still on legitimately — our sincere apologies. Kindly understand our action as necessary in self-protection just because you are so near this theater of war activity. To U. S. amateurs: Let's avoid trouble. Steer clear of calls to even legitimate sounding stations in belligerent territory. Have no contacts with the theater of war at all. Observe A.R.R.L.'s Neutrality Code. Reasonable precautions pay bigger dividends than any selfish satisfaction in a momentary contact. Neither the Century Club nor DX Competition rules will credit or encourage any work that might indirectly jeopardize the larger interests of amateur radio.

What DX, then? With the prohibition in the DX Competition rules against work with *any* European countries, and with CN, FE8-FY8, SU, VP1-3-5, VQ6, VS4, ZD4 etc. (*all* British and French colonies, we mean) added to the never never list, to keep ham radio above suspicion under U. S. neutrality, some of you may be asking what to look for. Our idea of that would be to set our beams for ASIA and SOUTH AMERICA as the most productive continents. The PK's and XE's and the distant U. S. territories also should not be neglected . . . and after 100 points per each for knocking off some of these, we have a new hurdle that should command attention!

W-DX for W's: We mean that it is going to be interesting to see just how many W hams are actually able to knock off the multiplier of 27 which comes from performing a fixed quota of W-contacts and requires the ability to use three different amateur bands. Should you be unable to get 27 to add to your country multiplier this way, what part of the 27 *can* you get? We don't believe that anyone can win the contest by just this U.S.A. work with W's — but we are equally sure that no one is going to win the contest for his Section without it!

— *F. E. H.*

W4DVO unknowingly worked two unlicensed stations in the 8th District, and has to do some explaining to the F.C.C. His log will be used in subsequent court action according to F.C.C., so you see what is likely to happen to a guy if his log is not up in every respect!

— *W4PEI, S.C.M., E. Fla.*

A.E.C.* Members Perform Notable Communications Service in Storm!

SEVERAL Alabama amateurs, including Emergency Coördinators, have an agreement that, when weather conditions become bad and it appears there is a possibility that communication might be disrupted in some part of the state, they will listen for each other and for any other station that might need assistance. At about 6:30 P.M. on January 23rd, W4AUP, E.C. for Montgomery County, awoke to find a heavy snow on the ground. He realized that this was a "one in five years" thing for that section of Alabama and also realized that probably it was much worse in the northern part of the state. He turned on his receiver and began cruising over 1.75, 3.9 and 3.5 Mc. (the bands agreed upon). He heard W4CCP at Gorgas (location of the Alabama Power Company's largest steam generating plant) calling him. CCP knew AUP's working hours and about what time he would be at his receiver. They contacted, and OM Lineberry of W4CCP told AUP that communication with Magella sub-station at Birmingham was cut off. W4AUP called the Montgomery power division dispatcher and told him amateur radio was ready to handle orders from the Gorgas plant if he (the dispatcher) could relay them to Magella via the company's 'phone lines. This circuit was set up, and from 6:40 A.M. until noon W4AUP and W4CCP handled all load orders and switching orders for the Magella Sub and the Gorgas steam plant. W4CCP was first operated by CCP himself, later by W4CYL and W4CPO. At noon contact became difficult, since operation was on 1.75 Mc. and the distance was more than 140 miles. W4FQP, and O.P.S. at Birmingham, heard CCP and AUP trying to carry on. He called in and offered to handle the Birmingham end of the circuit, thus eliminating the long haul from Gorgas to Montgomery and the relay by telephone from Montgomery to Birmingham. W4FQP took W4AUP's place, and all the absolutely necessary orders needed to coördinate the loads and switching of the main system of the power company were handled until about 4:30 P.M., when a line was placed in service from Gorgas to Magella. W4DEW, operated by W4FSW, W4JI, W4DEW and W4FYH, assisted in relaying W4CCP and W4FQP, and in copying W4CCP through heavy QRN. All of this was following the sleet and snow storm of January 22nd–23rd, and thus our amateur radio rendered another real service. It is of interest to note that all operators in the work were members of the A.R.R.L. Emergency Corps.

— *W4DGS, S.C.M., Alabama*

* The success of the work here cited is almost entirely due to the fact that there was a pre-arranged stand-by period to function in the event of communication emergency or conditions threatening such, and to the experience of these amateurs in the A.R.R.L. Emergency Corps. All individuals concerned were members of the Emergency Corps.

Are *you* registered with the League in the Emergency Corps? Every licensed amateur should be! Do you have the A.E.C. identification card? Membership in the League is not a prerequisite, except for those A.E.C. members who become community Emergency Coördinators. (See explanation of their work on page 54 Jan. 1940 *QST*.)

You are invited to add to the strength of A.R.R.L. emergency planning and organization by registering to-day in the Emergency Corps. Be sure you get lined up for an emergency card, with every other responsible amateur licensee.

Get information and blanks for Emergency Corps registration — from your S.C.M., from the nearest Western Union telegraph office, or from A.R.R.L. Headquarters. Register in the A.E.C. to-day!

San Diego Hamfest—March 16th

The Helix Amateur Radio Club will hold its Sixth Annual Hamfest on March 16th, 7:00 P.M., at the U. S. Grant Hotel, San Diego, Calif. A snappy program of entertainment, reservation prize and door prizes for men and ladies, good eats, dancing and a big raffle. Tickets $1.10, including tax. For reservations write Eugene Harris, W6ANU, 5060 Bancroft Dr., La Mesa, Calif.

Add Code Practice Stations: W6CE. the Nevada Amateur Radio Association, Reno, is transmitting code practice on 1915 kc. from 8:00 to 8:30 P.M. PST, Mondays through Fridays.

NEW ARTICLE CONTEST!

The article by Eric Ledin, W6MUF, is the first winner in the new article contest announced in February *QST*. Mr. Ledin presents his case for "Forty-Meters" as the "Most Interesting Band." So far, the articles submitted are equally divided in favor of Forty-Meters, Eighty-Meters and Ten-Meter 'Phone. Surely the other bands have some champions, too!! Let's hear from them!

For the next several months we are inviting articles for the C.D. contest based on various individuals' ideas of "the most interesting frequency band." Practically every operating amateur has a "favorite" band, one that he would swear by to the bitter end. What is *your* favorite?

Send in your article on why such-and-such-a-band is, in your opinion, the best available. Each month we will print the most interesting and valuable article received on this subject. Please mark your contributions "for the C.D. contest." Prize winners may select a 1940 bound *Handbook*, *QST* Binder and League Emblem, six logs, eight pads radiogram blanks, DX Map and three pads, or any other combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

The Most Interesting Band

BY ERIC LEDIN, W6MUF*

AT 3 A.M. on a sleepless January morning, the hand that starts the percolator invariably reaches for the Forty-Meter coils. At 10 A.M. on a lazy Sunday morning in November, a mike and Ten-Meter rig can keep any Saturday night celebrant awake. There's nothing like Eighty to fall back on with a message for Sacramento 60 miles away, and while trying a whirl of mobile work One-Sixty is rather awkward. In actually picking the band that is your favorite though, the current flame must be ignored and the choice made on the basis of which band has taken the most consistent thumping throughout your years as a ham.

About the time *QST* was printing articles on 100-meter experimentation, a bootleg 202 took to glowing nights in my bedroom to the accompanying hiss of 80-odd borax-filled tumblers. (The "bootlegging" ended with the tube, as in those days with the two standard makes listing at $9.00, a manufacturer who put one out for $3.50 was dubbed "bootlegger.") Highly intelligent modulation was accomplished by wrapping a turn of wire around the helix in series with a glorified telephone, and "anywhere below 200" was usually 199 meters plus.

Eventually I too sweated the base from that shapely bottle and after a day spent misguidedly pairing a hundred-foot vertical cage down to twenty odd feet, the cross-country DX in the 80-meter log seemed a pipe dream.

Not until the adventurous were working across the pond nightly, and the most old-fashioned no longer mentioned "antenna amps," was the rig finally wrestled down to Forty Meters, and there it stayed for many years completely content with North America and an occasional VK to satisfy the ego. The chemical rectifier sneaked off to join the counterpoise and the T.P.T.G. finally bowed in favor of crystal control, but Forty was too good a friend to desert.

In poring over ham publications throughout these years, there was one subject that caused a steadily increasing uneasiness. There was a fascination in the DX Column and the Calls Heard that could not be overcome, but the whole thing was so much alphabet soup, as far as my rig was concerned. Not that the cards from 14 countries were not Exhibit A in the shack — somehow DX was for the other fellow.

Being a consistent die-hard and old-fashioned, it was not until last summer that curiosity outweighed inertia, and a doubler was jacked under the final. Perhaps the Goddess of Twenty set out to avenge her honor, because that first evening five new countries were added to the meager list in my log. Here at last was the band that would obviate plug-in coils. Around the country with ease any hour of the day, and elusive DX to chase in the early evening hours. Why move at all from this happy hunting ground? Snappy operators, snappy QSO's, my enthusiasm was almost childish.

Autobiography must end and conclusions be drawn. There must be some justification for the fact that the old Forty-Meter coil is back in the rig. I have tried all bands except "2½" meters, but throughout the years the band that keeps coming back for more is *Forty-Meters*. These, in part, are the reasons.

"One-Sixty" lacked excitement, as it is the most predictable of all, and in addition b.c.l. troubles were considerable. Five meters had a little more to offer in the novelty of pioneering but as to actual contacts, it was as limited as the other. Eighty-meter c.w. was dependable for short-haul traffic and rag-chewing, but with limited hours of operating it soon became too confining.

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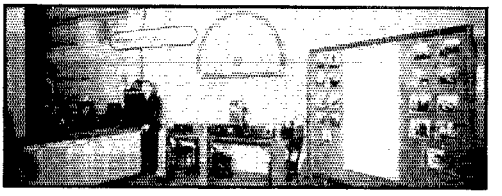

QST can present but a limited number of photos of radio exhibits due to space limitations. Representative of the best in ham radio exhibits, we present this month (above) the Milwaukee Radio Amateurs' Club exhibit at the Second Wisconsin Hobby Show, and (below) an exhibit at the Texas State Fair under the auspices of the Dallas Amateur Radio Club. Excellent publicity results from well-run amateur radio exhibits. They foster increased public appreciation of the amateur. It probably will be some time before we are again able to present additional exhibit photos.

Above: At the operating position are W9VDY (left) and W9HRM (right). W9LJU is standing at the end of the counter. Under the chairmanship of W9DIJ the following coöperated in operating the show station and in furnishing equipment for display: W9SZH, W9EEL, W9ZTP, W9VDY, W9EYH, W9UIT, W9HRM, W9ANA, W9VD, W9UHZ and W9NRX. Operation was under the call W9SZH/9 for the four days of the show, November 30, December 1, 2, 3, 1939. The exhibit also included transmitting and receiving units built by club members for an Emergency Equipment Contest at the Hobby Show. W9LJU was chairman of this contest, which was judged by W9OT and Mr. Stachura of W9JUE. Winners were W9GSP, First Award, W9NRX, W9DIJ, W9AVL and W9JGE.

Below: Left to right — W5IBE and W5HIP are at the control position of W5IME at the Texas State Fair. In charge of this exhibit were W5DAS, W5GSE, W5GZH, W5ECA, W5HIP, W5DW, W5CJJ and W5CKH.

Ten-meter 'phone had much to offer for a season, but its period of usefulness was too short. There are evenings between week-ends, and somehow short skip cannot make my spine tingle though the band does resemble a graveyard with darkness. For night watchmen, yes, but my pay check is eked out when the band is hot.

Twenty-Meters was the closest contestant and, with the short whirl it was given, perhaps is being treated unfairly. If it were 1930 instead of 1940 — if I had paired those coils sooner — and if — but the greatest allure she had was DX, and somehow she is losing her looks. I still slip down there occasionally on a Sunday afternoon to roam the East Coast, but a still house and glowing panel lights are my choice of atmosphere, and the capricious lady starts to fade so early in the evening.

My pet of the past and apparently of the future is still consistent old "Forty" who can "Swing-It" far into the night and still turn up with a surprise for those who haunt the wrong side of the clock.

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Y.L.R.L.

Plans are being completed for 7- and 3.5-Mc. C.W. Nets for the YL Radio League. YL nets may be organized on the other bands if there is a demand for them. Frequencies selected for Y.L.R.L. so far are 3610 and 7220 kcs. These nets are primarily for rag-chewing and getting acquainted with other YL's. If you are looking for a YL contact on those bands, those are the spots on which to concentrate. Do we hear a sudden grinding of crystals and swishing of e.c.o.'s?

On the night of December 29, 1939, five members of the Y.L.R.L. engaged in a round-table QSO on 3.5-Mc. c.w. — W9ILH, W9ZWL, W8SJF, W1GQT and W9NBX. The fellows who think all of the girls stick to 'phone are badly mistaken!

— Enid Carter, W9NBX
Secretary, Y.L.R.L.

High A.R.R.L. Party Scores

New highs in both scores and participation were reached in the 3rd Annual A.R.R.L. QSO Party held January 6th and 7th "for members only." Basically a "family gathering," the affair took on the aspects of a "junior Sweepstakes" with the usual contest men swinging-to-town! It was great sport, with many reunions, and new friendships established. Complete results are scheduled for July *QST*, but we're listing here some of the high claimed scores. Figures represent score, members worked, and sections worked in each case:

W3BES	43130–360–60	W9TQD	23490–217–54
W9RQM	38552–316–61	W3ATR	23232–242–48
W8OFN	37560–313–60	W4EDR	23097–195–59
W1TS	37200–310–60	W3GKO	23052–226–51
W2GSA	36669–360–51	W6PUZ	22624–202–56
W9RSO	36580–310–59	W9VBQ	22440–204–55
W2IOP	35169–313–57	W9GKS	22200–185–60
W9ZAR	33640–291–58	W3GJY	21658–221–49
W9FS	33120–276–60	W6BBR	21336–191–56
W9EYH	33110–301–55	W3HQE	21320–205–52
W9VDY	33060–285–58	W1UE	21200–200–53
W5WG	31742–269–59	W6AM	21010–194–55
W9TH	31692–278–57	W8OQF	20944–187–56
W3EDP	31130–283–55	W8QAN	20257–219–47
WQWDU	30030–273–55	W1KTB	20140–191–53
W4EV	29431–250–59	W2EQS	20100–201–50
W5KC	29028–246–59	W8LCN	20034–189–53
W2HHF	27984–264–53	W8DZC	19992–204–49
W6KFC	27560–265–52	W4CXY	19928–188–53
W1BFT	27500–250–55	W3BZE	19584–204–48
W3DGM (2 ops)	27280–248–55	W4FCU	19552–189–52
W9CWW	27000–225–60	W6ONG	19546–169–58
W2LXI	24380–230–53	W4AGI	19012–194–49
W4CYC	24360–210–58	W3GDI	18624–194–48
W8NCJ	24200–220–55	W5IHM	18150–182–50
W6MUS	23632–215–56	W6IOJ	18105–178–51
W9VKF	23548–203–58	W8NUV	17800–178–50

BRASS POUNDERS' LEAGUE

(December 16th–January 15th)

Call	Orig.	Del.	Rel.	Extra Del. Credit	Total
W6PCP	1238	1250	234	1000	3722
W8GZ	25	45	2297	37	2404
W9QIL	231	167	1480	144	2022
W3EML	100	192	1536	186	2014
W7EBQ	44	211	1464	150	1869
W6IOX	34	132	1352	130	1648
W3HRS	49	234	1071	231	1585
W6LUJ	180	687	0	685	1552
W3CIZ	59	152	1037	140	1388
W4IR	65	258	686	226	1235
W6PGB	44	79	984	76	1183
W6RBQ	5	48	1073	48	1174
W3BWT	81	188	697	152	1118
W5CEZ	25	103	874	18	1020
W7NH	10	23	845	22	900
W5MN	34	165	540	157	896
W9NFL	12	55	775	49	891
W1INU	77	111	698	0	886
W3GKO	27	61	728	53	869
W2HMJ	17	62	732	44	855
W1AKS	58	53	728	9	848
W8OXO	47	61	678	29	815
W8SJF	23	15	770	7	815
W3GJY	54	14	721	14	803
W9ILH	20	40	674	23	757
W3BZX	6	7	732	0	745
W1FFL	122	171	424	22	739
W1LWH	21	68	626	23	738
W2GVZ	47	154	392	130	723
W6LMD	1	11	691	6	709
W6FYR	17	43	598	41	699
W3ECP	13	120	438	118	689
W4PL	14	40	604	28	686
W5FOM	169	200	114	200	683
W5FDR	81	118	374	104	677
W5CDZ	71	16	542	16	645
W9YXH	43	62	492	32	629
W3GTS	233	162	132	101	628
W8CJL	11	79	466	66	622
W4FCU	18	34	539	29	620
W3NF	4	2	592	1	599
W4AOB	55	123	241	151	570
W9OUD	29	25	492	13	559
W6DH	21	112	324	101	558
W1EOB	49	42	444	20	555
W8ISK	30	3	501	1	535
W5EOE	15	83	374	48	520
W9SEB	21	66	407	24	518

MORE-THAN-ONE-OPERATOR STATIONS

Call	Orig.	Del.	Rel.	Extra Del. Credit	Total
KA1HR	2612	1443	906	1416	6377
KA1HQ	926	486	1160	475	3047
W5OW	298	239	2300	202	3039
W3CXL	36	83	2652	0	2771
W9BNT	53	102	968	51	1174
W2SC	58	339	334	337	1068
W1AW	144	117	358	108	727

These stations "make" the B.P.L. with total of 500 or over. One hundred deliveries+Ex. Del. Credits also rate B.P.L. standing. The following one-operator stations make the B.P.L. on deliveries. Deliveries count.

W2IOP, 400	W8ASW, 162	W7WY, 128
W7APS, 318	W9PYF, 153	W2MT, 126
W6ZX, 300	W1KCT, 144	W9GMT, 121
W9CRO, 288	W9QG*, 140	W9HFC, 120
W8KWA, 276	W9UN, 140	W2LZR, 113
W2CGG, 241	W6RH, 139	W2AXZ, 111
W3AKB, 213	W6EJA, 138	W6HH, 108
W5GPV, 198	W2KI, 135	W1IQZ, 106
W8IHR, 183	W1EPE, 131	W1JCK, 104
W9QG, 172	W5DWN, 129	W5FSK-4, 101
W1EMG, 162	W2PF, 128	W1GTN, 100

A.A.R.S.

MORE-THAN-ONE-OPERATOR STATION

Call	Orig.	Del.	Rel.	Extra Del. Credit	Total
WLM (W3CXL)	357	296	5312	255	6220

A total of 500 or more or 100 deliveries Ex. D. Cr. will put you in line for a place in the B.P.L.

* November–December.

DIRECTORY OF A.R.R.L. NETS

STATE, CLUB, SECTION NETS, ETC.

Name of Net	*Frequency*	*Operating Hours*	*Net Members*
ALABAMA O.R.S. NET	3712-kc.	7:30 P.M. CST, Tues.; 2:30 P.M., Sun.	W4FMI ERW EVJ CWB EBZ CYC DGS
CENTRAL CALIFORNIA NET	3803/ 3785-kc.	10:00 P.M. PST, daily; 7:00 P.M., Tues.-Thurs.-Sat.	W6LLW AMM KME ONX NTP LMD HH EY MFH RH CIS ZF MTS FMZ FYW IOX MXE JAT FBW MGL MYY QMV DYQ BKZ 7EBQ 7FPN 7HXK
SACRAMENTO VALLEY SECTION NET	3725-kc.	7:30 P.M. PST, tri-weekly	
AMATEUR NET FOR AMERICAN LEGION	1825-kc.	8:00 P.M. PST, Mon.-Wed.-Fri.	Not available; all Calif.
CONNECTICUT NUTMEG NET	3640-kc.	6:45 P.M. EST, exc. Sun.	W1BCG CCF CJD CTI EFW HSX ITI JMY JQD JXP KFN KKS KQY KSJ KYF KYQ LQK LUN LVQ MEC MHF TS UE VB
FLORIDA NETS	7-Mc. Band	8:30 A.M. CST, exc. Sun.	W4AXP DNA DWI DZX GEV FJR
	7-Mc. Band	1:30 P.M. CST, Tues.-Thurs.-Sat.	W4AXP DNA DUA DXH GFI GKB FJR
CENOIS AMA. RDO ASSN. NET (ILL.)	1975-kc.	Noon, CST, daily	W9CJV EQT KPS LIV LPR MJG NFL OFI OQB UJV
ILLINOIS EMERGENCY NET	3940-kc.	6:30 P.M. CST, exc. Sun.	District A: W9BRY UAO ZYL EWH RPX KOF YTV RZC LIG District B: IER RVI MCW QJS BJE HQD UNS FLS THB
ILLINOIS STATE NET	3765-kc.	6:30 and 8:30 P.M. CST, daily	
INDIANA EMERGENCY NET	3950-kc.	Noon, CST, Sundays	W9JZA PQQ TRN JUA VMG FIH SYJ EIJ DYI VCO ALQ CNG FCG RE NJQ UNI
INDIANA TRAFFIC NET	3656-kc.	6:30 P.M. CST, daily	
KENTUCKY KYN NET	1776-kc.	6:30 P.M. CST, exc. Sun.	
KENTUCKY KYE NET	3600-kc.	7:00 P.M. CST	
MAINE PINE TREE NET	3597-kc.	7:30 P.M. EST, Mon. through Fri.	W1GXY HSE IBR IIE INW IQZ IST ITH JCT KAS KLH LER LRP EJS GOJ GQ HSD IJF ISH KCO KOH KVK
EASTERN MASSACHUSETTS O.R.S. NET	3745-kc.	7:30 P.M. EST, daily	
MICHIGAN QMN NET	3663-kc.	5:00-10:00 P.M. EST, daily	
MICHIGAN EMERGENCY NET	3930-kc.	9:00 A.M. EST, Sundays (6:05 P.M. EST, daily)	W8BQA BTP BJD EJR EXJ EBN FM GHP GSC IGS JO KHK LKV LVY LWC MYG PPN PXT QPO STH SDH WF W9CWD PFK QEP WNT
MINNESOTA STATE NET	3795-kc.	7:00 P.M. CST, daily	W9BBL BHY CRO DNY HEN ITQ MZN NCS OMC YNQ WAS ONI CYX FUZ HFF CGK KFF
MISSOURI TRAFFIC NET	3755-kc.	6:30 P.M. CST	W9PYF EKW FSI KCG KIK KLJ NSU OUD TBU YTW
MISSOURI A.M. TRAFFIC NET	3.5-Mc. Band	7:00 A.M. CST	W9OUD DMR AEJ NSU QMD QXO WIS WIN TBU 5GFT
NEW HAMPSHIRE TRAFFIC NET	3840-kc.	6:30 P.M. EST, daily	
NO. NEW JERSEY NET	3630-kc.	8:45 P.M. EST, exc. Sun.	W2GVZ HCO CMC KMI CGG LMN BZJ LXI KHA
SO. NEW JERSEY O.R.S. NET	3700-kc.	8:00 P.M. EST, Tues.-Thurs.-Sat.	W3AVJ BEI BYR BZX DNU EWK FBM GMY HLV HMR HSL IHD ZI CCC VE HPX
SO. NEW JERSEY O.P.S. NET	1980-kc.	8:00 P.M. EST, Mondays	W3EUH ABS ACC AEJ CFS FMR GNU IHO IIC OQ
NEW MEXICO STATE NET	3703-kc.	7:00 P.M. MST, exc. Sun.	W5ZM GPV ENI ETM HAG DGP HJF BKD HRB FSP GSD HDN HPV GGO GUZ EWT CHU ND
NEW MEXICO 'PHONE NET	1.75-Mc. Band	Once weekly	W5ZM ICD INI DER INC IAQ BHU
N. Y. C. & L. I. SECTION NET	3710-kc.	8:30 P.M. EST, daily	W2AZV AZM BWC CTN DBQ DW DOG GDF GIC IOP ITX LBI LGK LEB LR LPA IPB MT
N. Y. C. & L. I. SELF-POWERED A.E.C. EMERGENCY NET	3710-kc.	9:00 P.M. EST, Wednesdays	W2AZM GDF ITX LGK LR LID LEB IPB
N. Y. C. & L. I. 1.75-MC. SECT. NET	1752-kc.		W2LR ITX LID MT DOG AZM
W. NEW YORK SECTION NET	3720-kc.	7:00 P.M. EST, exc. Sun.	W8BJO CSE DSS DHU FCG GWY PLA PCN QMR RRS RKM RVM SZK SBV SMI USA JQE
TU-BORO RADIO CLUB NET (L. I.)	3813-kc.	11:00 A.M. EST, Sundays	

Name of Net	*Frequency*	*Operating Hours*	*Net Members*
OHIO REGULARS SECTION NET	3730-kc.	6:30 P.M. EST, exc. Sun.	W8NAB AQ AYS BEW CBI CJL FFK FNJ IET LVU LZE PGI SJF WE
OHIO RIVER EMERGENCY NET	3960-kc.	1:00 P.M. EST, Sundays	W8PUN LKU RMC VZ EUN KVF OVB CDR NPZ
OKLAHOMA SECTION NET	3682-kc.	6:30 P.M. CST, Thurs.-Fri-Sat.	W5AAJ BOR BYC CEB CEZ DAK DTU EGP EIO EMD ERW FOJ FOM FRB FRW GAQ GER GFH FRZ GFT GVV GZR GZU YJ CLS EXZ
E. PENNSYLVANIA TRAFFIC NET	3835-kc.	6:00 and 9:45 P.M. EST, Mon.-Tues.-Wed.-Fri.	W3AQN HCT DXC IAY EFH EML EKG HYD GDI AOC W8ATF OML RHE LZD
W. PENNSYLVANIA TRAFFIC NET	3752-kc.	8:30 P.M. EST, daily	W8OEM QAN KWA NCJ
SOUTH CAROLINA SECTION NET	3832-kc.	7:00 P.M. EST, Mon.-Wed.-Fri.	W4AFG CPU CZA DXF EDO FMZ FNT FXH GJF
SOUTH CAROLINA 'PHONE NET	1960-kc.	4:00 P.M. EST, Sundays	W4BGD FNC CSP CUS DGG DPN EGH EHF EPK EOZ FFH FHE GIM EXY CO CPZ EXJ
SOUTH DAKOTA SECTION NET	3717-kc.	7:30 P.M. CST, Mon.; 8:00 P.M., Wed.-Fri.	W9DUC FOQ ILL KYZ QAK QJJ QVY SEB GLA SMS VOD VQN ULQ WLP WPA WUU ZCC ZWL ZYD
SOUTH DAKOTA 'PHONE NET	1904-kc.	11:00 P.M. CST, Wednesdays	W9GLK SIA LLG OQQ IYN INT KOS ORE ZBU SGI WZH EXX QAK LDU
TENNESSEE TRAFFIC NET	3737-kc.	6:30 P.M. CST, daily	W4AFC DEP RO BQK PL BDB DFR FCU FX CXY EGE
SOUTHERN TEXAS NET	3626-kc.	6:00 P.M. CST, daily	W5CVQ DDJ MN GXT FDR HNF HBQ HBN
OLD DOMINION NET (VIRGINIA)	1895-kc.	9:00 P.M. EST, Sundays	W3HIA BKG BSM FBL GRU EQQ CLD ALP GKL HF CQW HWB HXV EAI HLC HFL HME GWQ
ZERTZ NET (VIRGINIA)	7060-kc.	2:00 P.M. EST, Sundays	W3BZE EBK EHL EVN FBL GKL
SEWING CIRCLE (VIRGINIA)	1.75-Mc. 'Phone	12:30 P.M. EST, daily	
VERMONT TRAFFIC NET	3860-kc.	8:00 P.M. EST, daily	W1BNS, organizer
WASHINGTON REGULARS SECTION NET	3692-kc.	7:30 P.M. PST	W7FCG WY FPN GIN ETO
WEST VIRGINIA SECTION NET	3770-kc.	7:00 P.M. EST, exc. Sun.	W8GBF DYB BOK BTV DFC EHA JM JRL KKG KWI MKE NEU NTV OXO QBS SIG TNC ORD SFV SJF TWI
WISCONSIN STATE NET	3775-kc.	6:30 and 8:00 P.M. CST, exc. Sun. and Mon.	W9HSK AKT SZL GWK ZTP YXH EYH

GENERAL-COVERAGE NETS

ATLANTIC-PACIFIC TRUNK	3630-kc.	9:30 P.M. EST, daily	W1VB, Conn.; W2EC, N. Y.; W2HCO, N. J.; W8RKM, N. Y.; W3HUM, D. C.; W4FX, Tenn.; W9GMT, Ill.; W9AEJ, Mo.
ARMY OFFICERS' AMATEUR RADIO NET	7132-14264-kc. 7273 (alt.)	Varied	Regular Army Officers who are radio amateurs; W2LLS organizer; general call: CQRAO
A.T.E. NET[1]	3570/ 7140-kc.	8:00-10:00 P.M. EST, Mondays	New York: W2ALB IHI ZA W3HIH: Wash'n: W3ANJ HN; Cleveland: W8DBC LLG LEX FP; Chicago: W9GY SBC FQ WC; Denver: W9FA FKQ; San Francisco: W6JJ KM ACX IY PHS CRO; Hollywood: W6OSH
BOSTON & MAINE R.R. EMERGENCY NET	3.5-Mc.	——	Main Control Stns: W1CTS, W1ZZC. Fitchburg Div.: W1AJ, Control, SM FJK JXE LDV IIP W2BXP HZJ; New Hampshire Div.: W1BFT, Control, KLV JDP DUK ANS JBA FCI JGI TA IP AWU FX; Portland Div.: W1AEF KVK HMS LWO APE LVV.
CONTINENTAL RELAY SYSTEM	7286-7293-kc.	5:30 P.M. EST, daily	Ohio: W8REC KZO ROX LYZ CEI; Penna.: W3GKO W8OKD; Va.: W3CEY
CROSS COUNTRY NET	7270-kc.; 3635-kc.	5:00 A.M. MST	W9WVZ, Colo.; W6KHZ, Calif.; W7HAD, Wash.; W9YXH, Wis.; W3GKO, Penna.
"HIT & BOUNCE" NETWORK	3.5 and 7 Mcs.	5:00 A.M. CST, daily	W6IOX, Calif.; W5MN, Texas; W9QIL, Ill.; W4PL, Tenn.; W3CIZ, Md.; W3EML, Penna. Schedules: W6IOX-K6PLX; W9QIL-W7EBQ-K7/KA/K6; W4PL-K6QUJ; W3EML-K5AA
LOUISVILLE & NASHVILLE R. R. EMERGENCY NET	3830-kc. approx.	7:30 P.M. CST, Thursdays	Kentucky: W9ARU EDQ FQQ; Ind.: W9YJH; Tenn.: W4CXY DFB APC; Ala.: W4BFM FMI CUE; Mo.: W9KEI; Miss.: W5HAV; Fla.: W4QK; La.: W5DAQ
MACKAY OPERATORS NET	3669/ 7126-kc.	7:30 P.M. PST, Wednesdays	

Name of Net	Frequency	Operating Hours	Net Members
"MINK" EMERGENCY NET (Mo., Iowa, Nebr., Kans.)	1985-kc.	8:30 A.M. CST, Sundays	
MISSION TRAIL NET (Calif., Nev., Ore., Wash., Idaho)	1804-kc.	6:50 P.M. PST, daily	W6PGZ NOG LHH OND PZU NTU HHE JUQ JJE ITH NNN KZF OHN RYJ OJX PCA ZM HGN ANR QLM LMF HPE OIY ONU PST QFF BWK AVZ ISV DZZ OMC NQJ JTE QZA OML HVP KNZ OAE PMI ATP LHH IUZ AUZ
NATIONAL INTER-COLLEGIATE PRESS ASSOCIATION	7170-kc. or 3585	3:15 P.M. PST, exc. Sat. and Sun.	W7GWT, Seattle; W7YH, Pullman, Wash.; W7HXI, Bozeman, Mont. (Other members: W7UQ, W7EZL, W9PBT, W9YW, W9VGT, W9HPE, W8LT, W7LD)
PHILIPPINE EXPRESS NET	7 and 3.5 Mcs.	Individual schedules	Pacific Division: W6PGB, Net Control, W6EJA, W7YG, W9HFC, K7HJL, W6RBQ, K6PIT, KA1CO, W6PCP, KA1HQ. Atlantic Division: W3HRS, Net Control, W1MEC, W2LZR, W9MUX. W6PGB and W3HRS schedule to connect two divisions.
POLICE RADIO OPERATORS NET	3715-kc.	Varied	Operators call "QPO" to raise other members.
POTOMAC VALLEY NET	3935-kc.	9:00 A.M. EST, 2nd Sun. each month	W3ZD, organizer
TWO-LETTER CALL NET	3690-kc.	8:00 P.M. CST, Wednesdays	Holders of two-letter calls, and all old timers
WEATHER REPORTING NET (New Mex., Ariz., So. Colo., W. Texas)	3540-kc.	8:30 P.M. MST, Mondays	W5HAG DGP ENI ZM HJF HPV FSP GGO GYS BKD CHU HND EWT GPV BUV FMZ ICD HDH INI INC W6KOL PMJ EFC NXO RFS IIG LYU GBN IYZ JHV NVC SAV LKE PBD LJN OFE W9WVZ CDE NVU MDN TDR

In addition to the above, nets are listed on the following frequencies, but complete details are not available: 1915 kc.: N.E. Arkansas Net; 1950 kc.: 9-90 Net, and Shore Line Limited Network; 3550 kc.: Nashville (Tenn.) Emergency Net; 3561 kc.: Los Angeles Section Net; 3597 kc.: Arizona Section Net; 3657 kc.: Northern Texas Section Net; 3658 kc.: Nevada Net; 3905 kc.: Emergency Coordinators Inter-change Net (states of Ky., W. Va., Ohio, Ill., Ind., Mich.); 3910 kc.: Susquehanna-Emergency Net, and Knights of the Kilocycles (Fla.); 3920 kc.: Virginia 'Phone Net; 3970 kc.: West Va. Emergency Net; 3965 kc.: Ohio River Region 'Phone Net (W. Pa.); 3590 kc.: Ohio River Region C.W. Net (W. Pa.).

A.R.R.L. ALL-O.R.S. TRUNK LINES

Trunk Line	Frequency	Stations and Routing	Operating Hours
A	3565-kc.	(W9YXH, Mgr.) W2BZJ N. J.; W8IHR Penna.; W8QGD Mich.; W9TUV Ill.; W9YXH Wis.; W9HEN Minn.; W9DM No. Dak.; W7JC Mont.; W7FCG Wash.; W7CZY Wash. Alternates: W2GVZ W8QAN W9DKH W9DNY W9RZA W7FMV	9:00 P.M. CST, exc. Sun.
B	3795-kc.	(W9OUD, Mgr.) W3BZX N. J.; W8OXO W. Va.; W9EDQ Ky.; W4FFF Tenn.; W9OUD Mo.; W9KPA Nebr.; W9RVW Colo.; W6FYR Utah; W6CW Nev.; W6LMD Calif. Alternates: W3EFM W8GBF/W8BTV W9CDA W4CXY/W4FCU W9WIN W9EKQ W6LLH W6BIC W9POB	9:00 P.M. CST, exc. Sun.
C	3790-kc.	(W1JJY, Mgr.) W1LRP Maine; W1IP N. H.; W1JJY Mass.; W1AFB Conn.; W2IOP N. Y.; W3AKB Penna.; W3BWT D. C.; W3IFZ Va.; W4DLX N. C.; W4CZA S. C.; W4PEI Fla. Alternates: W1GOJ W1EPE W1FFL W1ITI W2MT W3EFH W3BZE W4EOP	Northern Division: 6:45 P.M. EST, exc. Sun. Southern Division: 7:30 P.M. EST, exc. Sun.
D	3620-kc.	(W5FDR, Mgr.) W4DXF S. C.; W4VX Ga.; W4DS Ala.; W5GHF La.; W5ANR Ark.; W5FDR Tex.; W5FOM Okla.; W5HAG N. Mex.; W6OQH Calif. Alternates: W5DDJ W5ERW W5GPV	Eastern Division: 8:00 P.M. CST Western Division: 9:00 P.M. CST
E	3705-kc.	(W7GEE, Mgr.) W3CIZ Md.; W8CJL Ohio; W9THS Ky.; W9ZGS Mo.; W9FWW Nebr.; W7GEE Wyo.; W7FFQ Idaho; W7FAF Wash.; W7CWN Wash. Alternates: W7GZG W8GBF	Eastern Division: 7:00 P.M. CST Central Division: 9:45 P.M. CST
F	3790-kc.	(W7WY, Mgr.) W7LD Wash.; W7WY Wash.; W7HD Ore.; W6MFH Calif.; W6MQM Calif.; W6GTM Calif. Alternates: W7ETO W6LMD W6BHV W6ISG	6:30 P.M. PST, exc. Sun.
G	3625-kc.	(W8BJO, Mgr.) W1JSM Mass.; W2MHW N. Y.; W8BJO N. Y.; W8IXJ Mich.; W9ILH Ill.; W9ABE Iowa; W9FOQ So. Dak.; W7CJR Wyo.; W7NH Idaho; W7DUE Ore. Alternates: W1LWH W8FCG W8RMH W9SEB W7FFQ	Eastern Division: 6:45 P.M. CST Western Division: 8:00 P.M. CST
H	3605-kc.	(W9ZCC, Mgr.) W9RZA No. Dak.; W9ZCC So. Dak.; W9YDZ Nebr.; W9JAP Iowa; W9QUY Mo.; W9UEG Kans.; W5DWW La. Alternates: W9NSU W9WIN	8:30 P.M. CST
J	3773-kc.	(W9BAZ, Mgr.) W9SZL Wis.; W9UN Ill.; W9BAZ Ky.; W4EDR Ala.; W4AXP Fla.; W4DNA Fla.	7:00 P.M. CST, daily
K	3755-kc.	(W5CEZ, Mgr.) W9QIL Ill.; W9PYF Mo.; W9VQG Kans.; W5CEZ Okla.; W5MN Tex. Alternates: W9YXH W9QXO W5GFT W5OW	6:30 A.M. CST, exc. Sun.

Trunk Line	Frequency	Stations and Routing	Operating Hours
L.....	3615-kc.	(W9FAM, Mgr.) W2ITX N. Y.; W8MOT Penna.; W8IET Ohio; W9YWE Ind.; W9NFL Ill.; W9DUA Iowa; W9FAM Nebr.; W9EKQ Colo.; W6DH Calif. Alternates: W2LR W8KNK/W8HCS W9PQL W9VEE W9KPA W9TDR/W9RVW	7:00 P.M. CST, exc. Sun. and holidays (W9EKQ to east) 10:00 P.M. CST, exc. Sun. and holidays (W9EKQ to west)
M.....	3585-kc.	(W5EOE, Mgr.) W2CGG N. J.; W3BKZ Md.; W8DYB W. Va.; W8LVU Ohio; W9QKJ Ill.; W9QMD Mo.; W5EOE Tex.; W5ENI N. Mex.; W6GBN Ariz.; W6MYT Calif. Alternates: W8NAB W9KIK W5DGP W6BHV	Eastern Division: 7:00 P.M. CST Western Division: 11:00 P.M. CST
NATIONAL T.L. NET	3670-kc.	(W1AW, N.C.S.) W9YXH/W8KWA TLA; W9RVW TLB; W3EFH TLC; W5FDR/W5DDJ TLD; W9THS TLE; W6LMD/W9RVW TLF; W9ILH/W8IXJ TLG; W9UEG W9ZZC TLH; W9BAZ/W9UN TLJ; W9PYF/W9VQG TLK; W9NFL TLL; W5ENI/W9QKJ TLM. (This net, composed of stations from each of the 12 main lines, provides traffic inter-change between all trunk lines.)	9:30 P.M. CST, exc. Sun.

[1] This net is getting under way, effective with this issue of *QST*, after a period of inactivity. Members listed are requested to get together at the time indicated to discuss a suggested change in name. "Amalgamated Transmitting Emateurs" and "Nationwide Boilermakers Club" are two of the names under consideration.

A Solution

As I listen to and try to read the "junk" that some of these "bug crazy," self-styled "speedy ops" are putting out, it makes me hot under the collar, so I am offering a solution, which I feel would better conditions considerably:

When the bug has attained a rate of speed with which the operator is unable to keep apace, watch bug carefully, seize the Wouff Hong and rap bug sharply on the dash contact. Then before bug regains consciousness, remove weights, wrap both bug and weights in cellophane, and encase them in solid concrete. Next charter a plane and go out over some deep harbor and dump said bug into "Davy Jones locker." Now the operator is ready to return home and with a key and buzzer start all over again to learn to send with the left foot. When this has been accomplished, there won't be any more Dah Dit Dit Dah Dit — Dah Dah Dit Dit Dah for CQ, and from the rock-bound coast of Maine to the sunny shores of California the ether will be permeated with something that can be read, and there is every indication that the Continental Code will again be used for amateur radio communication! — *W1AQL*

Michigan Storm Service

Upon reporting into the Michigan Net (QMN — 3663 kc.) on January 14th, W8DPE found that a heavy snow and wind storm was raging in the Upper Peninsula. Immediate contact was made with W9DVC of Ironwood, who advised that the roads were being blocked by snow and that the telephone lines were down between the Soo and St. Ignace, located on the Straits of Mackinaw. Contact was established also with W9UCD at Sault Ste. Marie, who called the telephone people and verified the statement that the lines were out. He informed them that the QMN Net of Michigan was standing by and would give any assistance necessary. At 7:02 P.M. W8QQK of Detroit was asked to get in touch with Police Radio Station WCK, which in turn contacted the Michigan Station Police Station at East Lansing (WRDS). WRDS monitored the Michigan QMN frequency while several stations in the net having two receivers monitored the police frequency. This enabled the State Police and the QMN Net to be in constant contact. At 10:25 P.M. WRDS called W8DPE and gave him an important message for W9UCD at Soo. This message was phoned to the addressee by UCD, and at 11:20 P.M. the answer was given to WRDS.

The net stood by all night for any possible emergency. The following stations assisted with fine coöperation: W8PLC, DAQ, HUD, IHW, QQK, OCC, QZH, SYO, RYP, DYH (WCK), TBP, SAY, YMN, W9YYA and WRDS. The State Police and the Michigan Nets are planning further coöperation in event of future disasters.

— *W8DPE, S.C.M., Michigan*

—•••—

Tom Serur, W5APM, of San Marcos, Texas, sends some interesting dope which he believes constitutes a record of some kind. He has worked and has cards from Fifth District stations with both two-letter and three-letter calls comprising the entire alphabet. In the two-letter group he has worked the following (note the first letter in each case): W5*A*C BB CT DP EQ FQ GZ HR IQ JH KA LM MS NB ON PP QZ RA SQ TQ UX VP WQ XA YH ZO. In the three-letter group, note the first two letters in each case: W5*AA*O ABQ ACZ ADO AEQ AFV AGU AHD AIY AJN AKN ALR AMX ANL AOW APZ AQC ARU ASP ATF AUQ AVU AWG AXU AYZ AZL. W5APM would like to hear from anyone who can beat this record, or equal it.

—•••—

W1AW Operating Schedule

OPERATING-VISITING HOURS

3:00 P.M.–3:00 A.M. E.S.T. daily, except Saturday-Sunday.

Saturday — 8:30 P.M.–2:30 A.M. E.S.T.

Sunday — 7:00 P.M.–1:00 A.M. E.S.T.

OFFICIAL BROADCAST SCHEDULE (for sending addressed information to all radio amateurs).

Frequencies

C.W.: 1761–3825–7280–14,254–28,600 kcs. (simultaneously)

Starting Times (P.M.)				*Speeds (W.P.M.)*						
E.S.T.	*C.S.T.*	*M.S.T.*	*P.S.T.*	*M*	*T*	*W*	*Th*	*F*	*Sat*	*Sun*
8:30	7:30	6:30	5:30	20	15	25	15	20	—	20
Midnight	11:00	10:00	9:00	15	25	15	20	15	15	—

PHONE: 1806, 3950.5, 14,237, 28,600 kcs.

Each code transmission will be followed in turn by voice transmission on each of the above frequencies.

GENERAL OPERATION:

Besides specific schedules in different bands, W1AW devotes the following periods, except Saturdays and Sundays, to GENERAL *work* in the following bands:

Time, E.S.T.	*Frequency*
4:30 P.M.– 5:00 P.M.	28,600 kc. Fone/CW
6:00 P.M.– 6:30 P.M.	14,237 kc. Fone
6:30 P.M.– 7:00 P.M.	14,254 kc. CW
8:00 P.M.– 8:30 P.M.	14,254 kc. CW
9:30 P.M.–10:00 P.M.	3950 kc. Fone
10:00 P.M.–10:30 P.M.	14,237 kc. Fone
11:30 P.M.–12:00 A.M.	1761/1806 kc. CW/Fone
1:00 A.M.– 2:00 A.M.	3825 kc. CW
2:00 A.M.– 3:00 A.M.	7280 kc. CW

7:00 P.M.– 8:00 P.M. Skeds on 80 meters.

10:30 P.M.–11:30 P.M. nat'l trunk NCS 3670 kc.

At other times, and on Saturdays and Sundays, operation is devoted to the most profitable use of bands for general contacts and to participation in special week-end operating activities. The station is not operated on legal national holidays.

Give W1AW a call for an accurate frequency measurement, to communicate with any department of A.R.R.L., to rag-chew when time permits, or to pass a message to ham friends in other places or on other bands.

How's DX?

HOW:

LAST year at this time we went prophetic and gave you the top men in the DX Contest as we saw them. For a neophyte handicapper we did all right (if you take the broad-minded viewpoint), and this year we'll show you how smart we really are — we aren't even going to try to pick the toppers. Why? Plenty of reasons, but all boiled down they're brought about by the condition Sherman so aptly defined with a single word we can't use. As DX men we resent it plenty, since it spoils our fun and that of many of our friends in foreign countries. And speaking of fun-spoiling, be sure to glom a glimpse at the revision of this year's rules given in this issue. It's tough, but it's true — you can't work any Europeans (or British or French colonies) whatsoever. If you're heard working one you'll be disqualified, since it was decided that the best way to keep completely clean in this matter is not to go near the mud puddle. Tough on the neutrals, say we, but doubtless the best for all concerned. But boy, oh boy, do we hope we can work 'em next year, if not sooner!

Now to get around to something pleasant. Would you fellows like to see what a fellow looks like who would forge cards in an attempt to get into the DXCC? We — meaning W1JMY, who handles the thing — recently caught two more fellows and we have a picture of one. We could run it, and print the names of the other fellows who have been caught, if you don't think it would be just too, too nasty for us to do. Of course, a guy who will pull such stunts is worthy of *all* the consideration we can give him. The nice part about the whole thing is that we aren't the least bit afraid of libel suits — we have these birds cold. As a matter of fact, and just between the two of us, W1JPE is suspected of submitting phoney cards. The very idea! (But that last time was plenty close — *Jeeves.*)

Which brings us down to the suggestion advanced by Boiled Owl No. 1, none other than the sage of the swisher, W1TS. Says he, "Jeep, you waste a lot of time on that pillar of yours. The day will come, but soon, when everyone will have crystal-controlled receivers and e.c.o. transmitters. Then all you will have to do is list the frequencies of the receivers and it will be a cinch for all of us to work the guys. Look up his receiver frequency, swish the swisher to the spot, and call until raise." Not bad, we counters — the only thing that will keep a guy from the DXCC is a typographical error.

WHERE:

WE HAVE some sad news now, stuff that may make a few feel badly but, in all fairness, we should get it straight once and for all. Many submitted cards from AC4JS and asked credit for Tibet. They didn't get it. Although the cards had "Tibet" printed on them, we had very good reason for believing that the station was not in Tibet. In the first place, for DXCC and the countries-list purposes, the word of the National Geographic Society and Rand & McNally is accepted, and they both place Choni in China. AC4JS didn't print the cards (XU4XA did) and we're not sure that he would have claimed Tibet. But the main, and deciding, point is that the authorities we go by put Choni in China. Cards from LX1SS aren't accepted because the LX society informed us that 1SS was a pirate. TA1AA comes under suspicion and is not accepted because of certain inconsistencies about the cards that came, supposedly from him, and reliable information we have from foreign sources. All this makes it tough on the fellows who had counted on credit for these stations, but we contend that their grievance lies with the misleading stations, not with the lads who are trying to keep the records straight.

Best DX of the month is probably **KC4USC**, the snow cruiser of the Byrd Expedition, who has been worked by W1ZI, W2BHW, W6ITH, KA1LB, W8PMJ and others on 7020, 14,400 and 14,350 c.w. and 14,140 'phone. He seems to get on at any odd time and has been worked at 0130 and 2330 GT, for example .. .. .. The 7-Mc. band is worth a try, particularly if you're an east-coaster looking for that Asian fill on your 40-meter WAC. W2BHW got his by working **XU8MI** (7055 T9) at 7 A.M., and he heard **J2KN** (7015 T9) .. .. .. There seems to be some question about **OK3ID** (14,400 T9), worked by W6JQB, but our guess is "OK" .. .. .. The French authorities seem to be checking on AR8AF, since a number of W's who worked him and sent cards to the address he gave have received official letters. It's rumored that one of the W's tried to get the official letter through for an AR8 QSL! .. .. .. Before we forget — Jerry Petranek out in Samoa writes to say that he thinks he is at last going to be given his license, which means that by now you should be hearing and working him. Dunno what his call will be, but anything that starts with a KH6 is good enough for us .. .. .. The RCC's (Cuba) magazine gives the address of **EA7BA** (14,030) as Sr. Jose Ma. Gil Guerra, Sagastas No. 33, Cadiz, Spain .. .. .. W2VY worked **KB6RWZ** (14,-

(Continued on next left-hand page)

♦

Tom Arnold, VU2AN, Fort Sandeman, Baluchistan, didn't let a 10-watt power limit hamper his activities. Well known on 14 Mc. for helping many to get a rare country, he was also active on 3.5 Mc. trying to get through to W. No luck yet, although he did manage several four-band contacts with G's.

The transmitter is a pair of 6L6's, run from the 220-volt d.c. mains.

♦

IN the November issue of *QST*, we mentioned on this page that we could install the Noise Limiter Circuit in existing receivers of the NC-100A series. We promised to let you know what the price would be as soon as we found out what changes were necessary. We have the information now, and you will find a price below. However, this figure covers the cost of completely overhauling the receiver circuit, not just installing the Limiter.

There are two reasons why we are quoting in this way. When we first described the Noise Limiter last October, *QST* remarked editorially that "one diode plus a couple of resistors equals one noise-peak-limiting circuit. . . ." This is true enough, but when it comes to actual installation in an existing receiver enough alterations have to be made to turn it into a major operation. A large part of the circuit has to be rebuilt.

The second reason is that we have made a number of improvements in receivers of the NC-100A and 101X series since they were first brought out, in line with our policy on all our products. Many of these improvements were contemporary with the Noise Limiter and almost equally worth while. Since we have to rebuild the set to install the Limiter, it seems foolish not to include these other new features at the same time.

We remarked above that the installation was a major problem. We know that we cannot get away with a simple statement like that, not on *this* page. So here is a brief outline of the changes required for the Limiter. The older NC-100's have a biased (power) second detector driving the PP output tubes through a transformer. An infinite impedance detector has been adopted as an improvement. This has lower output than the biased type, so that a voltage amplifier tube is required. This, with the Noise Limiter tube, makes two extra tubes. To make room, it is necessary to double up, using two twin triodes. One of these, a 6F8G, becomes the first audio and AVC. The second, a 6C8G, is the detector and Noise Limiter. This change would be simpler if the first tube was a triode-pentode, for the original AVC employed a pentode. However there was no suitable tube, so we redesigned the AVC to work with the triode. These circuit changes clear the way for the Noise Limiter, so the rest of the installation is simple enough. A new panel, a new instruction book, and a circuit realignment completes this job.

Among the other improvements, the most conspicuous are the new tone control and the new S meter. The tone control has a much wider range in controlling high frequencies, together with a bass control which is designed to give better compensation when using the crystal filter. The S meter changes include the addition of a db scale for signals above R9. The circuit has also been changed, making the meter much more convenient to use.

All of which adds up to $32.50 net to the amateurs. This figure covers modernizing a receiver that is sent to us in good condition, and does not, of course, mean that we will undertake any major change like turning an NC-100 into an NC-100A.

This is a very brief outline of what you get for your money. One amateur whom we quoted remarked that he could "listen to a lot of noise for $32.50." It is a lot of money, unfortunately, and unless you are in a noisy location, it probably is not a good investment. But where conditions are really tough, we are sure you will find it well worth the price.

DANA BACON

380 T9), who says he has over 300 cards waiting for the mail boat to come along and take.

WHEN:

Just because you don't hear them on 80 is no sign the band isn't good, W9UM kept a sked on 3500 with **HC1FG** just for a check. Incidentally, UM has been skedding the HC since 1927, which ain't bad skedding . . . . . **K6CGK** (3500) plans to be on week-ends during the spring for those east coasters looking for an 80-meter K6.

There's 40-meter representation, too, and W6QAP gives **J6CT** (7065), **PY1UR** (7030), **KD6FOU** (7190), **J2PK** (7140), **J4DC** (7125), and **J2KD** (7145), while W8JSU adds **LU1CW** (7200 T6), **CP1CF** (7030 T9), **HK5ED** (7095 T9), **HK3CD** (7160 T9), **NY2AA** (7020 T8), **KA1HQ** (7020 T9) and **XU6HW** (7030 T8) . . . . . W9RCQ voices the opinion of many when he says **KA1HR** (7150) has an awful noise level or else a tin ear . . . . . W1TS grabbed **KF6ROV** (7160 T9) the other A.M.

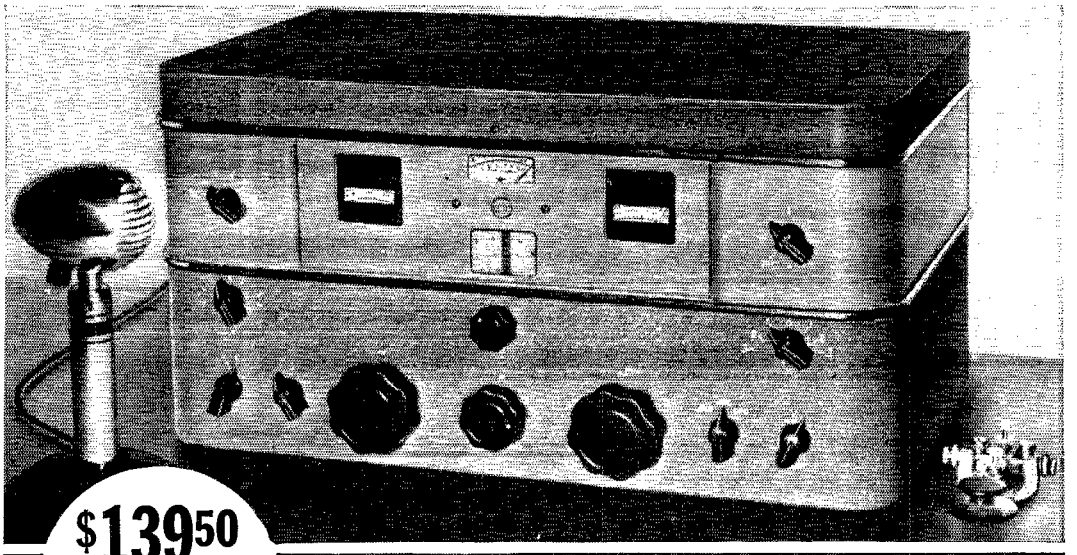
W9ZDS reports **ES5D** (14,375 T9) back on, and W8QVF worked **LY1KK** (14,345 T9x), **HA7E** (14,340 T6), **HA9U** (14,340 T8), **HA3P** (14,365 T9x), **KA1PO** (14,335 T9x) and **KA1LB** (14,275 T9) and heard **OQ5AV**(14, 340 T6) and **OQ5IM** (14,360 T9x) . . . . . On 20, W6QAP had **I1NZ** (14,400), **CE3EX** (14,350), **KA1AF** (14,400), **J6CD** (14,360), **J2MH** (14,400), **CX1BG** (14,400) and **CX1CB** (14,360) . . . . . HC1FG, via W9UM, sends the following list of frequencies: **ZP6AB** (14,040), **ZP3AC** (14,000), **YS4A** (14,000), **YN6EE** (14,255) and **ZP4AN** (14,020).

'PHONE:

W2GW IS THE latest to break into the DXCC via the 'phone route . . . . . W1ZI worked **XU8MC** (14,260) one evening when the Asian broke through, and W1ADM has worked **KA4RP** (14,130), **KA1MN** (14,140), **KA1SM** (14,110), **KA4LH** (14,125) and **KA1BB** (14,260) at that time. Other stuff at ADM includes **I1JKV** (14,060), **HA3B** (14,080), **EA7BB** (14,130), **HA9Q** (14,000), **HA1K** (14,045), **CX2CO** (14,055), **ZP2AA** (14,015) and **CP2AC** (14,065) . . . . . W6ITH has a nice list: **KF6JEG** (14,200), **CE2BX** (14,045), **CE1AO** (14,140), **LU5DD** (14,100), **LU2BG** (14,140), **LU6DJ** (14,070), **PY2IT** (14,130), **J5CW** (14,075), **XU8RJ** (14,075), **XU8ZA** (14,050), **J2KN** (14,040), **J7CB** (14,050), **J2NQ** (14,040), **CE1AC** (14,130), **LU9AW** (14,090), **CE1AS** (14,145), **CE3EW** (14,075), **LU4XA** (14,130), **OA4AI** (14,010), **HP1A** (28,225), **TG9AA** (28,355), **CE2BX** (28,310), **HC1JB** (28,375), **LU5AE** (28,110), **PY2AC** (28,190), **K7FNV** (28,615) and **OQ5AB** (28,210) . . . . . The DXCC heads would like the word passed along about 'phone counts in the DXCC. It seems that from time to time some will argue that it isn't fair to accept cards for the 'phone listing which do not confirm

(Continued on next left-hand page)

JEEVES



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AR-77 A NEW GENERAL PURPOSE COMMUNICATION RECEIVER BY RCA

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Only RCA offers all these features ...with exceptional performance

Dual R-F Alignment...air-dielectric trimmers *plus* inductance adjustment assures stable alignment and complete "tracking" of r-f circuits for uniform sensitivity.

Poly-Styrene Insulation... used for high efficiency 10 and 20 meter coil forms. High grade Ceramic insulation on range switch, r-f tube sockets, tuning and trimmer condensers.

Lower Circuit Noise . . . through circuit design that gives greater *usable* sensitivity for weak signals.

Negative Feedback . . . employed in the audio amplifier gives improved fidelity enabling operator to pass accurate judgment on quality of 'phone signals and to enjoy better entertainment reception.

Stay-Put Tuning . . . through use of temperature compensation and voltage regulation for r-f oscillator.

Uni-View Dial . . . slide shutter blanks everything except the calibration for the range in use. No confusion in reading dials.

Calibrated Band Spread . . . for 10, 20, 40 and 80 meter amateur bands.

Accurate Signal Reset. . . you can reset "logged" stations and check frequency closely with vernier index scale on both dials.

Variable Selectivity... in six steps through use of crystal filter. A real advantage for C-W telegraph *and 'phone* reception.

Improved Image Rejection... by use of high Q circuits and optimum L-C ratio.

Improved Noise Limiter . . . adjustable to meet local interference conditions.

Diversity Reception... by terminals provided for connecting two AR-77's together.

PLUS STANDARD SPECIFICATIONS

Antenna Trimmer, Pre-Selector Stage, 540-31,000 KC, 10 Tubes, Carrier Level Meter, Sensitivity Control, C-W Oscillator, Magnetite Core I-F Transformers, Audio Output 3 Watts, Headphone Jack, Standby Switch with Terminals for Relay, Modern Styling, Power Supply 105-125 V., 50-60 cycle—Special Power Supplies and Panel to Rack-Mount available on quotation.

RCA *for Amateur Radio*

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100% two-way 'phone contacts. The reason this isn't done is that it wouldn't mean anything — only in a very few cases can one tell from the card whether the DX station was using 'phone or c.w. For this reason, all cards submitted for the 'phone listing must show that the applicant was using 'phone at the time of contact, but there is no requirement about what the DX station was using.

WHO:

YS2LR WRITES to say that he's back in this country now and hopes to have a W5 call in the very near future. He is sending out about 600 cards, to catch up with his log, and if you still haven't received your card a few weeks after you read this, drop a line to 325 West 15th Street, Brownsville, Texas, and tell your story .. .. .. Which reminds us that we suggested you get in touch with VU7BR again if you didn't get his card. In case you don't have the address: T. J. Brown, Awali, Bahrein Island, Persian Gulf .. .. .. A note from G5BY, telling that he is with the B.B.C. during the "emergency" and misses his talks with the gang a lot. But a new G5BY is being built — on paper right now — in anticipation .. .. .. And G2YL, who would have had the distinction of being the first YL to make the DXCC, is anxiously waiting for the day when she can send over the precious cards without fear of their being lost .. .. .. HB9J is still in military duty, but manages to sneak in a listen to the gang on the high end every now and then .. .. .. To add to the confusion and controversy about AC4JS, W9VDX says he heard *two* AC4JS's, right at the time he was working one of them. A *very* popular call .. .. .. W4ZZ, batting around down in the West Indies, dropped in on the VP2 gang and found them anxious to get back on the air. K4AAN is apparently the only active one in KB4, says Herrick .. .. .. W8KPL refutes all operating theories by working WAC and WAS with 40 watts to a 6L6G and *one* crystal, on 14,308. Bill then goes on to tell how swell his new e.c.o. is .. .. .. W8JIW, who handles listener replies to this country, received several hundred cards from U.S.S.R. listeners for hams in the W1, 2, 3, 4 and 8 districts, so if you think you may have been heard and *want* the SWL cards, shoot JIW an inquiry .. .. .. W1BUX says **D4BIU** (14,300) is back on the air, with c.c. instead of the old 860 e.c.o. .. .. .. We had been saving our usual tips on how to win the DX Contest until the very last, but the best one we can give you this year is to acquaint yourself with the rules so you won't get disqualified. "The race is not to the swift, nor the Contest to the kilowatts." But lots of luck, laddies, and have fun. — *W1JPE*

O.O.'s Excel in Frequency Measuring Tests

As was mentioned in December '39 *QST*, the A.R.R.L. sets high standards for all Official Observers engaged in frequency measurement. Measuring tests are conducted through the year for qualification of those who can measure accurately, and individuals interested in O.O. appointment may place their names on file to be advised when future tests are scheduled.

In the first qualifying frequency measuring test period of last November–December, best measurements were made by the following observers:

Observer	*Average Error of Several Readings*	*Observer*	*Average Error of Several Readings*
W3HXQ.....	.0000915%	W9HQH.....	.001632%
W8BLH.....	.000575	W2IXQ.....	.002010
W5GHN.....	.000805	W6ITH.....	.002600
W1EAO.....	.001113	W9ARE.....	.002770
W9FA.....	.001330	W2GRG.....	.003030

"The miracle of radio! Every day new chapters are being added to the story of Ham Radio and on December 31, 1939, a paragraph, at least was written. That evening a family was reunited through the efforts of three hams, living in three different states. In Lancaster, N. H., W1JYY passed his mike to Mr. and Mrs. Davis, who talked with their sons, one in St. Johnsbury, Vt., who was introduced by W1JLF, and another in Skowhegan, Maine, at W1LJG. The family was able to chat almost as comfortably as if they were sitting in the same room. More power to hams!"

— *Mrs. S. O. Johnson, Skowhegan, Maine*

Transatlantic Tests Successful

OH, Mr. Printer, how many exclamation points have you got? Trot 'em all out, as we're going to need them badly, because WE GOT ACROSS!!!!!!

As we prepare the copy for this issue of QST our Transatlantic Tests are in progress and we have the highly gratifying news from Paul F. Godley, our special listener in Scotland, that the A.R.R.L. has spanned the Atlantic! For the first time in history the signals of United States and Canadian amateur stations have been heard across the ocean on schedule.

Mr. Philip R. Coursey, in charge of arrangements in Great Britain, radioed us on Dec. 13th as follows:

"Many your stations heard by British amateurs. Details later."

We are most impatiently awaiting receipt of Mr. Coursey's detailed report, the compilation of which necessarily will delay await the collection and examination of individual logs from the British listening-
It is the purpose of the tests in which particularly interested
British

Newmarket, and on his spark at that, but Mr. Coursey's report may show more of our cousins in the Dominion.

Station 1BCG at Greenwich, Conn., was reported on two consecutive nights and indications are that it had the greatest signal strength of any heard. This station was especially erected for the tests and was jointly owned and operated by Messrs. Minton Cronkhite, E. H. Armstrong, George Burghard, John Grinan, Ernest Amy, and Walter Inman. In its testing it has been reported from the Pacific Coast and must have kicked up considerable of a rumpus. Encouraged by the report of their signals, these men attempted to transmit an actual message, and to their credit be it said that they succeeded in putting across the first private radiogram ever transmitted across this space by an amateur station. The message was transmitted on the night of Dec. and acknowledged by a cablegram to R.L. Headquarters by Godley, reporting reception at 3 a.m. G.M.T. on The
ws:

18 Years Ago!

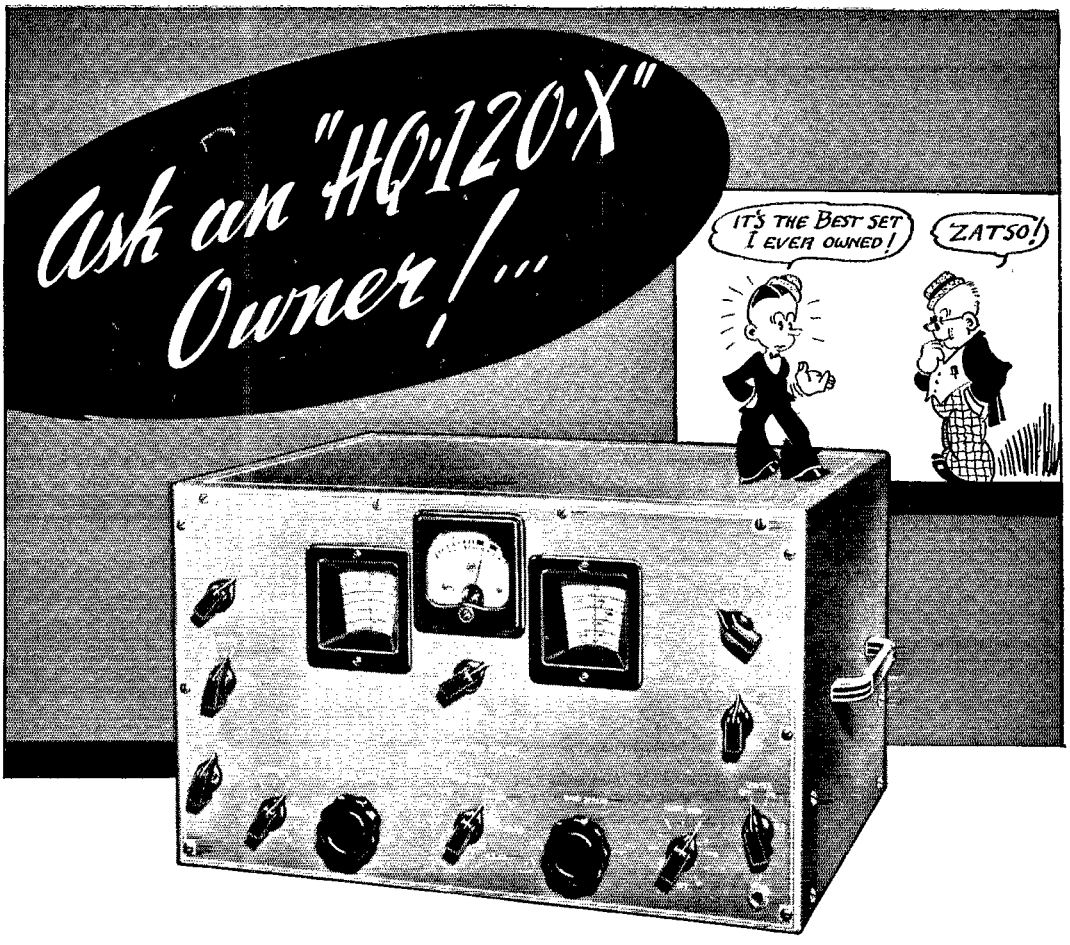
MEMBERS, DX CENTURY CLUB

W6GRL	147	G5BD	115	W4AJX	104
W2GT	147	W9KA	114	F8RR	104
W8CRA	145	G5RV	114	W3BEN	104
G6WY	145	W8BKP	114	W1GDY	104
W2GW	143	W2DC	114	W1GCX	104
W2GTZ	142	G2DH	114	W2BMX	104
W1TW	141	G5BY	114	W8LFE	104
G2ZQ	141	G6CL	113	G6KP	103
W9TJ	141	W2CJM	113	W8KKG	103
W6KIP	140	W4DRD	113	J2JJ	103
W8DFH	139	W2DSB	113	W5CUJ	103
ON4AU	138	W3BES	113	W3KT	103
W1SZ	137	W8MTY	113	W8DOD	103
W3EMM	136	W2GRG	113	W9NNZ	103
W6CXW	135	W9GDH	112	W2GNQ	103
W1TS	134	W6GAL	112	W4IO	103
W2BHW	134	W3EVT	112	W3AGV	103
W1LZ	133	W3GAU	112	W3GEH	103
W5VV	133	W8QXT	112	W4CBY	102
W8DHC	132	W1IAS	112	W8AU	102
G6RH	132	W6FZL	111	W8OXO	102
W8BTI	132	W2AAL	111	W1FTR	102
W4BPD	132	W1DUK	111	VE2EE	102
W8OSL	130	VE2AX	111	W2BXA	102
W5BB	130	ON4UU	110	W1GNE	102
W3CHE	130	PAØXF	110	W4BVD	102
HB9J	129	W9UM	110	W8JAH	102
W8OQF	129	W2AER	110	LU8EN	102
W2CMY	129	W8IWI	110	F8RJ	101
W8ADG	128	W5QL	110	VK3KX	101
W1FH	128	W2IYO	110	W6DOB	101
W3EPV	128	W3DDM	109	SU1WM	101
W8LEC	127	W6FZY	109	W8EUY	101
W2HHF	127	W3FQP	109	W1CC	101
W9KG	126	W6HX	108	SU1SG	101
W2UK	126	ZS2X	108	G6MK	101
W2JT	126	HB9BG	108	W4MR	101
W9ARL	125	HB9CE	108	W6GHU	101
W2ZA	125	VK3QK	108	W6BAM	101
W1DF	124	W1BXC	108	W8HGW	101
W8DWV	123	W2CBO	107	W6KWA	101
W4CEN	123	G5BJ	107	W4EQK	101
D4AFF	123	VK2DG	107	VK6SA	101
W8NJP	122	W1BGY	107	W9VDY	101
W9TB	122	VE3QD	107	LU7AZ	101
W3EDP	121	W7DL	107	W1AB	101
W9FS	121	W6MVK	107	G6NF	100
W5KC	121	W6AHZ	107	W6KRI	100
W8JMP	120	G2TR	106	W9UQT	100
J5CC	120	W1CH	106	VK2ADE	100
W2GVZ	120	W3AG	106	ZL1GX	100
W3FRY	120	W6TJ	106	HB9X	100
W1JPE	119	G2MI	106	W9RCQ	100
W1AXA	119	W9CWW	106	ZL1MR	100
W1BUX	118	W9RBI	106	PAOQF	100
ZL1HY	118	W1RY	106	W8BSF	100
W9ADN	118	W2VY	106	D3BMP	100
W7AMX	117	W2ARB	106	W8JTW	100
W9PST	117	W2OA	105	W9LBB	100
W3EVW	116	G5QY	105	W4CCH	100
W2BYP	116	VK3CX	105	W8KTW	100
W6ADP	115	W1ICA	105	W5ASG	100
W9EF	115	W2IOP	105	W8JIN	100
VK5WR	115	W1ZI	105	W8QDU	100
W2CYS	115	W4TO	105	W8AAJ	100
W1WV	115	W8LYQ	105	Radiotelephone	
W4CYU	115	W2AV	105	W2AZ	104
W1ADM	115	W3ZX	105	W2GW	101
W1HX	115	EI5F	104	W6OCH	100
		W1ZB	104		

The following have submitted proof of contact with 75-or-more countries: W9AJA 99; W1AVK, W1IOZ, W2ALO, W2BJ, W3AOO, W6ADT 98; G6GH, W2JME, W4TP, W8LZK, W8PQQ 97; W2CTO, W4DMB, W8BOX 96; F8LX, FB8AB, G6XL, W3AIU, W3EMA, W8IQB 95; W3FLB, W3GHD, W8CJJ, W9BEZ 94; G6ZO, ON4GK, PAØQZ, W2WC, W3OP, W4TZ, W6FKZ, W6MEK, W8TT, W9JDP 93; SP1LP 92; W9GBJ 91; D3CBC, G6YR, ON4FB, SP1AR, W1CBZ, W1DOV, W8LAV, W9OVU 90; VK3HG, W1KHE, W2CUQ, W8AAT 89; G2DZ, W2BZB, W3JM, W9PGS, W9VKF 88; G8IG, PY2DN, W6GPB, W6LDJ, W8JFC, W9AEH 87; W1BGC, W6NLZ, W8DAE, W9FLH 86; VK2TI, W4CFD, W6GK, W8OUK 85; SM6WL, W1BFT, W6AM, W8BWB 84; EI4J, OZ7CC, VE2GA, W2AWF, W2FLG, W6DTB, W6KUT, W8BFG, W8BWC 83; W1EWD, W3AYS 82; W9GY 81; G3BS, W1BPN, W2BNX, W2HTV, W3BVN, W3EPR, W4OG, W8CED, W8DGP, W8ITK, W9DIR, W9GKS, W9GMV 80; W3EUJ, W4ZZ, W3BHV, W9HUV, W9MRW 79; W3DRD, W4EPV, W8FJN, W9YNB 78; LA2X 77; PAØJMW, W1EH, W3BSB, ZE1JI 76; W3FHY, W4AHF 75.

Radiotelephone: W4CYU 94; W2IXY 91; G5RV 89; W3EMM 86; W8LFE 84; W1ADM, W1AKY 81; W2IKV 80; W2GRG 75.

Ask an "HQ-120-X" Owner!...



"HQ-120-X" owners are continually expressing their enthusiastic approval of this fine receiver. That is why we say, "Ask an 'HQ-120-X' owner." The variable selectivity crystal filter and the calibrated band spread dial have hit a vital spot with the amateur. Many say they would never be without these features again. This new crystal filter has everything for CW that crystal filters have ever had, and in addition, there are four wide band ranges, one for medium CW selectivity and three for phone reception without spurious peaks. It is absolutely smooth and stable. The calibrated band spread dial can be set for exceptional accuracy. Four amateur bands, 80, 40, 20, and 10 have scales of over 310 degrees. These are, by no means, the only features — talk to someone who owns an "HQ-120-X" and get the real low-down. You will be amazed.

We have prepared a 16-page booklet containing complete technical information — curves and diagrams included. If you do not have a copy of this booklet, ask your jobber for one or write direct to the factory. It contains a lot of useful information.

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PRECISION PRODUCTS FOR BETTER RADIO

HAMMARLUND

Checkers by Radio

BY AMOS UTTERBACK,* W9FB

INTEREST by playing checkers by radio is gaining by leaps and bounds. Many more hams would like to try this fascinating sport but don't know how to prepare their checker boards. It is rather difficult to explain this over the air, so a little enlightenment on the subject is about due.

To those who contemplate getting in on the fun, it is suggested that they first purchase a book on checkers and read up on the rules of the game. This will save embarrassment in case of question on any point. The books cost about 25¢ in book stores.

There are two accepted methods for preparing a checker board for radio games. One uses letters, the other numbers. Both systems are shown on the sketch accompanying this article. The lettering system was introduced in *QST* by W6DEG some years ago, and many players no doubt have boards prepared in this manner. Numbered boards are shown in practically all books on checkers. Either system

	1/A		2/B		3/C		4/D
5/E		6/F		7/G		8/H	
	9/I		10/J		11/K		12/L
13/M		14/N		15/O		16/P	
	17/Q		18/R		19/S		20/T
21/U		22/V		23/W		24/X	
	25/Y		26/Z		27/AA		28/BB
29/CC		30/DD		31/EE		32/FF	

may be used successfully, and it is a good idea to prepare your board as shown in the sketch, making possible the use of either method, as desired by your opponent. Simply determine whether his board is numbered or lettered, and play accordingly. The lettering process has the one advantage that it is somewhat easier to handle by radio.

Numbering and lettering may be done by cutting small pieces of paper about ½" x ¾", drawing a line across the center of each and placing the correct number above and letter below the line. After the pieces of paper are glued to the board they should be protected with a coat of shellac or lacquer (or coil dope—hi).

In playing, the board is always turned in such manner as to place the "double corners" at the upper left and lower right. The double corners are, of course, 1/A — 5/E and 28/BB — 32/FF. The game is started by placing the "men" in position with one color on the squares 1 to 12 (or A to L) and those of the opposite color on 21 to 32 (or U to FF). It is not necessary to indicate which color you are using, but rather you must indicate to your opponent whether your men are in the 1–12 sector or the 21–32 area at the start of the game.

Care must be taken that all moves are made *on both boards simultaneously*. A player may move as he chooses, telling the other player "6 to 10," "F to J," etc., so the same play will be made on both boards. To avoid errors and resulting confusion, it is best to acknowledge each play of your opponent by repeating the move back to him after he has given his instructions. If, for example, he says "6 to 10," you should acknowledge "6 to 10 OK, or 6 to 10 R," to show that you have made the move as directed. In case letters are used, the term "F to J" may be shortened to "FJ," etc. If a jump is made it is not necessary to mention the numbers or letters of the squares over which the piece passes, but just the numbers or letters on which the piece touches, thus "27 to 20 to 11 to 2," etc. The other player will then remove the captured pieces as required.

Checkers by radio offers a new thrill both for the game and

(*Continued on next left-hand page*)

* 2427 Schrage Ave., Whiting, Ind.

TAYLOR'S *New* TW-75

Another THIN WALL Carbon Anode Tube

Following the immediate and sweeping success of *the first* Thin Wall Carbon Anode Tube, the outstanding TW-150, Taylor Tubes proudly presents the TW-75. Scientifically designed and built to achieve "top efficiency" on the Ultra High Frequencies, the TW-75 is surely destined to receive its full measure of deserving approval and popularity. It will be a leading favorite with that large group of exacting communication engineers who demand the best in operating results and long dependable tube life.

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Grid to Plate—mmf	1.5
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Plate to Filament—mmf	7
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DC Plate Volts—max.	2000
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also for our hobby, as one never knows with whom he is about to play nor how good the other player is. Give it a whirl, fellows, and realize another pleasure from our hobby. IMPORTANT: Don't forget to sign your call at intervals as required by law!!

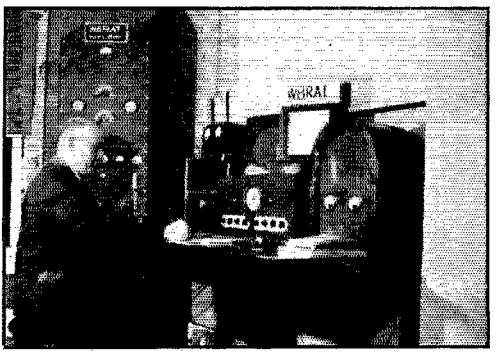
—...—

Tnx a Meg

BY NAZ. F. LaMARCA, W8RAT*

THE good old F.C.C. has with many blessings, no doubt, bestowed upon me this honorable call W8RAT and all that I can say is, of course, "Tnx a Meg" because — well I'm sure of one fact at least; and that is, I could not possibly blame that honorable body for the W8 part of it, but they must have been conscious of the fact that the remaining three little letters spelled such a mousing little word that if they knew they were actually giving me such a talisman, such chalice of joy, such a loaded barrel of fun they would want to charge me for occupying such an elevated and distinct throne in the hall of Hamdom . . . there can only be one W8RAT, so again I say "Tnx a Meg." Now to proceed with my story:

At first when I received my kingly call there was the business of my entire family and friends who decided to have such a good time of it that the house took an aspect of Christmas Eve. All seemed very happy about the whole thing, but as for me, I must confess, it looked more like the day after Christmas, and I wondered if I should not take my present back — for exchange — for, to top it all, that very evening in demonstrating the magic of my brand-new receiver, which had taken me eight months to put together, and calibrate its five bands — alas — the thing caught fire and, before I could disconnect the antenna, the ground and



the cord, the flames shot up and the coils and bandswitch burned to a crisp. Yes, sir, it burned and, to make it still worse, someone threw water on the whole set! So — there I was with a perfectly good brand-new ticket, the license to go on the air and important station equipment ruined — nothing to receive with even . . . so I proceeded to place my brand-new ticket in a neat little frame and stood it on the table where the receiver once stood, and placed a good-sized rat to watch over it.

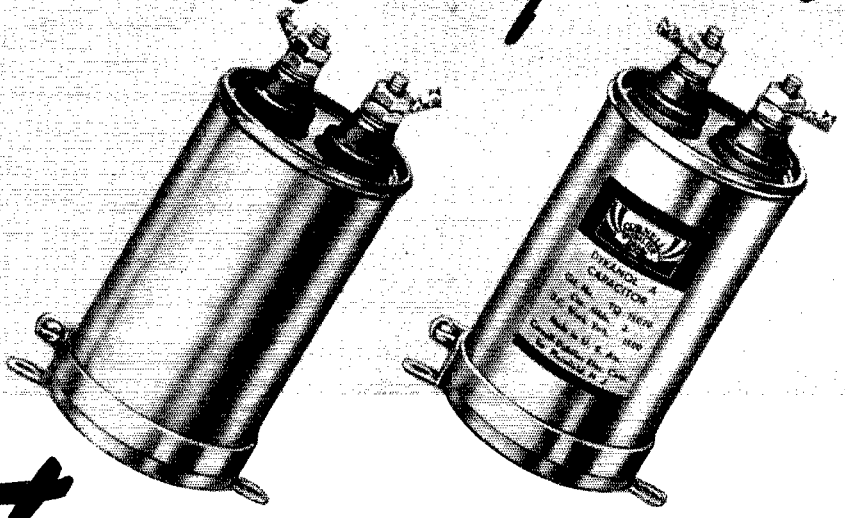
Evening after evening I would sit by watching both of them, wondering, thinking what to do next. I would plan, design, replan, redesign and wonder and think — thoughts of rebuilding the receiver! The XYL, bored I suppose to see me despondent, suggested that I should rebuild the transmitter. I proceeded to take that advice and evening after evening I found myself with the old soldering iron, looking at a hook-up. I put it together and I would tear it down again. I replanned the entire rig, redesigned it, put it together again. One rig — two transmitters and the third (right here I want to say that these weeks of really hectic and trying experience I would not trade for anything else in the entire Hamdom) but weeks did go by and results seemed so remote that I began to worry about when, if ever, I would be able to get on the air. But there came a light.

One evening after dinner, as I was about to resume my task in what was to be known as my Radio Room, I noticed a

(Continued on next left-hand page)

* O.P.S., 503 Lloyd St., Pittsburgh (8), Pa.

Twins at a glance



but

. . . actually, their resemblance is only "skin-deep." Down under — that's where you discover Cornell-Dubilier superiority. And this holds, not simply for the Type TQ (shown at right) but throughout the entire Cornell-Dubilier capacitor line. Type for type and feature for feature, C-Ds are better built capacitors. Thirty years of specialization does make a difference! A difference directly reflected in longer capacitor life . . . in greater capacitor dependability, and in the fact that there are more C-D capacitors in use today than any other make. Be specific — order capacitors by name. Ask your jobber for C-Ds — you can rely on 'em.

FEATURES LIKE THESE in Type TQ make all the difference!

Lower R.F. resistance
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huge cardboard case on the table before me. Sure enough, when I opened the huge case, there came from it one communication receiver. Gee! For the moment I could not possibly begin to think straight. My heart and mind were both tossing about so fast that I could not record what was transpiring in me, and as I succeeded finally in bringing myself down to a degree of calmness, there was the XYL with other members of our family, smilingly, telling me that the receiver was to take the place of the one which burned. We proceeded to tune in station after station and country after country until the wee hours, and as I awoke next morning I felt the satisfaction of my station having reached the halfway mark.

The transmitter was rebuilt and, with the help of the fine suggestions of OKK, MTL and MKF, we succeeded one evening in putting 20 watts input on the air. Right off the bat when we stood by the receiver was saying: "W8RBA calling the Rat." Even that sounded like a heavenly symphony to me. The first contact was established! There was the thrill and what thrill! Success at last, and everyone seemed to share in it immensely. The rig kept working and we kept on making improvements on it until it grew to the extent of being capable of 32 watts input. I began to build another transmitter, a homemade steel rack and panel job. This, when completed, increased the power to a capacity of 125 watts input. Friends on the air became numerous. The RAT seemed to catch on, and it seemed at times that the boys would load their receivers with cheese, for invariably one CQ would result in a round-table QSO. The RAT kept urging me on and I kept making improvements until now, with many thanks to Dieff, W8PJJ, whom we have learned to admire very dearly, the station has taken on quite a completeness. The rig is now capable of 400 watts input. A fine rack and panel job, 72 inches high, with a pair of 100TH's in the final, modulated with a pair of P.P. 809's Class B and a 913 scope incorporated into the modulator panel, and many other features . . . I again say the RAT is responsible for the rapid changes and aspirations, for the contacts are still popular and very friendly. From the very first contact we made with our 20 watts, the RAT has been bouncing in from one receiver to another. One day when we first received the ticket, a QSL card arrived from Coffeeville, Kansas, from W9RAT. He welcomed me in his great fraternal order of RAT. Now W6RAT has joined the brotherhood. Just three of us, think of it, with the entire United States to reign over with such a distinction! Let it be known that our fraternity, which shall be known as "the W-RAT of the air," is in progress and shall mature rapidly and . . . from such organization each district shall organize a club of the air. This club shall meet on the air at least once a week for the purpose of promoting good fellowship on the air, discussing improvements of signal, modulation, over-modulation and many, many other things pertaining to amateur radio. The club shall meet in the form of round table. Thus all problems and questions can be discussed under order and routine. This procedure should have a wholesome and psychological effect on everyone listening in. Boys not taking part in it may listen in and take notes, thus benefiting from the discussions.

Radio has been a sort of new lease on life to me; I enjoy every phase of it, although I am not a veteran of the air waves, I am approaching the half century mark on this Earth. I am very grateful and happy with my family, my work, my many friends and my RAT! Tnx a Meg.

BRIEFS

Possibly the youngest YL ham is thirteen-year-old W9HIG, recently licensed at Flaxton, N. Dak.

—•••—

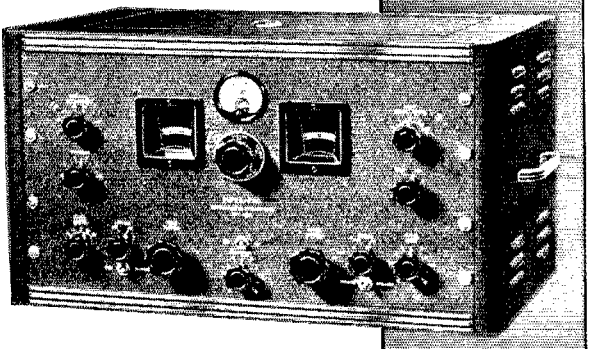
The score of W8EUO in the U.H.F. Relay of last November was given incorrectly as 55 in February *QST*. The true score was 130, which puts him in eighth place. FB, OM, and sorry for the inadvertent error.

—•••—

W1EOB offers two suggestions for message pushers: For a typewriter stand he suggests an orange crate or similar box. Have the YF cover the crate with burlap, and you have a respectable looking stand of just about the right height for the mill. For message paper to be used with a typewriter, a roll of adding machine paper suspended on the back of the typewriter stand offers continuous copy paper. A roll about three and one-half inches wide is just about right to get the heading on one line and five words per line for easy checking. Have a pair of scissors handy to snip them off as you finish a long string.

"ENGINEERED... *from every* ANGLE —

New SUPER PRO



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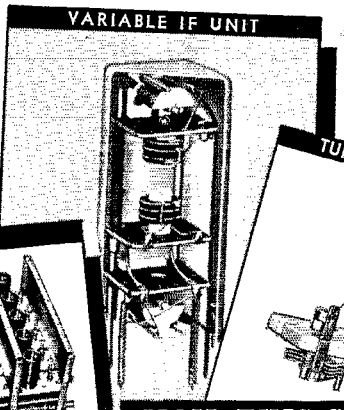
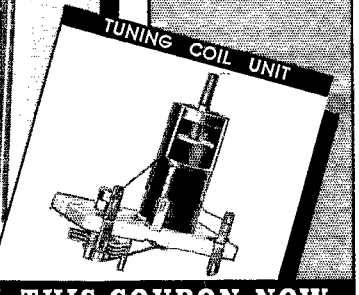
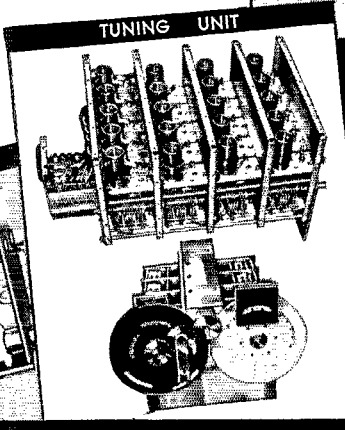
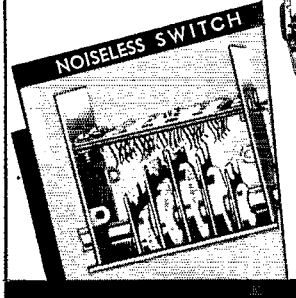




Write for complete technical details

Canadian Office: 41 West Ave., No., Hamilton, Ont.





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Address .....

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HAMMARLUND

Winning the National Radio Control Meet

(*Continued from page 27*)

off, but wheels still touching) and keeping it as straight as possible with the rudder control. Strangely enough, when the plane starts towards the edge of the runway (and it usually does) plenty of control is needed instantly to bring it back and then care must be taken not to over-control. Thrilling? Yes! But if you control wrongly a wing tip starts digging up the runway or vice versa!

The National Championship Meet

In winning the Radio Control event at the National Model Airplane Contest at Detroit this year, the radio and the plane performed in grand style. The radio-control planes were judged on their ability to execute a number of pre-decided maneuvers. The best flight we had lasted about 14 minutes. The ship climbed to approximately 1500 feet during the six minutes the motor was running. During the first part of the flight the model was sent down-wind to a field-light objective about one-quarter of a mile away, following the judge's instructions, and then was turned around and brought back over the transmitter. As you can see, this is an excellent stunt really to test the controllability of the model. Next, as we usually do, the plane was guided up-wind and the rest of the flight consisted of right and left circles, figure eights and the like, on command of the judge. At the end of this particular flight the job was landed about a hundred feet from the transmitter, thus establishing the first real radio-controlled flight at a National Contest.

Will any transmitter work the control? Yes, any one that's on the right frequency in the five-meter band. The five-meter gang from Detroit was on hand at the Nationals to help with the radio-control event and their main transmitter — a portable-mobile outfit — operated our controls very effectively. However, the coöperation between the contestants and operators was very gratifying and for the most part no interference resulted.

The only case of interference we've had in over a hundred flights this year and about fifty flights last year occurred in Chicago during a demonstration at the big Mid-Western States gas-model contest. We had flown the job in a strong wind in the morning and Walter had succeeded in landing the plane within two feet of the point where the wheels had left the ground on the take-off! Naturally, feeling so confident about the success in such windy weather, we decided to send her up again in the afternoon. It was my turn to "fly." Everything went fine until about thirty seconds after the motor cut, when the plane refused to respond any more — 1200 feet up, slightly up-wind and a 15-mile "breeze" blowing! Nothing we did on the ground had any effect — the plane was making great progress cross-country in a

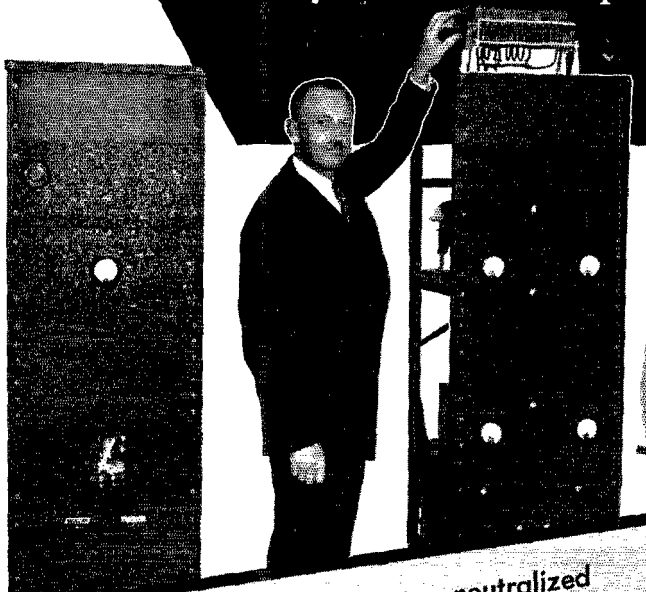
(*Continued on next left-hand page*)

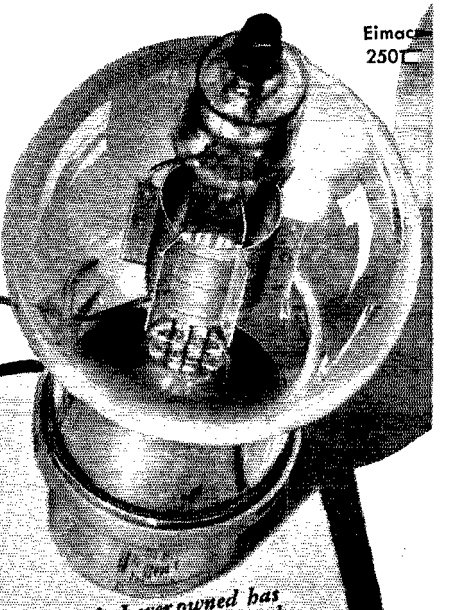
Frank Carter W2AZ

First Member to make Century Club on Phone

Verified Contacts with more foreign countries than any other amateur phone station.

...a loyal user of Eimac tubes





Put Eimac tubes in the sockets—neutralized and tuned up the rig—and then contacted 123 countries with 103 of them verified—not once bothering to re-neutralize.

Performance like this can only be obtained with the very best equipment and Frank Carter was fully aware of that fact when he ordered Eimac tubes for his station. Frank's rig is a home-made affair with a pair of old type Eimac 300T tubes in the final which are modulated with a pair of Eimac 250TH's. During the time he was getting the 103 phone contacts the plate and grid current did not change even as much as one mill.

Frank says: "No other tube I ever owned has maintained its characteristics so well, and I think the results say more than I could."

Why don't you follow the lead of the world's best known radio amateurs and technicians—adopt Eimac tubes for your transmitter—get better, more dependable performance and give the winners a run for their money?

See your dealer—if he can't supply you write direct for full information.

Eimac TUBES

EITEL-McCULLOUGH, INC. San Bruno, California

large circle, indicating half rudder position. Possibly another five-meter carrier was holding the relay down? The plane eventually landed about a mile and a half away and was finally recovered — but that's another story. The controls were checked and found to be in working order, leaving us with only one conclusion — that some amateur in the Chicago area was operating on the same frequency! (Time of flight, 4 P.M., Aug. 6, 1939.)

This system of control has worked as long as the plane has been in sight — about two miles. So far we've found no reason for flying it at a greater distance than that, especially when our original purpose was to bring the model back to the field so we wouldn't have to chase it!

This plane has done itself proud by winning the "Nationals" two years in a row, by taking the radio-control event in Chicago, by receiving first place in the original-design event at the Scripps-Howard Junior Air Races at Akron, by being possibly the first radio-controlled plane to be flown in Canada through a number of flights made at the Canadian National Contest at Toronto, and finally by its good behavior during demonstration flights at contests around Michigan.

We hope we've worked up your enthusiasm so that you may join this exciting diversion of amateur radio. All bragging aside, it's not easy, but, boy — it's lots of fun!

The Ionosphere

(Continued from page 35)

between the transmitter and receiver whose conditions determine the transmission, because it is there that the reflection from the ionosphere takes place. In multi-hop transmission, when the radio waves are reflected from the ionosphere, then from the ground, then back to the ionosphere, etc., the determining conditions are in the middle of each hop.

The maximum possible distance of transmission by a single hop is limited by the geometry of the earth's surface and the layer, and also by absorption or other limitation at the ground of those waves which are nearly tangential to the earth's surface. It is found in practice that the minimum angle with the ground of the radio waves transmitted or received (over land) averages about 3½ degrees. From these considerations the geometry indicates that the maximum distance along the earth by a single hop is ordinarily about 3500 kilometers for the F_2 layer, and about 1700 kilometers for the E layer. Single-hop transmission may sometimes be possible at greater distances than these while at the same time multi-hop transmission over the same path may be more efficient.

Because of the variation of ionosphere characteristics with longitude, different frequencies may be necessary for transmission in different directions from a given place. For example, around sunset in winter lower frequencies are used in transmitting eastward than in transmitting west-

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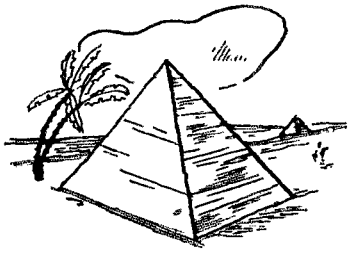

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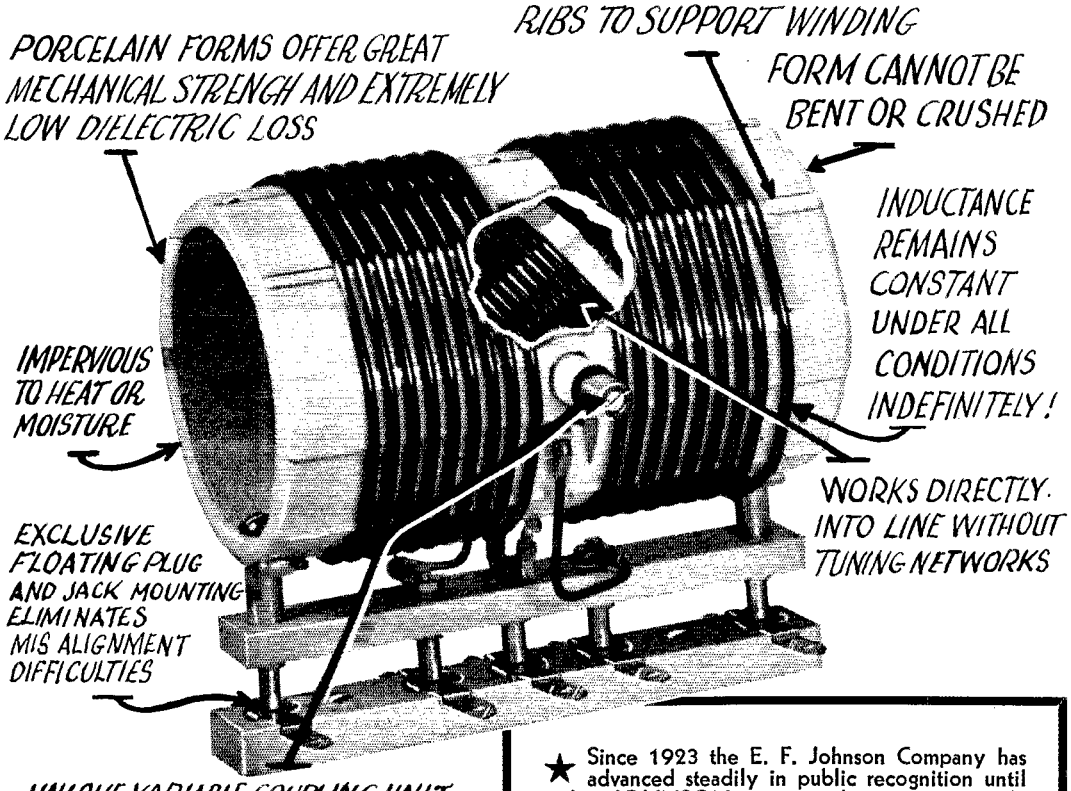

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rotates easily yet has sufficient tension to remain set when inductors are changed, eliminating necessity of readjusting coupling when changing bands. Offers wide range of impedances so that all inductors will easily couple into a 73 ohm untuned line, eliminating need of antenna tuner or matching network. The 10 and 20 meter inductors will easily match up to a 600 ohm line.

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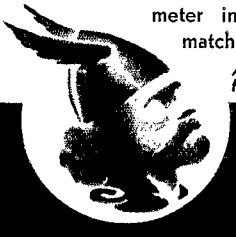

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ward from the same location. This does not mean, however, that different frequencies would be necessary or desirable in opposite directions over the same path.

For very long paths in which widely different longitudes (i.e., times of day) are involved, it sometimes happens that the waves travel different parts of the way by different layers. For such cases, it is necessary to take account of the heights of the different layers to determine the lengths of the several hops.

Effects of Ionosphere Irregularities

The primary effects of the ionosphere on radio wave propagation are those already described, which are due to the normal or regular characteristics of the ionosphere. The modes of variation of those characteristics have been shown to be of a regular and fairly predictable nature. There are some other ionosphere phenomena which are irregular in their times of occurrence, and make radio phenomena in general much less predictable. Five types of such phenomena have been identified: sporadic-*E*-layer reflections, scattered reflections, sudden ionosphere disturbances, prolonged periods of low-layer absorption, and ionosphere storms. While all five are irregular in time, the first two are primarily due to irregularities in space.

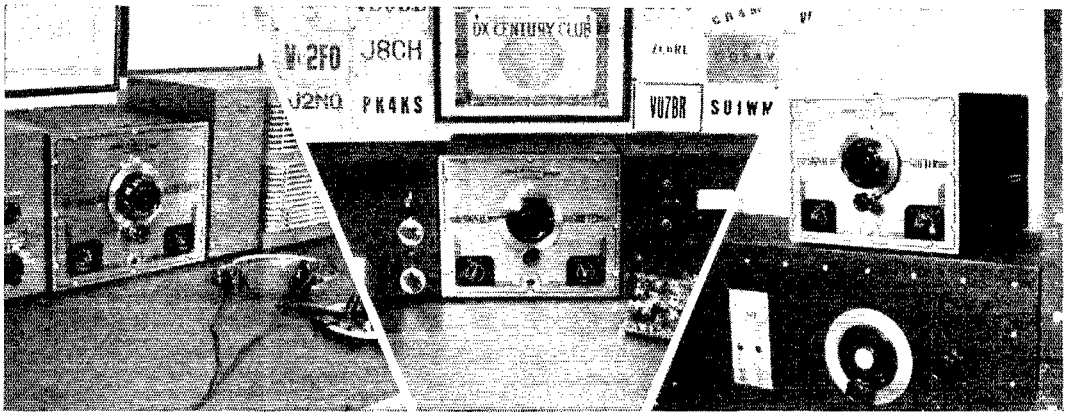
Sporadic E

It sometimes happens that waves are reflected by the *E* layer on frequencies higher than that at which the *E*-layer waves normally disappear and the reflection of waves by higher layers begins. Thus, in the example shown in Fig. 3 waves may sometimes be reflected at the *E*-layer height of 110 kilometers on frequencies of 4 or 5 or more megacycles. These reflections are due to a process different from the normal reflection in the ionized layer; the process is probably one of reflection from a sharp boundary of stratified ionization. The existence of these "sporadic *E*" reflections necessitates a redefinition of the term "critical frequency," previously defined as the highest frequency at which waves sent vertically upward are received back from the layer. When sporadic *E* reflections occur they may be received simultaneously with reflections from higher layers; for example, vertical-incidence reflections might be received at 8 Mc. from both the *E* and the F_2 layers. The *E*-layer critical frequency, more precisely defined, is the value (3300 kc. in the example shown in Fig. 3) at which the observed virtual height shows a sudden rise to large values as the frequency is increased. Except for the occasional occurrence of sporadic *E* reflections, all waves of higher frequency pass through the *E* layer and are not reflected by it.

Sporadic *E* leads to interesting results in long-distance radio transmission. It accounts for long-distance transmission up to higher frequencies than by any other means. Strong vertical-incidence reflections by sporadic *E* sometimes occur at frequencies up to about 12 Mc. By reason of the large angles of incidence possible with the

(Continued on next left-hand page)

Back of Record Performance



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G2ZQ	W4CCH
W2IOP	W8EUY
W9TJ	W6TJ
W2HHF	W8BTI

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E layer, this makes occasional long-distance communication possible on frequencies as high as 60 Mc. Such communication is generally for only a short time and for restricted localities. Sporadic *E* is thus patchy or sporadic in both geographical distribution and time.

Sporadic *E* occurs most commonly in the summer, May to August, particularly in the morning and evening, but may occur any time of day or night. It occurs occasionally at all seasons, particularly in the evening. It occurs more at high latitudes than in equatorial regions.

Scattered Reflections

An irregular type of reflection from the ionosphere occurs at all seasons and is prevalent both day and night. These reflections are most noticeable within the skip zone, or at frequencies higher than those nominally receivable from the regular layers. Like sporadic *E*, they occur at frequencies which may exceed the F_2 critical frequencies, but are unlike sporadic *E* in that they are complex and jumpy thus causing signal distortion; they occur and disappear fitfully, and are almost useless for communication purposes. Some types are of very weak intensity. The scattered reflections are characterized by very great virtual heights, usually somewhere from 400 to 1500 kilometers. Their occurrence was for a time thought to indicate the existence of another layer above the F_2 layer which might be called the *G* layer. It is now, however, thought that they are of several types, and that some of them are due to complex reflections from small, ephemeral, scattered patches or "clouds" of ionization in or between the normal ionosphere layers, and thence to one or more layers and ground by single or multiple reflection.

Sudden Ionosphere Disturbances

The most startling of all the irregularities of the ionosphere and of radio wave transmission is the sudden type of disturbance manifested by a radio fadeout. This phenomenon is the result of a burst of ionizing radiation from a bright chromospheric eruption on the sun, causing a sudden abnormal increase in the ionization in the *D* layer (below the *E* layer), frequently with resultant disturbances in terrestrial magnetism and earth currents as well as radio transmission. The radio effect is the sudden cessation of radio transmission on frequencies above about 1500 kc.

The drop of the radio signals to zero usually occurs within a minute. The effects occur simultaneously throughout the hemisphere illuminated by the sun, and do not occur at night. The effects last from about ten minutes to an hour or more, the occurrences of greater intensity in general producing effects of longer duration. The effects are more intense, and last longer, the lower the frequency in the high-frequency range (i.e., from about 1500 kc. up). It is consequently sometimes possible to continue communication during a radio fadeout by raising the working frequency.

The radio, magnetic, and other effects are markedly different from other types of changes in these quantities. The effects are most intense in

(*Continued on page 96*)

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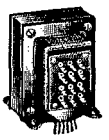
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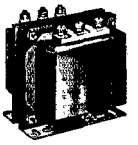
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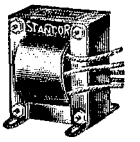
TYPE "D"


TYPE "FS"



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TYPE "B"

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A-4762	15	60	2.6:1, 3:1, 3.2:1, 3.4:1, 4:1, 4.5:1, 5:1	CD	3.30
A-4763	30	120	1.25:1, 1.5:1, 1.75:1, 2:1, 2.25:1, 3.2:1	CD	4.35
A-4764*	30	120	1.5:1, 2:1, 2.5:1, 3:1, 3.5:1	CD	4.35

*P.P. 6L6's with 16% inverse feed back.

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A-3891	15	45	45	90	D	2.5	$3.00
A-3892	30	80	80	160	D	6.0	3.90
A-3893	60	125	125	250	D	7.3	4.80
A-3894	125	150	150	300	D	12.0	6.30
A-3895	300	260	260	520	FS	35.0	18.00
A-3896	600	350	350	700	FS	75.0	37.50

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P-5053	1660–0–1660 1390–0–1390	1500 1250	300	11.10
P-6156	2150–0–2150 1850–0–1850	1750 1500	300	12.00
P-6154	2430–0–2430 2150–0–2150	2000 1750	300	12.90
P-6155	2950–0–2950 2400–0–2400	2500 2000	300	17.70
P-3012	1250–0–1250 950–0–950	1000 750	400	11.40
P-6153	1550–0–1550 1350–0–1350	1250 1000	500	13.80
P-6159	2150–0–2150 1830–0–1830	1750 1500	500	22.50

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Stancor Number	Primary Voltage	Secondary Volts	Secondary Amperes	Type Mounting	Insulation in Volts	Net Price
P-6140	115	2.5	5.25	N	2,500	$.96
P-3060	115	2.5	10	B	10,000	1.05
P-4088	115	5	3	B	2,500	1.20
P-6135	115	5	10	N	2,500	1.95
P-6307	115	5	22	N	2,500	3.45
P-5014	115	6.3	3	B	2,500	.96
P-6308	115	6.3	10	N	2,500	1.80
P-5016	115	10	4	B	2,500	1.65
P-6139	115	10	8	N	2,500	2.04
P-6164	115	6.3, 5, 2.5	2.5	B	2,500	1.20

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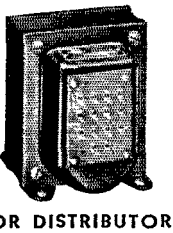

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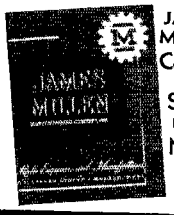

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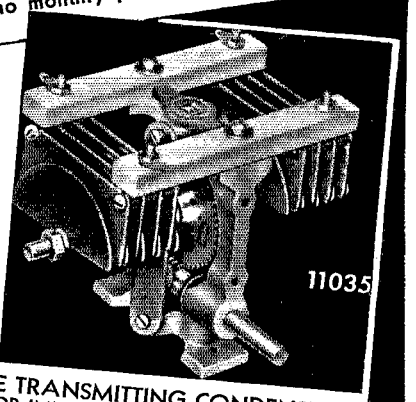

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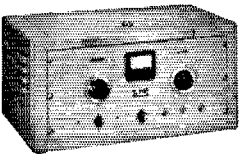

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110CM. 110-watt CATHODE MODULATED. 5 bands (less accessories and cabinet) **$48.75**

All Above are Exactly as Listed in Hamanual

STANCOR PLATE TRANSFORMERS

All primary voltages 115

Stancor Number	Secondary A.C. load volts	D.C. volts after filter	Current in M.A.	Primary V.A.	Net Price
P-5060	510–0–510	400	250	170	$3.83
P-3699	740–0–740	600	200	180	3.83
P-4030	1220–0–1220	1000	250	375	6.76
	880–0–880	750			
P-6152	1550–0–1550	1250	300	570	9.40
	1350–0–1350	1000			

STANCOR CHOKES

	Henries	M.A.	D.C. Res'ce	Insul'n	Price
C-1702	8–30	250	70	3,000	$2.21
C-1703	15	250	60	3,000	2.21
C-1710	8	150	200	1,650	1.18
C-1404	5–25	400	60	5,000	5.30
C-1414	10	400	60	5,000	5.30

FILAMENT TRANSFORMERS

Stancor	Volts C.T.	Amp.	Primary	Insulation	Price
P-3060	2.5	10	115	10,000	$1.03
P-4088	5.0	3	115	2,500	1.18
P-3062	5.0	6	115	2,500	1.47
P-5014	6.3	3	115	2,500	.94
P-3064	6.3	6	115	2,500	1.47
P-5015	7.5	4	115	2,500	1.18
P-6138	7.5	8	115	2,500	1.76

TWO NEW CATHODE MODULATION TRANSFORMERS

250 MA. For modulating RF amplifier inputs up to 250 watts. Eight output impedances from 150 to 2500 ohms available. No. A-3888. *Net*. . . **$2.50**

450 MA. For modulating RF amplifier inputs up to 600 watts. Eight output impedances from 150 to 2500 ohms available. No. A-3889. *Net*. **$3.53**

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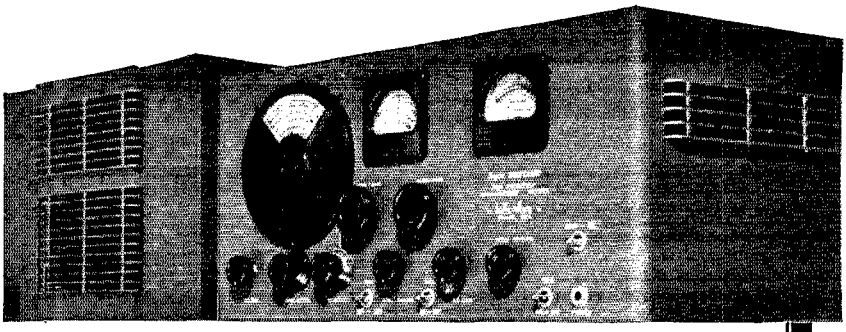

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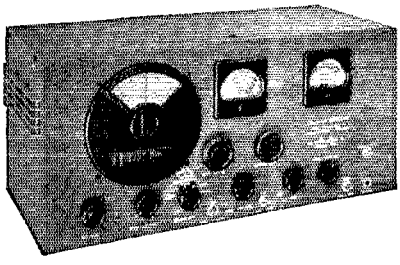
HALLICRAFTERS NEW "SUPER DEFIANT"

Complete with Crystal, Tubes, and Speaker in Matching Cabinet as shown

Be among the first to own Hallicrafters' sensational new receiver. You'll never miss the small down payment and you can spread the balance over many months. **IMMEDIATE DELIVERY** as soon as credit is approved. Figure your own terms this easy way . . . just deduct down payment from the cash price, add 6% carrying charge to balance, and divide into as many months as you want up to 12. *Complete cash price* **$99.50**

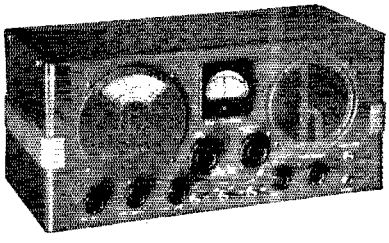


PAY ONLY ← Skyrider Defiant SX-24

$8.15 DOWN

Add 6% carrying charge to balance and divide into equal monthly payments as desired, up to 12 months.

Previous down payment cut in half under Newark's **NEW LIBERALIZED CREDIT PLAN.** Lowest down payment and lowest carrying charges ever offered on this fine receiver. Just send down payment with your order and we ship immediately upon credit approval. Cash price, complete with tubes, crystal and speaker, **$81.50**



← Famous Sky Buddy S19R

$5.90 DOWN

Add 6% carrying charge to balance and divide into equal monthly payments as desired, up to 5 months.

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New Sky Champion S20R →

Only recently available on Newark's Payment Plan. You can add a few extra parts or supplies and make your order total over $50 and pay only 10% down if you wish. *Cash price, complete*..... **$49.50**

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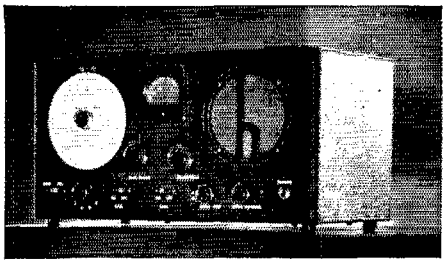

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that region of the earth where the sun's radiation is perpendicular, i.e., greater at noon than at other times of day and greater in equatorial than in higher latitudes.

Taking due account of the variation of the effects with frequency and distance, varying effects in differing directions can be explained. Reception in the United States from stations in the southern hemisphere usually exhibits greater effects than reception from other directions (because of passing the equatorial regions). Similarly, when the disturbance occurs at a time when it is morning at the receiving point the effects are usually greater in reception from the east than from the west, and vice versa for the afternoon (because of passing the region where it is noon). A radio fadeout sometimes occurs when it is night at the receiving point, but only when the path of the waves is somewhere in daylight.

Prolonged Periods of Low-layer Absorption

This phenomenon is similar to the sudden ionosphere disturbance in its effects and characteristics except that it has a longer time duration, commonly several hours. The intensity diminution is in general not as severe as in the more intense fadeouts, but sometimes the intensities fall to zero.

The low-layer absorption effect appears to be due to increased ionization in the *D* layer (below the *E* layer), exactly as for the sudden ionosphere disturbances. The increased ionization is caused by an abnormally great outpouring of ultraviolet light from the sun, but in this case it is not so sudden as in the eruptions which cause the sudden ionosphere disturbances. The variation of the effects with frequency, and other characteristics, are the same as for the sudden ionosphere disturbances.

Both phenomena occur at all seasons, but the prolonged periods of low-layer absorption have been found to occur in a group of several weeks' duration at periods of high sunspot activity, the groups being separated by more or less quiet periods of several months. They frequently but not always occur during periods when sudden ionosphere disturbances are numerous.

Ionosphere Storms

An ionosphere storm is a period of disturbance in the ionosphere in which there are great anomalies of critical frequencies, virtual heights, and absorption. Radio transmission is poor (except for the low frequencies, below 500 kc., which are sometimes improved). An ionosphere storm usually lasts one or two days, and occurs both day and night. It is usually accompanied by a magnetic storm (i.e., a period of unusual fluctuation of terrestrial magnetic intensity). During the first few hours of very severe ionosphere storms the ionosphere is turbulent, stratification is destroyed, and radio wave propagation erratic. During the later stages of very severe storms and during the whole of more moderate storms, the upper part of the ionosphere, principally the

(Continued on next left-hand page)

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Now available on our easy payment plan

110 CM TRANSMITTER

★ NEW SELF CONTAINED 100 WATT

★ FIVE BAND PHONE—CW TRANSMITTER

★ FEATURING CATHODE MODULATION

●

Complete kit for 5-band operation on phone or CW, with tubes, all coils, and three crystals, less cabinet.

Cash Price	*Down Payment*	*Per Month For 12 Months*
$84.96	$16.99	$6.12

LESS ACCESSORIES . . . **$47.78**

Write for complete descriptive literature

We can supply all Stancor kits with exact specified parts at lowest prices. Most Stancor transmitter kits may also be purchased on our easy payment plan. When requesting quotations or payment plan on Stancor kits, specify in what bands operation is desired and at what frequencies.

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STANCOR'S 110 CM TRANSMITTER *and* HALLICRAFTERS SX-24 SKYRIDER DEFIANT **$29.75** *Down*

Both transmitter and receiver may be purchased on our easy payment plan together. Write for particulars.

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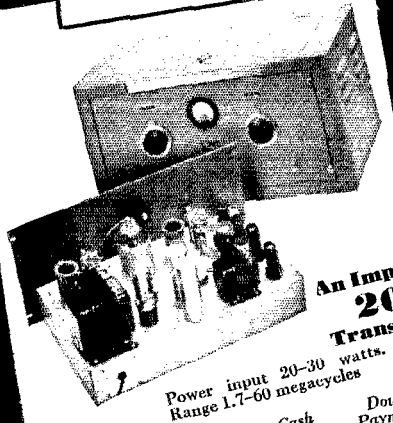

An Improved 20P Transmitter

Power input 20–30 watts. Frequency Range 1.7–60 megacycles

20P transmitter kit complete for 5 band operation on phone-CW, includes all coil forms, wire to wind them, tubes, less cabinet and crystals.

Cash Price	*Down Payment*	*Per Mo. for 6 Mos.*
$51.23	$10.23	$7.17

20P transmitter kit, less accessories **$36.26**

60P Transmitter

★ 60 Watt FIVE BAND Phone ★ CW Transmitter ★ PLATE MODULATED

60P transmitter kit complete for 5 band operation, on phone-CW, with all final coils, forms and wire for buffer coils, tubes, less crystals and cabinet.

Cash Price	*Down Payment*	*Per Mo. for 12 Mos.*
$65.47	$13.09	$4.71

60P transmitter kit, less accessories **$43.90**

Cabinet and crystals may be added to the easy payment plan, specify what frequency crystals, and De luxe cabinet $7.50 or Standard cabinet $4.30.

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The RADIO SHACK

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F_2 layer, is expanded and diffused. The critical frequencies are much lower than normal and the virtual heights much greater, and therefore the maximum usable frequencies are much lower than normal. It is often necessary to lower the working frequency in order to maintain communication during one of these storms. There is also increased absorption of radio waves during an ionosphere storm. Ionosphere storms are most severe in auroral latitudes and decrease in intensity as the equator is approached. Ionosphere storms occur approximately simultaneously over wide geographical areas. The condition of the ionosphere is much less uniform from point to point than on undisturbed days.

Multi-Stage Metering

(Continued from page 43)

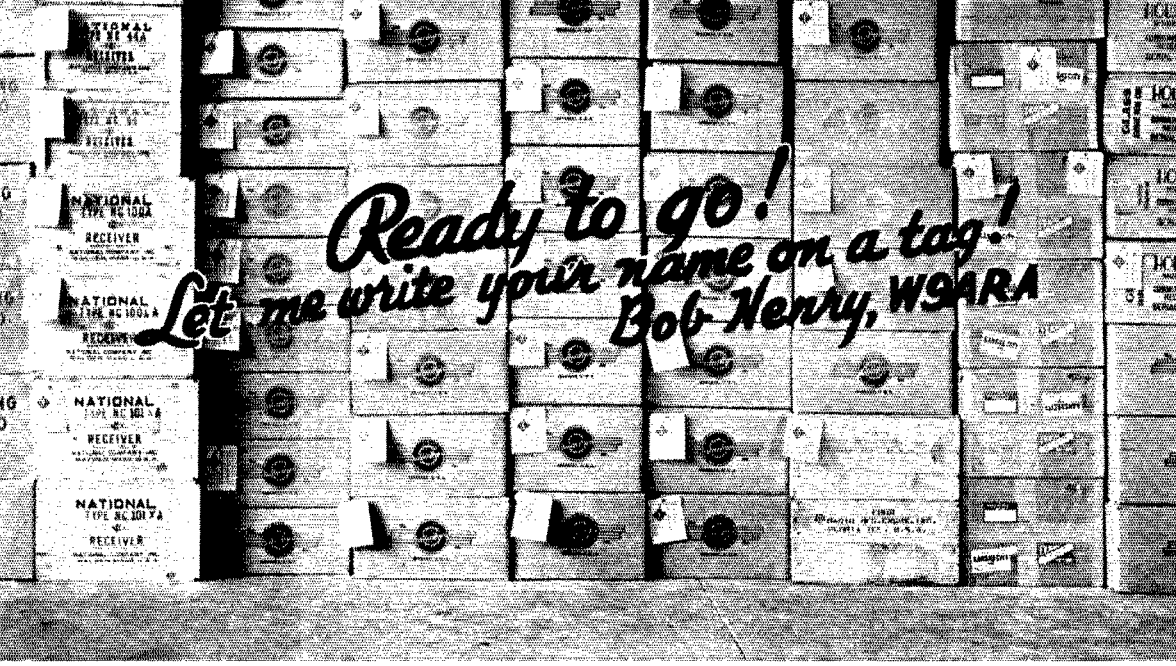
possible that some of the tubes in the exciter may be operating with elements tied together to operate as triodes, in which case removal of the plate voltage will result in a cathode potential reading caused wholly by grid current and which, therefore, can be utilized in analyzing the grid circuit conditions with respect to excitation or grid drive available.

Assuming that tubes of the 6L6 type are used, an initial bias can be provided by the use of cathode resistors having a value between 200 and 400 ohms, thus providing protection for the tube in the event that excitation is removed, as well as helping a great deal in providing a greater degree of circuit stability. These bias resistors will depend to a certain extent on the applied plate voltage and proportionate grid excitation or total grid bias required. In general, a value between 200 to 400 ohms will be satisfactory, and if the meter is one of the 0–1 ma. units, the series multiplier will have a value somewhere between 25,000 to 40,000 ohms if a full scale reading equivalent to 100 ma. is required. A series resistor of from 50,000 to 200,000 ohms can be used for full-scale deflections from 250 to 500 ma.

With the circuit in Fig. 5A the meter is grounded, and only one series multiplier is used, assuming that all stages will require a full-scale deflection not to exceed 100 ma., in which case the recommended value of the multiplier resistor is 40,000 ohms. An alternative arrangement, for use where the current drain of the individual stages differs to the extent that two or three full-scale readings of different values would be required, is shown in Fig. 5B. The meter can be connected directly between the gang switch and ground, and separate series multipliers connected permanently in the leads to the various cathode circuits.

In Fig. 5B this arrangement is outlined for use where two or three exciter stages are used to drive a medium- or high-power buffer with a full-scale reading equivalent to 100 ma. for the exciter stages, and a scale reading equivalent to 500 ma. for the buffer stage. Series multipliers for the exciter stages should, of course, be in the neighborhood of 25,000 to 40,000 ohms, with 40,000 ohms

(Continued on page 102)



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Write me fully about type of receiver you want. I will help you get the right receiver and will see that you are 100% satisfied. We stock all receivers — more than 25 models of all makes — and know all about them. Ask for technical information about any receivers.

YOU can buy on 6% terms financed by myself so you buy with less cost — more convenience — quicker delivery.

YOU get maximum trade-in for your receiver — describe it and I will tell you its trade-in value — and can pay the balance on my 6% terms.

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W9ARA

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Station Activities

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Fred Ells, W1CTI — Traffic activity showed a big increase. Both Hal and Geo at W1AW have had their Official Observer certificates endorsed to read Class I. EAO was fourth high in the whole country in the first Frequency Measuring Test, and has had O.O. certificate endorsed to read Class I. Congratulations, "Doc." KKS bemoans the fact that he missed B.P.L. by 52! GKM and ILI are out at 8AXZ and have schedules with UE and AFB. ITI wants to know if there are any amateur astronomers among the Nutmeg gang. MEC schedules 3HRS regularly, and is new O.R.S. GB wants some competition for their bowling team. The new all-band rig at KFN is working fine; features no tuning condensers, all bands preset. EFW reports that AIY works HDQ on 224 Mc. regularly. ACV and APA were appointed as O.R.S. ACV has 4 Vee beams, covering 180 degrees, 5 waves on leg and a new location in Easton. APA is only on week-ends, due to a job that keeps him on the road. JFN was in Chile attending conference. BDI had a temporary schedule with CE3DC on 14-Mc. c.w. which was later transferred to AW. AW works CE3AG on 28 Mc. and CE3DG on 14 Mc. GC was appointed O.P.S. and worked K4FKC on 3.9 Mc. EH worked CE3CZ and CE3AG for conference reports. DJC schedules 3IBS (ex-W1QP) and 4FAO (ex-W1CKP) on 7060 kc. JNJ and GPD are on 1.75-Mc. 'phone. LXH received an SX24 for Christmas. BAX is trying out a p.p. 24A e.c.o. LMK as 6V6-6L6G emergency rig. MCO moved and is trying to find time to get the rig back on the air. LOP has a Class A ticket and is on 1.75-, and 3.9- and 14-Mc. 'phone and c.w.

Traffic: **W1AW** 727 (WLMK 1) KKS 448 UE 346 KV 214 CTI 122 TS 112 AMQ 86 ITI 90 MEC 72 KYQ 71 CCF 60 LUN 52 BCG 42 KSJ 31 KFN 26 TD 22 EFW 18 FAJ 15 LVQ 14 ACV 11 LQK 7 BDI 6 LOC/1 5 GC-KQY 4 EAO 2 APA 4.

MAINE — SCM, H. W. Castner, W1IIE — The All-Maine QSO Party exceeded all expectations. Several hundred Maine stations took part, and we shall publish details in the next report. The U. of M. Radio Society is to be congratulated on doing such a grand job. The Legion Post of South Portland has a new radio emergency unit under the capable direction of "NR." The call is MKI. Mighty glad to report that BYI and BYP are greatly improved. IIE changed to crystal. GHT has moved to Portland from N. H. and is transferring his O.O. and O.R.S. We are very glad to welcome you, Ray. VF is active as O.B.S. and O.R.S. LMQ has new 7036-kc. crystal. CDX is planning a new three-element beam for 14 and 28 Mc. LHA is doing a fine job on E.C. work and has been recommended for P.A.M. The XYL of ITH gave him a new HQ120X for Christmas. LRP is an example of real help; he took over for GOJ and is doing a grand job. LER is new O.R.S. APX plans to be on actively soon, and connections in Rangeley will be of great help. DPJ has new rotary beam on 28 Mc. MAP is using a single 27 crystal osc. IOK has a single 807 final. MDA in Winthrop will be on soon with new rig. LHO is on at the C.C.C. Camp at S. West Hbr. LIC wants to know if any of the boys are interested in a 1.75-Mc. Net on Sundays? AFA will soon be on 3.5 Mc. HSE reports they are forming a radio club in Waterville. MKG is new call of the Auburn Armory, and LPA, LTM and EZR joined the 103rd Infantry Radio Department. KVK is pounding "Morse" brass in Waterville and staying with LWO. LIP is on 1.75 Mc. LYK writes that after counting the Maine calls in the call book, several times, he comes to the total of 525 licenses. We are pleased to learn that LOZ, LPA and BOC joined the League. QH sends a clipping from a Bangor paper on the Maine Party. QH did very well in the party with his low-power rig. LNY has a new rig. LRG built a new rig for 28-Mc. work. MVJ is new Bangor ham. LTQ has joined the Army and gone to Langley Field. MAZ is on 7 and 3.5 Mc. The new arrival at the home of CEM is a fine baby girl. Our hearty congratulations, Harry. FNL is in the hospital recovering from an operation. Our good wishes, Johnny. New officers of the Portland Amateur Wireless Association: FBJ, pres.; IRR, vice-pres.; EFR, secy.; JRS, treas.; LNI, chief opr. The club is building a new transmitter with 6L6 osc., 807 buffer, pair of 809's final. They have a receiver on 112 Mc., and going to have a transmitter to go with it. We are all delighted to know that RU is coming back on with a 38 e.c.o., 6L6 buffer-doubler, 807 final. RU was a war-time Signal Corps op and for several years Radio Editor of the *Courier-Gazette* in Rockland. Another bit of grand news is that JRX has renewed his ticket and is on the air! He will be on 3619 kc. We hear that FZD and KTT are aiming at 3597 kc. for help on the Pine Tree Net. EJS is doing a little 7-Mc. work. FQJ, GGF, LHX and JAA are on 1.75-Mc. 'phone. KYS is on 28 Mc. FZW plans high power on 14 Mc. KIT is new Rockland ham, stationed on the U.S.C.G. *Travis* with JCT. The Maine A.A.R.S. under the capable direction of CFO, is hitting new highs. After asking the boys to report I received over 100 reports this month. My sincere thanks to you all. BWR, who is Operations Officer of the Maine N.C.R., accepted a position as radio instructor of the C.C.C. Camp at Camden, Me. He is at present going through the necessary red tape to get permission to erect his station in the camp. LHA, Kennebunk, is on 7008, 7236, 3618, 3623 and 3961 ('phone) almost every evening.

Traffic: **W1**LHA 5 ITH 1 LRP 168 LYK 17 IIE 86 LKP 4 HSE 21 FBJ 29 AQL 1 AFA 6 LIC 63 LML 136 LER 1 JCT 8 CDX 4 IBR 19 IQZ 164 LMQ 31 INW 148 EWN 8. AARS: AMR 66 BTA 50 CFO 167 EFR 8 FAP 186 GE 99 GVS 208 IJF 27 IOM 19 IST 69 KMM 130 KOU 297 LAP 40 LIC 43 LML 182 LMQ 32.

EASTERN MASSACHUSETTS — Acting SCM, Carroll O. Peacor, W1GAG — Ass't SCM, JJY. The Eastern Mass. Section sincerely regrets that Larry Mitchell, W1HIL, found it necessary to resign. As S.C.M. his constructive, impartial, and genial leadership commanded the respect of all with whom he came in contact. The Section greatly benefited by his unselfish efforts. Well done, Larry. Our very best wishes. MDU received a pair of HK54's for Christmas. MHC is building two new rigs, c.c. 807's for 28 and 56 Mc.; 812's for low freq. Christmas traffic swelled the message total of BDU. KMQ reports 28-Mc. activity picking up locally with LVZ, LQQ, LYG, AWO, JNK and MJE/1 plus regulars on. AAR has all transmitters working a new QTH. LQV is increasing power to 75 watts output. GFW received S.W.L. card from Japan for 28 Mc. BDM is on 28 Mc. LTC is cleaning up 28-Mc. DX. GFW built new 28-Mc. rig for KOQ. JNV wants to organize Boston Ham Club. Anyone interested, drop him a line. EHT is going in for cathode modulation on new c.c. 56- and 28-Mc. rig. Says 56-Mc. activity is picking up. How about it, gang? MEZ is trying cathode modulation on 1.8 Mc. Three-element rotary of LO's is working FB. WV is adding RK25 osc. to RK20's. KTE reporting for Parkway Radio Ass'n states election of officers Jan. 4th, places KVH as pres.; JRN, vice-pres.; IPF, secy.-treas. Meetings 1st and 3rd Thurs. KKJ and his XYL MDV enrolled as new members. UX is back on the air. Welcome, Clyde. JTU is on 112 Mc. LBB needs Delaware for W.A.S. JDG is rebuilding. GKA is with P. & G. airlines in South America. BBM is doing 224-Mc. experimenting. Anyone else? BAQ is working new exciter overtime. KNW has new power supply. BRI sports new receiver. Amesbury adds new ham in MIB. KH has new freq.-modulated rig. Nice going, George. HIL is finally going to ¼ kw., new modulator and crystal mike. And, he's now O.O. GAG has revised speech equipment, plus new crystal mike from XYL. SS made his 100th 112-Mc. contact Christmas eve. KIX is on 112 Mc. LGG finally on 112 Mc. with LGY, DOO, HZB about ready to give it a try. LCC and HXE report activity on 56 Mc. picking up. LBH and XYL celebrated their tenth wedding anniversary on the 15th of January. We extend our congratulations, and hope you enjoy many more.

Traffic: **W1**KMQ 247 LMO 5 MDU 17 BDU 195 LQV 5 BB 11 AAR 181 HWE 76 EHT 2 GAG 3 LNN 8 GCU 10 WV 5 KTE 11 AGX 72 FWQ 19 IUQ 61 LWH 738 KH 30 QW 12 (CCIC 20) JJY 332 MEW 4 AKS 848 EPE 459 (WLGS 182) FSL 53 JCK 400 (WLGV 141) KCT 245 KZT 81 EMG 222. CCIE 15.

WESTERN MASSACHUSETTS — SCM, W. J. Barrett, W1JAH — EOB made the B.P.L. with nice total; Vic ran up 16,000 points in A.R.R.L. Party. BIV has been assigned A.A.R.S. call WLGN as S.N.C.S. for Central Mass. JAH finally put the rig in the cabinet, and now the input is five watts instead of ten — Hi. BKG is using pair of tens while dismantling old 211 rig. AZW reports nice time in A.R.R.L. Party. BVR was reappointed Radio Aide for First C.A. A.A.R.S. DUZ is building 112-Mc. rig. AJ reports shack is slicked up now, including new table for emergency gear. FOI is active in A.A.R.S. 'Phone Net. KRX is resuming activity after recent illness, starting off with 2256 points in his first A.R.R.L. Party. KJK is plugging away at his

cranky exciter. BNO rebuilt rig all way through, and is now on 28 Mc. with 350–500 watts. HDQ completed 224-Mc. acorn receiver and 112-Mc. freq. modulation super, and expects to have the HK-54's on 112 and 224 Mc. soon; Ed is keeping cross-band schedules with AIY in Conn., who is on 224 Mc. If you want Ed to listen for your signal on either of these bands, just let him know. COI is rebuilding for lower voltage final. Hollis got three KA cards same day, and also listener report from ZL2BW. KZU now has rig on 7 Mc., making it all bands, 28 to 1.75 Mc.

Traffic: **W1**EOB 555 BIV 302 (WLGN 5) JAH 155 (WLGH 32) BKG 115 AZW 106 BVR 82 (WLG 154) DUZ 67 AJ 32 FOI 25 LJF 15 DCH 7 KRX 2.

NEW HAMPSHIRE — SCM, Carl B. Evans, W1BFT-DMD — The Fifth Mobilization of the N. H. Emergency Net will be held on March 3rd, the first Sunday of that month. Keep the date in mind. A notice will be mailed to all N. H. stations a week or more before the mobilization date. We haven't had one of these tests since last summer. Let's all get on and make this a real bang-up affair. IDY reports being heard in England on 1.8-Mc. 'phone. BST has a new DM36 frequency expander for 56 and 28 Mc. The M.V.A.R.A. elected following officers: pres., LIN; vice-pres., GKE; secy., LVG; treas., BFT. They also voted an appropriation to help build up a high-power 112-Mc. transmitter. With further contributions from the members the transmitter is in the process of construction; it will use a pair of RK37's in short-line oscillator with about 150 watts input, cathode-modulated. A rotary Yagi beam with a possible (?) gain of 15 db. is being mounted on the roof at DMD for use with the club transmitter. KMH purchased JCA's RK20 suppressor grid-modulated transmitter. LTD reports good results with new RME-70. BHJ is rebuilding for 112 and 56 Mc. with quite an elaborate layout. APK is now the proud father of a baby girl. Congrats, Basil!! The Manchester Radio Club elected officers for 1940: pres., 1VU; vice-pres., CME; secy., CMR; treas., GMH. The newly formed Y.L.R.L. (Young Ladies Radio League) has three new members from N. H., BDN, FTJ and KKQ. The Nashua Mike and Key Club held its annual banquet Jan. 11th. Mr. Huntoon, ex-9KJY, now LVQ from A.R.R.L. Hq., was the guest speaker of the evening. A turkey supper was enjoyed by all and prizes were given out to top off the party. JKH and LVG are new O.R.S.

Traffic: **W1**FFL 739 (WLGB 55) JGI 252 CMR 202 TA 145 IDY 145 BFT 140 KIN 132 GMM 131 ANS 130 FX 76 JKH 69 KBU 66 JBA 53 IP 51 ITF 36 JBM 26 DMD-JDP 25 CEA 24 1VU-KKQ 23 EAL 18 ICS 15 HQS 14 LNG 10 LMC 6 HXJ 5 AEF 4.

RHODE ISLAND — SCM, Clayton C. Gordon, W1HRC — Rhode Island N.C.R. is very active; a new quota makes room for five physically qualified hams in Providence Unit; anyone interested call at East Providence Post Office on Thursdays at 8:00 P.M. This per IZO who is active on 112 Mc. with 70 watts to HK-24's. JNO has HY615-6L6G super on 112 Mc. and is building 112- and 56-Mc. c.c. rig. W1AQ activities: At annual election of officers BOY was elected pres.; 8RJX/1 vice-pres.; LAB, secy.; Geo. Hunter, treas. CPV is working on new rig. CH says there are plenty of Asians on 14 Mc. crying for R.I. contacts. BGA has a nice portable 56-Mc. transmitter in his car. Westerly Radio Club activities: The W.R.C. held its first annual meeting, Wed., Jan. 10th, with almost 100% attendance. Officers elected were AGJ, pres.; KRQ, secy.-treas. DJK was elected to the Board of Trustees for one year. After the meeting a lunch was served at KRF's home by his mother. A regular bull session followed the refreshment, and the meeting broke up at a late hour. AGJ has remodeled his shack, and now has his layout working swell on 3.9-Mc. 'phone. BDS moved to Ashway (a small town 4 miles outside of Westerly); Will is running 600 watts on 14- and 28-Mc. 'phone. INN changed QTH. KRF has a swell rig on 28 and 14 Mc. KRQ has emergency phone and c.w. rig for 1.75 and 3.9 Mc. LZD has new 812 final, reporting excellent results on 7 and 14 Mc. MAE has new rig with 809's in final. Providence Radio Association activities: The P.R.A. had annual meeting and election of officers on Jan. 2nd: JP was elected pres.; LCS, vice-pres.; DDY, treas.; LDL, secy.; LYE and KZN to the Board of Directors. KCS was appointed to the Technical Committee chairmanship. KKE continues as librarian. The official opening date for the club's school was on Jan. 11th, with 9 students. The club took a prominent part in the Y.M.C.A. activities pageant and handled 127 messages for the attending public. This traffic was handled from the Y.M.C.A. lobby to the club rooms by 112-Mc. 'phone and retransmitted on its way by the club's regular 3.5-Mc. job. JP has been heard in North Scituate on 112 Mc. by DBA. LCS is on 14 Mc. QR is back with us.

Traffic: **W1**INU 886 GTN 302 INT 209 KOG 193 CPV 177 KWA 149 LAB 142 KYK 123 IEG 106 AOP 87 LDL 70 BOY 66 LCV 52 HRC 27 JDX 34 KKE-IZO 23 KZN 11.

VERMONT — SCM, Clifton G. Parker, W1KJG — BZS kept schedule with JVS while JVS operated from Delaware over the holidays. The Burlington Amateur Radio Club conducted a code-copying contest in which Gene Holden captured the prize. This club meets each Wednesday evening at 25 Bayview St., and the gang will be pleased to have others attend any of their meetings. BNS completely revamped his station with new SX24 receiver, signal shifter and all-band final, and has been appointed O.R.S. and R.M. for eastern Vermont. All Vt. A.R.R.L. members are invited to join Vt. Traffic Net on 3860 kc. at 8 P.M. daily, starting Feb. 1st, each station to keep schedule with some other State Net, schedules being arranged by request to BNS. Any members interested, please contact BNS promptly. DPO is being heard occasionally on 1.85-Mc. 'phone. KIE is active on traffic nets. CBW has worked out a 6N7 Hartley oscillator circuit followed by a 6L6 push-push doubler which gives results comparable to most e.c.o.'s, and is having fine luck using it as variable frequency control. KTB has followed similar lines and uses a TNT exciter for frequency control. Both units give stable signal. IDM and XYL were recently visited by many friends in their new home for a housewarming. KTB reports much fun in A.R.R.L. party with 20,000 plus points. EJF received his Class A ticket, and is proud father of a new son. Congratulations! CUN is now located at Lyndonville. KZJ is at R.C.A. School in New York City. CGV and boss have acquired former WDEV transmitter. Donald Clark, Waitsfield, is new amateur with call MJU. KVY has left for Gov't Trade School in Maine. 2JBL/1 at Middlebury College spent week-end with FSV. AEA is now at Waterville, active on 3.5, and has completed low-power 1.75-Mc. 'phone. BJP shows up at times on 14 and 3.5 Mc. KUY, LJZ, LYD and IDM dropped in at KJG. KOO finished complete emergency outfit using battery receiver and 6L6G crystal osc. with 200-volt Vibrapack and, on test call, contacted Michigan on 3.5 Mc. Entire outfit and accessories housed in single 16 x 12 x 6 case — an FB job. DQK received another FB write-up in *Boston Post* on Jan. 13th. KEP is on 14 Mc. with 100-watt outfit. JZF is busily engaged rebuilding and adding to his rig.

Traffic: **W1**BZS 7 LRL 72 BNS 27 KIE 48 FSV 169 KTB 146 AEA 23 MCQ 2 KJG 145 DQK 8.

HUDSON DIVISION

EASTERN NEW YORK — SCM, Robert E. Haight, W2LU — KWG heads the Section with fine traffic total. HXQ is operating on all bands, c.w. and 'phone. 8BAW is operating portable from Scarsdale on 1907 kc. 2MHW is working 1.75-Mc. 'phone on 1840 kc. LLU is pounding out on 3.5 Mc. ALP is finishing transmitter started two years ago. SZ reports all time spent rag-chewing and experimenting. JKT reports attending Naval Radio School at San Diego, Cal. DVC finished 5th in Oct. O.P.S. Party. HNH is operating portable on 3620 and 7194 kcs. at Huntington, L. I. KFB is operating on 7 Mc. The Delaware Valley Brasspounders Assn. of Port Jervis received its club station call, MUB.

Traffic: **W2**KWG 171 HXQ 139 LU 76 8BAW 24 2MHW 6 LEI 5 LLU 3 BEW 2.

NEW YORK CITY and LONG ISLAND — SCM, Ed. L. Baunach, W2AZV-AZM and GDF are chairmen of the Communications Committee of the Queens County Red Cross. LZR is now O.R.S. IOP is O.B.S. on 3700 kc. LBI is Class Four O.O. LUU and MFR send in their first reports. 1IIN is now located in Brooklyn and can be heard on 14 Mc. using an 830 with 250 watts input. HNJ is back on after spending eighteen months with the C.C.C. EVA is up and around after being ill. ELK met a YL from Cumberland, Md., and is now joining the ranks of the Benedicts. HAE's new QTH: 150–09 88th Avenue, Jamaica. JBL/1 manages to keep on the air while away at college through 1FSV. AXZ is working hard to make the B.P.L. HXT keeps weekly schedule with 5ELC on Tuesday nights. LJP's new QTH is St. Albans. DOG can be heard on 3925-kc. 'phone every morning at 7. JHB is now working for the American Air Lines and expects to be on the air from Elmhurst. IXQ will soon be heard on 1.75 Mc. MLE rebuilt outfit using 6L6 crystal, 807 final, 65 watts input for c.w. and 6C5, 6L6 for local 'phone, 20 watts input. PF is using voice control

(Continued on page 104)

TO OUR READERS

who are not

A.R.R.L. MEMBERS

WOULDN'T you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read its purposes as set forth on page 6 of this issue. We should like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio. You will have the membership edition of *QST* delivered at your door each month. A convenient application form is printed below — clip it out and mail it today.

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I hereby apply for membership in the American Radio Relay League, and enclose $2.50 ($3 in foreign countries) in payment of one year's dues, $1.25 of which is for a subscription to *QST* for the same period. Please begin my subscription with the.....issue. Mail my Certificate of Membership and send *QST* to the following name and address.

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.....

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may send him a sample copy of *QST*?

.....

Thanks

recommended. The series resistor for the buffer stage, where a full-scale reading of 500 ma., is required (cathode resistor 200 ohms) is 100,000 ohms. Using standard methods for calculating series multiplier resistors required to convert a milliammeter to a voltmeter ($R = 1000E/I$, where R is the required multiplier resistance, E the full-scale voltage reading desired, and I the full-scale meter current in milliamperes) it is comparatively easy to determine accurately the exact value of multiplier required for any required full-scale deflection, depending on individual circuit requirements. The full-scale voltage reading will be the cathode resistance multiplied by the cathode current of the stage in amperes (milliamperes divided by 1000). With a 1-ma. meter, the series multiplier resistance in ohms required will simply be the voltage so found multiplied by 1000.

In addition to the methods outlined, it is quite possible that there are other similar solutions to the problem of making the best possible use of limited meter equipment. Perhaps the various circuits outlined will help the individual amateur to solve any unusual requirements by acting as a starting point. At any rate we don't claim credit for these ideas since some of them were adopted from commercial units we've dealt with, and others were gathered together so that the information would be available for our own uses. The amount of time involved in digging into various sources of information has been well repaid by simplifying and adding extra operating flexibility to our equipment.

A Stationary Reversible Beam

(Continued from page 56)

backyard. When used on 20 meters it is sometimes difficult to get enough height, but the array seems to work well with the bottom only 2 feet from the ground. Naturally this type of operation is not ideal if the antenna is screened by trees or houses, but it still out-performs a simple half-wave "Q" strung high in the air. The same formulas are used to compute element lengths on 14 Mc. — the spacing is double that of the 28-Mc. array.

The array has also been used in four directions. This was accomplished by using two 2 by 2 poles at the top of the mast, placed at right angles to each other, and four director elements instead of two.

One final word to those who might avoid this antenna because they consider inefficient the short wire used to change a director to a reflector. This wire represents such a small fraction of the entire length of the element that it can introduce but little, if any, loss.

Strays

A new 8-page Turner Microphone Catalogue is off the press, and a copy is offered free to anyone requesting it of The Turner Co., Cedar Rapids, Iowa. It is known as Catalogue No. 60.

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AMERICAN RADIO RELAY LEAGUE
WEST HARTFORD, CONN., U.S.A.

(*Continued from page 101*)

automatic break-in on 3905 kc. and finds it a great improvement, especially when breaking in a net or answering a CQ. LID is building his 60-watt modulator. HGO has resumed schedules with CJP, 3 GLQ and 9VFI on 7096 kc. KUY is operating on 3941 kc. 'phone. PL is making an FB comeback after being off for twenty years. HMJ's 7-Mc. A.A.R.S. Net boasts of 14 members. BGO is still going strong in the A.A.R.S. after ten years. HJY is operating on 112 Mc. with 18 watts to a pair of 56's. ESO is now 4GNO in Atlanta, Ga. MKX sends his report from Atlanta, Ga. EC is looking for an alternate for the "AP" trunk. US is on the Fisherman's Net. LVN is rebuilding for 1.75-Mc. 'phone. MQU, the Tenmen Radio Club station, is operating on 7 and 3.5 Mc. AEU completed his six-tube superhet. BVE is putting in P.P. HK54's. TuBoro Radio Club Net frequency is 3813 kc.; they are on every Sunday at 11 A.M. Section E.C. DBQ requests all A.E.C. members to notify him if they have self-powered portable equipment and are not registered in the Basic Division. LR is looking for more members to join the Section Net, especially in Manhattan and the Bronx for the delivery of N.Y.C. traffic. The net is on every night, 3710 kc. at 8:30 P.M.

Traffic: **W2**SC 1068 HMJ 855 IOP 423 LZR 265 AXZ 195 LR 185 PF 174 KI 163 ITX 120 GDF 77 MT 176 MKX 172 PL 106 DW 70 DBQ 67 (WLNB 120) AZV 57 LPJ 50 EC-JGC 48 LBI 37 AEU 34 AZM 33 BGO 19 AA-ADW 9 KYV-CET 8 CHK-CIT 7 LID-HJT 6 DLR 5 IRC 4 MLE-HYL 3 ELK-HGO 2 DOG-US-HBO-HXT-AVS 1.

NORTHERN NEW JERSEY — SCM, Pat Jessup, W2GVZ — R.M.'s: BCX, BZJ, CGG, GVZ; P.A.M.: HNP. Section Net freqs: 3630 and 7070 kc. New appointments: EC: GKX Woodbridge Township; HRZ Nutley; IZP Summit O.O.: HOP, Class III. IOZ moved to Grantwood and joined A.E.C. He received a negative answer from the Commissioner of Motor Vehicles to the petition asking for our call letters on car license plates. GKX joined A.E.C. and took over E.C. job for Woodbridge Township; he sports a nice 15-watt portable. We need a lot more E.C.'s. MHF is attending N.Y.A. Radio School at Haledon, and will run the 7-Mc. Net from there. BZJ took over the Eastern end of T.L. "A" on 3565 kc. MAX, with his 6L6 osc and 807 final (36 watts) on 7050 and 7070 kcs., needs only Vt., S. D., and Nev. for W.A.S. LAG jumped off the deep end and now has to report to both the XYL and the S.C.M. Congrats. LLT finished a "portable five" and is now engrossed in throwing a high-power rig together. KQT builds them up and tears them down every two weeks. JUC is active again with ¼ kw. to a 211. IMM joined the A.E.C. So should many more. JME with 112-Mc. job, with WE304A's in push-pull and a super-regen, works Princeton and N.Y.C. LTI runs 90 watts to a pair of 6L6's in parallel and ran up 800 contacts in six months. BPV runs 500 watts 'phone and c.w. on 28, 14, 3.9 and 1.75 Mc. LXI has 300 watts on a pair of P.P. 808's. ISV uses a 211 final to keep himself amused between trips to sea as Sparks. Pressure of other work forced MHF to resign as R.M. Sorry, OM. Accordingly, the 7-Mc. Net is cancelled until further notice. We will get it going yet. MPA has HQ120, and is going QRO. The Montclair police emergency Transmitter was built by INX. HNA keeps schedules with his son at Georgia Tech. HXO has new Hallicrafter S20. The elusive Del. and R. I., if snared, would give JT W.A.S. on 'phone. IOZ has new 14-Mc. vertical. Another proud pop is IOO. Congrats. An e.c.o. is in the making at IQM. KHA jammed all his traffic into two days during the holiday rush. MQE has e.c.o. functioning. JUC enjoys working in F.T.S. with his 211 final. MLM/1 made hay on vacation back home, and scored 250 QSO's in twenty states with 65 watts to an 809 on 1.8 and the HQ120X that Santa brought. The T240 final is working to the satisfaction of JRU. JKH built modulator and expects to get on 3.9 and 1.75 Mc. Emergency Coördinators are urgently needed in many parts of the Section, as well as A.E.C. members. How about doing your bit to help whether or not you have emergency power? MRJ is newcomer on 1.75 Mc. with 50 watts to an 809. CGG and GVZ made B.P.L. New officers of N.N.A.R.C.: IWY, pres.; KON, vice-pres.; LJY, secy.; and LIJ, treas. HNT tested his giant emergency power plant with good results, and with Dad watching over it in the cellar. GHO joined A.E.C. and is going to get married. JMX can lay hands on a ¼-kw. emergency rig if needed, by courtesy of JOC. LAG is getting hitched. HVK has wedding bells in mind also. LVT is active in Bloomfield. SN says Utopia is a small island with only one ham, and where there is no QRN, QRM, F.C.C. or QSL Manager.

Traffic: **W2**GVZ 723 (WLNI 29) CGG 464 LMN 286 5HUH/2 211 KHA 119 HCO 85 KMI 55 JDC 47 JUC 28 BZJ 21 LXI 16 HXI 1/9 MLM 1/9 IYQ 7 JRU 4 HQL 4 (WLNR 123) MEO 3 IKH 1 CMC 5.

ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES — ADE celebrated New Year's Day with the arrival of a nine-pound baby boy. 3BRZ beat him by ten ounces with a new Jr. opr. 3FYC did his bit with a brand-new baby YL. 3AGV, 3BES and 3GHD are competing for the first all-band W.A.S. 3AKB narrowly missed 500 but landed in the B.P.L. on "Deliveries." Another issue of 3AQN's "Eastern Penna Dots" is in the hands of the members of the E. Pa. Net. 8EU and 3BIL have low-power emergency rigs. 3DRO of Lancaster is ex-8RHE. 3EEW is going on 112 Mc. with an RK37 won at the Frankford Radio Club New Year's "Brawl." 3EFH is doing some "nifty" operating as N.C.S. of Trunk Line "C." 3EML continues to send in his "telephone numbers" for traffic reports. 3EOP, exponent of crystal control, challenges all E. Pa. O.R.S. with e.c.o. to a duel in the O.R.S. Party. 3FJU, O.P.S. Party winner, has one of 6CUH's "X-ECs." P.A.M. 3FPC wants more O.P.S. on 1.75 Mc. 3GET's new antenna puts out with only 12 watts input. 3BXE and 3GHD fought the O.R.S. Party with their Field Day rigs, and came out nearly even. 3GHM is a rising threat to the contest aspirants in E. Pa. It looks like we lose 3GJY temporarily to the balmy Florida weather. 3GYY is sporting a new 812. 3HBJ is hot on the heels of his W.A.S. 3HFE is now in the A1 Opr Club. 3HXA is building a portable-emergency rig. 3HZK is giving code practice on 7023 kc., Tuesdays, 6 to 6:30 P.M. Listeners are requested to send him copies for correction. 3IBG will soon have his 40-watt e.c.o. perking. 3ICK wants the Reading boys to put some time in on 112 Mc. 3QV is fooling with a rhombic trying to put all his signal south. 8ATF is giving 14 and 7 Mc. a whirl. 3FQP reports a seven-way round table on 112 Mc. 3EX is on 112 Mc. regularly noon to 3 P.M. Others active are 3DUJ, 3FTR, 3FTQ, 3FSM, 3GHO, 3GWO, 3DLR. 3FPE is on with test transmissions from 8 to 10 P.M. every 15 minutes beginning on the hour for 5 minutes sending V's three times and then his call. Arrange out-of-town schedules with 3FPE. 8RJL, Activities Mgr. of the Susquehanna Valley R.C., reports as follows: 8EDI is active on 3.9- and 28-Mc. 'phone. 8QJP has P.P. T55's in a 28- to 1.75-Mc. band-switching transmitter. 8SEL graduated from a lowly 6L6 to a T40. 8GGE favors 3.9-Mc. 'phone. 8RJL used his T125 on 7 Mc. in the A.R.R.L. Party. The Frankford Radio Club is offering a prize for the first member to prove a W.A.S. made in 1940. 3KT holds the upper hand at present. The Frankford Club's New Year's Party was well attended and afforded plenty of entertainment. 2JKK and 8PTE report that 8SZF of Scranton is a W.U. wire chief; 8SZF got some nice publicity in local paper. 1NH, new ham, 13 years old, is running 25 watts on 7 Mc.

Traffic: **W3**ADE 46 AGV 4 AKB 483 AQN 23 BES 42 BIL 12 BRZ 1 BXE 36 DGM 32 DXC 4 EEW 8 EFH 197 EML 2014 EOP 28 FJU 6 FXZ 7 GDI 12 GET 2 GHM 2 GJY 803 GKO 869 GYK 26 GYY 2 HBJ 38 HFE 14 HQE 16 HRS 1585 HZK 21 IAY 20 IBG 7 ICK 7 NF 599 QV 67 RR 6 8ASW 310 8ATF 41 8EU 2 8HKS 11 8OML 7 8RKZ 27 8SNZ 10.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — SCM, Herman E. Hobbs, W3CIZ — 3BWT, Chief R.M.; CXL, R.M. IMN is on 3608.5. EQK is on 3950 and EKZ on 1844 kc. HQU joined A.A.R.S. IDK is building new transmitter. DOG is rebuilding. AKR is on 7042 kc. AKR has new SX-24 receiver. ICT needs four states for W.A.S. ECP made B.P.L. in ten days. ILD has a nice 'phone rig on 1.75 Mc. BHE makes the following remark, "Boys, be careful, I came close to electrocution the other night." The Mike and Key Club, now the Baltimore Radio Assn., held a hamfest on Jan. 20th. The 1.75-Mc. 'Phone Emergency Net for Md. now consists of HAL, N.C.S.; Alt.; EQK; GUT, BFX, OKE, ICS, IBP, HPB, HJM, HLI, DXO, AKX, FPK, GRT, OZ, GXH, GZC, 17 in all. 3.9-Mc. A.A.R.S. 'Phone Net: GTN, N.C.S.; HAL, Alt.; EQK, ASZ, FTD.

Traffic: **W3**IMN 16 EQK 9 GYO 138 HQU 35 AKR 2 BKZ 210 BWT 1118 BHE 3 HUM 193 ECP 689 CIZ 1388 ICT 75 CXL 2771 (WLM 6220).

SOUTHERN NEW JERSEY — SCM, Lester H. Allen, W3CCO — Ass't SCM and A.A.R.S. Liaison R.M., Ed. G. Raser, W3ZI — R.M.'s: 3BEI, 3BYR, 3EUH. P.A.M., 3GNU. Section Net frequencies: O.R.S., 3700 kcs., O.P.S., 1980 kcs. All radio organizations, clubs, societies, etc., should

instruct their secretaries to mail monthly reports not later than the 16th of each month to your S.C.M., in order that your organization is given proper recognition and publicity through these channels. If you are not a member of any radio association, why not look into your local group and get acquainted? The following are the various groups in our Section: Delaware Valley Radio Association, Trenton; Somerset Hills Radio Club, Bernardsville; Greater Camden Amateur Radio Association, Camden; Trenton Radio Society, Trenton; South Jersey Radio Association, Haddonfield; and the Atlantic Radio Club, Pleasantville. Additions or corrections to this list will be welcome. The Delaware Valley Radio Association is celebrating its 10th birthday this year and is moving its Headquarters and club transmitter 3AQ to the Trenton Yacht Club as a birthday present. When in Trenton you are cordially invited to visit the new club Headquarters. GRW is chasing Idaho and Nevada for W.A.S. BWF is experimenting with a new e.c.o. circuit. GEV has added 10 new countries to his list. EUH has been appointed chairman of the 4th Annual Hamfest and Outing of the Delaware Valley Radio Association to be held this coming Aug. IAW is new Burlington station using 1.75-Mc. 'phone. AYC has new transmitter running at 300 watts input for 28, 14 and 7 Mc. HHZ built new fixed beam for 28 Mc. GNM returned to 1.75-Mc. 'phone. HAZ is building emergency gear for Field Day. DNU reported his largest traffic total. CCC and HLV are new members of the A.A.R.S. GVO passed the 2nd Class radio telephone exam. FSI sends best regards to his many friends in good ole South Jersey from Balboa Heights, C. Z. QL is plying the waters between Philadelphia and Port Arthur, Texas, on the S.S. *W. D. Anderson* (WICU) as radio operator. ABS worked all districts on 1.75-Mc. 'phone during the month. ATJ is now operating 28 Mc. with 40 watts input. HMR, one of our new O.R.S., is building a modulator. GNU has been heard in England several times during the last month on 1.75-Mc. 'phone. HTJ is heard regularly on 1.75-Mc. 'phone during the early morning hours trying to get a few of those hard-to-get states for W.A.S. EWK had quite a time for himself in the last A.R.R.L. QSO Party. ACC has been experimenting with 112 Mc. and has worked one station to date, EBC, 8 miles distant. ATF reports his teletype machine has 187 operations per minute which is equivalent to 31-code words per minute; Roland uses this gear for his Official Broadcasts; reports as to coverage would be appreciated by ATF. HWO increased power on his 112-Mc. transmitter. CFB was heard recently on 1.75-Mc. 'phone. GCU is still busy altering skyhook. HDJ reports fine results with new rig, using HK254's in the final, 500 watts input, Class B modulated with '03A's. Ernie is interested in starting a movement for advancing 112-Mc. in our Section and suggests a Certificate of Merit for the fellows who work all countries. (How about this, gang? Let's hear from you on this proposal.) ZI worked EHB/3 from an airplane while flying over Fort Dix. IHZ is new call in Trenton on 1.75-Mc. c.w. EFF has rotary beam for 14-Mc. 'phone. GUS is rebuilding to higher power. GZH moved recently to the Eastern Pennsylvania Section. Sorry to lose you, Bob. HLS/3 operated portable at Fort Dix during his 7 days of active duty. BYR and BZX received visit from ZI during Ed's period of active duty at the Cape May Naval Air Station. 3BZX is first to make B.P.L. during CCO's administration as S.C.M. BAY has new AR-77 receiver, and reports working lots of 14-Mc. 'phone. HSL and IMA are experimenting with 112-Mc. OQ and FMR have FB sounding rigs on 3.5-Mc. 'phone. BEI changed his final to a pair of 812's; Walt was heard in England with 45 watts during Sweepstakes on 3.9-Mc. 'phone. At meeting of the Delaware Valley Radio Assn. an excellent illustrated lecture was given by Bob Inglis, formerly of the MacGregor Arctic Expedition, on his experiences in the far North. Until next month, 73 to all.

Traffic: **W3**BZX 745 DNU 256 EFM 245 (WLNJ 71) ZI 168 EYT 124 EUH 122 CFS 112 HDW 108 BYR 103 (WLNV 18) GNU 82 CCC 58 IHO 50 AVJ 49 VE 43 FMR 38 EWK 36 OQ 35 HLV 33 HPX 31 GNM 30 HAZ 29 HSL 28 BEI 27 CCO 26 ATF 24 ASQ 22 HLS 21 HMR 14 ACC 11 AEJ 10 GCU 8 CYI 7 KY 6 EHB 5 FFE 4 ABS 2 TBAY 1.

WESTERN NEW YORK — SCM, Fred Chichester, W8PLA — R.M.'s: BJO, CSE, DSS, FCG; P.A.M.: CGU; E.C.'s: GWY, RGA, RVM, SBV. Net frequency: 3720 kc. Christmas brought the usual rush of traffic, and FCG tops our net with a nice score. JQE is rebuilding his RK20 rig, but goes right to town with his "peewee." TSM, TPA and UBR are newcomers on 1.75-Mc. 'phone in Buffalo. SZK, who just received his A.A.R.S. certificate, and TZC have joined Hdq. Co., 174th Infantry, N.Y.N.G., to work LJD/WLNL. QQB has left LJD to work his own rig. IUF is still working WCFT, the yacht *Yankee*, with great success. PCZ alternates between 'phone and c.w. on 3.5 Mc. UAX is operating 1.75-Mc. 'phone, portable in Cheektowaga. CQW is heard on c.w. after a long period on 3.9-Mc. 'phone. The Greater Buffalo 56-Mc. Club and the Kenmore-Buffalo-Tonawanda Radio Club are planning to make awards in June for outstanding operation on 112 Mc. In the contest, in which a point is counted for every mile covered, the K-B-T Club will award a bronze plaque, while the 5-Meter Club award is a trophy cup for the W.N.Y. amateur communicating over the greatest distance on 112 Mc. QZN, NOR and RV are pioneers in this work in the Buffalo area. MPN expects to be on 1.75-Mc. 'phone with an 807 final. UHI is new Kenmore call. Several of the boys with BJO as N.C.S. and RKM as N.C. 2 are attempting an A.A.R.S. Net on 7040 kc. RMR joined the F.T.S. and is handling quite a bit of traffic on the high end of 7 Mc. ROU finally got up enough nerve to give 3.5-Mc. c.w. a try. QGN has been putting out a nice signal on 1.75-Mc. 'phone. Seemed good to hear DOD and BLP back on 3.5 Mc. during the A.R.R.L. Party. BLP is still looking for Idaho for W.A.S. RVM reports A.E.C. well under way and the possibilities of a Traffic Net in the St. Lawrence Valley. JTT turns in nice O.O. report. FAL has been rebuilding, and expects to be back on the air soon with a pair of 809's. NYA expects to be on 28 and 14 Mc. with more power. BHK has been getting out nicely on 14 and 3.9-Mc. 'phone with 30 to 40 watts to an 807. We extend our sympathy to NA, who lost his wife of five months on Dec. 3rd. SFD is getting the traffic bug and may soon be with us on 3.5 Mc. UY is now on 28- and 1.75-Mc. 'phone. MZU's new XYL must be the reason for his not having been heard much lately. OPZ moved out of the state. RJO is back home. FKJ has some new FB masts up. NLY, club station of Mynderos Academy, at Seneca Falls, will be on the air when repairs have been made to the antenna. TJN worked TDB, whose handle is "Tap" and then hooked PSQ, who signs his name "Pat." MZU and NBJ are brothers in Seneca Falls. CMF (O.P.S.) is putting in new speech equipment. At this writing DOD and TUQ, working together, seem to be winners in the Monroe County QSO Party with a score of 69. AGU came in second. Feb. 24th has been announced as the date of the Rochester Hamfest. BCU has been relicensed after 10 years off. DHB is rebuilding to HY40. MCF has a new rig under construction for 3.5 Mc. UBC is a new YL op on 1.75-Mc. 'phone in Cortland. NNJ is giving TEP a hand with a new ¼-kw. rig. MJV is back on 7 and 3.5 Mc. with 300 watts. MMV is on 1.75 Mc. again from Stacy's Basin. QDP is active on 3.5 Mc. CPJ has a new final. SBV has been under the weather, but is back with us again. CSE is off temporarily with mumps. Hi. SEB burned out his 809's, and is on c.w. 'til he gets a new final. SEI got his Nevada QSL, and now needs only N. M. and Utah for W.A.S.

Traffic: **W8**AOR 64 BJO 307 CSE 147 CTX 29 DSS 73 DHU 14 FCG 453 GWY 60 JQE 307 NNJ 2 PLA 360 RKM 140 RTX 14 SBV 74 SZK 188 SEI 10.

WESTERN PENNSYLVANIA — SCM, Kendall Speer, Jr., W8OFO — Ass't S.C.M. in charge of Emergency Coordination, R.M. Francis, W8AVY. Feb. 24th promises to be a Red Letter day or evening for the Pittsburgh Area Radio Council, with a big Hamfest in store at the Fort Pitt Hotel. KWA made B.P.L. again with a nice group of deliveries. NCJ has QSL's for 45 countries worked. The XYL at NCJ joined the Y.L.R.L. MOT is active again in T.L. "L." CKO received a pair of HF200's from his YF for Christmas and will use them on 3.9-Mc. 'phone with 740 watts. KXP put a pair of T55's on 3.9-Mc. 'phone. BTQ is going on 56 and 112 Mc. HKU, TOJ and TWI took part in the A.R.R.L member party. TOJ is leaving for Florida. RAT and FTY received their Class A tickets. QVQ got an R.C.A. 111 for Christmas. OEM changed to 100 watts. QEM uses a T20 cathode modulated and SX24 receiver. KXP and IOH are using the new Meissner Deluxe Signal Shifter. HKU made 506 points in the A.R.R.L. QSO party. The Ohio River Region Nets have received their crystals from the U. S. Weather Bureau advises the E.C. 8PX. DGL worked several Asians. BOZ says TOJ has worked 43 countries with a single 6L6. ONW and RYC are using 3.9 Mc. 'phone.

Traffic: **W8**KWA 464 QAN 184 NCJ 133 MOT 105 NDE 72 QBK 50 CMP 49 CKO 33 PX 23 RIT 17 OUT 12 AXD-OFO 10 BTQ-DNX 8 TWI-RAT-SFV 5 AVY 4 QVQ-OEM 3 QEM 2 RAU 1 YA (WLMA 382).

On the Ultra Highs

(Continued from page 51)

VK2NO include reception by VK2DN, 360 miles, and the widely publicized reception of Don's sigs by Cecil Mellanby in Pwelheli, North Wales, an all-time 56-Mc. record of 10,000 miles. Two-way work on Five in ZL seems to have been confined to local work, though several instances of reception of signals over distances up to 350 miles are reported..

112 MC.:

We have on file the calls, and in many instances, the descriptions, of nearly one hundred stations heard regularly in W1, most of them being within working radius of Greater Boston. Another hundred are reported within shouting distance of New York City. The extent of participation in 112-Mc. activity has reached a point where it is impossible to report individual work in detail, and the large volume of mail received may render it impossible to acknowledge each report personally, but we want everyone to know these letters are a real help. They are always gratefully received and their contents carefully recorded for future use.

On the basis of reports thus far received it appears that the type of rigs in general use, the receivers, and the antennas, are, for the most part, half-scale copies of 56-Mc. technique of a few years back. The same good fun of pioneering in a new field is now to be enjoyed, and the same problems: drifting transmitters, radiating receivers, and, in the larger cities, terrific QRM, arise to plague the enthusiast on 2½. With the host of low-C tubes now available, the task of putting a rig on 112 Mc. is no more difficult than was operation on Five a few years ago; and the ease with which beams are erected is making it possible for the average amateur to work out fully as well on 2½ as he might have expected to do with similar power on Five in 1936. There is plenty of opportunity for experimental work and we note that some of the gang are doing a really fine job on this band.

Some idea of the extent of Boston's 112-Mc. population

(Continued on next left-hand page)

U.H.F. MARATHON REPORTS TO FEB. 1ST

Call	Contacts 56	112	224	Points 56	112	224	Month Total	States in 1940
W2MO	97			250			250	8
W3HOH	79			158			158	6
W1KLJ	47			127			127	6
W3BZJ	54	6		111	12		123	6
W2BZB	5	40		5	90		95	4
W1HDQ [1]	22	5		58	20		78	4
W1DJ	45			66			66	4
W3IIS	16			45			45	5
W1GJZ	18			40			40	4
W1LLL	23			37			37	3
W1AIY	12		1	13		20	33	2
W1LPF	19			29			29	3
W8RUE	12			27	2		29	2
W3FX	6	11		6	22		28	2
W1JLK	21			27			27	2
W1EHT	18			21			21	2
W3CGV	10			20			20	3
W3RL	10	1		15	2		17	3
W1CLH	10			16			16	2
W8QQS	4			10			10	1
W2HNY	2	2		3	6		9	2
W3EIS	7			8			8	2
W1LCC	7			8			8	2
W9ZJB	3			4			4	2
W9VWU	2			4			4	1
W3FJ	2			2			2	1
W3CYW	2			2			2	1
W6OVK	1			1			1	1
W6OWX	1			1			1	1
W2JND		25			‡		‡	3

[1] Not eligible for award.

‡ Claimed score and distances not included in report.

We might also mention courageous W5FYF who, though active regularly, heard no sigs. in Jan.!

may be gained from the report of W1SS, Arlington, Mass., who worked 91 stations in 1939. W1JP reports about thirty stations active within a radius of ten miles of Providence, R. I. Jack is one of the select few who are using crystal control or its equivalent, the line-up being as follows: 42 xtal, 6L6 quadrupler, 807 doubler, HK-24 doubler, p.p. HK-24's final, modulated with 46's. Others we know to be stabilized include W1HDF, Elmwood, Conn., HK-54, doubler-final; W1LIH, Hartford, HK-24 doubler-final; W2HGU, Ridgefield, N. J., HK-54's p.p.; W3FX, Philadelphia, RK-34 doubler-final; W1INF, West Hartford, HK-24's p.p. (either amplitude- or frequency-modulated); W6AVR, Colton, Cal., 35T's p.p.; and your conductor, HK-54's p.p.

We do not take the stand that stabilization is necessary at this stage of the game, but we admit that we were surprized to find that it's not half so difficult as it might seem; and once attained, there is real satisfaction to be gained from having done it "the hard way." As the quickest means of exploring the possibilities of the f.m. type of superhet, we used a commercially built 3-Mc. i.f. amplifier unit (Browning type 3000-A) which is designed for use in receiving the 43-Mc. f.m. broadcast stations. Instead of using the regular r.f. section, which in this unit is removable, we built an acorn converter section similar to that described in Jan. *QST*, added an audio system and power supply, and presto! — we have a 112-Mc. receiver which appears to do a very nice job. Preliminary tests indicate that it beats our super-regen at its own game in receiving the modulated oscillators with good sensitivity and surprising quality. Amplitude-modulated stations using crystal control sound fine, and the quality on the f.m. transmitter at W1INF would shame the best 'phones heard on any man's band! We plan to be on 112,100 kc. each Thursday night and have fond hopes of working into W2 or W3 one of these nights.

W2MLO says that QRM has reached serious proportions around New York and that many of the gang are attempting to improve matters by the addition of r.f. stages to their receivers, with not too much success in some cases. We offer the suggestion of W8GU, who uses battery bias on acorn r.f. stages to attain efficient performance on 224 Mc. It is well known that, with even the best bypass condensers obtainable, the cathode resistor and its associated bypass present a considerable impedance at very high frequencies, causing instability if the plate, screen, and suppressor voltages are set at values which are normally best from the standpoint of gain. The use of fixed bias has been found useful even at 56 Mc. and should help materially on 112.

"DX" to the Long Island gang is W3CGU, North Plainfield, N. J., who is being heard at distances up to 60 miles with good signal strength. A few stations are active in southern Connecticut, including W1LAS, East Portchester, and W1CPL, Devon, but W1 DX is still to be written into most New York logs.

Enthusiasm for 112-Mc. work has spread to all corners of these United States, and even to Hawaii, where K6QZW, K6RNX, and K6NSD are going strong, according to word received from K6RRA. "Mike" would like to see more dope in *QST* on simple rigs and receivers for 2½ and adds that he believes that many fellows with low-powered pocketbooks would be encouraged to try u.h.f. work if they realized how simple and inexpensive it can be. What say, gang? Do you want more 112 and 224-Mc. dope?

In Nogales, Arizona, W6KOL and W6MLL have 2½-meter rigs in operation, while in Phoenix the Junior College Radio Club has several members active, according to word received from the Arizona S.C.M.

The area around Youngstown, Ohio, has broken out with 112 Mc. as the result of pioneering work on the part of W8SRD. Active stations include W8's ETN, FET, FRY, QAK, QLP, OYQ, SSL, SDF, SIU, and SRD. Rigs in general are low-powered jobs using receiving tubes. Emergency drills are held once each month; an excellent plan, in view of the obvious value of rigs which are capable of handling short-distance traffic on battery power in time of local emergency. It is our opinion that a group of portable battery-operated 112-Mc. rigs should be a part of every amateur emergency plan.

224 MC.:

Several stations along Lake Erie have been active on 224 Mc. in recent months. These include W8's IPU, Cleveland; QKI, Ashtabula, Ohio; GU, Erie, Pa.; RV, Buffalo; and NOR, North Tonawanda, N. Y. Several fellows have been tracing their sigs by the use of mobile receivers, in order to determine their coverage. W8RV has heard his own sig at

(Continued on next left-hand page)

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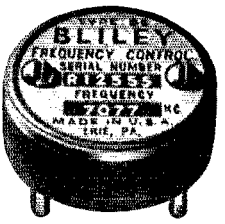

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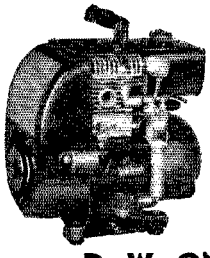

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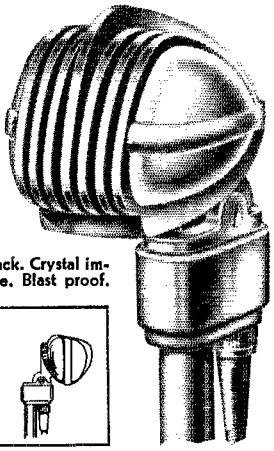

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a distance of 30 miles, while W8GU has been heard at 55 miles. Since this 55-mile record was set up, W8GU has been moved to a new location which is 400 feet above the land along the lake, and much better coverage is anticipated this spring. Many types of antennas have been tried, with 12-element and 18-element arrays of the type shown in the accompanying photograph giving the best results. The masts on which the antennas are mounted are steel and no insulation is used, but the arrays seem to be very efficient and the supporting mast seems to have no bad effects on the radiation pattern.

W1BBM is ready for business on 224 Mc., with an HK-24 feeding a Yagi beam. For receiving a 955 has been in use, but an HY-615 was installed recently with improved results. Bates in on 1¼ nightly and is eager for skeds with other 224-Mc. stations.

W1AIY, Wolcott, Conn., has an HK-24 going, also with a Yagi beam, and is furnishing your conductor a fine sig for receiver and antenna tests at a distance of 40 miles or more. At Wilbraham we have a 955, with separate quench oscillator, running on a six-element rotary, and we look forward to more activity on 224 Mc. soon.

Don't forget that ten-point multiplier for 224-Mc. work in the Marathon. Get a rig going and sell the band to a few of the gang. If nothing more can be accomplished, a few cross-band QSO's will build up that score aplenty. Monthly reporting of Marathon scores will begin in the April issue.

Quote and Unquote

(Continued from page 55)

cerned, but since the circuit goes out of balance and we are picking the voltage off of one side only, the assumption that we have a neutralized amplifier is erroneous.

When the operator tries to tune an incompletely neutralized amplifier, he runs into difficulty. The age-old method of tuning by adjusting the plate condenser or inductance for minimum plate current is reliable only when the drive E_g on the grid is constant. With E_g constant the plate current I_p varies with tuning capacity in the manner shown in Fig. 9, and C_o represents the correct setting. But if the grid excitation is varying during the process, being high on one side and low on the other, as indicated by the dotted E_g curve, the minimum of plate current will be displaced and a false indication of tuning obtained, as shown by C_o. The result is that the amplifier is not tuned, the efficiency is reduced, and the distortion is increased. There are probably many transmitters now on the air in which the operation is being impaired by improper plate tuning, as a result of incomplete neutralization of the interelectrode capacity.

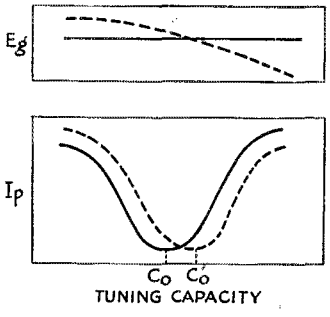

FIG. 9

Strays

We've had plenty of fun in years past with the newspaper reporters who write "frequency of 50 kilowatts," etc. Now we read about the new "frequently-modulated" systems. — *W1GRU.*

Fitting the Chassis to Layout

(Continued from page 39)

Circuit Details

The transmitter is primarily designed to operate on 10- and 20-meter 'phone, using a 40-meter crystal. The first 6V6 is the oscillator, operating at the crystal frequency, the output of which is fed to the second 6V6 which doubles frequency. The signal is then fed to the 807, which is either a straight amplifier or doubler driving the 812's in the final. If the 807 has a tendency to oscillate when working straight through, it can be cleared up by additional shielding between the leads to the plate and grid tanks, or by using 45 volts or so of fixed bias on the grid. It might be suggested that if 40-meter operation is desirable without going to an 80-meter crystal, a plug-in system could be used which would plug the crystal into the second 6V6 grid circuit and eliminate the regular oscillator. With that arrangement only a 40-meter T_3 tank need be wound, since the regular oscillator tank could be used in place of T_2.

The tank coils are wound on the one-inch diameter forms furnished as part of the exciter tank assemblies. The placement of the tap as given in the coil data should give good results, but a little experimentation will probably prove well worth while in obtaining optimum drive for the following stage.

Keying of the oscillator in the cathode circuit was tried and worked very satisfactorily, but since the author wished to use the rig on 'phone, no special provisions for keying are included. Any of the more common methods of keying should work very well. An extra terminal is provided on the terminal strip which may be used for the keying connections.

By-pass condensers C_7 are connected on the plate side of the meter jacks to keep r.f. out of the meter when it is plugged in. It should also be noticed that the same condensers serve to by-pass the 807 screen, but if meters are plugged into both meter jacks at once, the r.f. from the 807 screen will appear across the meters, and this condition should obviously be avoided.

The oscillator is lightly loaded and the plate current is only around 15 ma. The 6V6 doubler is more heavily loaded and the plate current should go up to about 25 to 30 ma. The 807 should drive the final sufficiently to give a grid current of about 50 ma.

No difficulty was experienced in neutralizing the final, and if the balanced arrangement is closely followed, no trouble should be encountered.

For 'phone operation a maximum of 1000 volts should be applied to the plates of the 812's. With 100 volts bias on the grids, a full-load plate current of about 200 ma. should be drawn. This will give an output of approximately 150 watts. For c.w. operation, 1250 volts on the plates and −125 volts bias on the grids will give a full-load plate current of about 250 ma. and the power output will be about 220 watts.

★ A.R.R.L. QSL BUREAU ★

For the convenience of its members, the League maintains a QSL-card forwarding system which operates through volunteer "District QSL Managers" in each of the nine United States and five Canadian districts. In order to secure such foreign cards as may be received for you, send your district manager a standard No. 10 *stamped* envelope. If you have reason to expect a considerable number of cards, put on an extra stamp so that it has a total of six-cents postage. Your own name and address go in the customary place on the face, and *your station call should be printed prominently in the upper left-hand corner.*

W1 — J. T. Steiger, W1BGY, 35 Call Street, Willimansett, Mass.
W2 — H. W. Yahnel, W2SN, Lake Ave., Helmetta, N. J.
W3 — Maurice Downs, W3WU, 1311 Sheridan St., N. W., Washington, D. C.
W4 — G. W. Hoke, W4DYB, 328 Mell Ave., N. E., Atlanta, Ga.
W5 — James F. Manship, W5ALE, 910 So. Boston, Tulsa, Okla.
W6 — Horace Greer, W6TI, 414 Fairmount Ave., Oakland, Calif.
W7 — Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8 — F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
W9 — Alva A. Smith, W9DMA, 238 East Main St., Caledonia, Minn.
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VE5 — H. R. Hough, VE5HR, 1785 First St., Victoria, B. C.
K4 — F. McCown, K4RJ, Family Court 7, Santurce, Puerto Rico.
K5 — Norman F. Miller, K5AF, 15th Air Base Squadron, Albrook Field, Canal Zone.
K6 — James F. Pa, K6LBH, 1416D Lunalilo St., Honolulu, T. H.
K7 — Jerry McKinley, K7GSC, Box 1533, Juneau, Alaska.
KA — George L. Rickard, KA1GR, P. O. Box 849, Manila, P. I.

Strays

A pair of toy telephones ($2.50 at almost any toy shop) will provide a good connection between the shack and the house. The set will work up to well over 100 feet. One of those 89-cent electric razors makes a good 110-volt buzzer for calling. — *W8FSB.*

★ NEW TUBES ★

12K8

THE 12K8 is a metal triode-hexode converter similar to the 6K8 except for heater rating. The heater of the 12K8 requires 12.6 volts, 0.15 amp.

12SR7

THE 12SR7 is a metal duplex-diode triode similar to the 6R7 but utilizes single-ended construction with the grid lead brought out through the base.

928

THE 928 is a gas phototube designed with a caesium-surfaced, cylindrical mesh cathode which has non-directional light pick-up characteristics.

1628

THE 1628 is a triode transmitting tube of the high-perveance type designed especially for use as an oscillator, r.f. power amplifier and frequency multiplier at the ultra-high frequencies. It may be operated at maximum ratings at frequencies as high as 500 Mc. and, at reduced ratings, as high as 675 Mc. Maximum plate dissipation of the tube is 40 watts for Class-C telegraph service.

The thoriated-tungsten filament is of the double helical type and is center-tapped within the tube to minimize the effects of filament-lead inductance. Another unusual feature of the tube is its double grid and plate leads which are brought out of the bulb through individual seals. The double leads facilitate neutralizing circuits within the tube. The grid and plate leads are short and heavy in order to minimize further lead inductance and resistance. The tantalum plate and grid are closely spaced to increase plate efficiency at the higher frequencies by decreasing electron transit time between filament and plate.

Typical operating ratings as a plate-modulated r.f. amplifier are as follows:

Filament voltage (a.c. or d.c.)	3.50 volts
Filament current	3.25 amp.
Amplification factor	23 μfd.
G-P capacity	2
G-F capacity	2 μμfd.
P-F capacity	0.4 μμfd.
D.c. plate voltage	800
D.c. grid voltage	−100
Grid resistor	9000 ohms
Peak r.f. grid voltage	160
D.c. plate current	40 ma.
D.c. grid current (approx.)	11 ma.
Driving power (approx.)	1.6 watts
Power output (approx.)	22 watts

These tubes are all released by RCA.

Strays

Metal lath, obtainable from lumber companies, makes better ventilating louvres than hardware cloth. — *W9ISA.*

Hq. Visits G.E.

(*Continued from page 16*)

tional cross-neutralization is used in the triode stages, which are push-pull throughout; coil neutralization was tried but did not work out successfully here. One special type of tube had two grid leads, made necessary by the fact that the impedance of a single lead was too high to permit successful neutralization — a tip to hams who don't watch the length and position of leads in u.h.f. neutralizing circuits.

Like to try working tubes in push-pull parallel on 71 megacycles? Well, they do it here in the low-power end of the 10-kw. sound-channel transmitter, and from all accounts it's one of the smoothest-running parts of the setup. Furthermore, the tank circuit is an ordinary coil-condenser affair, and the amplifier runs at normal ratings with an output of 200 watts. One of the photographs gives a close-up of this amplifier, and it's well worth studying. The 834's lend themselves beautifully to such an arrangement because of the way the grid and plate leads are brought out, and lead lengths in all parts of the amplifier are so small as to be almost negligible. Perfect balance is the secret of good performance; note the small condenser on the near side of the shield which compensates for a small discrepancy in input capacity between the two halves of the amplifier.

The minutes have wings when you start delving into the innards of as much u.h.f. apparatus as there is concentrated at the Helderbergs, and before we got a chance to go into the antenna situation closing-down time came along. We took a flying look at the collection of sky-wires ranging from doublets through rhombics to the chubby-element sight radiators, and mentally resolved that when we got a chance we'd come back again to find out what makes them tick. The view of the station shows the cubical television antenna, consisting of eight half-wave radiators formed into two squares, one a half wave above the other, this design being used to give low-angle horizontally-polarized radiation without marked directional effects in the horizontal plane. Making all the elements in such an array take the same amount of power — and thereby approach in practice the performance indicated by theory — isn't by any means as simple as one might think, and there's a story there that we hope to get some day.

Our program had called for finishing up the day at the receiving station, but snow and ice made it impossible to take the direct route over the top of the hill, and time did not permit going 'round the mountain by the long route. So we had to pass up an opportunity to see how well the Empire State programs are received up there. But when warmer weather comes. . . .

It is difficult to see as much as we did in one short day without developing a more or less serious case of mental indigestion, and if this story is a bit sketchy in places it's because only the high spots can be touched in the *QST* pages

(*Continued on next left-hand page*)

available. We can't close this account without acknowledging our indebtedness not only to the already-mentioned members of the party, but also to Messrs. John Gilmour of the television studio, H. G. Towlson, chief engineer at WGEO, and Larry Leeds at the Helderbergs, for their patience in showing us the equipment and answering innumerable questions, and to Mr. H. P. Thomas at the Helderberg receiving station, who was ready and waiting to perform similar good offices had circumstances permitted our getting there.

Correspondence Department

(Continued from page 65)

Thus, on 'phone a report of R2S5 would mean: Your signals readable with no difficulty, one of the strongest on the band. On c.w., a report of RST 238X would mean: Your signals understandable with no difficulty, are of average strength, and are almost pure d.c., with characteristics of crystal control.

The chief disadvantage of such a system at the present time would be its confusion with the present system. However, if it were generally accepted, popular use would reduce the confusion.

— *Edward R. Sherman, Jr., W1LNN*

CANADA CARRIES ON

9918 88 Ave., Edmonton, Alberta

Editor, *QST:*

If space can be found for this letter in the correspondence column of *QST*, it may lend a great deal of encouragement to other isolated Canadian ham clubs which may have endeavored as we have to remain organized, despite the blackout of ham radio.

The Northern Alberta Radio Club of this city is not a very big club as ham clubs go, but recent meetings have proven more successful than any before in its eighteen-year history. All this at a time when disturbing rumors are reaching us of other Canadian clubs disbanding completely.

Our secret? We have none (attendance is certainly not due to any feeling of being shipwrecked sailors on a desert isle), but if we were to be asked to give a few pointers for the benefit of other VE clubs they would be as follows:

(1) Throw overboard all formality and red tape and become, for the time being, a social club, with everything subordinated to the hamfest spirit of entertainment and fun.

(2) Throw a party now and then in between regular meetings. (Our last one was a bingo party — highly recommended! — and next on the club calendar is a whist drive and dance.) Picnic outings during the summer months are "musts."

(3) Absolutely essential is a live-wire program committee that can meet regularly to map out entertainment for the regular meetings. Provide it with a book on how to have fun at house parties.

(4) Don't overlook home movies as a form of entertainment. (A local photographer was glad to show us several reels of 16 mm. vacation shots in Kodachrome.) Your local factory representatives or travel agents have publicity films they will show for the asking.

(5) Technical talks are OK, but a good demonstration on anything scientific, something that packs a surprise, is many times better.

(6) YL club members are a tremendous asset. They are invaluable on the executive and on committees planning social functions. (We elected a popular local YL as president for 1940 and another as treasurer!)

(7) Refreshments are a drawing card. Soft drinks and donuts are easy to serve and go over well, winter or summer.

(8) Lastly, don't go stale by meeting too often. Once a month might spell success where twice a month would mean failure.

All this is a bit unconventional and might lead someone to

ask, "Yes, but what have you left of ham radio, and the old ham spirit?"

Well, all we can say is, we're sticking together at a time when it is so essential that we stick together, and without any mention of the word "duty." Should the need ever arise we'll be united to stand up for our rights as radio amateurs. We're still affiliated with the A.R.R.L., and since most of our members are giving renewed support to the League we intend to stay that way. And finally, at a time when war clouds are hanging over us and destiny shaping the lives of some of us, we're making the best of things by having more genuine fun as a club than we ever had before.

If that isn't showing the old ham spirit it's the best substitute we'll ever be able to offer this crazy world.

— *W. K. (Ken) Angus, VE4VJ*

OWL JUICE SEQUEL

Elmhurst, Ill.

Editor, *QST:*

The February "Dixie Jones" piece was interesting beyond its usual "moral." Having spent several years in Alaska myself, this may serve as a sort of sequel. . . .

It seems a trading post proprietor of Italian extraction got a yearning for grapes. Rather than wait several weeks for his order to reach the States by mail, he decided to send a telegram. A message was duly dispatched, ordering one barrel of muscatel grapes. No doubt many moments were spent day-dreaming about how those grapes would be prepared. Imagine how he must have felt, after weeks of waiting, to receive — not grapes, but a barrel of muskrat traps!

— *Geo. J. Maki, W9RQZ, ex-K7HV*

28-MC. C.W.

Leeds, Yorkshire, England

Editor, *QST:*

Please put me down as one who will be only too pleased to listen and report; we are going mad for something to do and will be only too happy for the chance of serving such a useful purpose for our brother hams.

Having listened on 28 Mc. since war broke out, I note only having heard two c.w. signals to hundreds of 'phones. Where has the W 28-Mc. c.w. gone? Ask the boys to get the keys oiled up; we are listening. A CQ means a report for 'em in *QST.*

SWITCH TO SAFETY

— *S. Roberts, G6QS*

Editor, *QST:*

A switch, prominently displayed on the wall, would be an asset to any ham shack. A little card with the words "Emergency Switch" would immediately inform all visitors that here was the black-out switch to be used in case of shock.

I feel certain that few hams, when visiting another shack for the first time, could walk right to the main power switch that would kill all line voltage to the transmitter.

— *Irving Herriott, Jr., W9LEH*

SAFETY ON THE ROAD

1711 W. Lee St., Greensboro, N. C.

Editor, *QST:*

. . . It seems to me that the practice of driving around in a car and operating an amateur station, at the same time, is one that should be discouraged except where the driver leaves the operation to a second person. To drive a car while trying to carry on a QSO violates all rules of safety and common sense. We all know that mobile rigs will "get out" while the car is in motion, so attempting to carry on a contact proves nothing and our public highways are no place for "stunt drivers." All the rules of safety I have seen say the driver should give his undivided attention to his driving and no one can do this and operate a transmitter and receiver. I have heard of instances where the "one-arm driver" has been haled into court on a charge of reckless driving.

Let us all try to observe the safety rules of the highways as well as the rules of safety we observe around our transmitters.

— *Al Parham, W4MR*

(Continued on next left-hand page)

SAFETY CAMPAIGN

224-26 143 Ave., Laurelton, L. I., N. Y.

Editor, *QST:*

There are few policies of importance that all people concerned with will agree upon. The A.R.R.L. safety campaign is an undertaking worthy of unanimous approval and as such is unquestionably applauded by all radio amateurs.

Unfortunately any safety campaign is never quite one hundred per cent successful. There are many of our ranks who have been electrocuted while engaged with this fine hobby of ours. Others will be equally unfortunate — unpleasant as the realization may be.

However, we do know that those who have met with accidents have in every case contributed something to our cause. Many of us owe our lives to those who have gone simply because their experience has enabled us to avoid circumstances that would have been disastrous.

Because of this I suggest that all amateurs who have died in pursuance of our hobby be permanently honored. If no provision has been made already I think a metal plaque engraved with the names of all amateurs who have thus died should be placed in station W1AW. The files of *QST* contain accounts of many fatal accidents and comprise a fairly complete record.

It seems to me such a commemoration would be the least we members of A.R.R.L. could give.

— *Stanley L. Grimes, K6PTY*

EXTRA-SENSORY PERCEPTION

4614 North 6th St., Milwaukee, Wis.

Editor, *QST:*

I've noticed a few letters in the correspondence columns regarding seemingly telepathic experiences that hams have had. It has been suggested that psychic research would be a good sideline for an amateur, as his rig would provide the long-distance communication desirable for some telepathy experiments and, at the same time, an amateur is apt to be inquisitive about that sort of thing. I'd like to endorse that suggestion and add a few of my own.

The psychology departments of many colleges are doing work of this kind, but few of them can obtain sufficient funds for extensive research of such a radical sort. Free long-distance communication would be very welcome. If you'd like to combine traffic handling with experimenting, see your local psychology prof.

Or, if you'd like to play around a little on your own, the card index and Reader's Guide at the library will provide an amazing amount of material to start with. I'd especially recommend *New Frontiers of the Mind* and *Extra-Sensory Perception*, both by Dr. J. B. Rhine of Duke University; *Mental Radio* by Upton Sinclair; and the article on page 331, volume 45 of *Science Monthly*.

Now that the war is spoiling so much of the DX, this may give some ex-DXers something to do.

— *Keith J. Hayes, W9ZGD*

CQ AMATEUR METEOROLOGIST

55 Hempstead Ave., West View, Pittsburgh, Pa.

Editor, *QST:*

I am not only interested in amateur radio but in meteorology, too. I have at the shack here a few pieces of weather bureau equipment which I am endeavoring to increase and improve. I should like to know if there are at present any clubs or organizations within amateur radio which feature the radio and weather bureau. I have been QSO'ing with several operators that are also interested and we thought it would be nice to join up with any present organization or, in case that none existed, originate one. The amateurs I speak of are W3ILC and W3HSD, both of Washington, D. C. After some discussion we concluded that amateur weather and radio stations would be a great idea, being of great service to both amateurs and other facilities depending upon weather to any extent for operation. Airlines and shipping would benefit by reports from locations where no U. S. weather bureau existed. . . .

— *Warren Repp, W8TZW*

A LETTER

912 West 30th St., Wilmington, Del.

Editor, *QST:*

I came home the other night and found this letter on my

(*Continued on next left-hand page*)

Where to buy it

A directory of suppliers who carry in stock the products of these dependable manufacturers.

super skyrider hallicrafters ultra skyrider

ALBANY, N. Y.	Uncle Dave's Radio Shack	356 Broadway
ATLANTA, GEORGIA	Radio Wire Television Inc.	265 Peachtree Street
BOSTON, MASS.	Radio Shack	167 Washington Street
BOSTON, MASS.	Radio Wire Television Inc.	110 Federal Street
BRONX, N. Y.	Radio Wire Television Inc.	542 East Fordham Rd.
BUTLER, MISSOURI	Henry Radio Shop	211–215 N. Main Street
CHICAGO, ILL.	Allied Radio Corp.	833 W. Jackson Blvd.
CHICAGO, ILL.	Radio Wire Television Inc.	901–911 W. Jackson Blvd.
CINCINNATI, OHIO	United Radio, Inc.	1103 Vine Street
DETROIT, MICH.	Radio Specialties Co.	325 E. Jefferson Ave.
DETROIT, MICHIGAN	Radio Specialties Co.	11800 Woodward Ave.
HARTFORD, CONNECTICUT	Radio Inspection Service Company	227 Asylum Street
HOUSTON, TEXAS	R. C. & L. F. Hall	4021 Huey Street
JAMAICA, L. I.	Radio Wire Television Inc.	90–08 166th Street
KANSAS CITY, MO.	Burstein-Applebee Company	1012 McGee Street
NEW YORK, N. Y.	Harrison Radio Co.	12 West Broadway
NEW YORK, N. Y.	Radio Wire Television Inc.	100 Sixth Ave.
NEWARK, N. J.	Radio Wire Television Inc.	24 Central Ave.
READING, PENN.	George D. Barbey Company	404 Walnut St.
SPRINGFIELD, MASS.	T. F. Cushing	349 Worthington St.
WASHINGTON, D. C.	Sun Radio & Service Supply Co.	938 F Street, N. W.

TRIPLETT INSTRUMENTS

ALBANY, N. Y.	Uncle Dave's Radio Shack	356 Broadway
ATLANTA, GEORGIA	Radio Wire Television Inc.	265 Peachtree Street
BOSTON, MASS.	Radio Shack	167 Washington Street
BOSTON, MASS.	Radio Wire Television Inc.	110 Federal Street
BRONX, N. Y.	Radio Wire Television Inc.	542 East Fordham Rd.
BUTLER, MISSOURI	Henry Radio Shop	211–215 N. Main Street
CHICAGO, ILLINOIS	Allied Radio Corp.	833 W. Jackson Blvd.
CHICAGO, ILLINOIS	Electric & Radio Supply Co., Inc.	25 North Franklin Street
CHICAGO, ILL.	Radio Wire Television Inc.	901–911 W. Jackson Blvd.
CINCINNATI, OHIO	United Radio, Inc.	1103 Vine Street
JAMAICA, L. I.	Radio Wire Television Inc.	90–08 166th Street
LITTLE ROCK, ARKANSAS	Beem Radio Company	409 W. 3rd St.
MINNEAPOLIS, MINNESOTA	Lew Bonn Company	1124–26 Harmon Place
MUSKOGEE, OKLAHOMA	Home Radio Mart	204 No. Twelfth Street
NEW YORK, N. Y.	Radio Wire Television Inc.	100 Sixth Avenue
NEWARK, N. J.	Radio Wire Television Inc.	24 Central Ave.
READING, PENN.	George D. Barbey Co.	404 Walnut Street
WASHINGTON, D. C.	Sun Radio & Service Supply Co.	938 F Street, N. W.

Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them.

operating table. I thought it might give the boys a laugh if they read it in *QST*. Here is the letter:

"The Shack

"Dear OM:

"I find it rather difficult to bring myself around to writing this letter, but I just couldn't put it off any longer. You will no doubt be startled to hear from me since I have never written before; I do feel that we know and understand each other, though, and I hope that we may become even better friends.

"The other day (Friday, I think) you were working a W1 up in Boston. I was following you letter for letter, as I usually do, but I'll have to admit that I really wasn't paying much attention to what you were saying. That happens a lot in ham radio, so it's nothing new I guess. Anyway, I did notice that the W1 said that he was using an e.c.o., and from the way he talked he was pretty much tickled over the way it worked. My ears did prick up a bit, however, when you started asking him questions about the thing. I've known you long enough to be able to tell when you are really interested in a guy's rig, and just not making polite conversation; this time you were interested. Frankly I was glad when that QSO was over, because that fellow was really selling e.c.o. to you. The thing that bothered me most was when you pulled out the big box of parts and started to look through them — you remember, right after you signed. Then when you pulled out the Handbook and started to look in the e.c.o. department I was really alarmed.

"Gosh, OM, don't build an e.c.o. I've worked with you for six or seven years now, and you've never gone wrong on anything we've done together. I think I first met you that day you received a ticket for working out of the band, or perhaps it was that time when you got one for having an unstable signal. It's not very important anyway, so I won't go into that any further. Together we have really done a good job.

"In the first place I'm built to stay in one place. If I can't do that I'm not doing such a good job. I have a good voice, too — always T9x. It doesn't make any difference to me whether your antenna is swinging around like a jumping rope, or whether a gang of rug-cutters are shaking the shack like an earthquake. I just laugh at them. They can't phase me, or cause me to move an inch, or better yet a cycle. When some big guy gets right on top of me I don't complain. I stand up for my rights, but if the big guy gives me too much trouble I can always double up and come out somewhere where there isn't some big guy beating on me. Sometimes it has been pretty hot in my house; it's been your fault, too. You bottled me up with so much current that I darn near passed out. Lots of times I whistled at you, but what did you do? You tapped on my roof with a pencil and told me to shut up. What kind of a deal do you call that? One time I got so darn uncomfortable that I left a brown spot on my floor, but anyone would have done the same thing in my circumstances. In spite of all that I kept right on going, and so far I haven't let you down once.

"Another thing. I know lots of fellows that hang around the same place that I do. You know them, too. They are the fellows that know your first name, and they are the ones that you would look up if you ran out of dough when you were in their towns. Sometimes when you try some other place to work from, the guys treat you sort of stiff-like. I'm not there with you to help you take that sort of stuff on the chin, but I'm usually around the shack listening in. When you do get fed up on that stuff we start working together again, and then we go to town. A couple of little taps on your bug and we are in on a three-way with a couple of old pals. Of course I know that it isn't always the best thing to live alone in your own little circle, but I'm of the opinion that if a fellow doesn't have much time to spend on the air he should spend it with his friends. Naturally that's my own opinion, but everyone is entitled to his own opinion.

"If you build an e.c.o. you will be all over the place. You

probably won't ever work the same guy twice. Sometimes you'll make a nuisance of yourself swishing all around, and some people will wish that you'd curl up and die. Then again, you know that you don't check your frequency like you should. If the F.C.C. knew what you have always used for a monitor they would probably slap you in the jug. It's OK with me; I'll keep you outside looking in, but do you think an e.c.o. could do that? No, indeed. It would sit around and laugh while you chopped rocks or made license plates. Some of these e.c.o. birds get the jitters too. They sound like they are trying to whistle with a mouth full of water. I can almost tell how much the OM weighs by the warble of the e.c.o., when he walks across the floor in the shack. Oh, I'm telling you old pal, those e.c.o.'s will do you dirt if they get half a chance.

"I guess I've preached enough by now. If you still want to buy that 802, go ahead, and may the Lord be on your side. If you ever do get in a spot, though, I will be sitting around ready to get back in the harness again.

"Yours through thick and thin,

"Old X Cut."

Well, there it is.

— *Len Yerger, Jr., W3BTQ*

PLUG FOR LOW POWER

1000 Kensington Rd., Grosse Pointe Park, Mich.

Editor, *QST*:

I suppose nearly every amateur, from the day he gets his license, finds his mouth watering for "the Big Tube." Feels that unless he puts out several hundred watts he is wasting his s. on the d.a., as T. Gray so aptly expresses it. But nothing could be further from the truth.

Of course high power will go to town and reach far away places — sometimes. Don't think, however, that low power (i.e., 50 watts output or less) will fail to yield big dividends. In spite of the fact that all this has been ably and frequently discussed, I should like to stick in my oar, for what it is worth. And the best way to make the point is to offer actual figures.

But first I will refer briefly to the results obtained with the QSL Forty and the QSL Sixty. There is a stack of letters here 5 or 6 inches high about these little jobs, and some of the fellows tell me that they have worked Australia, South America, England, Hawaiian Islands, Canal Zone, all W districts, etc., etc. I have a card here myself from Italy. And the joke is that most of them are doing a lot better than I am, but I am a punk operator which will account for that.

Now let's take a look at real low power. The transmitter used was the Portable Five, described in December *QST*, hooked to an 80-meter half-wave, end-fed Zepp with feeders about 55 feet long. The output was 5 or 6 watts. The figures given below represent the total operations from August 4 to December 22, 1939, not the best season, it will be observed. There were 238 "tries" from which 95 QSO's resulted, or 40% success.

(By the way, as I was writing this, I heard W9BGH, near St. Louis, Mo., calling CQ, and I answered him, getting RST 589x for the 5-watter. We had QSO'd — I like that verb! — last Friday when a QSL Forty with 50 watts output was used here and that report was only RST 599x. Lloyd said the signal of the 5-watter was nearly as loud as the 50-watter.)

Well, here is the dope:

Results by Districts with 5 Watts Output on 20, 40 and 80 Meters, at W8QBW, QDK.

W	*Total Tries*	*QSO's*	*No QSO's*	*Percent Success*
1	25	8	17	32
2	18	6	12	33
3	5	1	4	20
4	21	8	13	28
5	11	3	8	27
6	12	0	12	0
7	8	1	7	12
8	75	41	34	55
9	30	12	18	40
CQ	31	15	16	50
DX	2	0	2	0
Totals	238	95	143	40

As might be expected, the 8th and 9th districts lead and the East Coast shows up well. The Far West, 6 and 7 are disappointing, but may improve during the winter.

(*Continued on next left-hand page*)

The conclusion to be drawn is that 5 watts output will cover quite a bit of the U.S.A. if it works into a decent antenna and reasonable care is used in making calls. If the band is "dead," as it often is, or if your own frequency has a couple of stations parked on it, you won't do much, so use the skull and don't waste time or cause useless QRM.

The 5-watt job has worked 24 states so far, and two of these, Wyoming and Vermont, were two more towards WAS here. This, it seems to me, is a lot of territory for a rig that costs (less crystals) only $6.43, which includes power supply as well as the oscillator itself.

— *Fred Sutter, W8QBW–QDK.*

Strays

Labeling controls with a pen directly on crackled panels is impossible because of the nature of the surface, but by cutting off a small tab of transparent tape, affixing it to the position under the control and then by using fine pen point and white ink, the class of your labeling is limited only by your artistic ability. The white lettering set off against the dark background approaches closely a commercial job. — *W9ARE.*

—•••—

Said the proud owner of a genuine 5-tube depression superhet to W9NOY, "You're going to get into trouble. Last night your station came in on the broadcast band."

"Oh, no," says NOY, "my station didn't come in on the broadcast band — your receiver came in on the short-wave band."

HAM-ADS

(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.
(2) No display of any character will be accepted, nor can any special typographical arrangement, such as all or part capital letters be used which would tend to make one advertisement stand out from the others.
(3) The Ham-Ad rate is 15¢ per word, except as noted in paragraph (6) below.
(4) Remittance in full must accompany copy. No cash or contract discount or agency commission will be allowed.
(5) Closing date for Ham-Ads is the 25th of the second month preceding publication date.
(6) A special rate of 7¢ per word will apply to advertising which, in our judgment, is obviously non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Thus, advertising of bona fide surplus equipment owned, used and for sale by an individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League takes the 7¢ rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and all advertising by him takes the 15¢ rate. Provisions of paragraphs (1), (2), (4) and (5) apply to all advertising in this column regardless of which rate may apply.

Having made no investigation of the advertisers in the classified columns, the publishers of *QST* are unable to vouch for their integrity or for the grade or character of the products advertised

QUARTZ — direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Drill Carbon Co., 719 World Bldg., New York City.

QSL'S — samples. Brownie, W3CJI, 523 No. Tenth St., Allentown, Pa.

CALLBOOKS — Winter edition now on sale containing complete up-to-date list of radio hams throughout entire world. Also world prefix map, and new time conversion chart. Single copies $1.25. Canada and foreign $1.35. Radio Amateur Call Book, 610 S. Dearborn, Chicago.

QSL'S — By W8NOS — 13 Swan St., Buffalo, N. Y.

CRYSTALS, mounted, 80–160, $1.25, V-cut 40, $2.25. R9 Crystals, 338 Murray Ave., Arnold, Pa.

QSL'S, all colors, cartoons, snappy service. Write for free samples today. W1BEF, 78 Warrenton, Springfield, Mass.

CRYSTALS: police, marine, aircraft, and amateur frequencies. Descriptive catalog. Ham Crystals, 1104 Lincoln Place, Brooklyn, N. Y.

QSL'S, Maps. Cartoons. Free samples. Theodore Porcher, 7708 Navahoe, Philadelphia, Pa.

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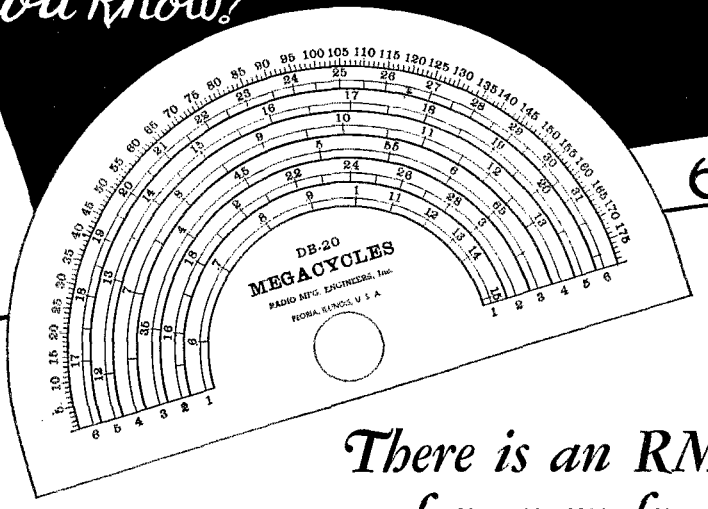

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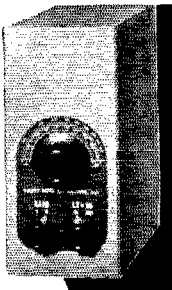

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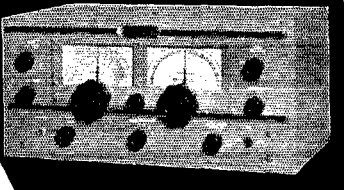

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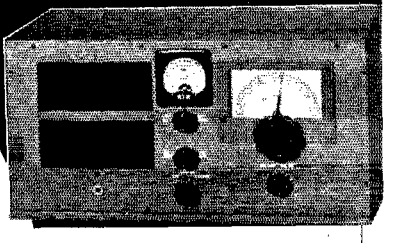

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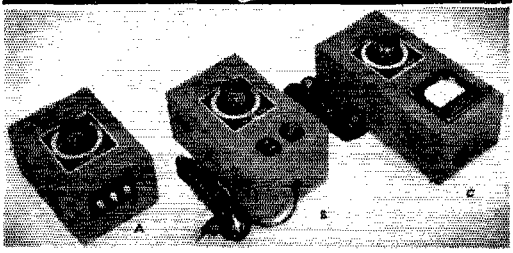

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Top and bottom mounting for laboratory bench or panel mounting. All units supplied mounted, with terminal strips as in Fig. A, except V-1 (Fig. B) and V-1M (Fig. C).

Type	Input Voltage	Output Voltage	Watts	Maximum Amps.	Approx. Wt. Lbs.	Net Price
V-0	115 volts	0–130	230	2	8	$7.50
V-0-B	230 volts	0–260	230	1	10	9.50
V-1	115 volts	0–130	570	5	11	10.00
V-1-M	115 volts	0–130	570	5	12	15.00
V-2	115 volts	0–130	570	5	11	9.00
V-2-B	230 volts	0–260	570	2.5	14	11.50
V-3	115 volts	0–130	850	7.5	14	14.00
V-3-B	230 volts	0–260	850	3.75	18	18.00
V-4	115 volts	0–130	1250	11	32	20.00
V-4-B	230 volts	0–260	1250	5.5	38	25.00
V-5	115 volts	0–130	1950	17	45	32.00
V-5-B	230 volts	0–260	1950	8.5	56	37.00
V-6	115 volts	0–130	3500	30	90	60.00
V-6-B	230 volts	0–260	3500	15	90	70.00
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V-7-B	230 volts	0–260	5000	22	120	95.00

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The new UTC OUNCER series represents the acme in compact quality transformer practice. These units weigh approximately one ounce and those which do not carry D.C. have high fidelity characteristics suitable for broadcast and similar applications. The OUNCER transformers are ideal for hearing aid, aircraft, glider, portable, concealed service, and similar applications.

The overall dimensions of these units are ⅞" diameter by 13/16" height, including lugs. Mounting is effected by two screws, opposite the terminal board side, spaced 13/16".

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(MAX. LEVEL 0 DB)

Type No.	Application	Pri. Imp.	Sec. Imp.	Net Price
0–1	Mike, pickup or line to 1 grid	50, 200, 500	50,000	$6.00
0–2	Mike, pickup, or line to 2 grids	50, 200, 500	50,000	6.00
0–3	Dynamic mike to 1 grid	7.5/30	50,000	5.40
0–4	Single plate to 1 grid	8000 to 15000	60,000	4.80
0–5	Single plate to 1 grid, D.C. in Pri.	8000 to 15000	60,000	4.80
0–6	Single plate to 2 grids	8000 to 15000	95,000	5.40
0–7	Single plate to 2 grids, D.C. in Pri.	8000 to 15000	95,000	5.40
0–8	Single plate to line	8000 to 15000	50, 200, 500	6.00
0–9	Single plate to line, D.C. in Pri.	8000 to 15000	50, 200, 500	6.00
0–10	Push pull plates to line	8000 to 15000 each side	50, 200, 500	6.00
0–11	Crystal mike or pickup to line	50000	50, 200, 500	6.00
0–12	Mixing and matching	50,200	50, 200, 500	5.40
0–13	Reactor, 200 Hys. — no D.C., 50 Hys. —2MA.D.C., 6000 ohms			4.20
0–14	50:1 mike or line to 1 grid	200	½ megohm	6.00
0–15	10:1 single plate to 1 grid	8000 to 15000	1 megohm	6.00

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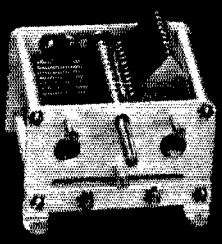

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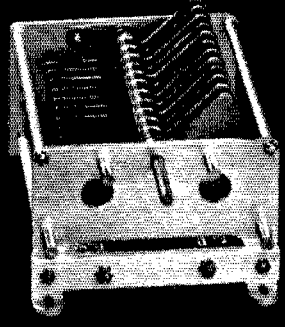

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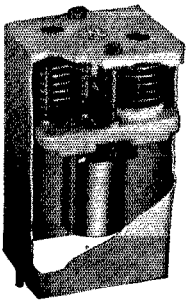

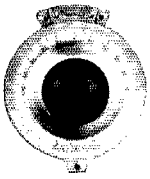

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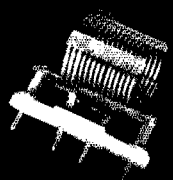

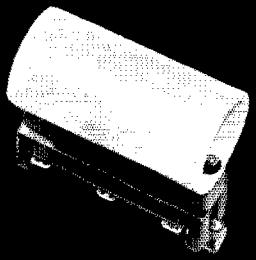

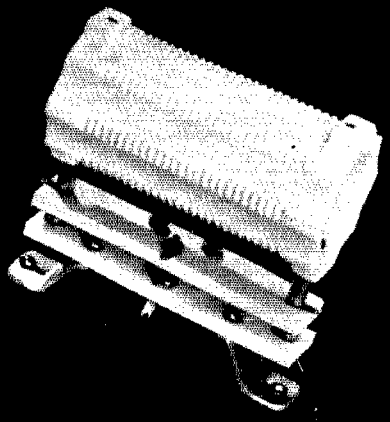

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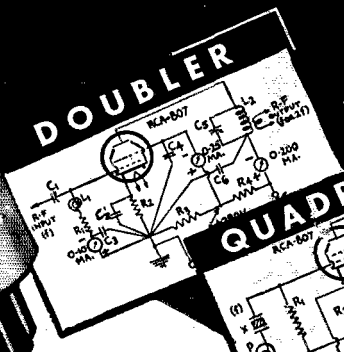

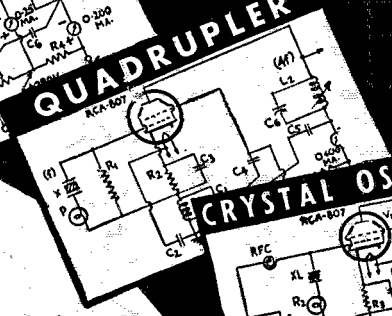

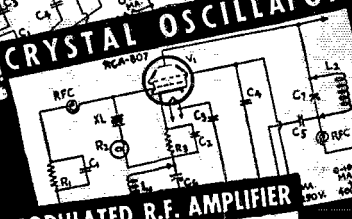

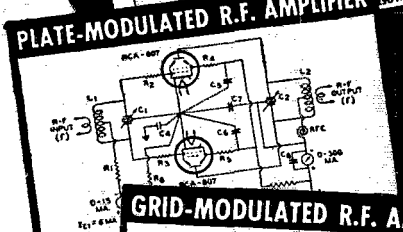

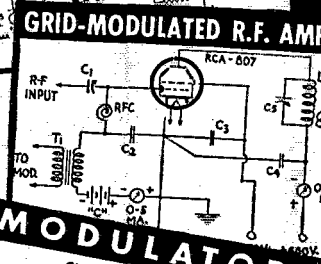

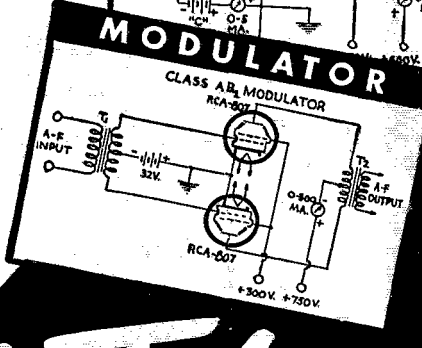

RCA-807..The "Little Magician" of Beam Power Amplifier Tubes

Most hams have used the RCA-807 Beam Power Amplifier, but not all are familiar with its ability to turn in a record-breaking performance on literally dozens of jobs. No matter how often you change your rig, there's nearly always a place for this versatile little tube. From crystal oscillator to doubler, quadrupler, buffer, Class C r-f amplifier, grid-modulated r-f amplifier, or modulator you can shift this little magician of beam power tubes and, each time, be assured of performance and durability not to be beaten at any price. It is especially useful for a low-power, portable, storage-battery-operated transmitter; a 6J5-G crystal oscillator will drive it very nicely. The RCA-807 is, without doubt, the handiest tube in any amateur shack. It will pay you to get acquainted with all of its countless possibilities.

RCA-807—HALF A DOZEN TUBES IN ONE

Plate voltage, 750 V. **Plate Dissipation, 30 W.**
Plate input, 75 W. **Amateur Net, $3.50**

The above ratings are maximum RCA ICAS Ratings (Intermittent Commercial and Amateur Service) for Class C Telegraphy.

All about Cathode Modulation! Ask your jobber for a copy of the Jan.-Feb. issue of RCA "Ham Tips".

RCA

Radio Tubes

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