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august, 1944
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Multiple Antenna Coupling

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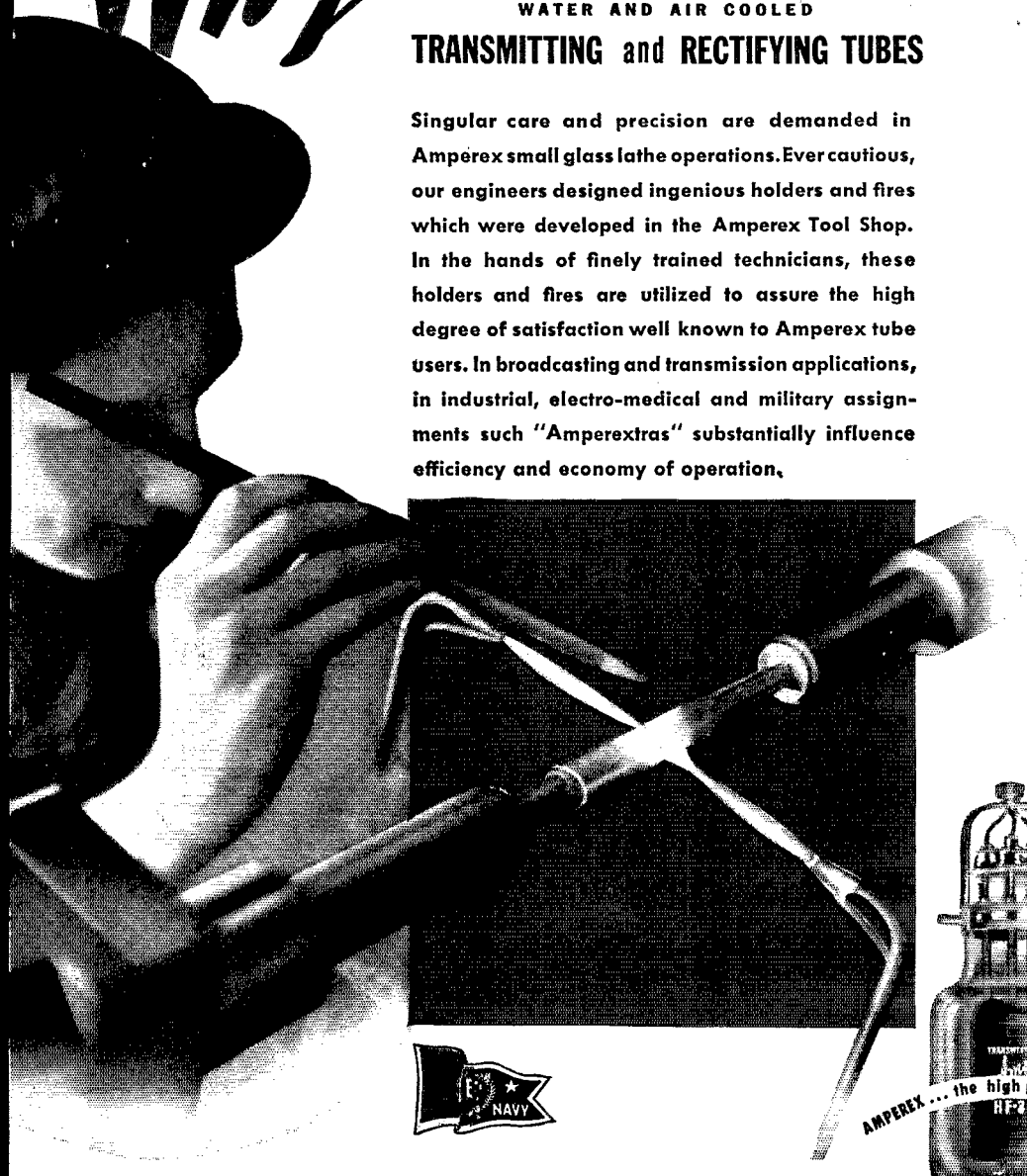

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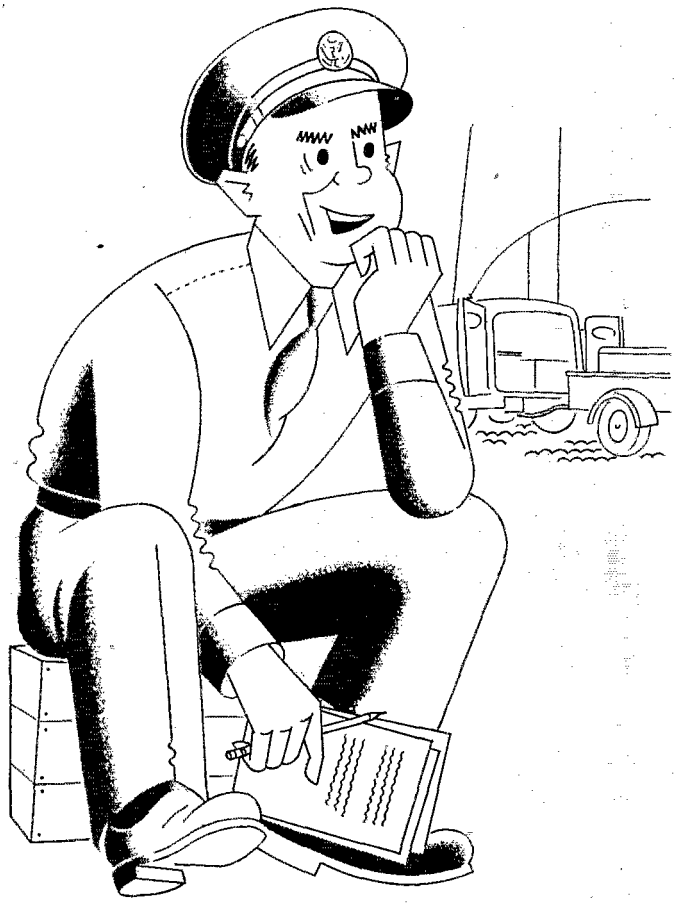

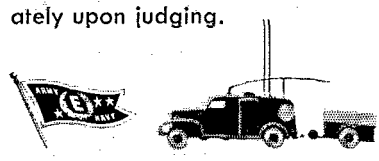

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THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

AUGUST 1944

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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

CONTENTS

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

Reports Invited. All amateurs, especially League members, are invited to report communications activities, training plans, code classes, theory-discussion groups, civilian-defense building or planning each mid-month (16th of the month for the last 30 days) direct to the SCM, the administrative official of ARRL elected by members in each Section whose address is given below. Radio Club reports and Emergency Coördinator reports representing community organized work and plans and progress are especially desired by SCMs for inclusion in *QST*. **ARRL Field Organization appointments,** with the exception of the Emergency Coördinator and Emergency Corps posts, are suspended for the present and no new appointments or cancellations, with the exception named, will be made. This is to permit full efforts of all in Emergency Corps plans.

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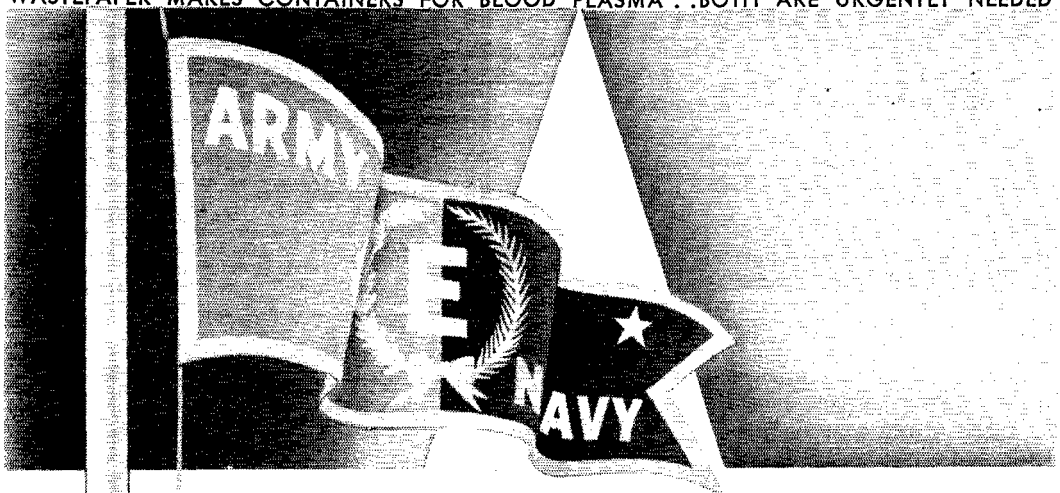

A White "Star" has been added to the "E" flag of the McElroy Manufacturing Corporation, symbolizing that McElroy workers have continued to excel in the production of radiotelegraph equipment for the Army and Navy. It is a matter of deep pride to us to learn that ours is the only organization of its kind in the country flying the White "Star" on our "E" flag. For this, our second award in six months, I publicly thank our loyal men and women employees and our suppliers.

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is a noncommercial 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 noncommercial 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, although full voting membership is granted only to licensed amateurs.

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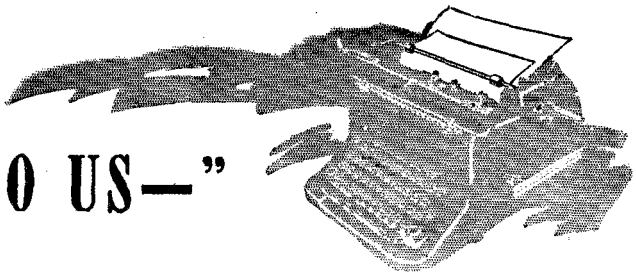

"IT SEEMS TO US—"

AFTER THE WAR

Boy, is this crowd at ARRL Hq. ever going to be busy after this war is over and the amateur frequencies have been restored! We had occasion a short while ago to suggest to FCC that, the way it looked to us, they ought to set up machinery to issue amateur licenses at the rate of about ten thousand a month for the first year or so after our resumption, with an easy hundred thousand hams by the end of the year and a quarter million in a few years. That shows you how busy we expect to be.

We're busy enough now, most of the time with far more pressing things than laying out plans for our future, but every once in a while we get a few minutes to think about amateur radio after the war and what our job at Hq. is going to encompass as we move into the work of rehabilitating ourselves. After a few minutes of this we realize that we're going to have so big a crew here that we shall bulge the walls of this building and we'll need either the addition of an extra floor or a whole new building. It well may be, seems to us, that we ought to erect our own Hq. office building after the war, a place that can be a fitting home for the amateur movement. And there's the Selden farm, where so many of the single members of our staff have lived and where so much experimental work has gone on in years past, including Ross Hull's first v.h.f. DX—maybe we'll need that in our plans as a site for dormitories and a u.h.f. station and facilities for you visiting firemen.

Well, without getting beyond our depth, some things clearly indicate themselves. Our Communications Department will have a big job of redoing itself: new appointments, new trunklines, improved procedures coming out of war experience, new activities made possible by the technical developments of the war, very possibly including automatic relaying. W1AW, although serviceable, probably will warrant rebuilding in terms of new techniques, and we fancy we'll have a microwave control link from Hq. The secretarial or membership-contact department is going to be a particularly hot spot of activity, with many more people than before. We have only to close our eyes to see our mail wagon limping up to Hq. with broken springs from the load of letters that must be answered about licenses, conventions, QRM, regulations, ordinances, publicity, questions about everything under the sun. There'll be hamfests and conventions and club meetings to attend, with the chance to spread the word on what's going on and to answer questions. The affiliated clubs are sure to have a great growth, too, and helping them reorganize and embark successfully is going to keep some folks pretty busy. The expanding structure of government regulations, with all the forced needs for changes in a bigger and faster growing organization, will be a major secretarial department concern, possibly requiring a branch office in Washington for a while. Somewhere in our postwar picture we see the need for a new headquarters department, a sort of educational or instruction section, which can help the newcomer get started and which can take on the big task of inculcating the standards and the sense of responsibility of old-time amateur radio in those who did not practice the game before the war. The right kind of fellows in such a section could do immeasurable good traveling the country and giving individual assistance to the members of the League, helping them to send well, to learn to copy, to get the station tuned up, to master the intricacies of proper "procedure." Maybe the section ought even to supply a correspondence course in amateur radio, for those who live in isolated regions.

Most of all we like to think of what the technical department of this office is going to look like after the war, the technical branch of *QST*'s editorial staff. There is going to be something! *QST* will have a great job to do then, for the war's radio developments will not be ready-cut and waiting for amateur use. They will first have to be adapted to our needs, simplified to meet our limitations of pocketbooks, comprehension and construction ability. In short, the advances of the war will have to go through the same process that we have seen applied to developments in the past, the thing that we call reduction to amateur practice. We therefore visualize for ourselves a greatly augmented technical staff, containing selected amateurs who have become ranking experts in various new developments, equipped with ample lab and shop and writing facilities. Think of the things we shall need to investigate and learn how to apply to amateur communication! There's the whole field of the superhighs or microwaves. More effective receivers

and much more convenient transmitters. New wrinkles in antennas that will add range. What about pulse technique? How to apply to ham operation some of the spectrum economy of new multiplexing methods? New conveniences in operating, panoramics and aperiodics and d/f, frequency meters of much greater precision. Ham gear for automatic relaying. Further applications of f.m. and other broad-band emissions. And, we've always thought, if the *QST* gang could ever get time to tackle an amateur version of facsimile, adapted to our needs, we could make it a most useful supplement to the technical conversations that go on on the air. (Yup, got an idea!) If you think this is quite a list, let us say that we are only trying to be suggestive; we don't really know yet what more interesting things there will be to work on and to apply to our communication and experimental work, as the "classified" developments of the war come tumbling out. We only know that we're going to have a high old time and that never, since the birth of amateur radio, has the outlook been so bright in technical interest for the ardent amateur.

Meanwhile, of course, we all have something harder to do. We must get that over first. Just wanted you to know that we think and plan, and that you can count on happy days ahead when we're all back in our shacks.

N.C.R. FOGIES

ONE of the gang dropped in the other day in the uniform of an Army first lieutenant. After luncheon at the local beanery we were chewing the fat about this and that and he told us how he had just received a fat check from the government for back pay and had bought himself some war bonds to help build a home after the war. It occurred to us that the incident would be of great interest to all you fellows who have ever been members of the NCR, so we're passing it along.

Back in the good old days our lad belonged to the NCR, with a rating of RM2c or something like that. He was faithful about drills but never took active duty. When the end of his four-year term came he had just taken a new job and thought himself too busy to accept reappointment. All that was back in the middle '30s, perhaps a bit later. When the draft came he was one of the first to be called up. He served a year as an enlisted man, during which he got his chance at OCS and came out a second lieutenant. A couple of years of that and, just recently, he was made a first. During his service as second lieutenant he drew a shavetail's pay, as seemed natural. But recently it occurred to him to drop around to the finance office on his post and have a talk with the paymaster. There he found, as you have by now suspected, that NCR service counts toward a fogy. The news was even better in his case. Seems the present Army pay policy provides that, after five years of any kind of military service, a second lieutenant draws first lieutenant's pay whether he has been promoted or not. Not only did the four years in NCR and the year as an enlisted man constitute one fogy but they qualified our ham for first lieutenant's pay during his whole commissioned service, with the fogy on top of it.

So Uncle coughed up over a thousand smackers — and got it right back for bonds! Our lad now draws sixteen bucks extra every month. Moreover, it won't be too long before he earns a second fogy. And if he stays in the Army as a career, he's also going to draw promotion pay for the next higher rank four years sooner than he'd otherwise do, right through his life.

All on account of that hitch in NCR, which was something none of us ever suspected when we joined. This probably isn't news to you boys in the Navy but we'll bet that most of you in the Army have never realized that the hamming you did in NCR is military service toward the much-needed fogy. If you're ex-NCR, you're in position to collect some extra dough and a visit to your hq. seems indicated.

K.B.W.

★ SPLATTER ★

OUR COVER

THERE are electronic soldiers of many sizes and shapes in all theaters of this war, but the little fellows pictured on this month's cover usually will be found up closer to the front lines than any of the others. Miracle-working midgets, they are the delicate internal organs of miscellaneous novel v.h.f. and m.h.f. communications gear — miniature handie-talkies, walkie-talkies, guidon sets, artillery and armored force portables, and a variety of other specialized equipment.

FOOTNOTES

FIRST on the alphabetical roll call of this month's trio of new *QST*-author recruits, **Elwood A. Capelle** (p. 29), possesses an electrician's license, a student pilot's license, a restricted radiotelephone permit, a WERS operator's license, and a Class B amateur license. That would seem to fix him up pretty well from the license standpoint — except that he didn't get his amateur station finished until after Pearl Harbor, and now he cannot get a license for it until after the war. Meanwhile, having become interested in flying in 1942, for the past year he has devoted all of his leisure time to organizing the radio communications system and training program for his local flight of the Civil Air Patrol. Born at Hazelton,

(Continued on page 78)

A Multiple Antenna Coupling System

A Method of Operating Several Receivers on a Single Antenna

BY MARVIN H. KRONENBERG,* W2IJU

When an attempt is made to operate two or more receivers on one antenna, several annoying things usually happen. There is often a very noticeable loss in signal strength because of the detuning effect which the paralleling of input circuits incurs. Probably the most troublesome difficulty is that which arises when the h.f.-oscillator signals get to wandering about at random among the receivers via the antenna. These and most other undesired effects can be eliminated by the use of the isolating antenna-coupling system discussed in this article. No additional tuning controls are required.

IN INSTALLATIONS where a number of communication receivers must operate simultaneously, the problem of receiver interaction presents itself. If the input circuits of several receivers are connected in parallel to a single antenna, a severe reduction in sensitivity at certain frequencies may result. Another cause of trouble is the local oscillator of the receiver, which is capable of transmitting a strong local signal, particularly when it leaks into the receiving antenna circuit. An investigation of a few of the foremost communication receivers commonly in use indicates the presence of these effects.

Tests show that interfering signals from the local oscillator may be introduced into neighboring receivers by at least three different paths; i.e., leakage to the antenna circuit and subsequent radiation by the receiving antenna, radiation from the case of the receiver, and leakage through the power line. The first usually is found to be the worst offender and the most difficult to control.

In one test two receivers were set up adjacent to each other and operated with their antenna circuits paralleled. Interference in one receiver from the oscillator in the other was measured at various frequencies and found to be equivalent to a signal input of 7000 μv. at certain points. The most troublesome interference occurred when one receiver was tuned to the fundamental frequency of the other receiver's local oscillator. Interference also occurred when tuning to harmonics as high as the fourth. It follows that this form of interaction is more complicated, and increases in proportion to the number of receivers in use.

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When receivers are operated with their antenna circuits in parallel, the extent of detuning is a function of their relative operating frequencies and the nature of their antenna-input circuits. The effects of detuning are particularly troublesome when one receiver is operating on a frequency much lower than the other, since the antenna input inductance of the higher-frequency receiver will appear as a much lower impedance at lower frequencies and thus tend to short-circuit the input of the lower-frequency receiver.

An Isolating Antenna Coupler

To minimize the effects of receiver interaction, a coupling unit using a vacuum tube as an isolation medium was constructed. It can be seen from the circuit diagram of Fig. 1 that the coupler is straightforward and simple in design. The unit

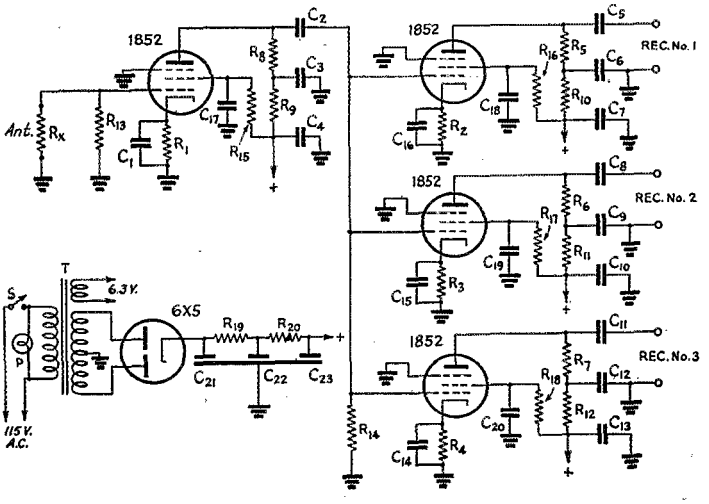


Fig. 1 — Circuit diagram of the isolating antenna coupler.

C_1 through C_{16} — 0.01-μfd. mica.
C_{17} through C_{20} — 100-$\mu\mu$fd. mica.
C_{21}, C_{22}, C_{23} — 8-μfd. 450-volt electrolytic.
R_1 to R_7 incl. — 100-ohm, ½-watt carbon.
R_8 to R_{12} incl. — 1000-ohm, ½-watt carbon.
R_{13}, R_{14} — 1-megohm, ½-watt carbon.
R_{15}, R_{16}, R_{17}, R_{18} — 65,000-ohms, ½ watt.
R_{19}, R_{20} — 1000 ohms, 2 watts.
T — Power transformer rated at 300 volts each side of center; 6.3-volt, 2.5-amp. fil.
S — S.p.s.t. toggle.
P — 115-volt pilot light.
R_x indicates antenna impedance.

was designed to permit operation of three receivers covering a frequency range of 1.5 to 20 Mc. on a single antenna, with a minimum of interaction. It contains five tubes, including the rectifier tube, and gives consistent operation over the entire tuning range without requiring tuning or adjustment. The arrangement consists of a "line" amplifier working into three isolation stages, the grids of the tubes of the latter being connected in parallel. Type 1852 tubes are used in all stages. Since the primary purpose of the coupler is to isolate one receiver from another, it is not necessary to provide any great degree of gain. This makes the use of resistance coupling permissible at these frequencies. The circuit values are not at all critical.

The antenna coupling unit is constructed on a chassis measuring $7 \times 7 \times 2$ inches and is housed in a metal cabinet. Coaxial cable connectors are used to provide proper matching and shielding of connections to the receivers. In the sub-chassis wiring and lay-out of parts no precautions were taken other than to follow the usual rules regarding short leads. A sketch of the complete coupler in its case and the lay-out of components on the chassis is shown in Fig. 2.

Performance

Measurements indicate that the coupler has a flat response within the required frequency range and has an apparent voltage gain of about 6 db. Full benefit of this slight gain is not realized in practice, however, because of noise introduced by the coupler into the receivers. This noise, which is inherent in the tubes, introduces an equivalent signal input to the receiver of about 1 microvolt. This reduces the signal-to-noise ratio on reception of weak signals, thus nullifying the slight amplification which it introduces. The addition of more resistance-coupled amplifiers in an attempt to increase the gain of the coupler results only in a further increase in noise which actually amounts to a reduction in the effective sensitivity of the system.

An investigation of the extent of interaction between three receivers operating simultaneously while using the coupler indicated that trouble from detuning was eliminated entirely, local oscillator interference was reduced to a negligible minimum, and the receivers performed exactly as they would if they were disconnected from the circuit and operated separately. Actual measurements on the attenuation of receiver oscillator interference introduced by the coupler showed an average reduction of about 55 db. For example, in a case where one receiver was generating a 6000-

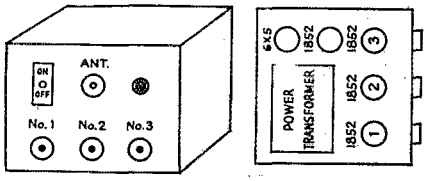


Fig. 2 — Sketch showing panel and chassis lay-outs.

μv. signal into another, use of the coupler caused a reduction in interference of about 3000 to 1, or down to 2 μv. Actually the small amount of interference still present was not even noticeable above the usual atmospheric noise level.

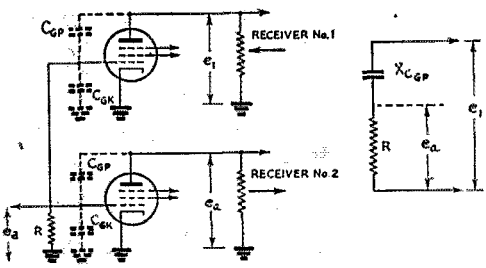


Fig. 3 — Diagram showing the various limiting factors which are involved in the multiple-receiver antenna coupling system, as discussed in the text.

Design Factors

The problem of designing an effective means of isolating three receivers for single-antenna operation was first approached by using the cathode-follower type of circuit. This method seemed a convenient way of obtaining the necessary low-impedance output, since it required no tuned circuits. However, the greater problem of preventing local-oscillator interference between receivers was still present, since this type of circuit provided very little isolation between receivers because of the relatively high grid-to-cathode capacity. In the circuit shown, use of the conventional resistance-coupled amplifier provides excellent isolation between channels.

In order to make up for any losses that might occur in other parts of the antenna circuit it was considered desirable to provide as much amplification in the unit as possible. As mentioned previously, one of the factors which limits amplification is the random noise generated in the tubes. More generally, however, the most important limitation on the gain of a resistance-coupled amplifier operating at radio frequencies is the shunt reactance of interelectrode, wiring and socket capacitances in the circuit. In this case, the highest value of shunting capacity occurs in the grid circuits of the isolating stages. Obviously, this is because the input capacitances of the three tubes are in parallel. It can be seen that unless some sort of compensation, such as that used in video-amplifier practice, be incorporated, the frequency range as well as the number of isolation amplifiers is limited. Also, in order to present a low impedance to the receiver antenna terminals a low plate-load resistance must be used in each stage. Thus, the effective plate impedance is limited to a small value.

The gain of a pentode resistance-coupled amplifier is principally a function of the plate-load impedance and the tube amplification factor. Therefore, since it is not possible to increase gain by increasing the plate-load impedance, a tube with high mutual conductance was selected.

Maximum Possible Degree of Isolation

An analysis of the path of feed-back through the coupler from one receiver to another is shown in Fig. 3. From this a comparison of the maximum possible attenuation with the actual measured values can be obtained in practice.

The interfering receiver acts as the generator feeding a signal across R. This signal appears in the grid circuit of the isolating amplifiers because of the small grid-to-plate capacitance. It can be seen that if wiring and capacity effects, other than that inherent in the tube, are neglected, the grid-to-plate and grid-to-ground impedances act as a voltage-divider network. If a frequency is chosen where the grid-to-ground reactance is much greater than the effective grid-to-ground resistance (considering R_L in the "line" amplifier), then the interfering voltage would be attenuated by an amount approximately equal to the ratio of the grid-to-plate reactance to the grid-to-ground resistance; that is:

$$\text{Ratio of attenuation} = \frac{X_c}{R} = \frac{1}{R\omega C}$$

$$\text{or, in db.,} \qquad 20 \log \frac{1}{R\omega C}$$

The maximum possible interference attenuation introduced by the coupler at frequencies around 4 Mc., as computed above, was 74 db. This compares with 66 db., the actual measured value. It is assumed that the discrepancy, although actually of little practical difference, is attributable mainly to the fact that capacitances in the circuit other than tube interelectrode values were neglected in the theoretical analysis.

It is well to note that, although the coupler is effective in reducing local oscillator interference caused by leakage of the signal into the antenna circuit, full efficiency of the coupler in this respect will be realized only if all antenna leads are very carefully shielded. For this reason, as well as to obtain a good impedance match, the use of coaxial cable is desirable.

Possible Variations

As shown above, the coupler has certain limitations as to frequency range and number of isolating channels. Its frequency range could be increased somewhat by the addition of compensating reactances, following video-amplifier practice. To operate at lower frequencies, it is merely necessary to increase the capacity of the by-pass and coupling condensers.

The addition of more isolating stages will reduce the frequency range of the coupler by introducing more capacity in shunt with the line amplifier. However, a greater number of receivers could be operated effectively by connecting two or more of the described couplers in parallel, as shown in Fig. 4.

Tube isolation between antenna and receiver is convenient in that it provides an effective method of impedance match. Since no tuned circuits are used in the input or output circuits of the coupler, it presents a fairly constant impedance to both antenna and receiver over a wide frequency range. The circuit described was designed to match a low-impedance transmission line to a low-impedance receiver input.

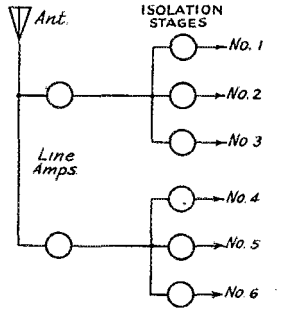


Fig. 4 — Scheme employed for coupling more than three receivers to a single antenna.

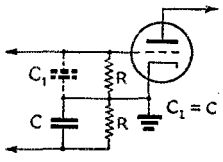


Fig. 5 — Alternative vacuum-tube coupling arrangement used for balanced-line input.

Almost any type of single-ended antenna can be coupled efficiently by this method, but the system will not suffice where it is necessary to maintain a balanced transmission line. A simple balanced-line arrangement is shown in Fig. 5. This system consists in using half of the transmission line in the grid circuit and connecting a phantom across the other half. Although a balance is obtained in this way, it is obvious that only half the signal voltage is usefully employed. This loss is compensated for somewhat through the slight gain introduced by the coupler.

While this coupler was intended for a specific installation, alternative arrangements of the circuit for similar applications undoubtedly will occur to the reader.

Strays

A new element, known as an electric hygrometer strip, has been developed to replace human hair in "Ray Sondes," the tiny radio transmitters manufactured by Julien P. Friez Co. which are carried aloft by balloons to determine weather conditions in the stratosphere. The human hair formerly used to register changes in humidity varied in length with changing moisture, while the new hygrometer strip, which is made of plastic, varies in electrical characteristics. Its edges are treated to provide conducting surfaces and the center is so treated that the resistance between the edges varies with the amount of moisture in the air. The strip does away with several of the moving parts previously used in the Ray Sonde.

Col. Ivan L. Farman, ex-W6MG, commanding officer of the Army Airways Communications System.

Hams and the AACS

Highlights and Sidelights

BY CLINTON B. DE SOTO,* WICBD

This is by way of a supplement to the recent *QST* articles (February and March, 1944) on the Army Airways Communications System. Those articles described in general terms the operations and history of the System and the rôle occupied therein by amateur radio. Here is a collection of yarns about some of the individual hams and episodes involved in the development of the most widespread radio network ever established.

To say, as has been said in *QST*, that the monumental structure which is the present-day Army Airways Communications System has in large measure been the work of radio amateurs is to convey little of the reality of their accomplishment.

In the picture of AACS so far presented [1] only the highlights have been shown. To view the picture as it is, to make it come to life, the delineating details must be seen as well. The perfunctory statement, "Hams installed stations in the Far North under the most trying conditions," fails to conjure up a mental image of Sgt. Johnny Jones toiling at a station out there on the North Atlantic route in weather 50° below, straining with frost-bitten hands to bend stubborn copper-clad antenna wire to a brittle insulator.

Actually, there is no way to recreate such a picture in all its whole on the printed page. You'd have to be there; you'd have to see it yourself to be able even to guess what it was like. And then you'd have seen only one small part of the overall picture — one incident only in the performance of Sgt. Johnny Jones.

Even then you wouldn't know, for example, about the years Sgt. Jones spent in his ham shack back home before the war learning how to do what he's doing now. You wouldn't know about the countless ham antennas he'd put up, or the hours of operating experience that taught him what a good antenna means.

Background is an important part of the picture, too. It explains how a few thousand good hams, inspired and wisely led by a few top-flight regular Army officers who, realizing the worth of amateur experience, employed it to maximum advantage, could build one of the world's largest communications systems in the course of three short years.

* Editor, *QST*.

[1] DeSoto, "The Army Airways Communications System," Part I, *QST*, February, 1944, p. 9; Part II, *QST*, March, 1944, p. 18.

Left — Lt. Col. Don C. McRae, W6RM, assistant chief of staff in charge of the operations and planning section. Before joining AACS, Col. McRae, himself a licensed pilot, was chief of Eastern Air Lines communications. *Center* — Major Ronald G. Martin, W6ZF, assistant chief of A-3 (operations) in the AACS. A veteran ham, long active in ARRL affairs, W6ZF was a crack commercial operator and station manager. *Right* — Major W. J. Retzbach, W4MM, is the assistant chief of staff who wrestles with problems of procurement and supply for the AACS.

In giving amateurs credit for that job we're not claiming that all AACS men are or were hams, or that the thousands of GI-trained operators in the outfit haven't done a good job, too. They have. One reason they have is that they became infused with the invincible amateur spirit. The hams bullied and cajoled, fraternized and led, held up the ideal of the amateur fraternity and demanded performance to match that ideal. The result has been that the rawest GI op in the System now likes to think of himself as a ham; and he is, in spirit, if not in fact.

The experience of each of the thousands of hams now in AACS alone would require a page; the full story of the 600-odd AACS stations around the world would fill an entire issue of *QST*. In this account, therefore, we can only attempt to fill in some of the details with isolated fragments from the stories of men whose amateur backgrounds superbly equipped them to do a crucial wartime job — the hams who today are the leaders of AACS.

Lt. Col. Wilmer L. Allison, W5VV, the ham who recruited thousands of other hams for AACS. Now commanding officer of the First AACS Wing in Chicago, recently served as liaison officer between Brig. Gen. Harold M. McClelland, air communications officer of the AAF, and Col. Ivan L. Farman, commanding officer of the AACS.

Evolution of a CO

There's no better example to start with than the story of Col. Ivan L. Farman, the present commanding officer of the AACS. Col. Farman is the second CO the System has had. He succeeded Col. L. H. Watnee, the presiding genius who guided AACS through its formative years, in November, 1943. Since then Col. Farman has proved himself an able commander, bringing the organization to even greater glories.

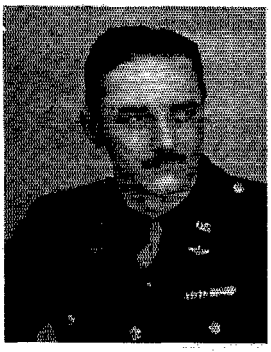
The layman might attribute that success to Col. Farman's long record of experience in Air Force communications — a record extending back to 1929, the year he won his wings at Kelly Field. But we know — as does Col. Farman, for he told us so — that the explanation goes back a long way behind that. It goes back to a spark coil and a pair of 75-ohm 'phones in 1914. It goes back to a ham station with the call 6MG in 1919 — and to the recurrent lure of the game that persisted through the years.

From the official record and from Col. Farman himself come the more formal details of his career. But it was his sister, Bobbe, who revealed the colorful sidelights in the career of that "bashful big brother" of hers. Miss Farman still recalls as one of her babyhood memories the fearful penalty for jiggling the catwhisker of a crystal detector just when a sought-for station was coming through. "I was his pesky kid sister, forever snarled up in wires and loops," she says.

Involved in the story, too, was the perpetual need for 200-meter coil forms. "At this time in our lives we were all forced to eat rolled oats whether we liked them or not — the boxes were so handy to roll wire on for coils. To this day we recoil at the mere mention of rolled oats!"

Then short waves and international DX came along, and again the pesky kid sister entered the picture at a fateful moment. After hours of patient hunting over his receiver dial one night 6MG heard a whispering CQ signing an "ac" prefix — a rare piece of DX even on the Pacific Coast in those days. He threw the switch and touched the key. The antenna ammeter fluctuated erratically. He slapped the key again and still the

Left — Major Glenn D. Montgomery, W9XEG, deputy assistant chief of staff in the operations and planning section. He was a project engineer for Bell Telephone Co. land lines before joining AACS. *Center* — Capt. Ralph S. La Montagne, W1IPR, assistant A-4 (procurement and supply), aids W4MM in filling requisitions for everything from typewriters with Russian characters to 40-foot whaleboats. *Right* — Capt. Norman R. McLaughlin, W6GEG, is assigned to the special projects division at AACS Headquarters in Asheville. He has been a radio ham since 1920.



Major Herbert L. Brown, W2HF, has been technical officer for the Alaskan Area, AACS, since July, 1943. He enlisted in the Army in 1925, resigned a captaincy in 1941, and reënlisted in 1942. His initial duty was as technical officer for the 2nd Airways Communications Region, followed by a tour at AACS headquarters in Asheville before his Alaskan assignment.

needle wavered waywardly. Only after a wrathful search did he discover a little girl's dollies' wash fluttering blithely from his aerial.

"By the time Ivan had worked up to Cal Tech he had acquired a superhet — a real fancy one," Bobbe divulged. "He was so darn proud of that gadget he played it loud and long. Gave many of the neighbors a neurosis. One irate lady went so far as to slash his tires with a carving knife in retaliation — only she got somebody else's car by mistake! Did we laugh — *and* did we move!"

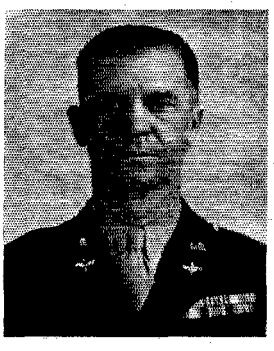
Manifest Destiny

After completing his college course, Ivan Farman decided to make Army aviation his career. He won his wings in 1929, graduating from the bombardment course at the Air Corps' Advanced Flying School at Kelly Field.

Radio, necessarily, faded into the background during the busy days of pilot training. But it did not remain submerged for long. "About every two years the ham itch seems to return," Col. Farman acknowledged recently in his Asheville office — the background murmer of the constantly warmed-up communications receiver behind his desk lending credence to his words.

Before continuing with the subject of radio, however, he talked for a while about his early days in aviation. Lounging, relaxed and yet alert, behind the massive carved desk, his easy informality contrasting sharply with the huge paneled room which had been the mayor's office, Col. Farman relived incidents in the impetuous years when aviation was growing up.

While those yarns had little to do with radio, they, too, form a part of the picture. For all



Major Charles Howard, ex-K7CNF, is regional control officer for the 21st Airways Communications Region, AACS. He has a long record of military service, beginning with the English army in 1915, with the Canadian forces in France, 1916–1919, and in the U. S. Army since 1925. In AACS since 1942, he served in Alaska, on a special Russian mission, and as assistant A-3 (operations).

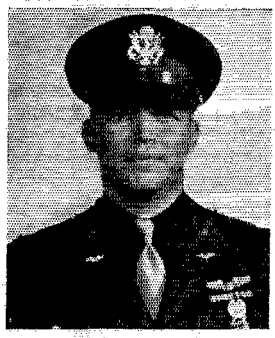
this time Ivan Farman was absorbing yet another vital phase of what was to be his specialty — the science of aviation communications. In addition to his ham's knowledge of radio, he acquired the intuitive comprehension of flying possessed only by an experienced, versatile pilot. He became a pioneer airways communications expert.

In 1935 Col. Farman graduated from the communications officers course then being conducted by the Signal School. For three years thereafter he was an instructor at the Air Force Communications School at Chanute Field.

The perpetual battle with weather being waged by airmen in time led Col. Farman into the study of meteorology. He became a weather expert of no small skill — so accomplished, in fact, that in 1938 he was assigned to the post of weather officer at March Field. Later he served as regional control officer of the Air Corps' First Weather Region.

Radio, aviation, meteorology — those were the crafts Ivan Farman mastered to fit him for the role in which Destiny was to cast him.

In early 1941 the curtain call came. Farman — then a major — was assigned to AACS, at that time still in the embryonic stage. He was sent to



Major James W. Spratlin, W4KV, has been regional control officer for the 4th Airways Communications Region, AACS, since October, 1943. He was an airlines communications superintendent for Eastern, Delta, Pan-Am, Grace and CAA before being commissioned in 1942. He served at Bolling Field before becoming RCO of the 12th Region in late 1942.

Newfoundland as communications officer on the staff of Maj. Gen. Gerald C. Brant, his primary duty the establishment of efficient, reliable airways communications over the vitally important North Atlantic ferry and transport routes which then were being opened up.

The Battle of the North Atlantic

It was one of the toughest jobs in the book — and one of the most important. But Col. Farman had the training and the capacity for it, and he did a superlative job.

On that North Atlantic route every skill in which he had perfected himself was called into full play. From his amateur background came many prime lessons — most important of which was a realization of the need for amateurs and amateur technique to lick the unusual problems faced by AACS in the Far North. He asked for hams in his installation and maintenance crews — and he got them. Then he asked for ham operators — and he got those, too.

Another important lesson from the past pointed the imperative need for assembling weather data by radio on a scale never before attempted in the North Atlantic region. To improve the accuracy

and completeness of reports, a number of new weather radio stations were set up.

Some of these stations were at locations so remote that all equipment had to be brought in by small boats. The men assigned to these stations were chosen on the understanding that they might not be relieved for two or three years. All radio maintenance work as well as the operating had to be done by the AACS personnel at the stations.

One typical weather station was established on a narrow ledge in an ice-jammed fiord in the uninhabited northern part of Greenland. There were four AAF weathermen and the same number of AACS radio operators in the crew manning this station. They were completely isolated for ten months of the year. There were no mail deliveries, and their only contact with the outside world was through radio — and then only in line of duty. To conserve the small supply of fuel available, no personal communications were permitted. Even holiday greetings were forbidden.

The fuel shortage also forced the shutting down of all power except during transmitting periods. This, of course, meant no electricity for lighting purposes. Repair work during the long winter nights was done by the dim light of old-fashioned kerosene lamps. The intense cold often resulted in freezing of the equipment, which required frequent and difficult maintenance care. Even the gasoline engine in the power plant proved irritatingly inefficient and unreliable under the severe operating conditions, and it was constantly in need of repair.

Major Michael L. Crimmins, W5BYO, is regional control officer for the 6th Airways Communications Region, AACS. An auditor and income-tax accountant in civil life, he had held an amateur ticket and was active on the air for fifteen years before entering the service. He was commissioned in 1942 and has been in the Army Airways Communications System ever since.

Yet that AACS crew not only put the station on the air — they kept it on! And the results were worth the cost. The reports transmitted proved invaluable in forecasting the North Atlantic storms which incubate in that region of the Arctic.

Toil and Trouble

The experience at that station is only typical of the adverse and arduous conditions under which the hams in those early Canadian and Greenland stations spent the winter of 1942. Often, in the northlands, living quarters were not available, and some of the crews were forced to winterize in tents — in temperatures reaching 50° below zero.

Even at the best-equipped stations it was a hard life — isolated, lonely, and cold. Buildings for living and working were not only inadequately heated but crowded and poorly ventilated. Operations buildings lacked both insulation and storm windows. Dust and soot from the soft coal supplied for heating permeated the equipment, posing serious maintenance and operating problems.

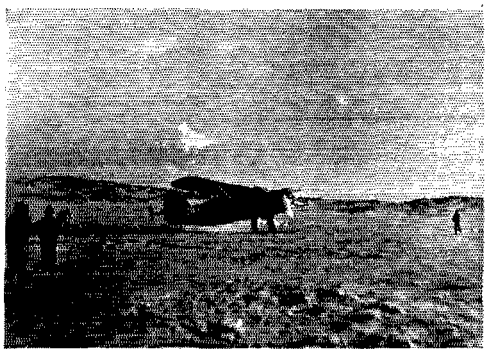
Lt. Col. Frank Bobulski, ex-K6EMS-W6JGN is regional control officer of the 12th Airways Communications Region, AACS. He has been in the Air Corps since 1925, serving in all enlisted grades and as warrant officer, in both planes and ground stations, as radio operator, mechanic and chief. Outstanding experience was installation of radio range for first Army U. S.-Hawaii, flight, 1927.

The only available furniture was made from packing cases. Cooking equipment and plumbing? There was none. The water supply was melted snow or a hole in the ice from which freezing water was dipped by hand. Outdoor latrines were the rule. Truly a hardy lot were those AACS pioneers in the frozen northland!

Living conveniences and operating equipment for some of the stations had been lost at sea or wrecked in unloading. While great ingenuity was shown in providing substitutes, in at least one instance even bedding had to be borrowed from a local contractor. All amusements were rationed, to save fuel. Trained medical personnel and cooks were unavailable, and the men were forced to be their own doctors, chefs, and kitchen police. At many stations the various installations were widely separated, and going on watch or to mess meant a gymnastic excursion for considerable distances over rough broken snow and ice.

No regular transportation facilities existed between the different stations, of course, and this interposed even more troublesome problems. There was one case where a group of twenty men destined for a major post were left stranded down the line. Meanwhile that station was kept on the air by only seven men — one of whom had frozen both his feet and his hands.

Major Robert J. Gleason, K7KD, is regional control officer for the 11th Airways Communications Region, AACS. His work in building up the Alaskan AACS net was commended as of material assistance in the campaign to drive the Japs out of the Aleutians. Before being commissioned in 1942 he was a radio engineer and airline communication superintendent for PAA.



Prop still spinning, the ski-clad AAF airplane carrying Lt. Col. Wilmer L. Allison, W5VV, on an Arctic inspection tour lands on the driven snow at a remote northern base — the first party ever to reach that region by air.

But it *was* kept on the air. That was the way the hams and their buddies in AACS performed. They unloaded their equipment from tiny open boats in storm-tossed, icy waters, often working far into the night in freezing gales to get their matériel to safety. They did much of their own construction work — drilling holes in the solid rock, erecting towers, stringing antennas under all extremes of weather. Indoors and out, they worked under the most severe conditions imaginable. But despite the worst that nature could devise they kept communications open.

The unswerving and unquenchable devotion to duty displayed by the hams in AACS is one of the brightest palms in amateur radio's medallary. The man who was most directly responsible for recruiting these amateurs into the System — Lt. Col. Wilmer L. Allison, W5VV — acclaims their contribution thus:

"I know the hams have done a lot of work in other organizations, but it is my considered opinion that the work they have done in AACS will be of more benefit to the fraternity — in good will and a more material foot-in-the-door position — than anything else they have done in the war effort."

W5VV for Victory

Lt. Col. Allison's own share in that contribution is a major one. The circumstances of his entry into AACS in 1941, of his appointment as assistant to Col. Watnee and the campaign for enlisting other amateurs which he organized, have been summarized previously in *QST*.[2]

W5VV knew that the one way to accomplish the almost insurmountable task that lay ahead was by making use of amateurs — that their self-instilled pretraining would be indispensable. It wasn't because he wanted to give fellow hams a soft berth that he brought them into AACS; it was because he recognized that they alone could do the job which had to be done.

At the same time his own extensive amateur experience equipped him to administer their activities understandingly and intelligently. Along toward the end of 1941, therefore, with the recruiting program well under way and the System branching out in all directions around the world, Col. Watnee made W5VV chief of the Foreign Airways Division.

It was a post that called for personal supervision of the work being done, and Allison spent much of his time in the air traveling the swiftly expanding network of U. S. Army airways. The first of several jaunts which took him to every corner of the world was in connection with the urgent North Atlantic route. In his own words:

"On January 1, 1942, I started out on an expedition which was to take me up inside the Arctic Circle during the following two months. We started with three single-engined aircraft equipped with skis. I chose a well-known Century Club member, Sgt. Julius Wengler, W8OSL, to be the radio operator.

"Before we were two weeks out — in fact, before we left Newfoundland — the airplane W8OSL was in crashed. So, with Wengler in the hospital with a split skull, I took over the operating for the balance of the expedition. Two weeks later we lost the second airplane. The three of us who were left (all of us from Texas) completed the trip in the remaining airplane without further accidents — but not without many incidents.

Candid snapshot of a world's champion tennis player recuperating after a shift on KP duty. W5VV discovered that in isolated AACS stations officers take their turns along with the enlisted men on KP and clean-up details.

"Almost without exception all the stations I contacted on that trip, both American and Canadian, were operated by former hams. Two in particular — one a Canadian stationed at a Northern Labrador base and one a W5 from West Texas stationed near the Arctic Circle — played a vital part in our safe return."

During the following months W5VV made a number of trips across the North Atlantic and the countries bordering that route. His mission was to plan and to help establish a reliable communications system along the route so that one of the Air Forces could be flown in the late spring.

"One thing in particular I remember," he said. "General Arnold had stated that we had to have a complete station operating at a northern Labrador outpost by May 1st. It was then April 1st, and there were at least eight feet of snow at this

[2] *QST*, March, 1944, p. 19–20.

post at the time. All personnel and equipment had to be flown in, living and operating quarters constructed, antennas erected, and so on.

"I sent to Texas for Jim Hunt, W5TG, whom I had known for twenty years and who I knew was a reserve officer. We gave Jim the job. With the aid of seven men, he got that station operating by the 21st of April. How he did it is one grand story, too. He received a letter of commendation from General Arnold for his splendid work.

"But the story of the AACS is literally studded with such examples of ham ingenuity," W5VV continued. "They are the rule rather than the exception. During the trips I have made over the North Atlantic, down in Central and South America and throughout the Pacific, it seems like I have run into every ham I ever knew.

"Incidentally, the first man I saw when I walked into one of our big stations in Australia was Sgt. Wengler. His head was all patched up and he was as good as new."

In May, 1943, Lt. Col. Allison was made A-3 — which means that he became assistant chief of staff for the Plans and Operations Division of the AACS Wing. This recognition of his worth was augmented when last December 1st, he was ordered back to AAF Headquarters in Washington to organize and head the AACS branch of the Communications Systems Division in the newly organized Office of the Air Communications Officer, serving as liaison officer between Brig. Gen. Harold M. MacClelland — himself a veteran radio experimenter with an early station in Manhattan, Kan. — and Col. Farman in Asheville. Early this summer W5VV left Washington for Chicago, where he is CO of the First AACS Wing.

Hyperbole and History

W5VV's mention of Major James V. Hunt, W5TG, recalled the report, illustrative of the peculiar problems faced in the Arctic, that came back from an AACS staff officer following an inspection of a certain far northern station.

This station was equipped with a fine pair of rhombic antennas, each supported on 35-foot telephone poles. During the inspection W5TG, then the officer in charge of the station, remarked that the men who had installed the antenna wires on the poles had complained of sore backs after the job was done. At the inspecting officer's puzzled query, Major Hunt explained that, after the poles had been erected, a day or two elapsed before the antenna wires were attached. In the meantime there had been a light snowfall — just enough so that only the tops of the poles appeared above the surface. The AACS men on the job had to bend so low to reach the tops of the poles that the next day their backs ached!

Major Hunt, being a ham himself, might not qualify as a wholly impartial witness concerning the work of amateurs in AACS. Indeed, a skeptical soul might even conclude that some of the stories he tells of hams up there in those Arctic posts are woven from the same cloth as the tall tales for which he is famous.[3]

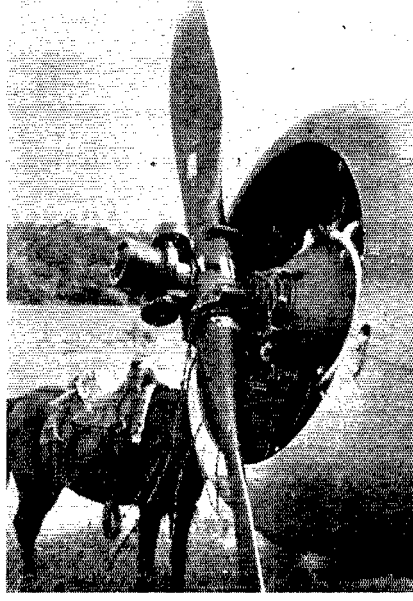
However, as an Army officer responsible for the successful performance of a vital mission, Jim Hunt does know results and how they are achieved. And it is his testimony that hams were the Army's salvation in establishing those supremely important North Atlantic routes.

"All of that so-called orthodox technique had to be thrown overboard up there in the Arctic," he explained. "You can't figure things the way the book says when the doggone ol' Heaviside layer starts riding up and down like it was a department-store elevator."

Conventional methods were ineffectual, according to W5TG. "The only sure rule up there was that what should work, wouldn't." Especially in north-south directions, the ionosphere would shift completely within only a matter of minutes — and invariably the shift was unpredictable. Jim Hunt and his crew of hams always found a way to get the traffic through, however. Some of the methods they evolved may, ultimately,

(Continued on page 80)

Theory vs. practice in Panama. While the rule-book-minded crew chief reads "Antenna Mast, Erection of" in the instruction manual, W5DGV (right) and a fellow ham simply go ahead and put the darned thing up.



A barbed-wire fence is no asset in a forced landing, as Maj. John E. Frizen, W9TQB, discovered on the Central American trip described in this article. The pensive saddle horse, presumably relishing the situation, seems to be contemplating the effect on its gleaming competitor in modern transport.

[3] Hunt, "The Wail of the Kee Bird," *QST*, Oct., 1943, p. 50.

A Portable Multimeter

A Combination Instrument for Servicing WERS Equipment

BY FREDERICK A. LONG,* EX-W8NE, EX-W8BSL

In these days of wartime shortages, one of the principal problems experienced in WERS construction is that of supplying the instruments needed for proper testing of equipment. Most of our meters have gone to war and, although production is beginning now to overtake demands, it is still practically impossible to pick up meters in any quantity without a priority rating higher than is available to WERS organizations. Local ham stations have not been very productive of test equipment for 112 Mc., simply because the use of these frequencies had not really begun to develop until war brought WERS to the foreground. At the same time, because of the multitude of gear associated with even a modest network, there is a real need for test instruments if the equipment is to be kept in good operating condition and ready to go at all times.

For the job of keeping New York's WERS equipment in working order, it did not take us long to decide that some sort of universal portable test kit was a practical necessity. From previous experience it was felt that the proposed unit should perform, so far as possible, the functions of voltmeter, milliammeter, ohmmeter, frequency meter, field-intensity meter, modulation indicator, 'phone monitor and neutralization indicator.

The finished product shown in the photographs comes pretty close to meeting these requirements. The V-O-M (voltmeter, ohmmeter, milliammeter) section covers the ranges of 0.2 to 5000 volts, 0.02 to 1000 ma. and 0.5 ohm to 1.5 megohms. Frequencies between 110 and 120 Mc. can be measured, while the field-intensity meter has a range of 0 to 25 db. If properly connected and calibrated, the instrument could also be used as a vacuum-tube voltmeter for measuring a.c. voltages. The single meter required is a milliammeter with a 1-ma. scale.

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In most of the WERS nets we know about, the few available licensed-amateur members get little chance to operate the equipment — this because to them falls the task of building and servicing all the apparatus. In this article "Ted" Long of the New York area tells how their job can be simplified by building an all-purpose circuit-checking and trouble-shooting instrument in one box, which can then be carried about from place to place in response to the SOSs received from the restricted-permit holders.

The unit is completely self-contained in a single box 8 × 13 × 7 inches, which has space for batteries, antenna, leads and charts. The total weight, principally in the batteries, does not exceed five or six pounds.

Circuit Discussion

The circuit shown in Fig. 1 is the result of much plagiarizing from and combining of units described in the ARRL *Handbook*. The V-O-M portion of the circuit is at the right. By means of the double-gang tap switch, S_4, any one of four current ranges, four voltage ranges or two resistance ranges may be selected. An additional voltage range and a "high-resistance" range are available by making connections to extra terminals provided for this purpose as shown in the diagram.

R_{11}, R_{12}, R_{13}, and R_{14} are the voltmeter multiplier resistors connected in series with the milliammeter, while R_6, R_7 and R_8 are the milliammeter shunts. R_{10} is the extra voltmeter multiplier resistor which is added in series with the others when connection is made to the special terminal for the 5000-volt range.

R_5 is the normal series calibrating resistor for the ohmmeter when using the medium-resistance range, and B_3 supplies the voltage to operate the circuit. R_9 and B_5 provide the additional resistance and voltage required when measuring high resistances by connecting to the special terminal marked *Hi-Ohm*. For low-resistance measurements, S_4 changes the circuit so that the unknown resistance is connected in parallel with the meter, the resistance of the meter then becoming the calibrating resistance. R_4 is for the zero-resistance adjustment to compensate for the drop in battery voltage with age.

The left-hand portion of the circuit is used as a frequency meter, field-intensity meter, 'phone monitor and neutralization indicator. It consists chiefly of a tuned circuit, LC_2, feeding a diode rectifier which drives a linear amplifier. The dual-purpose 1S5 tube takes care of both functions. When S_2 and S_3 are thrown to the left, R_3 is connected across the meter to provide a means of adjusting its sensitivity. R_2 is a variable series resistance for adjusting the screen and plate voltages. The pick-up antenna may either be connected directly to the tank circuit (terminal marked *Ant. 2*) or coupled through a small capacity, C_1.

Construction

The case is made of half-inch pine stock. Wood was used because it is both lighter in weight and more easily obtained than a steel

box. Inside dimensions of the box are 7 inches wide, 6 inches deep and 12 inches long. Partitions spaced one inch from each end of the box provide support for the 7 × 10-inch aluminum panel and also form pockets for storing the charts and connecting leads. The hinged cover is made 1¼ inches deep to accommodate the projecting knobs on the panel. When the box was finished, a coat or two of light-grey enamel provided a very attractive appearance.

The central compartment of the box, which houses the instrument panel, is lined with copper flashing obtained from a hardware store to provide the necessary shielding. Tabs placed at the same intervals as the panel mounting screws, extending from the upper edge of the copper liner, are bent over the molding around the top to provide contact between the shielding lining and the metal panel.

Except for the batteries, all components are mounted on the panel. The photographs will furnish guidance in laying out the parts, although in any specific case alterations in the arrangement may be necessary to take care of components of different dimensions. If the lay-out shown is followed in general, it should be possible to arrive at an arrangement which is both symmetrical and convenient.

After the required holes have been drilled, the panel may be rubbed down with steel wool and lettered with black touch-up Duco and a pen. A coat of clear varnish will protect both the panel surface and the lettering. Marine varnish is very good for this purpose, but water-color varnish from an art store or fishing-rod varnish from a sporting-goods store may perhaps be found superior.

The V-O-M and field-intensity-meter sections are separated by a 2½-inch transverse shield fastened to the back of the panel. The necessary connecting leads between the two sections pass through grommet-lined holes in the partition. The coil, L, tuning condenser, C_2, and the 1S5 tube socket are mounted as a unit, with the tube in a horizontal position, on a small subpanel underneath the tuning dial. This dial should be a good one with a vernier ratio of about 5 to 1.

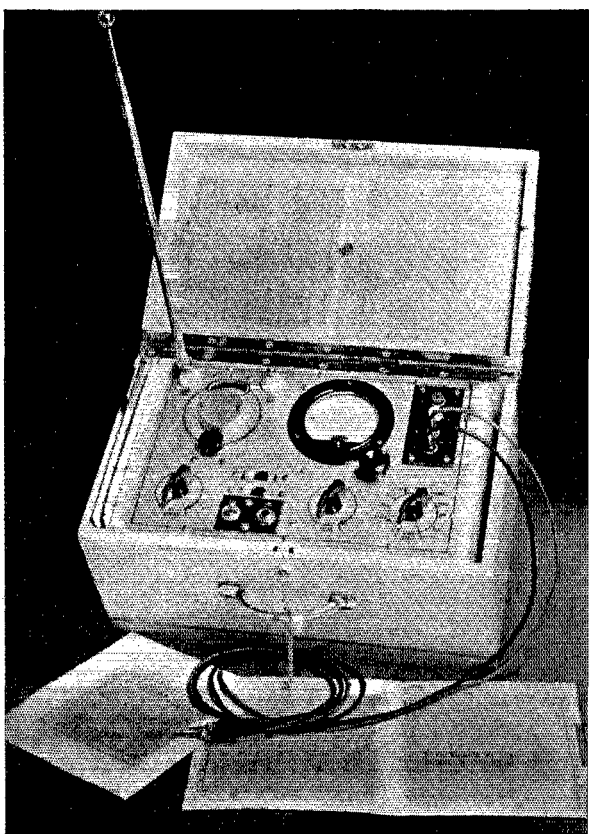
The V-O-M pin-jack terminals, the filament switch, S_1, and the 'phone jack, J, are insulated from the metal panel by mounting them on small strips of bakelite which, in turn are fastened to the panel. Resistors and shunts for the V-O-M are mounted directly on the range-selector switch, S_4. Care should be taken to provide good insulation around the voltmeter-circuit leads.

The various resistors and condensers in the field-intensity-meter circuit are mounted on the parts to which they connect. Tank-circuit leads and leads between the tank and tube should, of course, be as short as possible.

The antenna used for the field-intensity meter is a sawed-off 112-Mc. quarter-wave version of an auto whip antenna. A 24-inch length of ¼-inch copper tubing would do almost as well, although it has the disadvantage that it cannot be collapsed to fit inside the cover as the telescopic type can be.

Voltmeter

S_2 is thrown to the V-O-M position for all measurements of voltage, resistance or current. With S_4 in positions 2 to 5 inclusive, voltages connected between the (+) and (−) V-O-M terminals may be measured. Because the accuracy of voltage measurements depends upon the accuracy with which the actual values of resistance approach the specified values, the multiplier resistors should be selected with care. Since the usual manufacturer's tolerance is between 5 and 10 per cent, it may be necessary to make up each of the resistance values by means of two or three resistors in parallel or series. In this way, one with a resistance higher than the marked value can be matched with another having resistance lower than the marked value, each thus serving to compensate for the other. For instance, the 10,000-ohm resistance, R_{14}, may be made up of a 5500-ohm and a 4500-ohm resistor in series.



Front view of the WERS multimeter. In the upper left-hand corner of the panel are the antenna feed-through terminals and the tank-circuit dial controlling the tuning condenser, C_2. Below are the meter sensitivity control, R_3, the two slide-type switches, S_2 and S_3, the filament toggle switch, S_1, and the headphone jack, J, the latter two being insulated from the panel by the small strip of bakelite. To the right of the milliameter are the pin-jack terminals, also mounted on bakelite strips. The knob to the right of and below the meter controls the plate-voltage dropping resistor, R_2. In the lower right-hand corner are the ohmmeter zero adjusting resistor, R_4, and the selector switch, S_4. The frequency and field-strength db. charts are mounted inside the cover. Other charts, connecting leads, etc., are placed in the compartments at either end of the panel.

The paralled groups of four resistors (R_{10}) and of two resistors (R_{11}) indicated under the circuit diagram are necessary to prevent exceeding the voltage rating of the individual resistor units.

The full-scale voltage reading for each switch position is as follows: Tap No. 2 — 1000 volts, Tap No. 3 — 250 volts, Tap No. 4 — 50 volts, Tap No. 5 — 10 volts. With the switch in the No. 2 position voltages up to 5000 may be measured by connecting to the (−) V-O-M terminal and the (+) 5000-volt terminal. If the multiplier resistors are checked with care and the meter is known to be accurate, no further calibration of the voltmeter should be necessary. However, if means are available it might be well to check readings at a few points in each range to be on the safe side.

Milliammeter

The next four positions of S_4 — Nos. 6, 7, 8 and 9 — are for current readings, with the external circuit connected to the V-O-M terminals.

Making the required shunts for the milliammeter isn't at all difficult. The three ranges requiring shunts are in direct multiples of ten. Plenty of information on making milliammeter shunts from copper wire will be found in the ARRL *Handbook*.

To calibrate the homemade shunts, the 2000-ohm potentiometer, R_4, may be disconnected from the circuit and connected across the V-O-M terminals with a 1.5-volt dry cell in series. With S_4 in the No. 9 position (1-ma. current range), the variable resistor should be adjusted so that the meter reads full scale. Then, switching to the No. 6 position, the homemade shunt (R_8) should be adjusted until the meter reads 1/10 scale. With this shunt, full-scale reading will be 10 ma.

With S_4 in the No. 6 position and the 10-ma. shunt permanently connected in the circuit, the variable resistor across the V-O-M terminals should be readjusted until the meter again reads full scale (10 ma. this time). *The external circuit now should be opened.* This is important to avoid overloading the meter when the next step is taken. With S_4 turned to the No. 7 position *and the 100-ma. shunt connected* the external circuit may be closed again, care being taken not to disturb the setting of the variable resistor. The 100-ma. shunt, R_7, now should be adjusted carefully until the meter again reads 1/10 scale. It must be remembered that, before removing the shunt for the adjustment of its resistance, the external circuit *must* be opened to prevent damage to the meter.

The 1000-ma. shunt is adjusted in the same manner. After the 100-ma. shunt has been adjusted accurately and permanently connected in the circuit, the variable resistor is readjusted until the meter reads full scale with S_4 in the No. 7 position (100 ma.). The 1000-ma. shunt is then connected and with the switch in the No. 8 position is adjusted until the meter again reads 1/10 scale. Full-scale reading will then be 1000 ma. The precautions previously described for protecting the meter should also be observed when adjusting this shunt, of course.

Heat from the soldering iron may change the resistance of the shunt, and therefore it is a good idea to allow time for the wire to cool before checking the resistance each time.

Ohmmeter

When S_4 is in the Nos. 10 and 11 positions the circuit is that of an ohmmeter, the resistance to be measured being connected across the V-O-M terminals. In position No. 10, the circuit is a

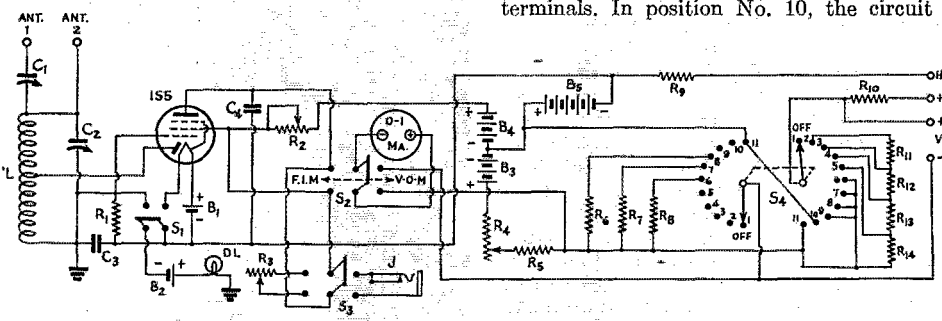


Fig. 1 — Circuit diagram of the WERS multimeter.

C_1 — 3-30-$\mu\mu$fd. ceramic-insulated mica trimmer.
C_2 — 35-$\mu\mu$fd. ceramic-insulated midget variable, cut down to approximately 7 $\mu\mu$fd.
C_3 — 250-$\mu\mu$fd. midget silvered mica.
C_4 — 0.002-μfd. midget mica.
R_1 — 1 megohm, ½ watt.
R_2 — 50,000-ohm wire-wound variable.
R_3 — 1000-ohm wire-wound variable.
R_4 — 2000-ohm wire-wound variable.
R_5 — 3000 ohms, ½ watt.
R_6 — 1000-ma. shunt resistor (see text).
R_7 — 100-ma. shunt resistor (see text).
R_8 — 10-ma. shunt resistor (see text).
R_9 — 40,000 ohms, ½ watt.
R_{10} — 4 megohms, 4 watts (four 1-megohm, 1-watt resistors in series).
R_{11} — 0.75 megohm, 1 watt (0.5-megohm and 0.25-megohm, ½-watt units in series).
R_{12} — 0.2 megohm, ½ watt.
R_{13} — 40,000 ohms, ½ watt.
R_{14} — 10,000 ohms, ½ watt.
L — 4 turns No. 14, ½-inch diameter, center-tapped for diode connection.
B_1, B_2 — 1.5-volt No. 6 dry cell.
B_3 — 4.5-volt "C" battery.
B_4, B_5 — 45-volt hearing-aid battery.
DL — 1.1-volt dial lamp.
J — Open-circuit jack.
M — 0-1-ma. d.c. milliammeter (good grade, 4-inch if possible).
S_1 — D.p.s.t. toggle switch.
S_2, S_3 — D.p.d.t. slide-type or toggle switch.
S_4 — 2-circuit, 11-position rotary switch (Yaxley).

series arrangement. The practical range of resistance measurement in this case is about 30 ohms to 250,000 ohms. R_5 should be as close as possible to the specified value. If the (—) *V-O-M* and *Hi-Ohm* terminals are used with the switch in the No. 10 position, resistances up to 1.5 megohms may be measured.

When the switch is turned to the No. 11 position the low-resistance range, which is suitable for measuring resistance, from about ⅓ ohm to 3000 ohms is provided.

The meter may be calibrated for the resistance ranges by connecting, across the *V-O-M* terminals, variable resistors whose resistances have been measured previously at several points by means of a borrowed ohmmeter. If no calibrating meter is available, various combinations of fixed resistors of known value may be used to obtain several points from which a resistance-calibration graph may be drawn. Any points which fall outside a smooth curve should be disregarded. These calibrating resistors may be checked by placing them in a battery circuit, measuring the current and voltage by means of the voltmeter and milliammeter which have already been set up, and applying Ohm's Law. The calibration also may be calculated with reasonable accuracy by the methods described in *QST* for April, 1944.[1]

Before calibrating or using the ohmmeter, the compensating resistor, R_4, should be adjusted with the V-O-M terminals or test prods short-circuited. It should be pointed out that resistance readings on the ohmmeter will increase from right to left with the series arrangement (switch tap No. 10) and from left to right with the parallel arrangement used for low-resistance measurement, (switch tap No. 11). Therefore, the point of adjustment for "zero" resistance with the terminals short circuited will be at maximum on the milliammeter scale for the first case and at zero in the second case.

Field-Intensity Measurements

For measurements other than those made by the V-O-M section, S_4 should be turned to the "Off" position; while S_2 should be thrown to the left for all except V-O-M measurements and 'phone monitoring.

The field-intensity-meter portion of the circuit has been discussed previously. Descriptions of such units will be found in the *Handbook* together with constructional suggestions. Any other diode-pentode or diode-triode which will meet low filament and plate-power requirements might be substituted. If available, a separate diode and an r.f. pentode from the 9000 series tubes would probably be better because they are designed primarily for very-high-frequency applications. The 1S5 was selected for this multimeter because it was not too hard to find and is a fairly good tube at 112 Mc., particularly if a good polystyrene socket is provided for it.

The coil, L, is adjusted to hit the band with C_2 by squeezing together or separating the turns. If this is done before placing in the case, allowance for capacity to the shield must be made. The band of 112 to 116 Mc. will cover about sixty degrees on the dial. This is about right, since any more bandspread would make the meter read too broadly and any less will make tuning more critical.

When using the meter for field-strength measurements it will be found to be quite sensitive. Two or three watts into a properly working antenna will give a good reading at distances of up to fifteen to twenty-five wavelengths. Checks on antenna length, antenna coupling, standing waves, reflections, shadows, antenna location and orientation, etc., become easy.

After adjusting the quarter-wave pick-up antenna to optimum length (24 inches is about right), the unit should be moved as far away from the r.f. generator as is possible and still get a good reading. The multimeter antenna trimmer, C_1, should then be adjusted for maximum deflection. Once set, it should be unnecessary to touch this trimmer again; in fact, it is important not to readjust antenna coupling, since it will change the frequency-meter readings as discussed later.

The field-intensity-meter amplifier is linear, and the meter can be calibrated arbitrarily in decibels as follows:

Meter Reading		*Db.*
0.9	=	0
0.72	=	+5
0.53	=	+10
0.35	=	+15
0.19	=	+20
0.03	=	+25

This will be satisfactory for all practical purposes. If greater accuracy is desired it will be necessary to calibrate the meter by using an audio oscillator, as described in the *Handbook*, or against another field-intensity meter for calibration by comparison. Such accuracy probably won't be found necessary in most cases, however.

Because the meter itself has a tendency to deviate from linearity at the ends of the scale, 0.0 db. is set arbitrarily at 0.9 on the 1-ma. scale. In making field-intensity readings the meter is set for an original 0.0 db. reading at 0.9 on the scale by use of the variable meter shunt, R_3, with S_3 thrown to the left. The calibration then continues from that point, the meter reading from right to left. By adjusting the voltage on the plate of the 1S5 with the variable voltage-dropping resistor, R_2, and then resetting the meter to 0.0 db. with R_3, a combination of factors will be found which will make the field-strength indication most sensitive. It is possible, too, that use of the antenna with the conductively coupled antenna connection will be found to be of assistance on weak signals.

Calibrating the Frequency Meter

When used as a frequency meter, the unit is essentially one of the absorption type with a v.t.v.m. indicator. For the indicator to operate, it is necessary, of course, that the circuit whose resonant frequency is being checked supply a

[1] Gadwa, "Ohmmeter Circuits," *QST*, April, 1944, p. 30.

small amount of power. An oscillating or superregenerating detector should provide sufficient r.f. output to give an indication on the meter. R_3 should be set at maximum resistance for greatest sensitivity, R_2 then being adjusted until the meter reads full scale. Resonance with the circuit under measurement is indicated by a dip in plate current.

Calibrating the multimeter for frequency-checking purposes is probably the most complicated process of any of those necessary, although it will not be found too difficult. There are several methods which can be used with good results. One method which is good *if* carefully worked out is the Lecher-wire system. However, care in using this system is important because there are so many variable factors to consider — body capacity, coupling to the r.f. generator, pick-up relationship of the frequency meter, selecting proper nulls and other conditions. On the first attempt (after several hours of trying) I managed to get three different and perfectly good sets of Lecher-wire measurements, all of which proved to be wrong. Anyone can make the same errors unless proper precautions are taken.

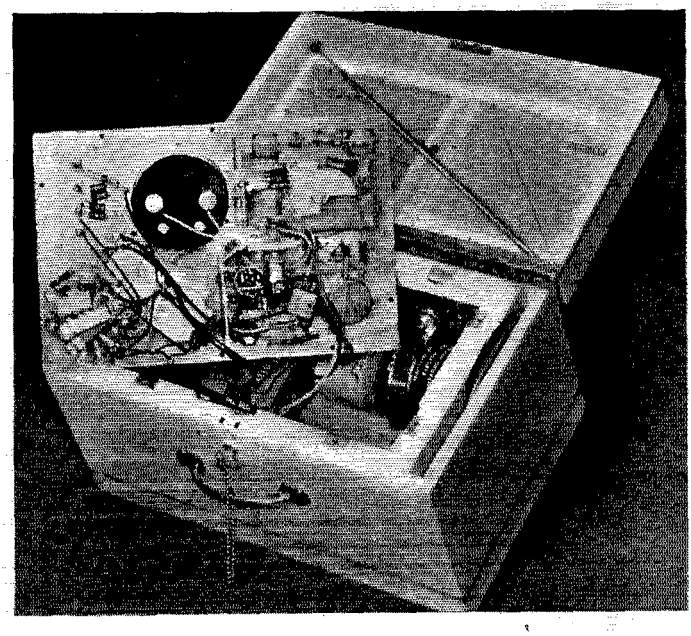
In the New York City WERS it happens that we have a number of crystal-controlled stations operating on various spot frequencies throughout the 112-Mc. band. It was not difficult, therefore, to plot a calibration curve with a considerable degree of accuracy, particularly since the tuning condenser in the meter is of the straight-line-frequency type. This method gave a very good calibration. It is realized, however, that comparatively few WERS communities have crystal-controlled stations on any such variety of frequencies. While it is possible to accomplish the same result with a crystal oscillator and a variety of crystals of known frequency, that method also leaves something to be desired. Not the least of the difficulties it involves is the availability and accuracy of the crystals themselves. The latter point can be a real problem when working with the 16th and higher order of harmonics of 7-Mc. crystals, especially considering the effects of temperature. Nevertheless, the crystal method was used first and the results were surprisingly good — entirely satisfactory for ordinary purposes, in fact, considering the normal tolerances which must be allowed in a homemade instrument of this kind.

The frequency meter should be allowed to warm up for about 10 minutes before it is used. Because the calibration will change somewhat as the tube ages and the battery voltage drops off, it should be checked periodically. A new graph need not be drawn each time; usually it will be satisfactory merely to make a note of the correction factor, which will be constant over most of the frequency range. If this is done and the meter is constructed carefully, checks have shown that the calibration can be depended upon for an accuracy of 0.05 per cent — which almost anyone will agree is entirely adequate for WERS work.

For accurate reading, the graph should be made quite large. On standard graph paper (10 divisions to the inch) it is suggested that one division be used for each dial division on the horizontal scale and one division for each 50 kc. on the vertical scale.

Greatest accuracy in frequency measurement is obtained when the coupling between the frequency meter and the circuit to be checked is made as loose as possible. Overly tight coupling will be indicated by a broad reading of the indicator or possibly a double indication. Removing the meter as far as possible also reduces the effect the presence of the operator has upon the tuning of the circuit when both are in close proximity.

(Continued on page 69)



This underside view of the multimeter panel shows the parts arrangement. The frequency-measuring and field-intensity-meter portion of the circuit is to the right of the milliammeter, while the resistors for the V-O-M section are to the left. A small vertical shield separates the two sections. The 1S5 tube is mounted horizontally. Room for all batteries is provided under the panel.

Photographs by Robert Cobaugh, W2DTE

HAPPENINGS OF THE MONTH

BOOTLEGGING ON 112 MC.

AT FCC we learn that there has recently been an increase in unlicensed operation on the 112-Mc. band. It generally takes the form of young lads trying to crash WERS nets, sometimes with mobile rigs in cars. None of it has been by licensed amateurs. The urge is understandable but the authorities take a pretty serious view of unauthorized operation during wartime and the consequences can be serious — both in interference caused and in the punishment. A fourteen-year-old in the Los Angeles region a short while ago got on a control-tower frequency and paralyzed traffic at the Burbank airport for a couple of hours before he was located, his gear seized, and his person taken before the D.A.

Because of the seriousness of interference to war communications, and because some uninformed person is sure to call each such case illegal "amateur" operation, licensed amateurs ought to do everything they can to prevent or stop such bootlegging. Offenders never get away with it for more than a few hours but they can sometimes cause considerable annoyance before being caught, as did the L.A. lad above. One of the most useful tools of FCC's Radio Intelligence Division in the quick apprehension of such operators is an ingenious aperiodic receiver which receives near-by signals regardless of frequency and which can be arranged to make unattended recordings over a period of days. When the time arrives that its details will not be of value to the enemy, we hope to describe its circuit in *QST*. Meanwhile it is so effective that it is providing frequent proof that in the radio world, as elsewhere, crime doesn't pay. Modern gear is not only capable of detecting and recording unauthorized signals on any frequency but of giving accurate bearings on the transmission of a single dot. Let bootleggers beware!

AMATEURS DEFENDED

LAST year, in the House Select Committee investigating FCC, the accusation was made that FCC had improperly sought draft deferments for some of its personnel. Counsel for the committee, challenging the competency of some of the deferred personnel in the Radio Intelligence Division, charged that they were "just amateurs" and disputed Chairman Fly's statement that they were hired not merely because they were amateurs but because they possessed the necessary qualifications. Counsel then proceeded to discuss 34 individuals in RID, endeavoring to take them apart.

After many months, FCC is having its "day in court." On June 21st Commissioner E. K. Jett offered 50 pages of testimony concerning personnel deferments and, amongst other things, gave the technical record and qualifications of all of the men concerned to show that they had outstanding qualifications for their posts. Many of them had the major portion of their experience as amateurs. On this subject Mr. Jett said:

"These 34 were accused of being 'amateurs' with the implication that their occupational deferment was unauthorized. In making this charge, Counsel implied that an 'amateur radio operator' was a novice and without skill in radio. The fact is, of course, that an 'amateur' denotes merely that the operations engaged in are not for profit. The treaty of Madrid of 1932 defines an amateur as 'a duly authorized person interested in radio technique solely with a personal aim and without pecuniary interest.' The Commission (Rule 12.2) adopted the same definition. In order to obtain an amateur license, a difficult and comprehensive examination must be passed, as I have already stated. Many commercial radio operators are 'amateurs' in their spare time. Instead of being a novice, an amateur is one who has a deep interest in radio. Many of our outstanding radio engineers and technicians are amateurs."

EXPERIENCED ENGINEERS & PHYSICISTS!

THIS is a technical war which is being fought, in large measure, with a wide variety of secret devices especially created for that purpose in American laboratories. This work is not over: it is still expanding. A pressing need exists for qualified and experienced physicists and radio engineers capable of working in original fields and particularly for those whose background would qualify them to undertake the direction of such projects. Although one would ordinarily think that there are not many such men available, it has been discovered that there are men (and women) of the proper caliber who are not satisfied that their present connections permit them to make maximum contribution to the war effort and who would value an opportunity to explore, in confidence, the possibility of making a change in connections without meanwhile disturbing present relations. Such a channel has been set up:

The president of ARRL, George W. Bailey, W1KH, is serving as chief of scientific personnel of the Office of Scientific Research & Development at 1530 P Street, N. W., Washington 25, D. C. Mr. Bailey is in position to undertake confidential correspondence with a view to the mutual exploration of possibilities. Interested radio engineers and physicists are invited to write him under personal cover to that end.

RELEASES TO MERCHANT MARINE

IT is well known that the merchant marine is in pressing need of qualified seagoing radio operators. We have numerous inquiries for data

ARE YOU LICENSED?

When joining the League or renewing your membership, it is important that you show whether you have an amateur license, either station or operator. Please state your call and/or the class of operator license held, that we may verify your classification.

on the procedure for releasing qualified operators from the armed services in order to serve in the merchant marine. Here is the information:

The War Shipping Administration has no such arrangements with the Navy. They are authorized, however, to support the request of an enlisted man in the Army, if he holds an FCC commercial radiotelegraph operator's license, is over 26 years of age, and has had previous sea experience as a radio operator. For information and instructions concerning the procedure for obtaining a release from the Army, such men should write to H. Chase Stone, Assistant Deputy Administrator for Recruitment and Manning, War Shipping Administration, Washington 25, D. C., giving the following data: (1) seaman's rating, if any; (2) number and date of issue of Certificate of Identification or Continuous Discharge Book and of License or Certificate of Service; (3) full name, Army Serial Number and complete camp address; (4) number and address of local draft board; (5) permanent home address; (6) date of birth; (7) maritime radio operating experience. Mr. Stone's office will then check qualifications and advise what to do next.

YOUR WAR SERVICE RECORD

THE headquarters office of ARRL at West Hartford, Conn., is endeavoring to compile a record of the war service of every United States and Canadian amateur who is employing his radio talents in the war effort. A great many thousand amateurs have registered the essential facts of their war service with us, but we are well aware that there are many thousands from whom we have not yet heard. We do not ask for any confidential information but we do most earnestly seek the essential facts of your wartime service, and of your immediate amateur associates, so that we may accumulate a record that will be both the history of the amateur contribution and invaluable data in the future protection of the amateur position in our countries.

We print a simple form on this page, which it will take you only a moment to fill out — or you may easily reproduce its essentials on a post card if you don't wish to cut your copy of *QST*. We are interested not only in amateurs in the armed services but in those in the auxiliary services listed and in industry which is 100 per cent devoted to the war effort. (As soon as we can take on the work involved, we shall solicit a similar record from the amateurs who have served in civilian defense and similar capacities, but we are not yet quite ready for that.) Since ARRL operates in Canada as well as the United States, we're equally interested in the record of Canadian amateurs.

Please!

STAFF NOTES

J. VENABLE FITZHUGH, W5VL, has joined our staff as an assistant technical editor, coming to us from OCSigO in Washington, where he served as a civilian engineer the preceding year and a half. For many years instructor in radio in the San Antonio Vocational & Technical School (W5GJD, Ven was working, two weeks after Pearl Harbor, as a civilian training administrator at Duncan Field, supervising the training program for aircraft radio mechanics and learners. In fact, he wrote the original outline which was adopted practically intact for the national program for that training job. He had his first license at the age of 13, has been continuously a member of ARRL for 20 years, and was among the first amateurs in the country to work the 7-Mc. band.

AMATEUR WAR SERVICE RECORD

Name

Present mailing address

Rank or rating

Branch or bureau: Signal Corps, AAF, Buships, WAVES, etc. If civilian industry, give title and company.

Call, present or ex; or grade of op-license only

SERVICE

- ☐ Army
- ☐ Navy
- ☐ Coast Guard
- ☐ Marine Corps
- ☐ Maritime Service
- ☐ Merchant Marine
- ☐ Civil Service
- ☐ Radio industry, 100% war

Sundry notes on former staff members, most of them on leave from Headquarters: Ev Battey, W1UE, and Art Budlong, W1JFN, are now both lieutenant commanders, respectively in USNR and USCGR. . . . Vernon Chambers, W1JEQ, formerly of our Technical Information Service, is now Pvt. Chambers, AAF. . . . 2nd Lt. Julius Galin, W1LOP, former *QST* laboratorian, now has his wings as a navigator and is getting a small injection of radar before proceeding somewhere on important business. . . . Chief Radio Man John Huntoon, USCGR, W1LVQ, is now in the vicinity of the District of Columbia, doing something pretty important. . . .The Jim Lambs have their fifth daughter. . . . Joe Moskey, W1JMY, formerly of our Communications Department, and Ed Tilton, W1HDQ, our v.h.f. editor, looked in at Hq. recently before proceeding to distant parts with their hush-hush specialties, one going East and the other West.

FREE RADIO TRAINING

WE HAVE been asked to announce that special free training in radio and electronics for technical workers in California war industries will be given in a series of short evening courses. The University of California will start these courses in August in major war production centers throughout the state, as part of the ESMWT program of the U. S. Office of Education. The prerequisites for enrolling in the courses are employment in a war industry and high school or equivalent education. Further details may be obtained from the following University of California War Training Centers: 201 California Hall, Berkeley 4, Calif. (THornwall 5377); 405 Hilgard Ave., Los Angeles 24, Calif. (BRadshaw 2-2171); 1302 First Ave., San Diego 1, Calif. (Main 2037).

AS THE August, 1919, issue went to press, "the ban on amateur transmitting has not yet been lifted by the Navy Department in spite of the fact that the peace treaty has been duly signed and that the country otherwise is practically on a peace basis. What good is being accomplished by this delay, it is hard to see. It is hoped, however, that these conditions will not long obtain." But Uncle Sam is still holding many of our members. Radio Inspector Arthur Batcheller, at a meeting of the New England Amateur Wireless Association, said that out of about 2400 amateurs in the first district, about 1100 were in some branch of the service. "Now that the German fleet has victoriously sunk itself, we may expect a return of our relay men." Meanwhile, the reorganization of the Operating Department is being pressed with remarkable vigor and success. Traffic manager J. O. Smith reports: "The fact that the foremost amateur radio men of the country are actively identified with the League's traffic organization is complete evidence that these men realize the value of organized effort not only as regards a traffic organization but with particular regard to future pernicious legislation affecting the future of the amateur."

Primarily in connection with the plans for resuming traffic work, the League announces its willingness to establish affiliation with local amateur clubs, "an interlocking of hands wholly fraternal and having for its aims the furtherance of amateur radio and that alone." Affiliating clubs will be expected to coöperate actively in relay activities and to take steps to control local QRM, particularly the curbing of willful and malicious interference. A further sign of early reactivation is an announcement from the Navy Department that NAJ, Great Lakes, will send nightly test messages to amateurs on 476 meters, not only providing code practice but constituting a willingness to coöperate with the amateur which is regarded as a distinct concession and is greeted with satisfaction. And Thordarson offers a prize of $35 to the first amateur handling a message over a distance of 1500 miles with a 1-kw. Thor transformer on 200 meters.

When we get away from the Navy we go back under our good old former bosses, the Department of Commerce, and Chief Radio Inspector Terrell. All licenses have expired and every amateur must be reëxamined, and the receiving test has been stiffened from five words per minute to ten. After receiving an operator's license, an amateur will be permitted to erect his station and then apply for blanks for asking for a station license. One very good thing is that the Department will permit us to operate as soon as the application for station license has been filed. There will be a completely new deal on call letters. The outlook is gloomy for special licenses, because of the possibilities of the airplane for carrying mail, and it is probable that the wavelength under special license will be reduced from 425 meters to 375.

QST's cartoonist, Don Hoffman, 8ADU, puts forward a very interesting idea: that the fellows with long-distance receiving sets make themselves up a form or post card, reporting received signals, and send one each time a new long-distance station is heard. In this way numerous relay possibilities will be discovered, while the fellows receiving the cards would keep them on file to show the range covered by their stations.

On the technical side, there is some interesting new gear for long-wave c.w. General Radio has brought out some 12-step inductors and deForest has produced a whole series of honeycomb-wound coils having standard plugs. The day of the hogshead loosecoupler and eight-foot loader seems over. Information has also become available on vacuum-tube amplifiers which will work on just one set of "A" and "B" batteries and which may be coupled between stages by resistance, inductance or transformers. "Whether or not the development of amateur radio operation will be in the direction of much less transmitting power and the use of high amplifications at the receiving end, the amplifier is today one of the most important pieces of apparatus in our stations."

Power-Supply Design

The Principal Factors Involved in Reduction of Ripple

BY G. EDWARD HAMILTON,* W9GSS

Ripple is something we don't want at the output of a power-supply filter system. While we can get by in most cases by simply using a "brute-force" filter with plenty of *L* and *C*, more efficient design is easy to attain. In this article the author brings to light a number of details about rectifier ripple on which little has been published for the amateur. Those hams who have struggled ineffectively with tables and plain cut-and-try methods will benefit from the more direct approach here given. The formulas are not hard to follow.

FREQUENTLY the assumption is made that, because of its apparent simplicity, no particular thought need be given to the problem of power-supply design. This attitude accounts for the poor regulation and filtering that sometimes results.

Some of the questions which must be answered before filter-design calculations can be undertaken are:

What is "ripple factor"?

What ripple factor is satisfactory for various classes of service?

What is "smoothing factor"?

How is the smoothing factor used in power-supply filter design?

If any of the above questions prove to be puzzling, the following information may be helpful.

Before the ripple factor can be defined, the term "ripple voltage" must be understood. The ripple voltage is the value of the alternating component of the unidirectional voltage from the rectifier. The ratio of this value to the algebraic average value of the total voltage, when expressed as a percentage, is known as "per cent ripple."

The ripple factor is the ratio of the amplitude of the fundamental component of ripple voltage to the average value of the total voltage (direct voltage). There are two ripple factors to be considered; i.e., the factor at the input to the filter and the factor at the output of the filter. The former is dependent upon the type of rectifier and the latter upon the permissible amount of ripple, according to the particular use. The ripple factors will be represented by the following symbols:

ρ_i = input-to-filter ripple factor
ρ_o = output-of-filter ripple factor

*346 Elmwood Ave., E. Orange, N. J.

Table I shows the allowable output ripple factor, ρ_o, for various applications, while Table II indicates the factors at the input to the filter obtained from the various types of rectifiers shown in Fig. 1

TABLE I

Class of Service	*Per Cent Ripple (ρ_o)*
Microphone circuit of a radio transmitter system	Less than 0.005%
Audio-frequency amplifiers (precluding high-gain systems)	From 0.01% to 1.0%
Cathode-ray circuits	Less than 1.0%

TABLE II

Circuit No.	*Supply Source*	*Per Cent Ripple at Filter Input (ρ_i)*	*Rectifier Output Frequency*
A	60-cycle single-phase ½-wave rectifier	157 %	60 cycles
B	60 cycle single-phase full wave rectifier	6.7%	120 "
C	60-cycle single-phase bridge rectifier	66.7%	120 "
D	60-cycle two-phase star rectifier	15.0%	240 "
E	60-cycle three-phase star rectifier	25.0%	180 "
F	60-cycle three-phase double-star rectifier	5.7%	360 "

The effectiveness of a smoothing filter in removing a component of ripple voltage of given frequency may be indicated by the ratio of the amplitude of a sinusoidal input voltage of that frequency to the amplitude of the resulting output voltage. This ratio is termed the "smoothing factor" and may be determined from the following relation, where α is the smoothing factor:

$$\alpha = \frac{\rho_i}{\rho_o}$$

Continuing from the above relationship, we may now set up the general equation for specific values of capacitance and inductance for any number of identical sections:

$$\alpha = (\omega^2 LC - 1)^n \quad \text{or} \quad LC = \frac{\sqrt[n]{\alpha} + 1}{\omega^2}$$

where $\omega = 2\pi f_r$, f_r being the ripple frequency in cycles,

L = inductance in henries
C = capacitance in farads
n = number of stages or sections.

Since there are two unknowns — L and C — in the formula, it is advisable to substitute a value of inductance or capacitance and solve for the remaining factor. If good voltage regulation is essential the input inductance must exceed the critical value, L_c, given by the following equation:

$$L_c = \frac{0.159\rho_i R_l}{f_r}$$

where R_t is the total load resistance, including the resistance of the choke.

In the case of a 60-cycle full-wave circuit,

$$L_c = \frac{(0.159)\ (0.667)\ (R_t)}{120}$$

$$= \frac{R_t}{1132} \text{ henries}$$

For conservative design, the factor 1000 often is used in the denominator. Thus,

$$L_c = \frac{R_t}{1000} \text{ henries}$$

To insure that the peak rectifier current is not excessive at full load, the inductance of the first choke, L_o, at full load should not be less than $2L_c$, or

$$L_o = 2L_c = \frac{R_t}{500}$$

Having determined the value of the first choke, it is now possible to substitute this value in the equation previously shown; i.e.,

$$\alpha = (\omega^2 LC - 1)^n$$

Fig. 2 shows the arrangement of circuit components for a single-section filter with choke input, while Fig. 3 shows a three-section filter.

To preclude the possibility of increase of amplitude in ripple voltage rather than a decrease, resonance at the ripple frequency in the individual sections should be avoided. Although the filter is a complicated circuit which may resonate at a number of frequencies, usually it is necessary only to make sure that the lowest resonant frequency of any individual section is less than the fundamental ripple frequency. The following equation gives the resonant frequency, L being the inductance at full-load current.

$$f = \frac{1}{2\pi\sqrt{LC}}$$

where f is in cycles, L in henries, and C in farads.

The selection of components also must be made with much care if best results are to be obtained. The choice of rectifier tubes, of course, depends upon the particular currents and voltages desired. In the low-voltage range, high-vacuum tubes

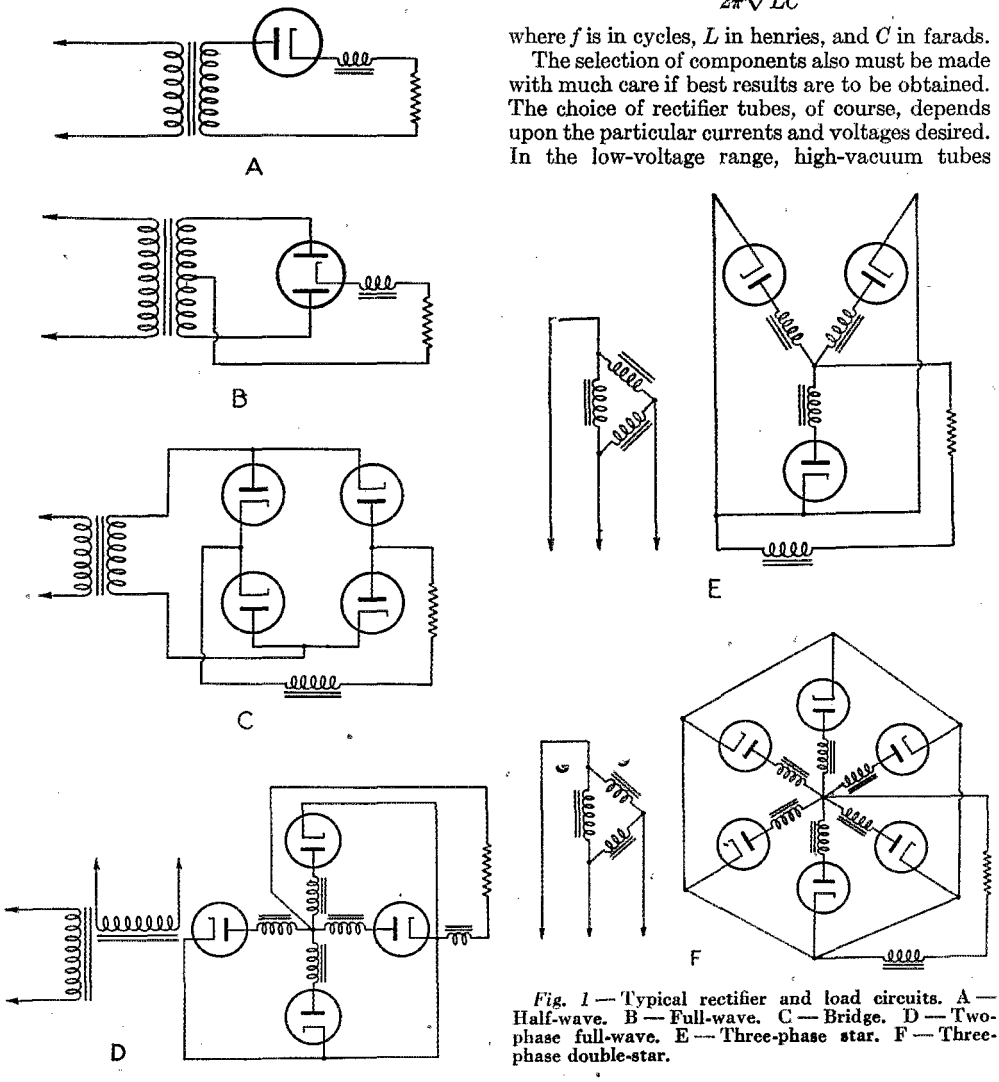


Fig. 1 — Typical rectifier and load circuits. A — Half-wave. B — Full-wave. C — Bridge. D — Two-phase full-wave. E — Three-phase star. F — Three-phase double-star.

find favor, while in the high-voltage range mercury-vapor tubes such as the 866 are more desirable because of their lower resistance and greater current-carrying capabilities. Whenever gaseous tubes are used it is desirable to place a

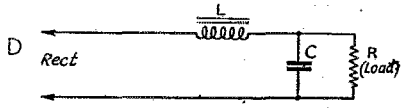


Fig. 2 — Single-section filter with inductive input.

small capacity of about 0.01 to 0.05 microfarad across the input of the filter to eliminate the "hash" which often is generated in near-by receivers when the gas-type tubes "break down." Complete metal shields placed over gas rectifiers also aid in reducing disturbances of this nature. This, of course, has no effect upon ripple filtering.

It is highly desirable, especially in high-voltage applications, to use a plate transformer which has as good regulation as possible, and filter chokes which have low direct-current resistance. Since the inductance of any choke decreases with the load current, because of the saturation of the core, it is important to use inductive components that are rated for the maximum current-carrying capacity at which the supply is to be used. Where the transformer peak voltage approaches the peak voltage rating of the rectifier tubes, series resistors of the order of 50 ohms should be inserted in each plate lead so that, if a third harmonic is present, the resistor voltage-drop will protect the tube. In all high-voltage applications, and especially where gaseous rectifiers are used, it is desirable first to turn on the filaments and then to apply the plate voltage, so that the tubes will not be damaged.

In calculating the rectifier d.c. output voltage, the following general equation may be used:

$$V_{dc} = 0.9\ V_{rms} - V_t$$

where V_{rms} = transformer voltage between center-tap and one end of secondary, and V_t = voltage drop across the rectifier.

An example of typical power-supply calculations follows:

Requirements (output): 500 volts, 300 milliamperes, 0.1 per cent ripple, a bleeder resistance of 20,000 ohms and two 5Z3 tubes to be used.

$$\alpha = \frac{0.667}{0.001} = 667$$

$$L_o \text{ at no load} = \frac{20{,}000}{1000} = 20 \text{ henries}$$

$$L_o \text{ at full load} = \frac{1550}{500} = 3.1 \text{ henries}$$

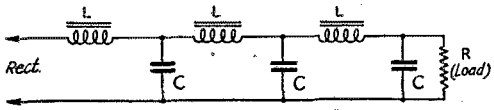


Fig. 3 — Three-section filter with inductive input.

For practical operation, a swinging input choke rated at between 5 and 20 henries, with a current capacity of 300 milliamperes, will be satisfactory.

Assume that all sections are capable of the same amount of filtering, and that two sections will be used. Then $n = 2$, and

$$LC = \frac{\sqrt[n]{\alpha} + 1}{\omega^2} = \frac{\sqrt[2]{667} + 1}{(2\pi\ 120)^2}$$

$$= \frac{25.8 + 1}{567{,}913} = \frac{(26.8)\ (10^{-6})}{0.568} = (47.2)\ (10^{-6})$$

For the second section, let $C = 4$ μfd.

$$LC = (47.2)\ (10^{-6}) \text{ or } L = \frac{(47.2)\ (10^{-6})}{C}$$

$$L = \frac{(47.2)\ (10^{-6})}{(4)\ (10^{-6})} = 11.8 \text{ henries}$$

For the first section, the minimum value of L_o (requiring the maximum value of C) is 5 henries.

$$LC = \frac{\sqrt[n]{\alpha} + 1}{\omega^2} = (47.2)\ (10^{-6})$$

$$C = \frac{\sqrt[n]{\alpha} + 1}{\omega^2 L} = \frac{(47.2)\ (10^{-6})}{5}$$

$$= (9.4)\ (10^{-6}) \text{ farads or } 9.4\ \mu\text{fd.}$$

To preclude the possibility of resonance in the supply resulting in an increase in ripple, the resonant frequency must be less than the fundamental frequency. Since

$$f = \frac{1}{2\pi\sqrt{LC}}$$

then, clearing of radicals and substituting values,

$$f^2 = \frac{1}{(2\pi)^2\ LC} = \frac{1}{(2\pi)^2\ (5)\ (9.4)\ (10^{-6})}$$

$$= \frac{10^6}{(2\pi)^2\ (47)} = 539$$

$$f = 23.2 \text{ cycles/sec.}$$

Strays

Substantial economies in time, manpower and money have been effected through the recent standardization of radio tubes used by the Army, Navy and the Canadian armed services. The specifications are based on the use of RMA and commercial type numbers. Results of the standardization will be full interchangeability of tubes, common stockpiles, elimination of dual inspections at manufacturing plants, the use of standard nomenclature and an improvement in the quality of the tubes, since it will no longer be necessary to make the same tube meet two slightly different sets of specifications.

A CAP Radio System

WERS in the Sheboygan County (Wis.) Flight as Organized from the Ground Up

BY ELWOOD A. CAPELLE*

The following article provides a bird's-eye-view of a CAP radio communications set-up and some of the attendant problems of its organization. The author invites comments and inquiries about the Sheboygan County Flight units, and will answer correspondence upon receipt of a self-addressed, stamped envelope.

WHEN the members of a CAP flight or squadron begin to think seriously about organizing and setting up a communications system, the commander of the group generally seeks out a licensed amateur or commercial radio operator whom he can appoint as flight communications officer.

This is a logical choice, since most amateurs or commercial operators are more than willing to accept such a post if they have the necessary time to spare. Although they must join the CAP voluntarily, without hope of receiving any salary or special recognition for their services from the government, there are several appealing aspects to such service. To some, one such aspect is the military flavor of the CAP. Since the CAP is an auxiliary branch of the U. S. Army Air Corps, each sworn member must agree to be governed by Army discipline, to wear a uniform while on duty, and to be subject to call at any time. To others, the work with CAP radio offers an opportunity for useful experience in the technical and operational phases of military communications, a means for continuance of the activities of a favorite hobby or profession, and the satisfaction of having made a contribution to the war effort.

It is to those amateurs and technicians who may be struggling to establish a satisfactory CAP radio system and training program that this article is directed as a possible source of helpful information. To others who are interested but not yet engaged in CAP radio work this article will perhaps serve as an introduction to some of the problems which they may expect to encounter.

The Objective

To begin with, the newly appointed flight communications officer is confronted with the task of organizing a radio communications system which can be used in airplanes, in automobiles, and in general field use. To set up such a system in accordance with all the CAP-WERS rules and regulations, and at the same time to set up classes for training operators, is not an easy job. In fact, there are few technicians who have found preliminary organization other than difficult. In all cases, however, it will be found that the assistance of the wing communications officer, who is in charge of all CAP radio communications and CAP stations existing within the borders of his state, will prove extremely helpful.

The wing communications officer will be glad to send all the printed material available on the subject of radio communications in CAP work to the local flight communications officer, upon receipt of a request addressed in the manner specified in CAP Military Correspondence Directive No. 29. Since most of this material is marked "restricted," care should be taken to ensure that the contents are not made available to persons other than those authorized to have knowledge of it.

The author demonstrating the operation of one of the standardized radio units employed by the Sheboygan County Flight of the CAP. The unit consists of a transmitter-receiver and vibrator pack assembled into a complete carrying case for portable-mobile work. When not in use the microphone is clipped to the left-hand side of the case. The cover of the power unit is used for making notes or filling out the log book.

* Flight Communications Officer, Sheboygan County Flight, CAP, Plymouth, Wis.

Training and Licensing

As the technicians and instructors begin to build up the equipment, the problem of training CAP members to carry on radio communications presents itslef.

All operators of CAP stations must hold at least restricted radiotelephone operator permits. This does not preclude the possibility that some of the members may already hold licenses of higher grade; but, in any case, a WERS operator permit must supplement either the restricted radiotelephone permit or any higher grade of license held by the applicant. Application for the WERS operator permit must be made on FCC Form No. 457.

Copies of the questions and answers for a restricted radiotelephone permit examination may be obtained from the wing communications officer.[1] These will be found useful for individual study use by the applicants. There is a total of sixty-two questions and answers to be studied and memorized. It is important that applicants be familiar with each question and answer, because any ten out of the sixty-two may appear in the examination. The ten questions are divided into three categories, as follows: five are on the rules and regulations of the FCC, three are on the Communications Act of 1934, and two are on the International General Radio Regulations (Cairo Revision).

In addition to knowledge of these questions and answers, CAP operator-license applicants must master the correct telephonic communications procedure as specified in CAP Manual No. 34-9 (pre-flight training). All CAP operators must be able to conduct operations in the prescribed manner in any situation which might arise. (Although CAP operators are licensed by FCC to operate only on WERS frequencies, operation is frequently conducted on the lower frequencies, as well. At such time all procedure is strictly under Army control.)

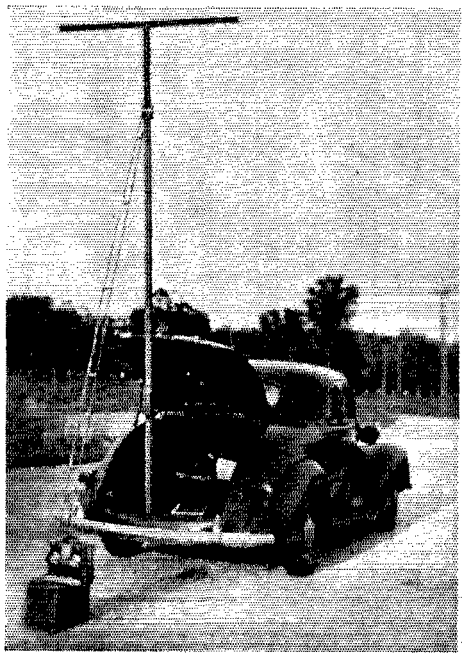
While on the subject of licensing, it should be pointed out that a CAP-WERS station license covers a whole state, and must be modified whenever a new squadron is to be included or whenever new transmitting units are added to any of the squadron set-ups. Certain information, prepared by the flight communications officer, must be endorsed by the squadron commander and forwarded to group headquarters, if that particular wing has such an office, or else to the wing commander. All the material is then reviewed and checked by the wing communications officer, who is responsible for preparing Form 455, supplementary statements, etc., for the station license application. The wing commander then signs and executes the application and sends it to national CAP headquarters. After it has been thoroughly checked there, it is sent on to the FCC.

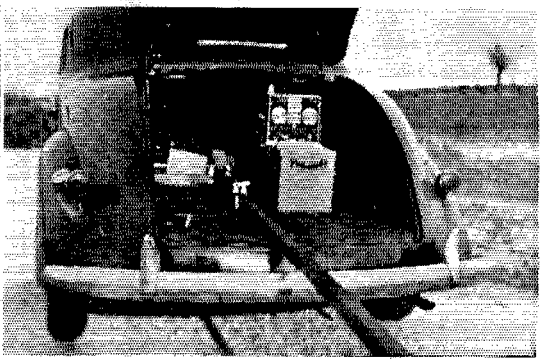
The Equipment Problem

The problem which is likely to cause the greatest headache is that of equipment procurement. Since no priorities are available for the purchase of radio equipment for CAP-WERS, only such equipment as is available without a priority rating can be utilized, and equipment of this sort is very scarce.

One method that has been found productive by the local squadron is the listing of all items of equipment needed, followed by an advertisement for these items in any of the various radio magazines with nation-wide circulation. (The author has found *QST* to be the best magazine for this purpose. Fully 75 per cent of the equipment now

[1] Also obtainable from ARRL Headquarters, 38 LaSalle Rd., West Hartford 7, Conn.





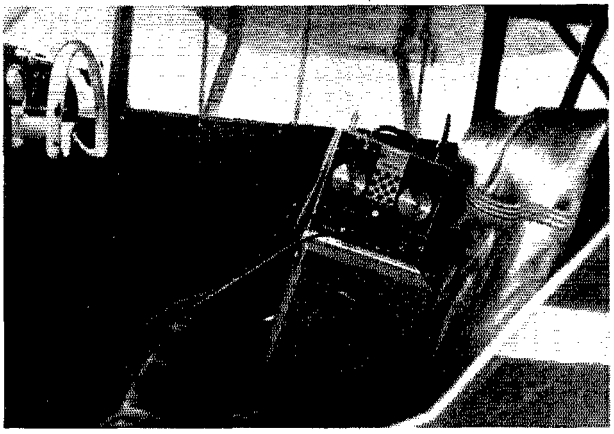
CAP requirements necessitate radio communication with personnel operating in automobiles as well as in airplanes. These two views illustrate use of the portable-mobile unit in the field. At the left the transmitter-receiver is shown set up on the ground, with the transmission line connected to a rotatable "Q" antenna mounted at the rear of the car. In the photograph below the same unit is shown dismantled and packed in the car trunk, ready for transportation.

in use in the Sheboygan County Flight was obtained in response to such an advertisement in *QST*'s pages.)

In designing equipment, it should be borne in mind that the CAP will not license fixed installations. All equipment must be designed either for portable, portable-mobile or mobile operation; CAP Headquarters prefers portable-mobile licensing.

The equipment used by the Sheboygan County Flight at the Kohler (Wis.) airport consists of factory-built Abbott TR-4 transmitter-receiver units, powered by Radiart No. 4200DF vibrator packs which give an output of 300 volts at 100 ma. from 6-volt d.c. battery input. By the additional construction of battery and power pack cases, etc., it was found possible to assemble the various components of each unit — vibrator pack, transmitter-receiver, and related controls — into one complete carrying case for portable-mobile use. Each of these units, which weighs 85 pounds complete with batteries, can be handled by one or two persons. These units can be placed on an automobile seat beside the driver and a radio operator (with the antenna mounted outside the car), or strapped down in a plane seat beside the pilot (with the antenna mounted on the outside of the plane). They are easily adaptable for use as regular field units, as well.

It is recommended by wing communications officers (and has also been found highly practical in actual experience) that standardized parts and connections be used in all installations. In case of emergency it is then a simple matter to exchange any part which fails in one unit for one from another unit which is in good condition. This is especially advised for power packs, antennas and microphone connections.



The transmitter-receiver unit in position on the seat of a two-place Akron airplane. To be operated in flight, the unit must be strapped down and the antenna mounted on the outside of the plane.

Antennas

There are many types of radiating antennas which can be constructed and put into use in set-ups of this kind. Consideration first must be given to the purpose which the antenna is to serve — whether it is to be used for directional signal transmission, or for general coverage within the working area. A vertically polarized antenna will give a signal of consistent strength throughout 360 degrees, providing that obstacles and the general landscape do not distort the field pattern set up by the antenna. A vertical antenna is usually preferable for local work with portable transmitters such as are used in CAP.

For directivity, and to obtain an increase in the range of the signal, a horizontal antenna is the best. A good portable horizontal antenna for general field use is the standard "Q" antenna, so rigged that it can be easily set up or taken down. The "Q" antenna is desirable mainly for use over distances which cannot be covered reliably with the regular vertical antenna.

In the Sheboygan County Flight we have found a vertical half-wave antenna useful for local communication in automobiles or out in the field. Since all communications are conducted on an assigned fixed frequency of 115.5 Mc., the length of the half-wave antenna which is required is about 48 inches. The "Q" antenna is used for covering greater distances and for obtaining directional effects in general field use. In the planes, a half-wave horizontal antenna mounted beneath the ship has been found most successful, because a more general field pattern is obtained with this arrangement while the plane is in flight.

The subject of transmitting antennas and the theory underlying each type is quite complex, but a good deal of information may be obtained by referring to Chapters Ten and Seventeen of the 1944 edition of *The Radio Amateur's Handbook*.

Operational Regulations

The law requires that every radio transmitting station shall provide a means of checking the frequency of its emissions, separate from the frequency control of the transmitter. The CAP requires that the frequency of each transmitter be checked at least once each week in the case of limited operations and more often in the case of continuous, or extended, operations. Therefore, prime consideration must be given to the construction of a frequency meter of a sort which can be precisely calibrated and used to make accurate checks on the transmitter frequency as required.

Lecher wires are not considered to be sufficient means for making CAP frequency checks. They may, however, be used to calibrate an absorption-type frequency meter, which in turn can be used to identify the correct harmonic on a heterodyne-type frequency meter. In the Sheboygan Flight, a frequency meter was constructed with a fundamental frequency of 19,250 kc. and accurately calibrated to within 0.01 per cent of that frequency. The sixth harmonic of the fundamental

(Continued on page 82)

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Gold Stars

CAPT. GEORGE D. FOGLE, W9JJT, 26, was killed March 11, 1944, in an airplane crash while serving in the Chinese war theater.

Enlisting in the Signal Corps in the spring of 1941, he was commissioned a second lieutenant and went to England with the first American group to receive specialized electronics training. Summoned to return immediately after the United States declared war, he transferred to the Air Corps to do research work at AAF Hq. in Washington. Most of his time was spent in the field and he served on missions in every theater, from the Aleutians to Africa, from England to China. He received numerous citations for his work, and was promoted twice.

W9JJT received his ham ticket at the age of twelve while attending grammar school. He was active in both his high school and college radio clubs, and held radiotelegraph and radiotelephone first-class licenses. He was preparing for his doctor's degree in physics at the University of Chicago at the time he volunteered for duty.

CAPT. DAVID G. RAUB, W1KCE – ex-W2BTO, 31, was killed December 15, 1943, in an airplane test-flight crash near New Castle, Del.

Commissioned a captain in the Air Corps in July, 1942, he was stationed at the New Castle Army Air Base. He was an officer in the 2nd Ferrying Group, later becoming an engineering officer at the base. At the time of the crash he was assistant test pilot.

Capt. Raub began his ham career with the call W2BTO, operating from Flushing, L. I. In 1931 he moved to Nantucket to become a partner in establishing the Nobadeer Airport. He received the call W1KCE, and worked 14- and 28-Mc. 'phone and c.w. During several emergencies, when Nantucket Island was without communication to the mainland, W1KCE assisted in handling emergency radio traffic and also by flying in supplies.

After the war, Nobadeer Airport, now serving as a Naval air base, is to be renamed Raub Field in Capt. Raub's honor.

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A CAP Radio System

(*Continued from page 31*)

frequency, which is equivalent to the assigned transmitter frequency of 115.5 Mc., beats against the emitted signal of the transmitter. After the frequency has been checked a dial lock is set on the transmitter, so that none of the operating personnel can accidentally shift the frequency by brushing against the panel.

The law also requires each station to keep an accurate, up-to-date log of all radio communications. The log must contain the date and time of all transmissions, stations called, stations calling the licensee, location of the station, name of operator on duty, type of communications handled, and a signal strength report on all received signals. The regular ARRL log books are useful for this purpose.

The individual technician or communications officer should also sign his name in the log after the entire operating period in question has been completed and the equipment is removed to a different location, for storage or for continued communication. In addition, all log sheets must be maintained for a period of at least one year after being recorded; if the log records should be questioned by the FCC, they can be destroyed only by FCC order.

New Tubes

AS RECENT additions to the family of miniature "button-base" tubes, which now includes twenty types, RCA has announced the 6AK6, the 6AQ6 and the 6AL5.

The 6AK6 is a power-amplifier pentode of the heater-cathode type, capable of an a.f. power output of 1.1 watts. The heater operates at 6.3 volts, 0.15 ampere. Maximum plate and screen voltages are 300 and 250 volts, respectively. The rated load resistance is 10,000 ohms.

The 6AQ6 is a duo-diode and high-μ triode combination with a 6.3-volt heater operating at 0.15 ampere, designed for use as a combined detector, amplifier, and automatic volume-control tube. Its electrical characteristics are similar to those of the metal-type 6Q7 except for lower grid-cathode and plate-cathode capacitances and the lower filament current. Maximum ratings allow a plate voltage of 300 and a d.c. heater-cathode potential difference of 90 volts.

The 6AL5 is a high-purveyance dual diode of the heater-cathode type. Its low tube-drop — 10 volts at 60 ma. per plate — permits the design of high-efficiency broad-band circuits. The heater operates at 6.3 volts, 0.3 ampere. Maximum ratings are a peak inverse plate voltage of 420 and a peak current per plate of 9 ma. The d.c. heater-cathode potential is 33 volts.

All of these tubes feature miniature size without sacrifice in performance and facilitate the design of small, compact receiver units.

A Sound-Operated Relay Control

A Circuit for Remote Control of B.C. Receivers and Other Devices

BY LENORE KINGSTON CONN,* W2NAZ

The sound-operated relay described here by W2NAZ is a trick gadget for which many uses might be found around the home or ham shack. Clap your hands or whistle once and the relay circuit closes. Repeat the sound, and the relay circuit opens. As the author points out, such a device is just the thing for cutting out unwanted portions of a b.c. program — among other useful purposes.

HAVING grown weary of having to rise from the easy chair and cross the room to the b.c. set to shut off an unwelcome soap opera or headache pill announcement or an ear-splitting soprano, a sound-operated relay — lovingly referred to in this household as a "commercial-eradicator" — was developed and installed. Now, whenever peaceful silence is desired during the broadcast day, one has only to give a short, sharp whistle or a clap of the hands to shut off the radio set's loudspeaker. When the resumption of the program is desired, another whistle or clap instantly turns the speaker on again. This simple and long wished-for device was constructed with a few parts which had lain dust-covered here in the shack for the past two years.

Of course, the use of a sound-operated relay of this type is not confined to such purposes alone. It can be used to close or open any circuit when ordered to do so by some sharp sound.

An interesting feature of the relay is the method used to obtain the operate-and-release sequence as a function of successive identical sounds. That is, the first sound will operate the relay and cause it to remain closed until the next identical sound impulse causes it to release.

Operating Principle

Referring to the diagram of Fig. 1, the amplifier portion may be any standard amplifier with an output of a few watts which has sufficient gain to operate from the microphone chosen. In the model described a crystal microphone was used, but the choice of a carbon mike or even a p.m. speaker would be more desirable from the standpoint of the lower gain required.

The output of this amplifier is fed through a set of contacts on the relay to one section of a duodiode tube, such as the 6H6. The resulting rectified output is taken off the diode load resistor, R_2, and applied as positive bias to the grid of a 6C5 whose normal operating bias is such as to make the plate current about 15 ma. This current is not sufficient to operate the relay in the plate circuit. However, when the positive bias from the diode is applied to the grid the plate current increases to about 25 ma., which is sufficient to operate the relay. The plate current immediately drops to 15 ma. as soon as the sound impulse ceases, but the relay does not release because its *release* point is below 15 ma.

The relay is now in operating position and one set of contacts will have performed whatever function is assigned to it (in this case, the opening of the speaker circuit of the radio receiver). Simultaneously the other set of contacts will have switched the incoming sound input to the second section of the diode, but connected in the opposite direction, so that any subsequent sound input will result in a negative bias on the grid of the 6C5.

When the next sound impulse is received this resulting negative bias reduces the plate current of the 6C5 to about 5 ma., which is sufficient to cause the relay to release. As soon as the sound impulse ceases the plate current will again increase to its normal value of 15 ma. This, however, is not sufficient to operate the relay, so that it remains in a nonoperated position until the next sound impulse is received.

The actual values of operating and release currents required will, of course, depend on the type of relay used. In this case it is a Clarke type having a resistance of 260 ohms, with an operating point of about 22 ma. and a release point of about 8 ma. These values may not hold if a relay of different make is used, but the system itself can be adapted to make use of any relay having different

(Continued on page 59)

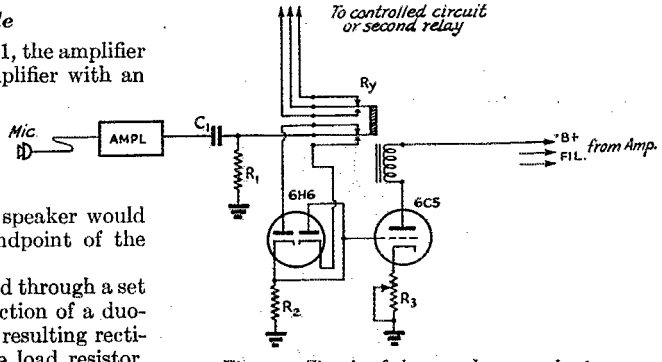


Fig. 1 — Circuit of the sound-operated relay.

C_1 — 500 $\mu\mu$fd.
R_1 — 5000 ohms.
R_2 — 100,000 ohms.
R_3 — 1000-ohm variable.
Ry — Relay (see text).

*815 Hays, Clinton, Okla.

IN THE SERVICES

A BRAND-NEW second lieutenant pilot, while visiting Hq. recently, made casual mention that he was thinking of naming his plane the "QRM," or something equally appropriate, and selecting an all-amateur crew — truly a ham Utopia!

While it might not be too easy to assemble a crew composed entirely of hams, we'd like to suggest that some enthusiastic ham member of a newly formed crew follow through on this idea and promote naming the ship, say "The Radio Ham." What better way to bring amateur radio and the people who are its pulse before the public in a favorable and indelible fashion? It's one of the "freedoms" every amateur is fighting for, so why not fight proudly and with confidence under a name that typifies a long record of ingenuity and accomplishment?

In the event this seed takes root and blossoms forth as the "handle" on, for instance, a Liberator, we'd be eager to learn the details and be kept in as close touch as permissible with its accomplishments.

ARMY—SIGNAL CORPS

1ERB, Kingsbury, Lt., foreign duty
1LNN, Sherman, Sgt., foreign duty
1MSU, Oakley, Pvt., foreign duty
1NCV, Kazanowski, Pfc., Camp Crowder, Mo.
2GBT, Sickinger, S/Sgt., foreign duty
2JFY, Cheslow, Sgt., address unknown
2JWF, Ekblad, 2nd Lt., Ft. Monmouth, N. J.
2KLQ, Marx, Pvt., Camp Crowder, Mo.
2MZX, Zimmerman, 2nd Lt., Lakeland, Fla.
2NLE, Root, Pvt., Camp Crowder, Mo.
2OA, Porter, Major, foreign duty
2OHP, Liebers, Pvt., Camp Crowder, Mo.
2OLI, Quinn, Pvt., Camp Crowder, Mo.
3ANK, Hurst, Capt., Robins Field, Ga.
3IWV, Stott, Sgt., foreign duty
ex-4BGR, Applewhite, Lt., Ft. Monmouth, N. J.
4CVQ, Jacobs, Capt., foreign duty
4GOK, Harris, 2nd Lt., Ft. Monmouth, N. J.
5GCX, Courtney, Pvt., Camp Crowder, Mo.
5GWI, Penick, S/Sgt., address unknown
5GYD, Biedenharn, 2nd Lt., Ft. Monmouth, N. J.
5HOC, Preston, 2nd Lt., Ft. Monmouth, N. J.
5IJV, Sullivan, T/5, foreign duty
5JHN, McCathran, T/3, Camp Crowder, Mo.
6HDC, Peterson, Pfc., Davis, Calif.
6NSJ, Brenessel, 2nd Lt., foreign duty
6NUZ, Ware, Pfc., Davis, Calif.
6OSS, Grillo, S/Sgt., foreign duty
6PHY, Mijares, T/Sgt., address unknown
6UTY, Cromp, T/5, Davis, Calif.
7CRE, Beasley, M/Sgt., foreign duty
7DJM, Bush, Pvt., Davis, Calif.
7HYM, Walters, T/5, foreign duty
7IQE, Hammond, Pfc., foreign duty
8NPE, Gregory, S/Sgt., foreign duty
ex-8OFQ, Raymond, Pvt., Ft. Monmouth, N. J.
8OIH, Casto, M/Sgt., foreign duty
8OPB, Moser, S/Sgt., Ft. Benjamin Harrison, Ind.
8OWW, Triplett, Sgt., address unknown
8QHG, Hall, Pvt., Camp Cooke, Calif.
8RBR, Daney, Pvt., Camp Crowder, Mo.
8UBN, Tice, Pfc., Davis, Calif.
8USL, Eyring, Pvt., Davis, Calif.
8VHF, Morin, Pfc., Camp Crowder, Mo.
8VVT, Gilmer, Pfc., Ft. Monmouth, N. J.
8WQZ, De Felice, T/Sgt., foreign duty
9DDA, Miner, Pfc., Camp Crowder, Mo.
9FNV, McManis, Pvt., Davis, Calif.
9FRV, Weishaar, Pvt., Camp Crowder, Mo.
9GAL, Edwards, Pvt., Davis, Calif.
9JGZ, Kingery, Pvt., address unknown
9JIT, Starks, Pvt., Camp San Luis Obispo, Calif.
ex-9NMG, Clarke, 2nd Lt., address unknown
9OGV, Johnson, Lt., foreign duty
9PLH, Covert, Cpl., Davis, Calif.
9RKL, Suda, S/Sgt., foreign duty
9SYR, Stout, 2nd Lt., Ft. Monmouth, N. J.
9VDI, Russell, Cpl., Camp Crowder, Mo.
9YVR, Turner, Capt., foreign duty

Operator's licence only:
Falk, Pvt., Camp Crowder, Mo.
Frank, Sgt., Davis, Calif.
Greenfield, Lt., address unknown
Lentz, Pvt., Camp Reynolds, Pa.
Madsen, Pfc., foreign duty
Moran, S/Sgt., Falls Church, Va.
Peaceman, Pfc., Ft. Monmouth, N. J.
Vaughn, Lt., address unknown
Vicich, T/4, foreign duty

NAVY—SPECIAL DUTY

ONE of the lucky hams, V. E. Westerfield, W6ARL, now an RT1c in the Navy, is getting all the radio he can handle. He tells us this weird into-the-future stuff has had him pounding his head on bulkheads and sitting up in bed screaming, but he's happy and hopes Uncle will remember his loving nephew and make him a CRT one of these days.

1JYJ, Ellis, Lt. (jg), foreign duty
1KPE, Strautman, CRT, foreign duty
1MEJ, Kimball, RT1c, Washington, D. C.
1VE, Dougherty, RT3c, Clarksville, Ark.
2BLO, Dornbusch, RT1c, Clarksville, Ark.
ex-2DYI, Kirkham, RT3c, Lyndhurst, N. J.
2IWM, Myers, CRT, Clarksville, Ark.
2JOG, Wentink, Ens., Cambridge, Mass.
3AFO, Schaffer, RT1c, Clarksville, Ark.
3ARA, Adamo, RT2c, foreign duty
3JSH, Boonin, RT3c, Clarksville, Ark.
3JVD, Momiroff, RT3c, Clarksville, Ark.
4DCY, Hinson, RT1c, Clarksville, Ark.
4GSB, LaForce, RT1c, Clarksville, Ark.
5JWY, Kattawar, RT3c, College Station, Tex.
6FHX, Hanratty, RT2c, foreign duty
6MAK, Ramsey, RT1c, foreign duty
6MFZ, Harris, RT2c, foreign duty
6PUY, Real, RT1c, foreign duty
6PZL, Field, RT1c, Terminal Island, Calif.
6SFY, Wignall, RT2c, Clarksville, Ark.
6SJQ, Lively, CRT, foreign duty
6TKM, Ramey, RT1c, foreign duty
6TWJ, Lopez, RT1c, foreign duty
7HEX, Stammerjohan, RT1c, Clarksville, Ark.
7HKR, Brusch, RT1c, foreign duty
7HXJ, Skaalheim, RT1c, Clarksville, Ark.

These hams stationed in Persia got together to have their picture taken for *QST* to inform the gang as to their whereabouts and, they add, "maybe effect more activity at mail call." (Address correspondence to ARRL Hq. for forwarding. — *Ed.*) Represented by the group are three branches of the services. *Left to right:* Capt. C. A. Koppe, W8CHO, AAF; Lt. (jg) E. C. Pauly, W6SAN, USMS; Lt. M. L. Settles, W9TXV, ASC; S/Sgt. F. W. Bove, W8SUF, AAF; S/Sgt. F. A. Petrucci, W2LFI, ASC; Sgt. J. L. Gillson, W3GAU, AAF; Sgt. W. Welsh, W8CLA, AAF.

7IRC, Deppe, RT2c, Clarksville, Ark.
8IQS, Pollauf, RT1c, Clarksville, Ark.
8OH, Weisburg, RT2c, Clarksville, Ark.
8RTV, Fantaski, RT2c, Clarksville, Ark.
8VAD, Vignos, RT2c, address unknown
8VRJ, Mills, RT1c, address unknown
8WHP, LeMasters, RT3c, address unknown
ex-9EOV, Hawley, RT1c, Clarksville, Ark.
9HJI, Carpenter, RT1c, Clarksville, Ark.
9KEN, Doggett, RT2c, Treasure Island, Calif.
9LCE, Davidson, RT2c, Treasure Island, Calif.
9MBK, Callahan, CRT, foreign duty
9VGO, Kantor, RT3c, Stillwater, Okla.
9WQZ, Killman, RT1c, Clarksville, Ark.

Operator's license only:

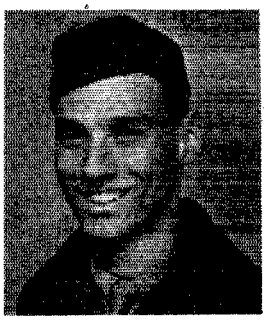
Sievers, RT1c, Virginia Beach, Va.
Smith, RT2c, Treasure Island, Calif.
Swedblom, RT3c, foreign duty
Weems, RT1c, foreign duty

ARMY—AIR FORCES

1BGJ, Fichthorn, Pvt., Rome Field, N. Y.
1LSB, Friberg, Pfc., Rome Field, N. Y.
1NMT, Bright, Pvt., Godman Field, Ky.
2CLZ, Balaker, S/Sgt., Napier Field, Ala.
2FQR, Umina, Cpl., Scott Field, Ill.
2IOZ, Donadt, Pvt., Camp Luna, N. Mex.
2LEU, Kollmar, Pfc., foreign duty
2LJI, Kosinski, S/Sgt., foreign duty
2NJG, Nelson, Cpl., Langley Field, Va.
2NOU, Hargesheimer, Capt., Salina, Kans.
2OBQ, Levine, Pvt., Robins Field, Ga.
2OIX, Schofield, T/Sgt., Rome Field, N. Y.
3BT, Winbigler, A/C, New Haven, Conn.
3EHA, Jones, Lt., Boca Raton Field, Fla.
3GXX, Manious, A/C, Maxwell Field, Ala.
3HBJ, Brown, Cpl., address unknown
3HJT, McAfee, Cpl., Langley Field, Va.
K4HLF, Lingard, Lt. Col., foreign duty
5GIC, Goin, Sgt., foreign duty
5GKI, Cunningham, Lt., Drew Field, Fla.
5HUU, Wilson, Capt., San Angelo Field, Tex.
ex-5IQM, Shelton, Lt., foreign duty
5JIQ, Neathery, Cpl., Frederick Field, Okla.
5KIN, Vincent, Cpl., foreign duty
6BWS, Striplin, Capt., Harvard, Neb.
ex-6CDX, Hiett, Sgt., foreign duty
6DRC, Hoffman, Major, foreign duty
6KIK, Wilson, Major, Boca Raton Field, Fla.
6MWM, Coomes, S/Sgt., foreign duty
6NFH, Morrison, Pvt., Fresno, Calif.
6NFO, Tresisze, S/Sgt., foreign duty
6NHN, McGary, 2nd Lt., address unknown
6OLV, Fischer, Cpl., Reno, Nev.
6OWM, Stockel, Cpl., Mather Field, Calif.
6TBQ, Rich, Sgt., Lawson Field, Ga.
7ANX, Decker, Lt., Spring Lake, N. J.
7EDB, Dayton, T/Sgt., Winter Haven, Fla.
7IYP, Parker, Pecos, Tex.
8IIA, Lewis, M/Sgt., Topeka Field, Kans.
8LEH, Allgower, S/Sgt., foreign duty
8PDQ, Stefanik, Lt., Long Island City, N. Y.
8SDF, Zimmer, S/Sgt., Wilmington, Del.
8TEM, Jawniak, S/Sgt., Walnut Ridge Field, Ark.
8THI, Kulpa, T/Sgt., Miami, Fla.
8VYT, Jenczewski, A/C, New Haven, Conn.
9BAQ, Chandler, Pvt., Truax Field, Wis.
9DKX, Shriver, Cpl., Boca Raton Field, Fla.
9GUW, Harrison, Pvt., Sheppard Field, Tex.
9HGA, Schwartz, S/Sgt., foreign duty
9JKH, LaPointe, Pvt., Amarillo Field, Tex.
9MUF, Hagen, Pfc., Sheppard Field, Tex.
9OII, Mason, Pvt., foreign duty
9WNZ, Magdziarz, A/C, Independence Field, Kansas
9ZQI, Graver, Pvt., Asheville, N. C.

Operator's license only:

Brown, Cpl., Spokane Field, Washington
Engel, Cpl., Crestline, Calif.
Kamitian, Pvt., Sioux Falls, S. D.
Maffuci, Pfc., Abilene, Tex.
Mahler, 2nd Lt., foreign duty
Mitchell, Sgt., Lake Charles, La.
Newell, A/C, Carlstrom Field, Fla.
Palmer, Sgt., foreign duty
Robinson, Sgt., Topeka, Kansas
Samaras, Sgt., Robins Field, Ga.
See, S/Sgt., Lincoln, Neb.
Smith, R., Pvt., Beaumont, Tex.
Smith, S., Pvt., Bergstrom Field, Tex.
Spellman, Pfc., Sioux Falls, S. D.
Still, Sgt., Lawson Field, Ga.
Tatum, Pfc., Scott Field, Ill.



Taking the laurels for being the first U. S. amateur we've heard from after he took part in the invasion of France is Cpl. E. C. Talley, W4IDI. This 19-year-old Signal Corpsman was a radio operator aboard the flagship carrying Gen. Omar N. Bradley himself when the general led the big parade across the Channel on "D-Day."

NAVY—AERONAUTICS

LT. (jg) E. J. Collins, W4MS, now stationed at Philadelphia, Pa., sends in the following little parody which was evolved at the Technical Training Center, Ward Island, Texas. Tune: "Mairzy Doats."

A.c. volts and d.c. volts—
Little amps will thrill you.
"B" plus will kill you, too!

3ABZ, Angeny, ACRM, Ft. Lauderdale, Fla.
3BRS, Campbell, ART1c, foreign duty
3JAF, Unger, ART3c, Corpus Christi, Tex.
4HPJ, Kennedy, ART1c, Clinton, Okla.
ex-5AYW, Smith, ARM2c, Alameda, Calif.
5CLR, Taylor, WRE, foreign duty
ex-6DSO, George, ART1c, foreign duty
7IYD, Albiston, ARM3c, Miami, Fla.
8RQN, Borgeson, ART3c, Corpus Christi, Tex.
8SIS, Galgan, ART2c, San Diego, Calif.
8TJI, Smith, ART1c, Whiting Field, Fla.
8TVD, Henry, ACRT, foreign duty
8UXU, Czaplak, ART3c, Corpus Christi, Tex.
8VTE, Carretta, ART3c, Corpus Christi, Tex.
9LVW, Strecker, ACRM, foreign duty
9MNG, Snider, ARM1c, foreign duty
9QWB, Shonerock, ART3c, Corpus Christi, Tex.
9RPA, Boniger, ARM3c, Atlanta, Ga.

ARMY—GENERAL

1DKF, On, T/4, New London, Conn.
2KGN, Owens, Pvt., Camp Upton, N. Y.
2NUL, Nordblom, Capt., foreign duty
3HIB, Fronczak, Pvt., Camp Hood, Tex.
3HIE, Winter, Pvt., foreign duty
4FBU, Carter, T/4, Norfolk, Va.
4FGO, Fernandez, Sgt., foreign duty
4GAJ, Holland, Sgt., foreign duty
5AKZ, Porter, Lt. Col., foreign duty
ex-5GOY, Fernald, Sgt., foreign duty,
5JAR, Hicks, Pfc., Ft. Huachuca, Ariz.
6ILQ, Moser, T/3, foreign duty
6SES, Burns, T/Sgt., Ft. MacArthur, Calif.

Though we've been publishing the names of hams in "Navy-Aeronautics" for some months now, the first OM to personalize our listing is ACRM H. C. Oefinger, W1GUP, who is stationed at Municipal Field, Spartanburg, S. C. It may look like a soft job, but 1GUP is in charge of the entire crew of radiomen at the station — enough said.

6TGH, Amendt, Pvt., Ft. Riley, Kansas
6TPF, Martin, Pfc., foreign duty
6TPQ, Burns, Pvt., Camp Shelby, Miss.
6ULV, Woffinden, Sgt., foreign duty
K7GVG, Reichlein, S/Sgt., foreign duty
8DNO, Weidenhamer, Cpl., Ft. Sill, Okla.
8KYK, Girt, Cpl., addess unknown
8MND, Lemley, T/Sgt., address unknown
8MZP, Larrick, Lt., Hines, Illinois
8QA, Leist, Lt., address unknown
8SWG, Bauernfeind, Pvt., Jefferson Barracks, Mo.
8VDQ, Hayes, Pfc., address unknown
8VTN, Kelley, Pvt., Camp Gruber, Okla.
8WES, Pecnik, Sgt., foreign duty
8WTO, Eisenberg, Pvt., Camp Croft, S. C.
9BIX, Jackson, Pfc., Ft. Snelling, Minn.
9CKY, Shank, Capt., foreign duty
9GDL, Miller, T/4, Camp Campbell, Ky.
9GTY, Kilby, Pvt., foreign duty
9KMK, Swift, Maj., foreign duty
9PYA, Lynn, M/Sgt., Washington, D. C.
ex-9TJS, King, T/4, foreign duty
9TKR, Stover, Pvt., Camp Beak, Calif.
9WPR, Mohar, Cpl., foreign duty

Operator's license only:

Baker, Pfc., foreign duty
Byrer, Sgt., address unknown
Cohn, T/4, foreign duty
Davids, T/5, Ft. Totten, N. Y.
Dorsch, Pvt., Camp Shelby, Miss.
Foradas, Cpl., address unknown
Grover, Cpl., Norfolk, Va.
Kelley, foreign duty
McClendon, Lt., Ft. Sill, Okla.
Pettengill, Pvt., Camp Blanding, Fla.
Queen, Pvt., Washington, D. C.
Sperry, Capt., Washington, D. C.
Welsch, T/4, Ft. Benning, Ga.

MERCHANT MARINE AND MARITIME SERVICE

1JNM, Ryder; 1KAY, Gleszer; 1NAE, Watts; 1NRR, Allen; 2DSH, Gatley; 2ETP, Ruston; 2MHW, Eidel; 2NUF, Seaman; 3AG, Hunton; 3IHX, Plimpton; 3JAG, Williams; 3JJD, Miller; 3NE, Jones; 4CJW, Caine; 4FIK, Talbot; 5KJS, Makins; 6MHK, Richards; 6QLL, Vaus; 6SFW, Sadler; 7CRJ, Huber; 8EPQ, Krute; 8LRV, Buntain; 8SVC, Kenyon; 8UTQ, Rydzewski; 8VMM, Bond; 8VWN, Stevens; 9AFB Boddie; 9AHJ, Turrell; 9FUZ, Brattland; 9HSI, Sieverin; 9PGW, Carlson; 9SLV, Schoene; 9UAD, Robinson; and 9WHF, Sommerville. Cook, Crosby, Gaiser, Hatzell, Kaufman, Whittaker, Wong, and Yaskell hold operator's license only.

NAVY—GENERAL

ex-1BVN, Urlwin, S1c, Great Lakes, Ill.
1ECG, McGinn, CRE, foreign duty
1GPZ, Burchell, S1c, Michigan City, Ind.
1IPU, Drew, RM1c, Clarksville, Ark.
1JHV, Leonard, Lt., foreign duty
1MNQ, De Kay, Bainbridge, Md.
1NAA, Taft, RM3c, Clarksville, Ark.
1NPQ, Connolly, A/S, Worcester, Mass.
2BEG, Fuld, Lt. Comdr., foreign duty
2MFI, Schmitt, S2c, Bainbridge, Md.
2MNI, Finkler, S1c, Clarksville, Ark.
2OAF, Nocks, A/S, Sampson, N. Y.
2OJL, Compton, RM2c, Clarksville, Ark.
3CTS, Farlow, RM2c, Bainbridge, Md.
3DVZ, Fischer, Ens., foreign duty
3GIX, Steigleman, RM3c, Bainbridge, Md.
3HSZ, Ritter, RM1c, foreign duty
3IUM, Homer, RM2c, Bainbridge, Md.
3JAW, Carel, S1c, Great Lakes, Ill.
3JCH, Sherman, S1c, Clarksville, Ark.
3JQH, Kelley, A/S, Great Lakes, Ill.
ex-4EQ, Davenport, RMlc, Clarksville, Ark.
4ERB, Rish, SK3c, Portsmouth, Va.

4GMU, Sanders, RM3c, Bainbridge, Md.
4GOM, Merrit, Bainbridge, Md.
ex-4GPC, Jackson, RM1c, foreign duty
4IGV, Dickinson, A/S, Camp Peary, Va.
5ABN, Jennings, Lt. (jg), foreign duty
5BZY, Withrow, Lt., foreign duty
5CCl, Butler, S2c, Great Lakes, Ill.
5ELY, Treece, CRM, Miami, Fla.
5EWT, Summers, Sp.(M)1c, foreign duty
5FLM, Vicknair, RM1c, Clarksville Ark.
5HQV, Sasser, RM2c, Los Angeles, Calif.
5IVZ, Dart, Ens., foreign duty
5KRL, Hewlett, S2c, Los Angeles, Calif.
6AXV, Blackford, Ens., Denver, Colo.
6IDR, Vyne, S1c, Great Lakes, Ill.
6NRZ, Manhart, Lt., foreign duty
6NSR, Metzgar, S1c, Great Lakes, Ill.
6NSX, Haupt, Lt., Philadelphia, Pa.
6OFU, Sampson, S1c, Great Lakes, Ill.
6PCG, Blancher, S1c, Great Lakes, Ill.
6SYX, Park, S1c, Great Lakes, Ill.
6TBT, Taylor, S1c, Great Lakes, Ill.
7EUY, Johnson, S2c, Los Angles, Calif.
7EVL, Mehner, S1c, Great Lakes, Ill.
7GKN, Scully, RM2c, foreign duty
7HRD, Lidstrom, S1c, Great Lakes, Ill.
7HYL, Scheider, Indianapolis, Ind.
8BON, Brigham, S1c, Great Lakes, Ill.
8CYH, Roberts, CRM, San Francisco, Calif.
8DNC, Riegler, RM2c, address unknown
8HDT, Walsh, EM3c, San Pedro, Calif.
8INU, Long, RM2c, address unknown
ex-8KTZ, Triman, S1c, Clarksville, Ark.
8LXJ, Hostetler, S1c, Great Lakes, Ill.
8LZO, Hall, Lt. (jg), Mare Island, Calif.
8MBP, Klass, AM3c, foreign duty
8MOA, Kantor, RM1c, address unknown
8MRL, Branch, S1c, Great Lakes, Ill.
8NDH, Walkuski, RM2c, Baltimore, Md.
8OEF, Benskin, Ens., address unknown
8QFZ, Brown, RE, address unknown
8SHL, Jarrett, RM3c, Bainbridge, Md.
8SWB, Emms, RM2c, Clarksville, Ark.
8TFP, Brown, Ens., foreign duty
8TIH, Anderson, EM3c, foreign duty
8UYL, Volzer, S1c, address unknown
8VEK, Whipple, S1c, Great Lakes, Ill.
9ABP, Frank, RM3c, College Station, Tex.
9CSV, Cook, S1c, Great Lakes, Ill.
ex-9GZM, Couch, RM2c, Bainbridge, Md.
9HTZ, Kirby, address unknown
9ILF, Lile, RM1c, Clarksville, Ark.
9KBZ, Murray, RM2c, Clarksville, Ark.
9KKF, Kenneth, MoMM1c, Clarksville, Ark.
9NNO, Nelson, W/O, foreign duty
9NYX, Helm, CRT, foreign duty
9RPG, Hakeman, S2c, Farragut, Idaho
9RQE, Carceis, Lt., foreign duty
9SIA, Meyer, S1c, Great Lakes, Ill.
9URA, Marian, S1c, Great Lakes, Ill.
9VBE, Cook, EM2c, foreign duty
9WIL, Galey, S1c, Clarksville, Ark.

Operator's license only:

Bonner, S2c, Sioux City, Ia.
Coppolelli, A/S, Sampson, N. Y.
Dobbs, Durham, N. C.
Drenning, RM3c, foreign duty
Hill, A/S, Fulton, Mo.
Houseal, RM1c, foreign duty
King, A/S, Chattanooga, Tenn.
Kreuter, RM2c, Jupiter, Fla.
Menefee, RE, Portsmouth, Va.

Prince, S1c, Great Lakes, Ill.
Rains, Lt. (jg), foreign duty
Reggia, RM1c, Clarksville, Ark.
Selkirk, S1c, Clarksville, Ark.
Thompson, Treasure Island, Calif.
Winder, S1c, Great Lakes, Ill.
Wood, S2c, Clarksville, Ark.

CIVIL SERVICE

A CIVIL SERVICE radio technician, L. J. Foley, W7HQT, says that in order to keep things going he has made parts and robbed all the old receivers from Washington to Minnesota. He now has eighteen pets all going strong, their parts manufactured out of everything from stove elements to Ford coils. FB!

1DJC, Edwards, OWI, foreign duty
1IJN, Jackson, SC, insp., Cambridge, Mass.
2DME, Peterson, SC, radio engineer, Ft. Monmouth, N. J.
2DXR, Boise, SC, radio technologist, Philadelphia, Pa.
2ISL, Porterfield, SC, engr., New York, N. Y.
2KSP, Abrams, SC, radio engineer, Washington, D. C.
2MRV, Elrod, OWI, foreign duty

Col. William P. Clarke, W5DZ is now communications officer for the AAF at Randolph Field, Texas. An amateur since 1920, Colonel Clarke worked for the Southwestern Bell Telephone Company before being called to active duty as a reserve officer in February, 1941.

3ALF, Johnson, SC, instructor, Camp Holabird, Md.
3ART, Akins, OWI, foreign duty
3FOS, Saeger, BuAero, inspector, Hollywood, Calif.
3IKB, Kanuck, SC, insp., Philadelphia, Pa.
3GGT, Goodman, Air Service Command, Middletown, Pa.
4GRT, Fariss, SC, radio mech., Atlanta, Ga.
ex-5ABM, Coates, AAF, inspector, Oklahoma City, Okla.
5GEX, Washburn, FCC, Grand Is., Nebr.
5JGY, MacDowell, CAA, inspector, Ft. Worth, Tex.
6AYL, Hansen, Air Service Command, radio engineer, San Francisco, Calif.
6BEZ, Wagener, Navy Dept., Terminal Island, Calif.

Pvt. O. N. Lassiter, a potential fourth-district ham; Pfc. J. E. Cann, W3IEM, and Cpl. E. A. Parker, W2LDV, are here seen checking up on the autographs they have collected in a copy of a 1941 edition of the *Radio Amateur Call Book*. They were at the AACS Radio Operators School, Truax Field, Madison, Wis., at the time of this rag-chew.

K6BS, Freeman, Navy Dept., Terminal Island, Calif.
6DTD, LaGasse, Navy Dept., Terminal Island, Calif.
6EON, Hampton, Navy Dept., Terminal Island, Calif.
6JMI, Haggerty, Navy Dept., Terminal Island, Calif.
6KW, Griggs, Navy Dept., Terminal Island Calif.
6MKC, Schapiro, Navy Dept., Terminal Island, Calif.
6NGZ, Dodge, Navy Dept., Terminal Island, Calif.
6SIY, Schneider, Navy Dept., Terminal Island, Calif.
6SPZ, Phipps, Navy Dept., Terminal Island, Calif.
6TS, Willis, Navy Dept., Terminal Island, Calif.
6UGZ, Beauchamp, Navy Dept., Terminal Island, Calif.
7AOY, Bloss, Navy Dept., radio inspector, Portland, Ore.
7BDN, Esselstyn, AAF, radio mechanic, Pendleton, Ore.
7CXI, Killian, CAA, foreign duty
7DNB, Sterett, Portland, Oregon
7FIS, Weeks, CAA, aircraft communicator, Coeur d'Alene, Idaho
7FWB, Smith, Engr., Quonset Pt., R.I.
7HVM, Guichard, CAA, Ellensburg, Washington
8DJI, King, Wright Field, Ohio
8FYI, Sheridian, Navy Dept., Terminal Island, Calif.
8STW, Johnston, SC, radio engineer, Wright Field, Ohio
9BNU, Hoops, CAA, radio electrician, foreign duty
9BVN, McAllister, FCC, monitoring officer
ex-9CAE, Maynard, Navy Dept., Terminal Island, Calif.
9FEB, Woods, St. Louis, Mo.
9GOZ, Bates, SC, Independence Field, Kans.
9JAV, Nelson, aircraft communicator, foreign duty
9MIK, Schuman, SC, inspector, Chicago, Ill.
9VSU, Dervishian, Navy Dept., inspector, Chicago, Ill.

Operator's license only:

Thompson, BuStands, Washington, D. C.
Todd, CAA, radio electrician, foreign duty
Walton, NRL, Washington, D. C.
Wilson, AAF, instructor, Sioux Falls, S. D.
Young, SC, radio mechanic, Belmar, N. J.

100 PER CENT WAR WORK—INDUSTRY

AGAIN this month we're listing more amateurs whose contribution in the war effort bring them under the general heading of 100 per cent war radio industry. Though they range from the OMs in the research labs to the manufacturers, each is an important cog in the wheels of progress and we're mighty proud to establish them in our roster.

We hasten to say that, while there almost certainly will be some names incorrectly included on the various lists, at the time the record was compiled all were employed as indicated.

National Company

1AGE, Silbert, Melrose, Mass.
1ATD, Gagnebin, Malden, Mass.
1AUJ, Leonard, Malden, Mass.
1BAQ, Bradley, Melrose, Mass.
1BHW, Ciarlone, Malden, Mass.
1BZR, Bacon, Malden, Mass.
1CDJ, Casey, Melrose, Mass.
1CJ, Dennis, Malden, Mass.
1CTW, Hadlock, Malden, Mass.

Working at radio repair and maintenance for the Signal Corps, Cpl. W. C. Hieber, jr., W9PGB, has acquired plenty of ideas he wants to put to work after the war. Though stationed in the tropics, he isn't getting much of a tan since he spends much of his free time on his second hobby — photography.

1DCU, Hagood, Malden, Mass.
1DKM, Poore, Melrose, Mass.
1DRO, Card, Malden, Mass.
1DXD, Simms, Malden, Mass.
1EU, Bartlett, Melrose, Mass.
1EXR, Osborne, Melrose, Mass.
1EYZ, Ringland, Melrose, Mass.
1FRZ, Hinds, Malden, Mass.
1FSN, Murray, Malden, Mass.
1GNV, Mitchener, Malden, Mass.
1HOH, Smith, Malden, Mass.
1HRK, Baxter, Malden, Mass.
1HRW, Messina, Melrose, Mass.
1HSV, Ivers, Malden, Mass.
1HYE, Connors, Melrose, Mass.
1JDG, Jacobson, Malden, Mass.
1JHI, Rossi, Malden, Mass.
1JMK, Zerega, Melrose, Mass.
1JOX, Williams, Melrose, Mass.
1KPB, Lopez, Malden, Mass.
1KWU, Gould, Malden, Mass.
1LEN, Gentry, Malden, Mass.
1LFF, Stanley, Melrose, Mass.
1LNV, Waden, Malden, Mass.
1MFZ, Thurston, Malden, Mass.
1MTO, Ogden, Melrose, Mass.
1MTS, Penny, Melrose, Mass.
1MXC, Poulin, Melrose, Mass.
1NFZ, Hall, Melrose, Mass.
1NMG, Burwin, Melrose, Mass.
1NSQ, Margi, Malden, Mass.
1RX, Bateman, Malden, Mass.
1TV, Doyle, Melrose, Mass.
2DKJ, Lynch, Malden, Mass.
5CI, Patterson, Malden, Mass.
5JVI, Tillotson, Melrose, Mass.
6QD, Becker, Malden, Mass.
8WVM, Harris, Melrose, Mass.

Operator's license only:
Prusak, Malden, Mass.

Submarine Signal Company

1CIC, Frank, Boston, Mass.
ex-1DGH, Poor, Boston, Mass.
1HDQ, Tilton, Boston, Mass.
1JIT, Richardson, Boston, Mass.
1TA, Gallagher, New York, N. Y.
2CVJ, Hart, Boston, Mass.
4HKP, Miller, Boston, Mass.
6OVK, Brannin, Boston, Mass.

Operator's license only:
Stevens, Boston, Mass.

Mass. Inst. of Technology

1AAA, Bosma, Cambridge, Mass.
1ALP, Baker, Cambridge, Mass.
1BNU, Jackson, Cambridge, Mass.
1DID, Zink, Cambridge, Mass.
1HCR, Jelatis, Cambridge, Mass.
1IVU, Perkins, Cambridge, Mass.
1JOJ, Baker, Cambridge, Mass.
1LIP, Blaney, Cambridge, Mass.
1NTS, Shepherd, Cambridge, Mass.
1NVI, Miller, Cambridge, Mass.
1ZI, Fahnestock, Cambridge, Mass.
3EDA, Doremus, Cambridge, Mass.
3ILR, Thomas, Cambridge, Mass.
5FJE, Senter, Cambridge, Mass.
5GWZ, Nicolas, Cambridge, Mass.
6CBK, Curran, Cambridge, Mass.
6CJ, Lindgren, Cambridge, Mass.
ex-6NRR, Graham, Cambridge, Mass.
6OE, Johnson, Cambridge, Mass.
ex-8CNC, Magee, Cambridge, Mass.
ex-8FJ, McConnell, Cambridge, Mass.

Operator's license only:
Logan, Cambridge, Mass.
Spirer, Cambridge, Mass.

Bendix Aviation

2CSM, Ozsvath, plant chief inspector
4HEP, Morris, aligner
ex-6AXO, Stanley, foreman, radio inspection dept.
6CHY, Baker, dept. foreman
ex-6CKR, Gardiner, production tech.
6GTD, Harding, radio inspection tester
6IQE, Evans, radio engineer
ex-6JN, Livesay, foreman, radio rework
6JWY, Jayne, radio inspection tester
6KTH, Lindquist, chief, radio testing
6LFN, Wippert, radio engineer
6MMX, Oppelt
6MZB, Leitch, instructor U of C & projet radio engineer
6NLI, Taylor, radio engineer
6NYU, Lovelace, radio lab. mechanic
6OCO, Shaug, radio lab. mechanic
6QVN, Krulish, process engineer
6RIP, McMann, wireman
6RLL, Tomasevich, radio developing eng. tech.
6RMZ, McHolland, radio standards engineer
6RSV, Rohland, radio engineer
6RXE, Martin, production elec. tester
6SRJ, McCoy, radio engineer
6SSK, Wilcox, production tester
6SVG, Barwick, supervisor
6TCH, McVay, radio inspector
6TYE, Siltamaki, radio engineer
6UIW, Lambert, radio tester
6UQX, Trenary, production tester
8CDC, Kilpatrick, elec. engineer

Operator's license only:
King, lab. mechanic

Brewster Aircraft Plant

2KKE, Kaye, engineering dept.
2KUB, Kramer, project engineer
2MNK, Engle, engineering dept.
3AFA, Albright, foreman, elect. & radio dept.
3AFJ, Rubincam, maintenance
3AGJ, Molinara, radio mechanic
3CFJ, Floyd, armament dept.
3CQV, Bowers, inspection dept.
3FWL, Irwin, inspection dept.
3GDP, Street, inspection dept.
3GKR, Herbatt, radio mechanic
3IFC, Cooper, inspection
3IMA, Worman, tower operator
3IOU, Yates, inspection dept.

Farnsworth Radio Corp.

3HKT, Hackles, Marion, Ind.
8UIW, Wright, Marion, Ind.
9AIY, Hilligoss, Marion, Ind.
9CIP, Lines, Marion, Ind.
9EOY, Wyman, Marion, Ind.
9GBI, Delfenbaugh, Marion, Ind.
9GZE, Johnson, Marion, Ind.
9HZB, Minnear, Marion, Ind.
9LHR, Vance, Marion, Ind.
9MXV, Whitcomb, Marion, Ind.
9OIY, Wiegel, Marion, Ind.
9OYD, Minch, Marion, Ind.
9PKK, Underhill, Marion, Ind.
9UKI, Conkwright, Ft. Wayne, Ind.

HAM HOSPITALITY

THREE points of the British Empire are represented below this month, though there's a long hop between them, and we extend our sincerest thanks to the individuals who have advised us that there is a most hearty welcome awaiting any "W" boys who find themselves in G, ZS, or VK land.

Heading off our welcome roster is LAC/Elec. G. J. Smith of the RAF. He says he has not met any American hams as yet, but would be pleased to hear from any who are in England. They will always be welcome at 22 Drummond Drive, Stanmore, Middlesex.

According to a letter from Roy P. Jonasson, VK3ND, he hasn't met any hams from the United States, either. Mr. Jonasson informs us that he would be glad to meet any American amateurs who chance to be in his vicinity. He can be reached in care of the State Electricity Commission and his QTH, Farnsworth Street, Castlemaine, Victoria, Australia.

Lastly, a change of address for the Radio Amateurs Society (S.A.). L. W. Ensor, ZS6BJ, Honorary Secretary of the Society, has asked that we publish the address of their new Hq.: 107 Grand National Buildings, Rissik Street, Johannesburg, Union of South Africa.

With the thermometer continuing to climb here in West Hartford, we're rather envying CRM T. S. Lym's present duty 'way up in the Far North. W7HGA is a member of ARRL and his home state is Oregon.

A "Hand-Screening" Process for Amateur Instrument-Panel Lettering

A Simplified Ham-Brew Method for Labeling Controls Based on the Commercial Silk-Screen Process

BY NORMAN J. FOOT,* W9GQP

To the casual observer, one of the principal differences between the appearance of good home-made amateur gear and of commercially built apparatus lies in the lettering of identifying labels for controls on the panel. As a result, amateurs who take pride in their equipment have tried many methods in the attempt to give their hand-made transmitters and receivers the appearance of factory-built gear.

In the past it was not unusual for an ambitious ham to send bakelite or hard-rubber panels to a professional engraver for proper marking. This was both expensive and time-consuming. At one time it was possible to secure small decalcomania transfers to be used on such panels, and metal nameplates are still available at most radio dealers. While useful in many instances, such methods lack flexibility and often necessitate compromises.

The desirability of a suitable process for panel lettering is self-evident. In addition to the improved appearance which results from a professional looking job, the proper identification of controls is a great convenience.

Silk-Screen Stenciling

Modern factory-built equipment is usually mounted in crystalline- or wrinkle-finished metal cabinets, with the lettering applied by a stenciling process using a photographically prepared silk screen. Heretofore there has been no way in which the amateur really could duplicate the panel lettering used on this type of apparatus. By the method to be described, however, results may be obtained which are practically identical with those to be had by the commercial process.

The materials and equipment necessary for "hand-screening" are:

1) Sponge rubber stamp pads.
2) Printer's ink of desired color (usually white).
3) Cellotype (1089K) mimeograph stencil sheets.
4) LeRoy lettering set with a special stenciling tool or a typewriter.

The stamp pads are made in various convenient sizes and consist of a small block of wood with a strip of sponge rubber $\frac{3}{16}$ inch thick fastened to the bottom with rubber cement. For ordinary requirements in identification of controls three pads will usually be sufficient; the $\frac{1}{2} \times \frac{1}{2}$-inch, $\frac{1}{2} \times$ 1-inch and $\frac{1}{2} \times 1\frac{1}{2}$-inch sizes. For multiple-line stamping any of these stamps could be made either $\frac{3}{4}$- or 1-inch wide, depending upon the height of the letters.

The mimeograph stencils used for this purpose are postcard size. Stencils can be secured direct from the A. B. Dick Co., Chicago, if they are not available locally.

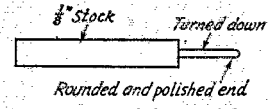


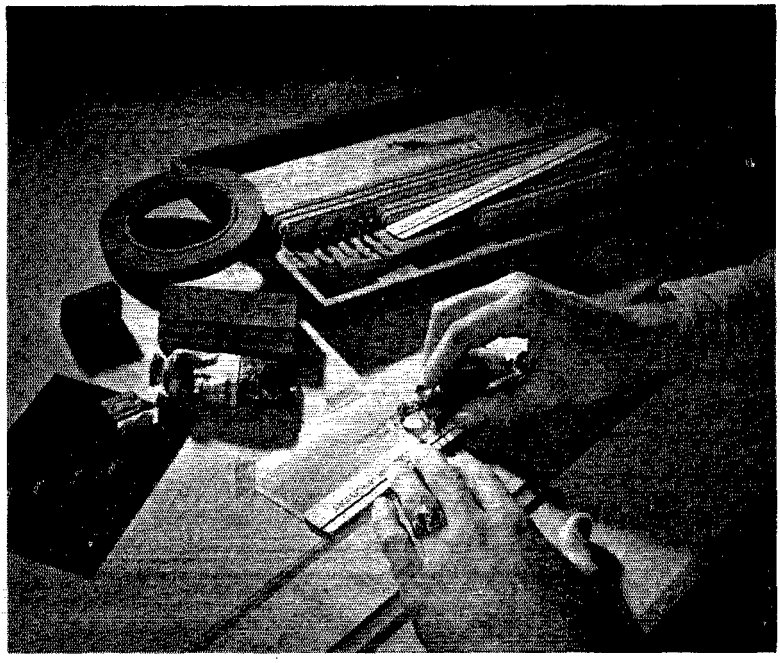
Fig. 1 — Construction of the special stencil tool.

Cutting the Stencil

In order to produce a really professional-looking job it is essential that the stencil be cut accurately. A LeRoy lettering set is ideal for this purpose, the only change necessary being the substitution of a special stencil tool for the usual inking pen. This special tool can be turned from a piece of $\frac{1}{8}$-inch brass rod, as shown in Fig. 1, or it can be filed to shape by hand if no lathe is available. The ball point of the tool should be polished, to prevent tearing the stencil.

At the left above is shown a sample of amateur panel lettering done by the process described in the text and beside it ,for comparison, a lettering job done by the commercial silk-screen lettering process.

*Engineering Department, The Hallicrafters Co., Chicago, Ill.



Illustrating how the LeRoy lettering set is used with a special stencil tool to cut the stenographic stencil which serves as an ink screen. A typewriter may be used for the purpose, if desired.

In the absence of a LeRoy lettering set any other form of lettering guide may be used. Alternatively, the stencil may be cut on a typewriter if one is available with a suitable type face. A machine with an "all-caps" keyboard, such as those used in Western Union offices and commercial radio stations, will make good-looking labels. It must be borne in mind that the finished job can be only as good as the stencil from which it is printed.

Having secured the needed materials, proceed as follows:

1) Using the lettering guide or whatever other means is available, cut the desired wording on the stencil. Make sure that the stencil is cut deeply enough so that light shows through clearly when it is held up to the window or a lamp.

2) Cut out the piece of the stencil to be used, making it slightly larger than the stamp pad so that its edges will overlap the edges of the pad and thus prevent smearing.

3) Spread a generous layer of ink over the rubber stamp pad.

4) Place the stencil *upside-down* on the pad and press it down firmly.

5) Try the stamp several times on a test panel until the ink flows freely and good results are obtained.

6) Mark the panel to be screened with guide lines or provide some other means to ensure putting the lettering on straight. If several similar panels are to be screened at the same time, it will probably save time and assure more accurate work if a suitable jig is set up to ensure proper positioning of the stamp.

7) Apply the stamp carefully to the panel. If the appearance of the lettering is not satisfactory the first time, wash it off at once with carbon tetrachloride or thinner. Allow the panel to dry, and then try again.

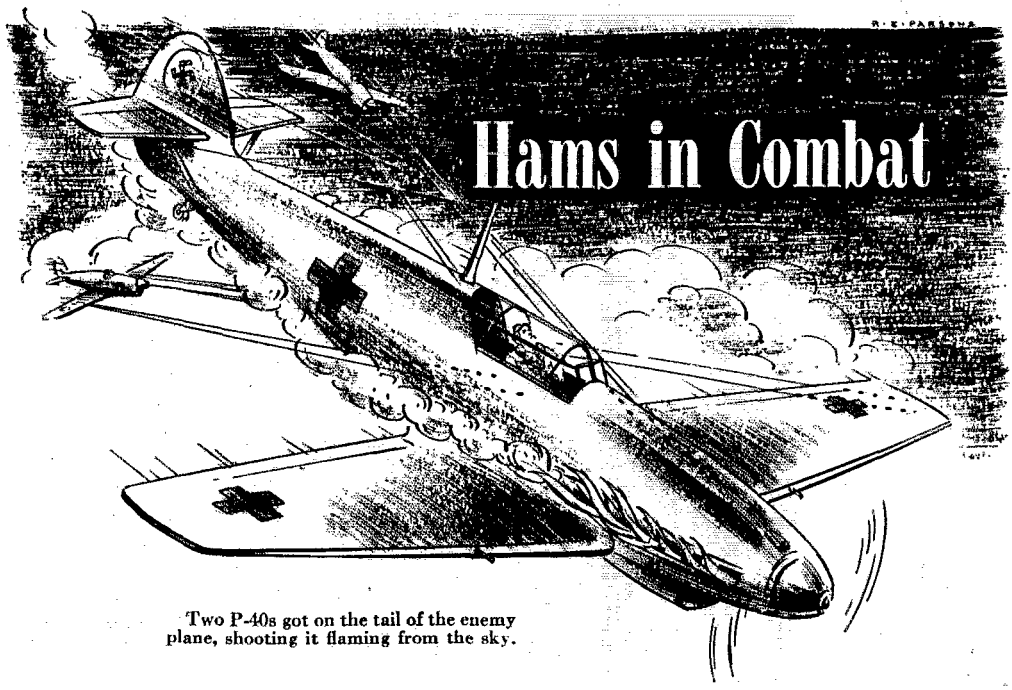
8) After the panel has been screened it is advisable to cover each block of lettering with clear shellac, using a fine camel's-hair brush. If a small spray gun is available, spray clear lacquer over the lettering. Do not attempt to apply the lacquer with a brush, however, as the ink will smear. This will serve to shorten the drying time required from a period of several hours to ten minutes or less.

Results

If the stencil is accurately cut and the process of screening done carefully, the results obtained by this method will be indistinguishable from those of the commercial process, and the professional appearance and added convenience will be well worth while to any amateur who takes pride in the appearance of his station. This method of hand-screening can be used for small production runs of laboratory equipment, etc., as well as for amateur purposes. The stencil should last for at least 200 stampings before wearing out.

The problem of lettering labels on panels — that finishing touch which often spells the difference in appearance between home-made and "boughten" gear — has always been a headache to the amateur constructor. The author shows how this problem can be licked by applying a simplified "stamp-pad" version of the professional silk-screen process used for this purpose by leading manufacturers of radio equipment.

Hams in Combat



Two P-40s got on the tail of the enemy plane, shooting it flaming from the sky.

Radioman-Gunner in a B-25

BY T/SGT. CHARLES W. TINSLEY,* W8HGC

PROBABLY the first time I became conscious of the fact that my ham experience would be of particular use to the army was when, upon entering the service, I was almost immediately assigned to a bomber group in the Army Air Forces. Upon completion of basic training I went to work in the communications department as a radio instructor. Since I was already familiar with radio operating it was only necessary for me to become acquainted with GI methods, the rudiments of which I learned in a short time.

After two months of this duty I was sent to Scott Field, Ill., to take a more extensive course in radio operation and maintenance. Upon completion of this course I was assigned to a B-25 crew and began learning the fundamentals of aerial gunnery.

Following twelve days of hasty preparation, we were loaded on transports and on our way to the African theater of operations. A two-day stopover in Durban, South Africa, provided the only rest we had during the tedious trip. Of course we were disappointed at being unable to fly over in our own plane, but it is easily seen that all the members of a bomber group — including the ground crews and other personnel — could not fit into the limited number of planes.

*Co. Z, 803 Signal Training Rgt., Fort Monmouth, N. J.

Eventually the journey ended. As luck would have it we arrived in time to participate in the historic battle of El-Alamein. We were assigned to duty with the British Eighth Army. Several months later the Yanks invaded North Africa.

We had been in Egypt about five days when orders came for us to proceed to an airport on the Suez, about one hundred miles from Cairo, called Deversoir. It was there we found our sleek, new B-25s awaiting us. They were positively beautiful!

We were a nervous yet enthusiastic group as we assembled in the ready room that evening for the briefing which was a prelude to our first raid over enemy territory. The crews received their final instructions; the navigators were given their routes and the radio operators were acquainted with the proper codes and authenticators, as well as the frequency channels on which they were to operate.

Not long afterward we were on our way over the desert runway and out into the black, starless African night.

The journey to the target, which was a German airfield at El Daba, was simply another night flight. But to us it was our first mission, and I think that if some sort of electronic meter had been placed on each man's pulse it would have shown something quite out of the ordinary in the way of response.

Our bombing run was made against the glow of fires already started by the incendiaries and flares dropped from pathfinder planes which had gone before us. We encountered light and heavy flak going in, and on our return trip it followed us until we were once more over the Mediterranean.

Soon a call came over the plane interphone: "Radio operator from pilot, radio operator from pilot."

"Go ahead," I answered.

The pilot continued: "We'll need a bearing; better hurry and call for a QDM. We've been chased toward Crete by an Me.109 and I'm not sure where we are."

I answered with a snappy "Roger; wilco" just like a veteran. Inwardly, however, I was not nearly so self-assured.

Here I was, on my first mission — making my first bombing raid and experiencing my first attack by enemy aircraft. As if that weren't enough, now I had to get a QDM — and do it quickly, too. Our gas was running short and we were still somewhere out over the Mediterranean, many miles from our base.

It was then, for the first time, that the full realization of my responsibilities became plainly defined. The purpose of my previous training could be boiled down to one thing — to arm my ability to handle a key to the extent of reaching my ground station. Now that the time had come, would I be able to get through?

The other planes were all working on the same frequency, and as soon as I opened up I found they were using it for all they were worth. As I had expected, the ground station was up to its neck in transmissions. It was with a heart full of prayer that I batted out the request for a bearing.

Luckily, the operator at the base was in a more collected frame of mind than I, and it was not long before I picked out my call. The bearing came through at the right moment, and not long afterward we spotted the field lights of our runway at Deversoir. How much gas did we have left in the tanks? About enough to have kept us in the air for five minutes more!

The first mission was over. That is probably the hardest one for a man to face. It is then, because he is still unsure of himself, wondering how he will act under fire, that the novice radio-gunner has his biggest question marks before him. Will he handle the key right? What if something should happen for which he is not prepared? Most of all, will he be afraid? Nevertheless, after we were down and I was able to look back and analyze my experiences, I came to the firm conclusion that the mind is most clear and at its best under fire and in times of stress.

Following my combat initiation at El Daba, other raids came in rapid succession. Rommel was still making his bid for Alexandria and Egypt then, and we were too occupied changing his plans to do much else but fly. German airfields, supply lines, shipping, convoys and communication lines were continually under our fire.

About a month after my call for the QDM on that first sortie, our crew was ordered to bomb ground installations along Rommel's front line. Apparently S-2 (intelligence) had expected enemy fighter opposition, for not long after we were in the air we were joined by an escort of P-40s and Spitfires on a daylight raid.

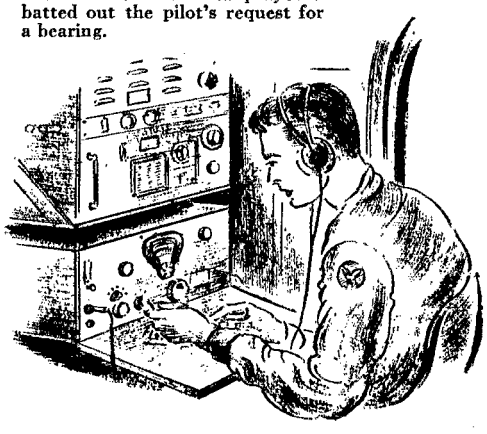
The feeling of steadiness and safety that air fighter escorts give the man in a bomber is heartening. Sometimes they would fly under or above us where they couldn't be seen by all of the crew; but every so often one would dart out to question some speck on the horizon, and it was then we felt most secure in the reassuring knowledge of their presence.

We were tail-end Charlie in our formation on this raid. As we neared the target I glanced out of the window in time to see several particles of metal falling past from above. I would never have noticed them had it not been for the brilliant sunlight reflecting on their shiny surfaces. It was unnecessary for me to see another such exhibition to realize that these were, not the customary flak splinters, but gunfire — gunfire from an enemy plane. A moment later, while my eyes were still fixed out of the window, an Me.109 swished by and began circling to make a second attack on our ship. With an air of seeming nonchalance, two of our P-40 escorts peeled out of formation. They got squarely on the tail of the enemy fighter before it had completed its turn, shooting it flaming from the air.

Throughout the entire episode no noise was audible save the steady drone of our engines. I felt as though I were watching a silent film from the back of an empty theater. There were eight or ten enemy planes in the group which attacked us, and dogfights were in progress in several parts of the sky. However, soon after we left the target area the enemy air action ceased, and we returned to our base unscathed.

Probably one of the most important facts for an aircraft operator to remember — and the one which makes it difficult to dramatize a radio operator's activity in the air — is the ironclad rule of radio silence which is imposed as soon as the plane leaves the ground. It is the duty of the radio operator to monitor his command frequency constantly during the flight, but he must not open his transmitter for any kind of sending. Under no circumstances, except in cases of extreme emergency, is the transmitting key to be

With a heart full of prayer I batted out the pilot's request for a bearing.



used while en route to the target. There is no better way of warning the enemy of an impending air attack than to send out a signal while on the way to bomb his positions. Consequently, in actual combat sorties it is seldom that radio transmission is used until after the bombing run has been made.

As soon as the bombs are released, however, the radio operator opens up and contacts his ground station, advising the results of the raid, the condition of the plane, and if there are any injured men aboard. It is then that the radio operator comes into his own. The d/f bearings by radio he provides are frequently of material aid in bringing planes back safely to their bases.

As is probably realized by most hams, there are various methods available to the radio operator by which he may help the navigator or pilot to determine their position as well as the course to follow to reach a given destination. Aside from maps and charts, the operator has access to strategically located radio stations from which bearings may be obtained. The procedure most often used is that commonly known as "obtaining a QDM." QDM is simply one of the many U. S. Army Q-signals, meaning a request for a magnetic bearing by which to steer with a zero wind to reach the station from which the bearing is determined.

However, simply because a QDM is requested does not mean that it will be as freely given. A system of authenticators, or what would commonly be known as signs and countersigns, must be exchanged between the communicating stations. Such "passwords" are the only way by which the ground station can know that the request is coming from a friendly aircraft rather than from an enemy invader.

When the plane nears friendly territory, a new and additional step is taken for identification. This is commonly referred to as the IFF system (identification of friend or foe). It is the radio operator's duty to see that this equipment is turned on — and woe to the operator who fails to use this equipment! His ship will be shot from the air as readily as would any enemy aircraft — unless, of course, it is identified by other means. Our ground defenses cannot take chances.

Throughout the period I spent overseas I never lost sight of the fact that, at heart, I was still a ham. I sincerely believe that the bond of fraternity built up among amateurs has done much to aid radio communications in this war. Wherever I went, in the States or on the war fronts, I constantly came in contact with amateurs. The different units of our forces and those of our allies all had former hams in their ranks.

After my seventh mission my services were needed in the ground communications department of the group. It was some time after that before I again took to the air on combat duty, but then I continued flying until I had fulfilled my quota of missions.

The most significant part of my work, or at least that which most closely involved my experience as a ham, began when I was chosen to take charge of the group ground station. I have no doubt that the reason I was chosen for this assignment was because of my background as an amateur.

Not long afterward I was made section chief for the entire group. Again, I feel strongly that it was because of my previous work with ham radio that I was promoted to this position. My duty was supervision of all communications for the group. This included telephones, teletype and d/f as well as direction of the accompanying personnel, which included large numbers of RAF wireless operators and mechanics (WOPS, in British jargon).

The problems of running a ground station are numerous, especially in desert country where one must contend with the elements as well as the more commonplace difficulties. In the territory in which we were working our greatest obstacle was sand. The very word is synonymous with the desert, and from the beginning we knew that our chief enemy would be, not Jerry or the Eyties, but the ever-present sand and dust. We could do very little to combat it. Batteries, gas tanks, motors and almost all movable parts were attacked. The only available protection consisted of covering the equipment with sheets of canvas and wooden packing boxes. In most cases, of course, such measures were sadly inadequate.

In managing communications, the constructional phase of ham work proved most helpful. A person can't build transmitters and receivers and not learn what makes them tick. My earlier amateur experience in this line was invaluable to me. After all, a condenser is a condenser and a coil is a coil, whether it be used in GI or ham gear.

Periodically, the group would pack up and strike out in convoy for a new location. This was necessary to keep up with the changing front line. Naturally, during such times we were fair game for any Luftwaffe pilots lurking in the vicinity. A bomber group moving in convoy is definitely a "military objective."

U. S. War Bonds for Stories of War Service

***QST* wants reports on the experiences of radio hams in active service on the battlefronts — for immediate publication in this section, where feasible, or to be held confidential where security considerations so require.**

Do *you* have a story of war service to tell — either your own or that of someone you know? Then write us a letter giving full details, including photographs, clippings and other substantiating data where available. If your story is published in *QST*, you will receive a $25 U. S. War Bond. Please indicate clearly on the report if it is available for publication in its entirety, if names, dates or places should be deleted, or if all information must be held confidential.

Since there was danger of our being attacked at any time, we were instructed to keep the base headquarters informed of our whereabouts and condition every two or three hours. This requirement made it necessary for us to develop a mobile radio unit which could be used for rapid emergency transmission. I succeeded in assembling a mobile outfit which could be set up and put in operation within five minutes. Today this would be unnecessary, since we have especially built mobile units which can transmit while moving. Then, however, we had to get by with the absolute minimum of equipment. Every inch of space and each single item of material was of much more consequence than it would be in similar circumstances today. The supply situation hampered us badly then.

The antenna was tuned to the right length by backing the truck until the transmitter gave maximum output.

Group communications was assigned one truck, a three-quarter-ton weapons carrier (GI version of the familiar old open-topped delivery truck such as grocers once used). This was to become our radio headquarters while en route.

The radio gear was salvaged Army aircraft equipment obtained from cracked-up planes, and was mounted in the truck on a board placed just back of the driver's cab. The station consisted of a single low-power transmitter, a receiver, key, batteries and a dynamotor.

Our solution of the antenna problem was in characteristic ham style. A fixed antenna mast was permanently mounted alongside the door of the truck. When the time came for us to stop and transmit, one end of the antenna was attached to the mounted mast and the wire unreeled. The transmitter controls were always left at settings such that the output stage became tuned to resonance when the antenna was made the right length. This was easily and quickly accomplished by backing the truck the necessary distance from the collapsible mast — which, in the meantime, was being erected — or to a fixed object to which the antenna might be attached. When the transmitter showed maximum output, the truck stopped. Thus, without manipulating a single dial on the set, it would be tuned and ready for operation on the correct frequency almost immediately.

During the time we were operating our radio equipment, whether ground or airborne, one of the most disturbing problems was that of jammed frequencies. Jerry manages to jam a frequency by various methods and in doing so makes it almost impossible to receive a signal with understandable clarity.

Probably the most common type of jamming is that which is known as the bagpipe effect. This consists of a series of notes, each of a different pitch. These notes are sent in varying order, giving a sound not unlike the Scottish bagpipe. Sometimes the "bagpipes" are combined with a static or buzzer effect not unlike the noise created by an electric razor in a home radio set. Together these jamming signals disturb the operator to such an extent that, although the signal may conceivably be received through repetition and perseverance, the strain is hard on the nerves and the necessity for repeats slows up communications to a considerable degree.

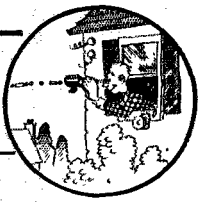
When I again took up my bombing missions, the picture of the war in Africa was quite different. Rommel had been defeated. His armies, which had been defiant and ruthless Nazi legions, were now ignominious prisoners of war or masses of dead bodies vainly fertilizing the sandy wastes of Africa.

Pantelleria, Sicily, and Italy were next on the list. We bombed incessantly and the war was constantly being brought nearer the Axis. Towards the height of the Sicilian campaign we were ordered to bomb Messina. This target was considered by veteran pilots to be the most heavily protected by flak of any we had ever encountered; the BBC pronounced it the most heavily defended spot on earth.

During this part of our work much of our flying was near or over water, and we used our radio equipment to maximum advantage. QDMs were often requested, but by this time I had overcome my buck fever and the procedure soon became quite commonplace.

One day, just prior to the time our base was shifted to Italy, I was called into the orderly room of the squadron. The commanding officer told me that orders had been issued for my return to the states. My missions were completed and I was due for a rest. The next day a B-25 ferried me to Tunis, from where a transport plane carried me to Algiers. Five days later, I boarded a troop ship and was on my way home.

EXPERIMENTER'S SECTION



Address correspondence and reports to ARRL, West Hartford, Conn.

PROJECT A

Carrier Current

Warning!

SEVERAL of those who have been experimenting with carrier-current systems have suggested coupling the output of the transmitter (or the input of the receiver) to the power line on the street side of the meter, the object being to eliminate the meter as a source of loss. However, it has been pointed out to us recently that any such connections to the public-utility side of the line, regardless of their purpose, have the same status as connections made to telephone lines, and are therefore illegal. — EDITOR.

—···—

I have constructed the c.c. transmitter using a 6L6 as a Hartley oscillator as described in *The Radio Amateur's Handbook*. At a location in St. Davids, Pa., I have so far been successful in communicating with all houses on my side of the distribution transformer secondary. This represents a maximum single line length of approximately ¾ mile.

I have found that a simple grid-leak detector or, better still, a regenerative detector serves adequately as a receiver.

Anyone interested in forming a c.c. net in this region is invited to communicate with me (Sundays only). — *John Ditton, 18 Hilaire Road, St. Davids, Pa.*

—···—

I have just completed construction of a c.c. transmitter similar to the one described in the March, 1942, issue of *QST*, running a power input of approximately 8 watts.

Not having completed work on a receiver I have no contacts to report, but I would appreciate hearing from any others in my area who are interested in c.c. — *Norbert Larky, 223 West Summit St., Somerville, N. J.*

—···—

Although Lee Heflinger, WW6LOH, and myself, WW6BTJ, are the only ones operating on c.c. here at present, we have had some swell QSOs.

We both have Hartley oscillators using 6L6s and running from 5 to 6 watts input on 165 kc. As a receiver, WW6LOH has a 6K8 converter feeding into his RME receiver. I have a regenerative 6SJ7, the output of which is amplified by my speech amplifier.

We live at an airline distance of about ¾ mile from each other. Although WW6LOH is on a 60-cycle circuit and I am on a 50-cycle line, our signals are R9 at both ends.

If there is anyone interested in getting on with us, please let me know. — *Bob Johnson, 2241 Cooley Place, Pasadena 7, California. Tel. Sy-7-5372.*

—···—

A few friends have been experimenting with carrier current. We have tried various circuits and wound up by using the Hartley oscillator with a 6L6 tube, as shown in the *Handbook*. We have been using a regenerative detector and one stage of audio as the receiver.

Results have been good, but we would like to locate other fellows in our vicinity who may be interested in c.c. — *Phil Chiarello, 101-32 108 St., Clifford Paterno, 104-44 108 St., and Harold Becker, 119-01 Liberty Avenue, all of Richmond Hill, Queens, N. Y.*

—···—

I am not a licensed amateur but am interested in c.c. transmission. I am building the 20-watt m.o.p.a. transmitter shown in the 1944 edition of the *Handbook*. I am interested in making contact with anyone else in this section who is interested in c.c. — *Eugene R. Roeschlein, Naval Training Station, Co. B, Sec. 5, Purdue University, Lafayette, Ind.*

—···—

I have just completed a transmitter using a 6L6 with 400 volts on the plate and a regenerative receiver with one stage of audio. I have tried it out over a distance of about ½ mile. Signals come through fine with practically no line noise.

I think that wired wireless is an excellent way to learn the code if you can get someone else to practice with you.

Please enter my name as one who wishes to meet others in the vicinity interested in carrier current. — *Robert L. Bailey, Demopolis, Alabama.*

—···—

I am interested in carrier current and would be glad to hear from anyone living in Huntington or vicinity who is also interested. My telephone number is 29447. — *Fred Livezey, jr., 1326 Sixth Ave., Huntington 1, W. Va.*

—···—

Please run all the latest dope on carrier current in future issues of *QST*, and in the *Handbook*, too, as many of us are much interested. — *Joseph Dolgos, 204 W. Olive St., Westville, N. J.*

C. H. Pennington of 20 Valley Road, Madison, N. J., is interested in carrier-current communication. He has sent to the Experimenter's Section a newspaper clipping concerning an application of carrier current on the lines of the Pennsylvania Railroad, now operative over a 67-mile branch of the road.

The rails as well as the overhead wires are used to carry the signals. Crews on trains several miles apart can communicate with each other, and the engineer in his cab is able to maintain constant oral communication with his conductor in the way car. Block operators are able to transmit orders, reports and information to speeding trains over the c.c. system.

PROJECT B

Light Beams

AUDIBLE reception of keyed light-beam signals can be accomplished by modulation impressed upon the signal at the receiver. The method of mechanical modulation by means of a motor-driven light chopper is only one of several methods, and is open to several objections. A d.c. motor is required, an item not easily obtained in these times. The added bulk and weight of the motor and chopper are undesirable in portable equipment.

An electronic method for converting the light-beam impulses into audible signals is shown in Fig. 1. The anode voltage to the photocell is modulated by the output of a local audio-frequency oscillator (neon tube). An ordinary audio transformer, *T*, is used for coupling the oscillator output to the cathode circuit of the photocell. The modulation level is adjusted by a 10,000-ohm potentiometer, R_5, across the transformer secondary.

The photocell offers very high resistance to the passage of current when no light reaches its sensitized cathode. Pulses of light from a signal source, when concentrated on the cathode, reduce the resistance of the photocell in proportion to the amount and color of the light, and for the duration of the pulse. As anode current flows, released by the incoming signal impulses, the oscillator-modulated voltage is impressed upon the grid of the first amplifier tube, a 1LN5, through the voltage divider formed by R_5 and the photocell with its load resistance, R_6. The duration of the tone

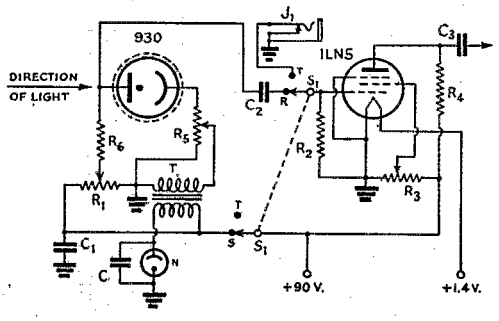


Fig. 1 — Input circuit of the *QST* light-beam receiver (April, 1944) modified for tone-modulating incoming light signals by means of a neon-tube oscillator.

R_1 — 3-megohm potentiometer.
R_2 — 2 megohms, ½-watt.
R_3 — 0.5-megohm potentiometer.
R_4, R_6 — 0.25 megohm, ½-watt.
R_5 — 10,000-ohm potentiometer.
C — 0.05-μfd. paper.
C_1 — 2-μfd. paper.
C_2 — 0.01-μfd. paper.
C_3 — 0.002 μfd. mica.
T — Audio interstage transformer.
S_1 — D.p.d.t. wafer-type switch.
N — Neon bulb (½-watt size).

heard in the amplifier output will be governed by the length of time a light beam is impressed upon the photocell. Thus the dots and dashes of the incoming signal will be reproduced in audible tones.

Another method is shown in Fig. 2. Here the first two stages of the amplifier are made to operate as a resistance-capacity oscillator. The feed-back network comprises *C*, R_7, R_3, and the photocell. The latter is connected in series with the feed-back voltage. The oscillation point will depend upon the setting of the voltage divider formed by R_7, R_3 and the photocell. The 1-megohm variable resistor, R_7, functions as a "sensitivity" control. It is adjusted to the point where oscillations barely commence with the photocell covered so that no light reaches its cathode. Decreasing the resistance below this point will decrease the audio output with a given signal.

The tone of the oscillations can be controlled either through varying *C* or inserting different values of capacitance between the anode of the photocell and ground. The anode contact is pin number 4 on the octal base.

Either of these electronic methods of modulation is far superior to any mechanical method such as the light-chopper. — *Edwin Fernandez De Castro, Calle 18, No. 8, Vedado, Habana, Cuba.*

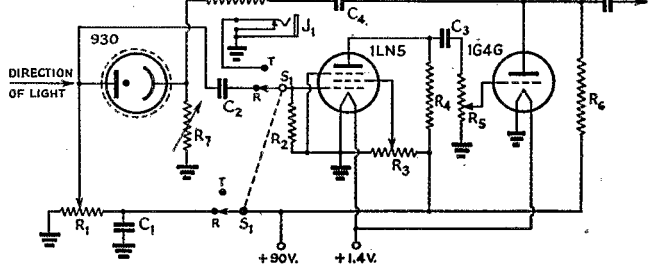
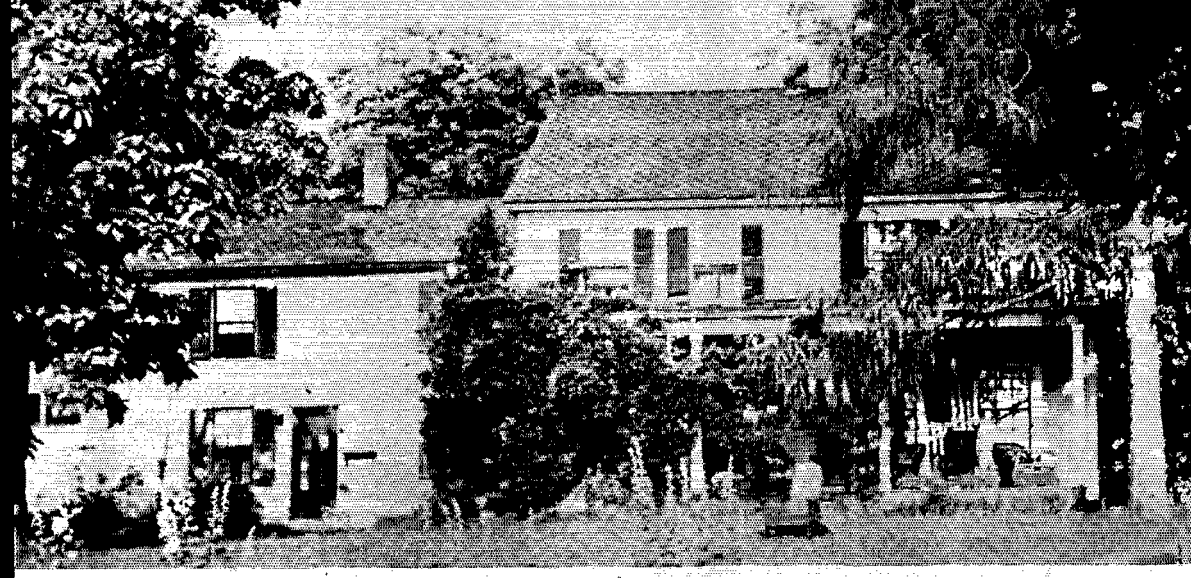


Fig. 2 — An alternative method of providing local oscillations for audio-modulating the input of a light-beam receiver.

R_1 — 3-megohm potentiometer.
R_2 — 2 megohms, ½-watt.
R_3 — 2-megohm potentiometer.
R_4, R_6 — 0.25 megohm, ½-watt.
R_5 — 0.5 megohm, ½-watt.
R_7 — 1-megohm variable resistor.
C_1 — 2-μfd. paper.
C_2, C_4 — 0.01-μfd. paper.
C_3 — 0.002-μfd. mica.
S_1 — D.p.d.t. wafer switch.



The Legend of Selden Hill

BY CYRUS T. READ,* W9AA

On the outskirts of West Hartford, where U. S. Highway 6 climbs over the divide into the Farmington Valley, a shaded side street winds up a wooded slope. From the highway the grade does not appear particularly steep and the trees successfully conceal the true height to which it rises. He who essays to climb it in these days of gasoline rationing will, however, find himself "all out of puff" as he emerges a third of a mile and twenty minutes later face to face with one of the most beautiful views in all New England — the vista from venerable Selden Hill.

This hilltop, with its aura of pastoral antiquity, has been the scene of many pioneering achievements in amateur radio. Spread out below its commanding height is the town of West Hartford, dwarfed by distance into the semblance of a toy village. Beyond lies the city of Hartford itself, its taller buildings rising above the intervening hilltops. The 526-foot Traveler's Tower pierces the skyline and the gilded dome of the State Capitol flashes in the afternoon sunshine. On the horizon, twenty miles away, the ridges that bound the other side of the Connecticut River Valley are visible through a silver haze.

Planted firmly on the very top of the hill is a century-old farmhouse. A rambling, comfortable structure, it is as much a part of the landscape as the gnarled and venerable maples which shield it from the north wind. Tradition has it that the pioneer Selden who first settled there back in 1720 picked the site to escape "those everlasting floods" that had plagued him yearly on his river-bottom farm. The fact that he had inadvertently picked one of the best radio locations in the eastern United States was of small concern in an age that had not yet heard of the telegraph.

The "invasion" of Selden Hill by the cohorts of amateur radio began in 1931. In January of that year ARRL Headquarters was moved from the "1711 Park Street" address which had become known the world over to its present location in West Hartford. Many of the staff members naturally sought living accommodations convenient to the new office. At that time the old farmhouse on the Hill was occupied by Henry Selden, a great-great-great-grandson of the first settler, and his wife, Jenny. Of their family of seven children, four had married and moved away; and Mother Selden, with true New England thrift, had placed a sign, "Rooms for Tourists," on the main road at the foot of the hill.

On that long-past "D-day," two dyed-in-the-wool hams of the Headquarters gang were out looking for a suitable place to live — which, of course, meant a good radio location. Driving west

* Assistant Secretary, ARRL.

When Cy Read came to Headquarters in March of this year to help out in the secretarial department he was, as a matter of course, advised by the Hq. gang to take a room at Rilla Selden's. At the time that name bore no particular significance for him. In the months that followed, however, he gradually acquired some of the lore of Selden Hill. The many tales of high adventure in amateur radio that took place there proved sufficiently fascinating to the newcomer to engender the belief that they would be of equal interest to hams everywhere. That is why they are retold here.

Right — Selden Hill in autumn, from a linoleum-block cut hand-carved by Ross Hull in 1936. This scene with the trees standing sere and bare contrasts with the luxuriant summer foliage pictured on the facing page.

towards Farmington they spied Mother Selden's "Tourists" sign. They turned into the steep, rocky side road, shifted into low gear, and drove up to investigate. What their thoughts may have been when they realized they had found a practically ideal location are not known, but it is recalled that they went into action without delay.

By dint of fast and persuasive talking, a well-known ham accomplishment, they convinced Mother Selden that she no longer wanted to take in tourists; that what she really needed at Selden Hill was a couple of regular boarders, nice young fellows who spent all their spare time tinkering with that modern mystery called radio. Within a few days these two — Ross Hull and Clark Rodimon, associate editor and managing editor of *QST*, respectively — moved in and took possession. The Hill has never been the same since!

The Birth of V.H.F. DX

Roddy, W1SZ, was primarily interested in DX and it was largely his desire to find the best available location for contest activities that led to their choice of the hilltop QTH. The same factors that made the Hill ideal for such purposes also proved invaluable in the v.h.f. research which Ross was shortly to undertake, however.

In 1931 the 56–60-Mc. band, so far as most amateurs were concerned, was still pretty much unexplored territory. In the first rush to the short waves a few years before this band had been tried, but when it failed to deliver the ever-greater DX expected from experience on 20 and 10 it was abandoned as more or less useless. Amateur radio as a whole, disinterested in backyard communication, concentrated on the lower frequencies.

Then came the great increase in amateur population of the early '30s. It was evident to the ARRL Hq. staff that all available amateur frequency assignments must be occupied to accommodate these added numbers without undue mutual interference, and that some means of making the 5-meter band attractive had better be found. Accordingly, Technical Editor James J. Lamb, W1AL, and Ross Hull went to work to develop suitable equipment, Jim taking up the transmitter problem and Ross the receiving end.

The first report on their labors in this field was carried in *QST* for July, 1931.[1] From that time on there appeared frequent articles telling of new accomplishments in the v.h.f. field — which then was called u.h.f. Selden Hill proved as ideal a location for 56 Mc. work as it had for the lower frequencies, and many pioneering amateur v.h.f. achievements were accomplished there.

[1] Hull, "'Five Meter' Receiver Progress," *QST*, July, 1931, p. 21.

Clark Rodimon did not remain long at the ideal location he had helped to discover, however. The call of Eros led to nuptial ties which had a stronger pull. He married before the end of the year and set up his own home. By then, however, the reputation of Selden Hill was so firmly established that, combined with the genuine hospitality of the Selden family, it was enough to ensure a more or less continuous occupancy by DX-minded amateurs. All but one of these were members of the Headquarters staff, the one exception being Lester Webb, W1HBD, who appeared on the scene after Rodimon left and was there during much of the Hill's most hectic period of ham activity.

Hull's 56-Mc. experiments were in full stride by 1932 and continued to be a major activity for several years. The first two-way 5-meter contact between Hartford and Boston — an airline distance of approximately 100 miles — occurred in the fall of 1934,[2] and the first 112-Mc. work over the same route took place the following spring,[3] both from Selden Hill.

The seismic wave of excitement set up in ham circles by these events can hardly be realized today. Perhaps the most succinct account of the milestone represented by that first 56-Mc. contact is that given by Miss Rilla Selden, present owner of the Hill. According to her: "They strung up a big contraption among the trees. Then Ross talked to half a dozen fellows in Bos-

[2] Hull, "Extending the Range of Ultra-High-Frequency Amateur Stations," *QST*, October, 1934, p. 10.

[3] Hull, "Hartford-Boston Link Established on Two and One-half Meters," *QST*, March, 1936, p. 16.

Eventide on Selden Hill. Miss Rilla Selden is in the center, with Mrs. Roland Ledger-Thomas and her daughter, Marjorie, English visitors who are now among her guests. Center of attention, as usual, is Buddy, the venerable Spitz who rules the household.

". . . They strung up a big contraption among the trees. . . ." Summertime or wintertime, that day was counted lost at Selden Hill which did not see a new antenna raised.

ton and none of them would believe he was in Hartford." Needless to say, the "big contraption" was a high-gain beam array, and it is only too true that when the crew on the Hill signed off for the evening they spent the next half hour listening to the Boston hams discussing "that bootlegger who claims to be in Hartford" and how they would go about unmasking him!

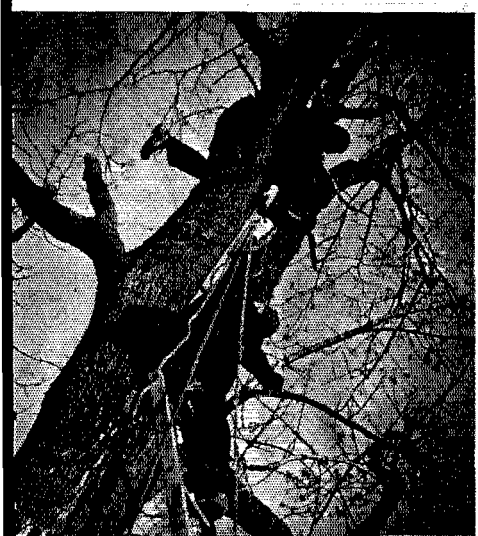
The Rhomboid in the Meadow

While all this v.h.f. work was going on there was still plenty of activity on the lower frequencies. In 1935 Byron Goodman, ex-W6CAL, came to West Hartford from San Francisco and without delay acquired a new identity as W1JPE. He took one of the rooms in the old farmhouse and the problem of antenna space began to get acute. Then came the day when Ross Hull's brother, A. G. Hull, back in Sydney, Australia, secured an amateur license. Daily skeds were started but contacts were spotty. The success of high-gain beam transmission on 5 meters prompted the crew on the Hill to try for similar results on 20. A multielement beam array being out of the question on the lower frequencies, they put up a rhombic antenna in the meadow to the west of the old house, running it from the peak of the roof, through and around various trees, and across some large and flourishing beds of poison ivy. According to Ross Hull,[4] "Study of the layout of the many trees around the place revealed chiefly that the guys who planted them had very little knowledge of directive antennas." Despite these incidental handicaps, however, the antenna turned out to be a great success.

The DX capabilities of Selden Hill were also employed to good advantage in 1937, when David Houghton, *QST*'s circulation manager, journeyed to South America to arrange for the publication of an authorized Spanish version of the *Handbook*. At one point Dave was confined to his hotel in Buenos Aires by illness but he still managed to keep in touch with his family and the staff at Headquarters — talking via land-line to LU2TA, who relayed by radio to W1JPE at Selden Hill, and thence by land-line again to his home or 38 LaSalle Road.

The varied radio activities carried on at Selden Hill during the years in which Ross Hull lived there as its guiding spirit were often reflected in the pages of *QST*. It was the growing realization of how many of the important events in amateur radio's history had actually occurred there that prompted the writer, a comparative newcomer at Headquarters, to attempt this story. A majority of the exterior photographs which appeared as *QST* covers during those years were taken on the Hill. Scrambling over the old slate roof to put up new transmission lines or erect a new sky-wire was a favorite Saturday afternoon sport, and most of the Hq. gang helped out at one time or another. To this day it is possible to find, tangled in the treetops, pieces of old Zepp feeders that the scrap drive missed, and Rilla Selden has learned now to listen rather unsympathetically to any antenna plans which involve roof climbing. "The roof never leaked until the hams came to the Hill," she will hint then.

Among the many projects carried out on the Hill during its career as a hatching ground for new ideas was the building of radio-controlled



". . . The guys who planted those trees had very little knowledge of directive antennas. . . ." The rhombic nevertheless was a great success.

[4] Hull, "Plain Talk About Rhombic Antennas," *QST*, November, 1936, p. 28.

gliders and sailplanes. In 1937 and 1938 Hull and R. B. Bourne, W1ANA, assisted by a corps of enthusiastic if not overly skillful collaborators, built several experimental gliders. The steep slopes of Selden Hill provided an ideal place from which to launch such craft, with occasional updrafts even permitting soaring flight. One of these soarers, with a wingspan of sixteen feet, reposes at present in the museum-lobby at ARRL Headquarters.[5]

As early as 1931 Ross Hull had written an appraisal of the television of that day for *QST*.[6] This article, accurately evaluating the methods then in use and clearly explaining the obstacles and limitations yet to be overcome, was instrumental in "debunking" the premature publicity then going on and helped to clear the way for serious experimenters in the field to get on with their work.

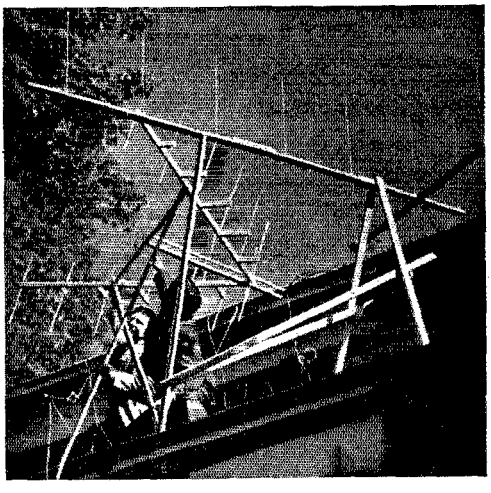
By 1937 new techniques, employing cathode-ray tubes instead of scanning discs and operating in the v.h.f. portion of the spectrum, had been introduced, and Hull embarked upon a series of television experiments with his usual enthusiasm. Besides a desire to "reduce to amateur practice" the complicated theories and equipment then in use, he was firmly convinced that then-current opinions as to the maximum useful range of television transmitters were entirely in error. By means of a highly directional beam array erected on Selden Hill he successfully received the transmissions from the Empire State Building in New York City, thus greatly exceeding the range of 30 to 40 miles then believed by professional television engineers to be the maximum possible.

Ross Hull left the Hill in June, 1938, to move into his own home at Bolton, Connecticut. His development program, looking towards the use of television by amateurs, was never finished, nor were any of his findings published. As many League members will recall, it was an experimental television receiver that caused his death by electrocution in the fall of 1938.[7]

[5] Hull and Bourne, "Radio Control of Model Aircraft," *QST*, October, 1937, p. 9.

[6] Hull, "Television, What About It," *QST*, November, 1931, p. 20.

. . . A majority of the exterior photographs which appeared as *QST* covers were taken on the Hill. . . .



". . . The roof never leaked before the hams came to the Hill. . . ." Scrambling over the old slate roof to erect a new skywire was a favorite Saturday afternoon sport.

Hallowed Hearthstone

If this story of Selden Hill seems to be concerned largely with RAH, it is only because he was the moving spirit in so much of the work that went on there and because he lived there for so long a period. Much valuable work was done by other members of the Headquarters staff who operated from the Hill. Among these were John Huntoon, W1LVQ; Thomas Ferrill, W1LJI, and Arthur L. Budlong, W1JFN. Johnny Huntoon became a perennial, second only to Hull and Goodman, living there from 1939 to 1942. He confined most of his operating to the traffic nets and normal activities of the Communications Department. Tom Ferrill spent a few months on the Hill in 1939 and carried out a number of experiments there in connection with his work as assistant technical editor of *QST*.

Bud, ARRL's widely known assistant secretary, had his own home on Long Island Sound at South Lyme, fifty miles from West Hartford, from which he commuted in summertime. He lived at Selden Hill during the winter months, however. A confirmed QRP addict, it was a simple matter for him to transfer his peewee rigs from one location to the other. It is strongly suspected that Bud might not have been so much in favor of low-power rigs if he had not had such a wonderful location from which to use them.

Nor do these names complete the roll. No less than six other members of the ARRL staff have enjoyed the hospitality of the Hill during recent years. Charles Brunelle, formerly *QST*'s assistant advertising manager, was there at the same time as Johnny Huntoon and Tom Ferrill.

(Continued on page 76)

[7] Editorial, *QST*, November, 1938, p. 7.

Practical Applications of Simple Math

Part IV—Designing a Two-Stage Audio Amplifier

BY EDWARD M. NOLL,* EX-W3FQJ

THE design of an audio-frequency amplifier is initiated at the loudspeaker and is carried back toward the microphone or pick-up device. The factors which determine the power output to be required of the system are the area to be filled with sound and the composition of the material within that space. A certain power output is required at the speaker, and the last stage or power amplifier of the audio system must be capable of producing a sufficient current variation through the impedance of the voice coil to produce this required speaker power (I^2Z). Since the power amplifier can produce the large current variation required only when sufficient signal is applied to its grid, the preceding stage or voltage amplifier must be capable of amplifying the very small output of the microphone to a level which will furnish sufficient grid signal excitation to the power amplifier. In installations where more power is required, more stages must be employed to convert the small voltage from the microphone into a large current variation which will excite the speaker voice coil. In many cases the final power amplifier requires grid driving power, and therefore the preceding stage must not only develop the required voltage swing but must also supply power.

In the design of the two-stage amplifier shown in Fig. 1, an output of three watts is required. The amplifier utilizes a 6F6 power amplifier and a 6J7 voltage amplifier, operated by a carbon microphone. The output stage works into an 8-ohm voice coil.

The first step in determining the circuit values is the construction of the power-amplifier load line. Since the power amplifier must deliver a large current variation to the voice coil, the problem is to obtain a large current variation across a reasonably high value of plate load resistance. For this reason the power-amplifier load line approaches a more nearly vertical position than that for the voltage amplifier treated in the previous installment, in order to obtain a maximum current variation. Thus the optimum slant of the load line will provide for a maximum power output (I^2Z) with a minimum distortion.

Another factor to be considered in the construction of the power load line is the low d.c. resistance of the output-transformer primary. It will be remembered that, in the resistance-coupled amplifier, the operating voltage is always considerably lower than the supply voltage. However, since there is only a very small average voltage drop across the primary, the average plate voltage may, for all practical purposes, be considered equal to the supply voltage. Thus the supply voltage is the actual operating voltage, and the a.c. voltage across the transformer resistance adds and subtracts about this value. One of our operating points will, therefore, be located somewhere along the vertical 250-volt coördinate in Fig. 2.

Since this is a single-ended pentode stage, we do not want the grid-signal voltage to swing in excess of zero volts bias. Consequently, another point on the load line must be at some position along the zero-bias line. In order to obtain the greatest power output without excessive distortion, the point on the zero-bias curve is set at the very end of the linear portion of the curve just before the excessive bend or knee in the curve. We now drop a perpendicular from this point (line AB in Fig. 2) to the plate-voltage axis. To complete the load line, we use a straight-edge with point A as a pivot to construct a load line which will set off *approximately* equal sections ($AO = OD$) on each side of the vertical plate-voltage axis (CO), giving an equal swing of grid potential on each side of the operating-bias curve (grid swing from O to A equal to grid swing from O to D). The procedure to be followed in finding the required circuit values is similar to the method described in the previous installment in July *QST*.

1) Total load resistance or slope of load line on characteristic curve is

$$R_l = \frac{XZ}{YZ} = \frac{480}{0.07} = 6857 \text{ ohms.}$$

2) Average plate current is the point at which line OE, drawn from the operating point, crosses the plate-current axis, or

$$I_b = 35 \text{ ma.}$$

*117 S. Woodlawn Ave., Clifton Heights, Pa.

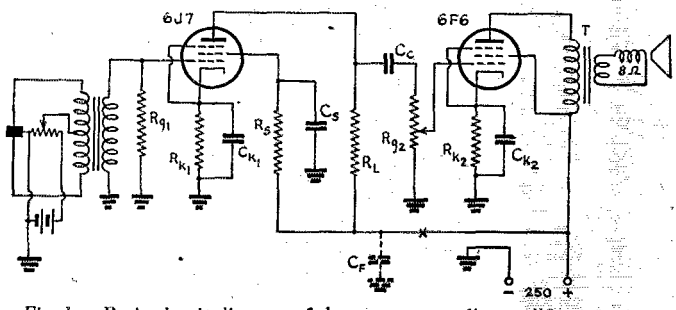


Fig. 1 — Basic circuit diagram of the two-stage audio amplifier.

3) Screen-grid current in the case of a power-amplifier pentode is approximately 20 per cent of the average plate current, or

$$I_s = (0.2)\ (35) = 7 \text{ ma.}$$

4) Total cathode current is equal to $I_b + I_s$ or 42 ma. Since the operating bias indicated at point O is equal to -16.5 volts, the value of the cathode resistor required is

$$R_{k_2} = \frac{16.5}{0.042} = 393 \text{ ohms}$$

5) The value of the plate resistance is

$$6857 - 393 = 6464 \text{ ohms.}$$

Since there is no actual resistance in the plate circuit except for the very small d.c. resistance of the primary winding, an effective plate impedance must be reflected to the plate of the tube by the transformer. The secondary of the transformer is terminated in 8 ohms (the voice coil impedance) and therefore the transformer must have a turns ratio which will reflect 6464 ohms to the primary from the 8-ohm secondary termination.

The transformer turns ratio is equal to the square root of the impedance ratio. Therefore,

$$\text{turns ratio} = \sqrt{\frac{6464}{8}} = 28.4.$$

In other words, the output transformer should have 28.4 primary turns for each secondary turn.

6) The peak-to-peak plate-current swing can be determined by drawing perpendiculars to the plate-current axis from the extremities of the grid alternations on the load line. Since the operating bias is -16.5 volts, a 33-volt peak-to-peak grid signal can be applied, the signal swinging between the zero-bias curve and the -33-volt curve. When the signal is at the peak of its positive alternation the instantaneous plate current is 67 ma., while at the peak of its negative alternation it is 5 ma. Thus there is a peak-to-peak plate-current variation of 62 ma., and the average plate-current with signal is

$$I_b = \frac{0.062}{(2)\ (1.414)} = 21.92 \text{ ma.}$$

7) The power output across the primary of the output transformer is

$$P_o = I_b^2\ R_l = (0.02192)^2\ (6464) = 3.1 \text{ watts.}$$

Since the output transformer has a small inherent loss, the output across the speaker voice coil is approximately three watts when maximum excitation is supplied to the grid of the power amplifier.

8) The cathode condenser should have a reactance at 60 cycles equal to the value of the cathode resistor, or

$$X_{C_k} = R_k = 393 \text{ ohms}$$

$$C_k = \frac{1}{2\pi f X_{C_k}} = \frac{1}{(6.28)\ (60)\ (393)} = 6.76\ \mu\text{fd.}$$

9) The maximum value of grid resistor permissible for safe operation with cathode biasing of the 6F6 is 500,000 ohms.

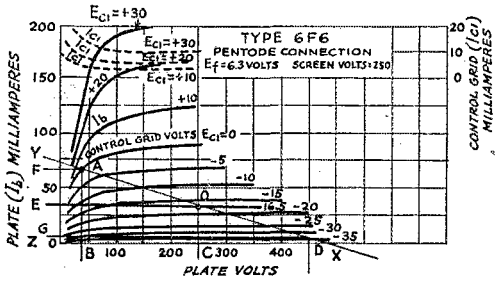


Fig. 2 — Average plate-voltage vs. plate-current characteristics of the 6F6 output pentode.

10) The value of the coupling condenser which will have a reactance at 60 cycles equal to the value of the grid resistor is

$$X_{C_c} = R_g = 500{,}000 \text{ ohms}$$

$$C_c = \frac{1}{2\pi f X_{C_c}} = \frac{1}{(6.28)\ (60)\ (500{,}000)} = 0.00528\ \mu\text{fd.}$$

With this value of capacity the response at 60 cycles is down to 70.7 per cent of that at 400 cycles. If the reactance of the condenser at 60 cycles is made equal to one-tenth the value of the grid resistor, the response is down only to 99.5 per cent, or

$$X_{C_c} = R_g = \frac{500{,}000}{10} = 50{,}000$$

$$C_c = \frac{1}{2\pi f X_{C_c}} = \frac{1}{(6.28)\ (60)\ (50{,}000)} = 0.0528\ \mu\text{fd.}$$

The interstage coupling condenser and grid resistor form a voltage divider across the output of the 6J7 voltage amplifier. At the middle and high range of audio frequencies, the reactance of the condenser is negligible and the output voltage appears almost in its entirety across the grid resistor, and consequently at the grid of the tube. However, as the frequency decreases the capacitive reactance rises, and an increasingly greater percentage of the voltage is lost across the coupling condenser. As a result, less voltage is available as useful grid signal.

If the coupling condenser were replaced by a resistor whose value is equal to the impedance of the grid resistor the grid signal would be cut in half, as shown in Fig. 3-A. Since the capacitive reactance and grid resistance are in vector relationship, the grid signal drops to only 70.7 per cent when the reactance equals the resistance. This point is demonstrated in the following example.

When a 60-cycle 10-volt-peak signal is applied to each of the three circuits shown in Fig. 3, the results are as follows:

Circuit A: Both resistors are of the same value and the voltage divides equally, leaving 5 volts on the grid of the tube.

Circuit B: The capacitive reactance is equal to the value of the resistance. The voltage again

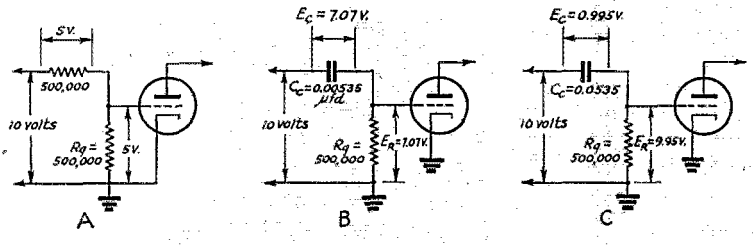


Fig. 3 — Circuits showing the effect of varying the size of the coupling condenser, C_c. Values are selected to prevent serious loss of response at a lowest frequency of 60 cycles, as discussed in the text.

divides equally but, since the voltages are in vector relationship, 7.07 volts are developed across both the condenser and the resistor. Although it appears, upon first observation, that 14.14 volts is divided with an applied voltage of only 10, it must be remembered the voltage across the condenser builds up to its peak value 90 degrees behind the peak value across the resistor. Thus both voltages attain a peak value of 7.07 volts but the instantaneous sum of the voltages is always 10, or the same as the applied voltage.

The impedance of the resistor and condenser combination is equal to

$$Z = \sqrt{R^2 + X_{C_c}^2}$$
$$Z = \sqrt{500{,}000^2 + 500{,}000^2}$$
$$Z = 707{,}000 \text{ ohms.}$$

Since 10 volts total appears across 707,000 ohms, by proportion the voltages appearing across the condenser and the resistor are

$$\frac{E_t}{Z} = \frac{E_R}{R} \qquad \frac{E_t}{Z} = \frac{E_C}{X_{C_c}}$$

$$\frac{10}{707{,}000} = \frac{E_R}{500{,}000} \qquad \frac{10}{707{,}000} = \frac{E_C}{500{,}000}$$

$$E_R = 7.07 \text{ volts} \qquad E_C = 7.07 \text{ volts}$$

Circuit C: The reactance of the condenser at 60 cycles is one-tenth the value of the grid resistance. This combination of coupling condenser and grid resistor effectively prevents serious loss in response at 60 cycles.

$$Z = \sqrt{R^2 + X_{C_c}^2}$$
$$Z = \sqrt{500{,}000^2 + 50{,}000^2}$$
$$Z = 502{,}500$$

The voltage across the condenser is

$$\frac{E_t}{Z} = \frac{E_C}{X_{C_c}}$$

$$\frac{10}{502{,}500} = \frac{E_C}{50{,}000}$$

$$E_C = 0.995 \text{ volts.}$$

The voltage across the resistor and at the grid of the tube is

$$\frac{E_t}{Z} = \frac{E_R}{R}$$

$$\frac{10}{502{,}500} = \frac{E_R}{500{,}000}$$

$$E_R = 9.96 \text{ volts}$$

The above examples explain clearly the necessity for making the reactance of the coupling condenser small in comparison to the value of the grid resistance, and also demonstrate a method of calculation which indicates the relative response of a coupling network.

The cathode condenser holds the power-amplifier grid bias constant. Since the cathode resistor is a part of the power-amplifier plate load, the same variations in plate current existing across the primary of the output transformer also are present, although to a lesser extent, across the cathode resistor. The cathode condenser filters these variations, maintaining the cathode bias constant as determined by the average current flow through the resistor. However, as the frequency is decreased the capacitive reactance increases and the condenser becomes less effective in maintaining a constant bias. This action becomes more apparent when we consider that the time constant, and consequently the rate of charge and discharge, of the condenser remains constant. At the same time, however, the alternations are occurring less frequently, permitting the condenser to charge and discharge over a longer time interval. As a result, there is considerable variation in voltage across the cathode condenser, and at the frequency at which the capacitive reactance is equal to the cathode resistance there is sufficient voltage variation across the cathode resistor to drop the amplifier response to 70.7 per cent of the normal value over the middle range of frequencies.

The effect of the voltage variation across the cathode resistor is demonstrated in Fig. 4. It may be seen that, with an amplifier having a gain of 10, application of a 10-volt signal produces 100 volts across the output when the cathode bias is held constant. However, if we apply a 10-volt signal and there is a 3-volt variation across the cathode resistor, the 3-volt signal effectively reduces the grid signal to 7 volts, producing only a 70-volt signal across the output. This reduction in grid signal is a result of the algebraic addition

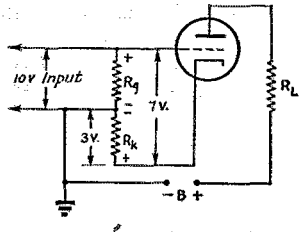


Fig. 4 — Instantaneous polarities when the signal is on its positive alternation, causing an increase in plate current and rise in voltage across the cathode resistor, R_k.

of the two voltages existing between grid and cathode.

Another point to be considered, if we desire an over-all response curve which is down only 70.7 per cent at 60 cycles, is the fact that the drops in response are cumulative. Therefore, if we have a 70.7 per cent drop across the input coupling circuit and another 70.7 per cent drop because of insufficient cathode by-passing, the total drop across the plate circuit of the power amplifier at 60 cycles would be 49 per cent. Furthermore, if the output transformer were of poor design there would be a further decrease in low-frequency response. Consequently, the coupling

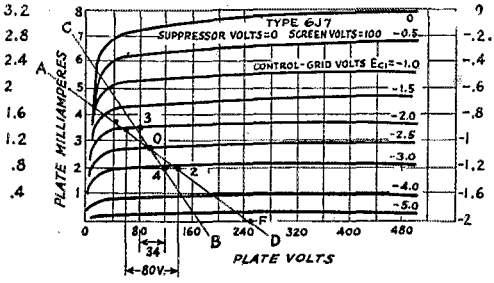


Fig. 5 — Average plate characteristics of the 6J7.

condenser is designed to have a reactance of one-tenth the value of the grid resistor at 60 cycles. This value is low enough to prevent any 60-cycle degeneration, as shown in Fig. 3.

The voltage amplifier increases the output level of the microphone to an amplitude sufficient to drive the grid of the power amplifier between zero and −33 volts when the grid input is tapped off the top of the gain-control potentiometer. At no time may the signal exceed 33 volts; otherwise, the power amplifier will be overdriven and distortion will result. Thus the voltage gain of the 6J7 amplifier must be set at the proper level to prevent over-excitation.

Since the plate current of the pentode voltage amplifier is directly proportional to the screen voltage over a wide range of screen potentials, while the plate current, in turn, is proportional to the grid bias, the characteristic curves normally drawn for a screen potential of 100 volts can be used with minor revisions for approximate calculations at a lower screen potential. These curves, as shown in Fig. 5, may be converted using the following procedure.

a) The plate-current and grid-bias values of the pentode are reduced by the same ratio as that by which the screen potential is reduced.

b) The screen potential for operation of the 6J7 as a voltage preamplifier is approximately 40 volts. Therefore the plate current and grid bias are reduced a corresponding amount.

c) When drawing the load line on the curves, it is permissible to extend the load line into what appears to be a region of distortion. Actually, at lower screen potentials the curves would be linear over a slightly greater range and would not fall off as early as is indicated on the curves drawn for a screen potential of 100 volts.

11) The resistance represented by the load line to be drawn on the characteristic curves consists not only of the plate and cathode resistors but also the grid resistor of the power amplifier, since the latter is effectively in shunt with the plate resistor. Thus the actual total plate resistance is as shown in Fig. 6,

$$R_t = R_k + \frac{R_L R_g}{R_L + R_g}$$

Furthermore, the peak-to-peak signal which must be developed across the parallel $R_L R_g$ combination is 33 volts. Some of the other known factors are that plate-supply voltage is 250 volts; that at low screen potentials the manufacturer recommends that the 6J7 tube not be driven more positive than −0.7 volts at the peak of the positive alternation of the signal; and that a peak-to-peak voltage of 0.4 is developed by the microphone across the secondary of the microphone transformer.

12) The gain of voltage amplifier, therefore, must be $\frac{E_o}{E_i}$, or

$$\text{Gain} = \frac{33}{0.4} = 82.5$$

13) The bias point is set so that the positive alternation of the signal swings up to −0.8 volts. Since the peak-to-peak signal is 0.4 volts, the bias is set at −1 volt.

14) The first load line, AD, is drawn through points F (supply potential) and the point on the −0.7-volt bias curve just before the curve bends sharply. Now the operating point (−1 volt) may be located and the signal permitted to swing 0.2 volts on either side. However, perpendiculars dropped from these extremities show that the variation in voltage across the output is 80 volts, which is in excess of the amount required for excitation of the grid of the 6F6.

15) Therefore a load line of a lower resistance must be drawn which will produce a smaller voltage variation with the same amount of grid variation. Line CB answers the requirements and when perpendiculars are dropped from points *3* and *4*, only 34 volts is set off. The resistance of the load line is:

$$R_t = \frac{175}{0.00255} = 68{,}600 \text{ ohms}$$

16) The value of cathode resistance required to develop one volt with a plate current of 1.1

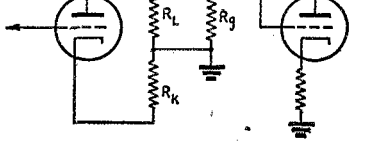


Fig. 6 — Equivalent of the a.c. coupling circuit between the two stages, showing how the total plate resistance of the 6J7 voltage amplifier is derived.

ma. current at operating point O and a screen current of 0.275 ma. flowing through the resistor is

$$R_k = \frac{E_c}{I_b + I_s} = \frac{1}{0.000275 + 0.0011} = 727 \text{ ohms.}$$

17) The value of $R_L R_g$ combination is 68,600 − 727 = 67,873 ohms.

Since the value of R_g is 500,000, R_L itself is found as follows:

$$R_t = \frac{R_L R_g}{R_L + R_g}$$

$$67{,}873 = \frac{(R_L)\ (500{,}000)}{R_L + 500{,}000} \text{ and}$$

R_L = approximately 78,500 ohms

18) As we reduced the slope of the load line, the potential to be supplied to the stage has been lowered from 250 volts to 175. Thus a resistor must be inserted at point X in Fig. 1 which will produce a drop of 75 volts.

The total current flow through this resistor is

$$I_b + I_s = 1.1 + 0.275 + 1.375 \text{ ma.}$$

The value of resistance required is

$$R_f = \frac{E_{drop}}{I_b + I_s} = \frac{75}{0.001375} = 54{,}500 \text{ ohms.}$$

19) Since we do not want a variation in applied potential, the voltage variation across the resistor must be adequately filtered

$$X_{C_f} = \frac{R_f}{10} = \frac{54{,}500}{10} = 5450 \text{ ohms.}$$

$$C_f = \frac{1}{(6.28)\ (60)\ (5450)} = \text{approximately } 0.5\ \mu\text{fd.}$$

20) The reactance of the cathode by-pass condenser at 60 cycles must equal one-tenth of the value of the resistor, or

$$X_{C_k} = \frac{729}{10} = 72.9$$

$$C_k = \frac{1}{(6.28)\ (60)\ (72.9)} = 36.5\ \mu\text{fd.}$$

21) Since a small amount of the output voltage is lost across the cathode resistor, the signal potential present on the grid of the 6F6 is actually

$$\frac{E_o}{34} = \frac{67{,}873}{68{,}600} \text{ and } E_o = 33.6 \text{ volts.}$$

22) The value of the screen resistor must be sufficient to drop the applied 175 volts to 40 volts, or

$$R_s = \frac{175 - 40}{I_s} = \frac{135}{0.000275} = 490{,}000 \text{ ohms}$$

23) The reactance of the screen by-pass condenser at 60 cycles should be one tenth the value of the screen resistor, or

$$X_{C_s} = \frac{490{,}000}{10} = 49{,}000$$

$$C_s = \frac{1}{(6.28)\ (60)\ 49{,}000} = 0.054\ \mu\text{fd.}$$

The two-stage amplifier used as an example in this discussion was designed with the stated intention of obtaining three watts of audio output with normal signal input. As a result, all of the calculated circuit values are critical and all operating potentials must be exact.

To avoid such strict requirements in construction, the average audio system is so designed as to be capable of handling at least 20 per cent more output than is theoretically required with normal signal input. Thus, in the case of an amplifier which is designed for three-watt output with normal signal input, the basic design may actually be made such as to handle at least four or five watts. Therefore the amplifier will, within reason, be capable of taking care of changes in signal input and variation in operating potentials, and will permit selection of standard values, the tolerances of which are not strict.

It must also be pointed out that the exactness of the design is to a large extent dependent upon the accuracy of the characteristic curves, and also their size.

Missing in Action

W9HXF, Pfc. Richard E. Pettijohn, St. Paul, Minn., reported to have been missing July, 1943, following the sinking of his ship off the coast of Sicily in July, 1943.

W9PJF, Pvt. Paul Swearingen, West Frankfort, Ill., while serving as radioman in a bomber, was shot down in a raid over Germany.

Silent Keys

It is with deep regret that we record the passing of these amateurs:

W2BCG, Philip W. Heideloff, Irvington, N. J.
W2JNS, Sgt. Walter Haut, Newark, N. J.
W2MVX, Lt. Jesse Greenebaum, Brooklyn, N. Y.
W5EHT, Wm. J. Russell, Oklahoma City, Okla.
W6EB, Lyndon F. Seefred, Los Angeles, Calif.
W6KIO, Hans R. Porter, Redlands, Calif.
W6PSS, Lt. Comdr. John C. Mitchell, USNR, Oakland, Calif.
W7ABT, J. Arthur Lamb, Kalispell, Mont.
W8OMJ, Harold B. Lingle, Rome, N. Y.
W8WNQ, Lloyd L. Victory, Dayton, Ohio
W9BQK, Lt. Jack C. Boltz, AAC, Newport, Ky.
VE4LS, Capt. Howard C. Weiben, RAF, Allan, Sask., Canada
G5NI, W. H. D. Nightingale, RAF, Norton, Birmingham, England
G6XX, Air Commodore Viscount Carlow, RAF, Dunsfold, Surrey, England
S/Sgt. John J. Byrne, San Francisco, Calif.

HINTS AND KINKS FOR THE EXPERIMENTER

SMOOTHING THE PERFORMANCE OF THE PEAK-LIMITING AMPLIFIER

SOME of the fellows who built the peak-limiting amplifier which I described in September, 1943, *QST*, have had trouble in obtaining smooth and quiet limiting action from the unit. This is caused by using unmatched tubes. It is necessary for the limiter stage to be balanced as nearly perfectly as possible.

Plate-current vs. grid-voltage curves should be run on a number of 6K7s or 6SK7s or whatever type of remote cut-off pentode is to be used, choosing a pair whose curves most nearly coincide. Possibly the local parts dealer will allow such matching tests on a number of his stock tubes, if it can be done without removing the tubes from their cartons.

Two changes were made in the circuit of this amplifier after publication. A 20,000-ohm resistor was connected across the primary of T_2, the transformer coupling the 6K7 to the 6N7, resulting in a flattening of the frequency response between 100 cycles and 10,000 cycles. With the 20,000-ohm resistor incorporated in the circuit, the 6K7s being pentode-connected, the excellent frequency response of triodes combined with the good a.v.c. action of pentodes was obtained.

The other change from the original circuit is that of placing a 20-μfd. by-pass condenser across R_{17}, the cathode resistor for the 6V6s.

No other changes have been made in the original unit, which is giving very satisfactory service. It is possible to compress a signal 35 db. above the threshold level without distortion. The measured distortion at 12 watts output, from the threshold level to about 30 db. compression, is only 2.5 per cent. With an increase in signal level of 30 db. above the threshold level, the output signal increases only 5 db. All of the foregoing measurements were made using laboratory instruments. — *Robert Lewis, W8MQU.*

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THE 14Q7 AS A 12SA7 SUBSTITUTE

THE 14Q7 tube is a better substitute for the 12SA7 than either the 12K7 or the 14A7/12B7. Since it is a pentagrid frequency converter rather than a pentode, it more nearly approaches being an exact replacement.

While the 14A7/12B7 substitution described by W6HWJ in April *QST* (Hints and Kinks, p. 53) will work, the receiver will lack "pep" and there will be little control over the volume as a result of the grid-voltage requirements of the 14A7/12B7 in the receiver circuit.

The wiring diagram for connecting a loktal socket for the 14Q7 to the old 12SA7 tube base is shown in Fig. 1. If each connecting wire is cut to a length of exactly 1⅛ inches, using No. 18 wire, it should not be necessary to realign the receiver circuits.

Judging from my observations and inquiries around New York City, 14Q7s are plentiful enough to sink a battleship! — *Arthur E. Hohman, W2IHP.*

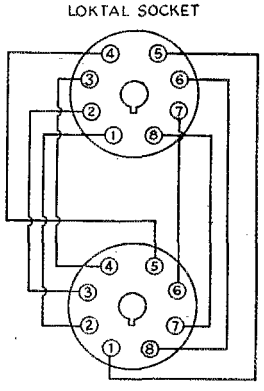

Fig. 1 — Wiring diagram of the adapter used in substituting a 14Q7 tube for a 12SA7. Connections between the loktal socket and the 12SA7 tube base should be No. 18 wire, cut to 1⅛ inches.

A report from W8VD brings to bear the experience of a serviceman on the substitution of the 14A7/12B7 tube for the scarce 12SA7:

"This usage is not so hot for any receiver which does not use the Hartley-type oscillator. The effect is a heavy tube hiss, hard to eliminate except in the case of local stations or whenever the signal intensity is sufficient to allow the gain control to be backed down below the hiss level."

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A MULTIRANGE V-O-M

I NEEDED a double-section multipoint rotary switch in the construction of a multirange volt-ohm-milliammeter, but couldn't get it. Since I had to be content with a single multipoint switch section, the circuit shown in Fig. 2 was used.

For voltage measurements, range 4, 5, or 6 is selected (numbering according to the resistor numbers in the circuit diagram) and jacks J_2 and J_3 are used for the input.

For current measurements, range 1, 2 or 3 is selected, flexible connector C is plugged into J_2, and J_1 and J_3 are used for the input.

For high-range resistance measurements, range 7 or 8 is selected and J_2 and J_3 used for the prods.

For low-range resistance measurements, C is plugged into J_2 and J_1 and J_3 used for the prods.

The low-resistance range was designed for minimum current consumption. The number of ranges shown is merely suggestive and each builder may suit his own needs, within the limits of the switch available.

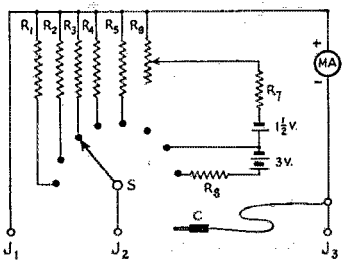


Fig. 2 — Circuit of the simple multirange V-O-M.
R_1, R_2, R_3 — Current (shunt) multiplier resistors (values depending upon ranges desired).
R_4, R_5, R_6 — Voltage (series) multiplier resistors (values depending upon ranges desired).
R_7 — 1000 ohms, ½ watt.
R_8 — 3000 ohms, ½ watt.
R_9 — 1000-ohm potentiometer.
S_1 — Single section multipoint rotary switch.
J_1, J_2, J_3 — 'Phone tip jacks.
C — Flexible lead with 'phone tip.
M — 0-1 ma. milliammeter.

No values are given for shunts or multipliers, since these will depend upon the meter used as well as on the choice of ranges desired. [Data on their design will be found on page 401 of the 1944 *Handbook*. — Ed.] A 1-ma. movement was the basis of my own meter.

This V-O-M is a practical, economical and efficient service instrument. — *Pvt. David M. Rice, W2NXR.*

SIMPLE WIRING HARNESS FOR CLASS-ROOM CODE INSTRUCTION

Code instruction at the Pittsfield (Mass.) Vocational School must be carried on in a classroom which at other times is used for chemistry classes. The student's desks cannot be permanently wired, and no special code-practice table is available.

To solve this problem, a flexible wiring harness equipped with double Fahnestock clip connectors, together with a control panel for the instructor's desk, was constructed in such a way that it could easily be installed and removed.

At the close of a class period the students simply remove their 'phones and keys. The harness is then rolled up around the control panel and stored away until the next session.

Although fundamental ideas were drawn from the flexible code-table circuit described by W9LBJ in April, 1944, *QST*, a simplified circuit, shown in Fig. 3, was designed to save wire and connectors. The smaller amount of wiring in the cable should reduce any possible tendency toward cross talk and background tone. — *Milton A. George, W1BKG.*

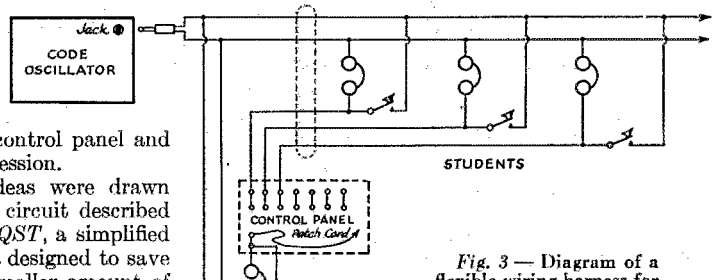


Fig. 3 — Diagram of a flexible wiring harness for code-practice class use.

ADAPTING A ZENITH B.C. RECEIVER FOR CODE RECEPTION AND CODE PRACTICE

Inspired by earlier notes in *QST*, I have been able to make a Zenith Model 6B16BT b.c. receiver serve as a receiver for c.w. and also as a code-practice oscillator.

Although this receiver has no beat-frequency oscillator and I was unable to secure the parts needed for building one, c.w. signals can be received satisfactorily when the single i.f. stage is made regenerative.

A 2-inch length of wire is affixed to the plate prong of the i.f. tube and a similar wire to the control-grid prong. These wires are brought out to the rear of the chassis, parallel to each other and approximately one inch apart. The exact spacing is found by bending the wires until best results are obtained. The i.f. tube holds the wires firmly to the socket, so that no soldering is required. When normal reception of b.c. programs is desired, the wires are separated until the capacity between them is insufficient to sustain feed-back. Although this arrangement is a makeshift, it has the advantage of simplicity and no tools are required to effect it.

To adapt the same receiver for use as a code-practice oscillator, a length of insulated stranded wire is affixed to the case of the speaker output transformer and another to the "Phono" terminal of the phono-radio switch. A key is placed in series with these leads. When the circuit is closed by pressing the key, audio feed-back is produced. The tone can be adjusted by means of the receiver tone control and the audio gain control. The available volume is more than sufficient to drive the speaker to capacity. — *Capt. William W. Orr, C.A.C. (overseas).*

USING A FLIT GUN AS A PAINT SPRAYER

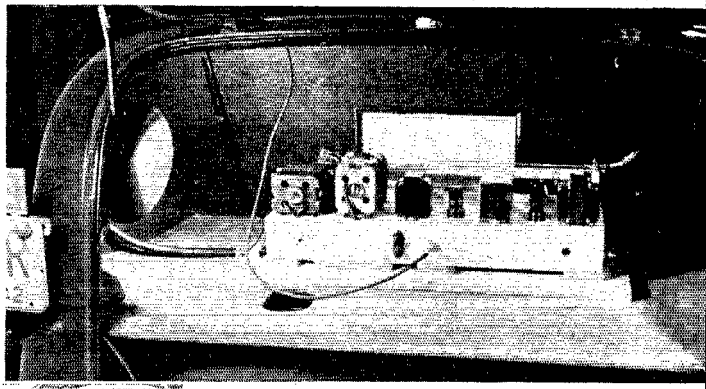
An ordinary insect spray gun does an excellent job of spraying smooth or wrinkle-type finishes on chassis, racks, panels and other amateur gear. Such a sprayer has even been used to paint an automobile fender, although the covering of such large surfaces involves the application of a generous amount of elbow grease.

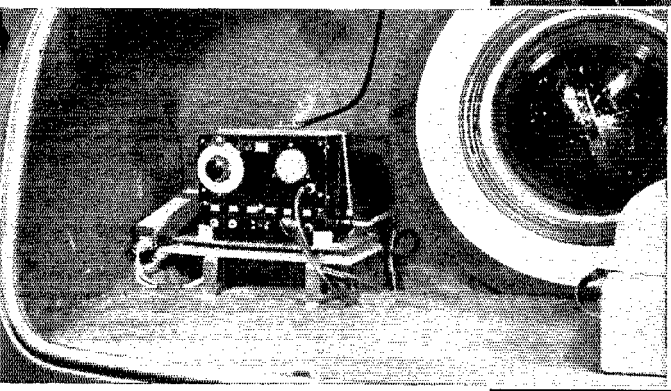
It is recommended that the paint sprayer be used only for painting; another spray gun should be for flies. — *Robert Lewis, W8MQU.*

Four WERS Mobile Installations

Essentially Similar in Circuits and Tube Line-Up, These Mobile Units Illustrate Varied Methods of Construction and Installation

Pictured on this page are four mobile units operating in the Dayton (Ohio) WERS network under the call WJTW. These photographs represent an especially interesting collection because they illustrate the wide range of installation and constructional methods possible even when similar basic designs are employed. All of these four units have essentially the same fundamental characteristics in common: all are mounted in automobile rear-trunk compartments; all were constructed by members of the same WERS group; and all but one utilize the same circuits and tube line-up, the same kind of antenna, the same type of power supply, and the same cabinet-style construction. But would you guess it from the photographs?





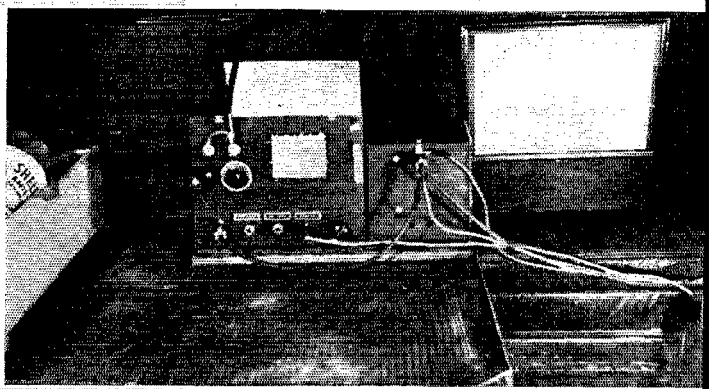
Above is the chief exception to the rule — Unit No. 22, built by Harris C. Haines, W8IBQ. Using the combination breadboard-chassis style of construction usually reserved for table-top home rigs, the transmitter in this unit has an RK34 in a long-lines oscillator circuit which is modulated by a Class-B 6N7. Two genemotors, which can be seen mounted at the left of the chassis, provide the plate power source; one supplies the oscillator and receiver and the other powers the modulator when transmitting.

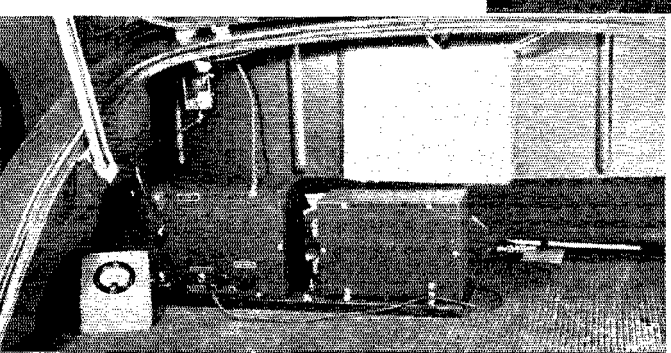
In common with each of the other assemblies, Unit No. 22 is equipped with a simple superregenerative receiver and a quarter-wave vertical antenna. The antenna is mounted on the rear deck of the car, and is fed by a short length of coaxial cable.

Above — Unit No. 35, owned by Emil Henrich, W8OVL.
Right — Unit No. 30, owned by John H. Kantrowe, W8RHH.
Below — Unit No. 37, owned by C. H. Ely, W8LJ.

Each of these three installations has for the transmitter an HY75 in a conventional oscillator circuit, modulated by a Class-B 6N7 or 6Y7G. Vibrator-pack power supplies are used.

Like Unit No. 22, each has a conventional superregenerative receiver. The antenna in each case is a quarter-wave vertical mounted on the rear deck of the car, fed by a short length of solid-dielectric concentric line.





Note in particular the divergent mounting methods employed — in one case full-length cushioning sheets, in the others combinations of rubber blocks and grommets.

The performance of all of these mobile installations is closely similar, and they have demonstrated uniformly excellent coverage. All have worked successfully over distances of 15 to 20 miles with the various fixed stations of the WJTW network.

STRAYS

Unusual interest and significance are attached to the FCC's recent authorization to AT&T for the construction of a series of wideband relay stations between Boston and New York.

Frequencies have been assigned in bands from 11 to 23 Mc. in width at various points in the spectrum between 1900 Mc. (15 cm.) to 12,500 Mc. (2.4 cm.). These frequencies are the highest ever licensed by FCC, and it is believed that they are higher than any frequencies used heretofore for practical communication.

The chain of stations, with a separation of about 30 miles, will be unattended. It is to be used for the transmission of high-fidelity f.m. and television, multiplex telegraphy, and facsimile. A power of 10 watts is authorized.

The immediate purpose of the project is to make a comparison between the radio-relay system and other available systems, such as concentric high-fidelity transmission lines of the type installed between New York and Philadelphia.

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FCC recently revealed observations on long-distance bursts at distances up to 1400 miles causing interference on the very-high-frequency bands, including the 42–50-Mc. f.m. band. The bursts are sharp increases of signal strength which seldom cover more time than it takes to speak a single word, and have been observed from the higher-powered f.m. stations. A systematic variation in the occurrence of bursts has been observed, the greatest number occurring at sunrise and the fewest at sunset.

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Lt. David H. Calk, W5BHO, radio communications officer at Avenger Field, Tex., is shown above instructing Women's Airforce Service Pilot (WASP) trainees in radio communications and procedure. W5BHO designed and built the mock-up radio equipment soon after his transfer from Laughlin Field to Avenger Field, the AAF's only WASP school. The women pilots soon will be ferrying planes from factory to field and performing other non-combat piloting for the Army Air Forces.

The record recently set by the Army Communications Service in relaying a test message around the world within a half hour was considerably bettered by that organization on Samuel F. B. Morse memorial day. During the services at the War Department Signal Center in the Pentagon Building, the message, "'This is what God hath wrought," was flashed around the world in 3½ minutes.

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Radio 'phone conversations in military zones are nearly all passed through "inverters" to garble speech against eavesdropping. During the Tunisian campaign a message came to headquarters from a lone American doughboy mounted on a camel, patrolling a remote sector, which aroused great excitement. It said: "Rommel captured." For hours the receiving operators protected that radio channel and strained their ears for confirming news. Next day came a supplementary message: "Correction — instead of 'Rommel captured,' read 'Camel ruptured.'" — *Radio Retailing Today.*

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Further details on the foxhole radio sets (see Strays, p. 62, June *QST*) now have been received from a correspondent in Italy. The razor blade and safety-pin detector is described as follows: "A station was found by moving the point of the safety pin, anchored at the other end, over the opposite end of the blade from where it is connected to the coil and antenna. The 'phones are inserted between the pin and the grounded side of the coil." He adds that "reception was very good."

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One Sunday recently I was enjoying a swim in the surf at Jones Beach on Long Island when an ARRL membership card floated within my reach. How could I forget a reminder brought to my attention in this manner? — *W1JL.*

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Did you see in a recent issue of the *Saturday Evening Post* the account of how a radio officer aboard a merchant ship turned medico and saved an eye of a fellow crewman? The sailor was at work with a pneumatic paint-chipping tool when a steel splinter lodged in his eye. The splinter was deeply embedded in the eyeball, and attempts to extract it with forceps threatened to do further damage. Assisted by engineers, the radio officer dismantled a powerful generator and used its field coils as the winding for an electromagnet. For a core, a steel shaft was machined on the ship's lathe to a needle point. This was held close to the seaman's eye. When the switch was closed the steel fragment leaped from its place in a painless instant. The sailor's sight was unimpaired.

Supersonic frequency emissions produced by an especially designed high-frequency sound generator are used to precipitate suspended matter in smoke, fumes, fog or air. The generator is built along lines which closely parallels the construction in ordinary electromagnetic or dynamic loudspeakers, with a resonant bar replacing the cone or diaphragm. The vibrations of the bar are imparted to the gas which is to be "cleaned." Exceptional efficiency is claimed for the method.

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Two new types of high-temperature thermoplastics, "Styramic HT" and "Cerex," are now being produced by the Monsanto Chemical Co. in St. Louis.

Because of the necessity for wartime secrecy, the first, Styramic HT, is described only as a "specialized high-cost material of critical importance in superhigh-frequency insulation." Cerex, whose electrical properties are said to surpass those of most thermoplastics, is being used in such applications as coil forms, crystal holders, condenser cases for radar equipment, and aircraft battery cases.

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A new type of electronic fluxmeter has been developed to aid in the production of radio and radar instruments. Designed primarily for checking the saturation of Alnico meter magnets, the device also may be used for checking and comparing the magnetic flux of any type of permanent magnet. Search coils of many different sizes and shapes can be used and may be made small enough to be inserted in the air-gaps of assembled meters. A direct-reading meter shows the value of flux as long as the search coil is anywhere in the magnetic field. The instrument employs a vacuum-tube amplifier circuit and is operated from a.c. lines.

Cairo Convention

CAIRO, EGYPT, again was the scene of a United Nations Amateur Radio Convention, held there on May 5, 1944. The morning meeting was attended by 35 amateurs and the evening session by 57, including: *England* — G3AP, 3NZ, 3PX, 3TG, 4CG, 4LV, 5DN, 5NU, 5SI, 5WZ, 8KW, 2DKX, 2DOS, 2FFM, BRS: 3261, 3856, 4362, 4649, 6175, 7262; *Scotland* — GM3LG; *Egypt* — SU1AX, 1CR, 1MS, 1WM, 5KW; *Canada* — VE3AAA, 3ET; *U.S.* — W1GPR, 2OA, 2MEO, 3HJE, 8GGY, 8NFQ, 8OPJ, 8SUF, 9CGT, 9EPO, 9GZS, 9LGS, 9OEF, 9PLX, 9SCB, 9WKY.

It was reported at the convention that meetings of the Cairo Amateur Radio Club are to be held on the first Saturday of each month. To obtain notification of the programs, American amateurs are invited to write to Maj. C. A. Porter, W2OA, USA FIME, APO 787, U. S. Armed Forces.

It is planned to hold the next convention at the Bystander, Cairo, on November 24, 1944. Full details can be obtained from W. E. Marsh, SU1WM, 3 Rue Kattini, Tanta, Egypt.

A Portable Multimeter

(Continued from page 21)

'Phone Monitor

To use the instrument as a 'phone monitor, S_2 and S_3 must be thrown to the right and a pair of headphones plugged into the jack, J. The tank circuit must, of course, be tuned to the frequency of the transmitter being checked. Volume may be adjusted within reasonable limits by means of R_2. To prevent overloading the detector, the multimeter should be moved as far as possible from the transmitter. In the case of a very strong signal, it may be desirable to remove the antenna to cut down the signal.

When S_2 and S_3 are thrown to the left, the meter is substituted for the headphones as an indicator. While it is not possible to measure modulation percentage with any degree of accuracy, a rough indication may be obtained by observing the difference in decibel readings on the meter produced by the carrier with and without modulation.

Neutralizing Indicator

To use the multimeter as an indicator for checking neutralization it should be set up as described for field-strength measurements, except that a piece of insulated wire is substituted for the antenna. The free end of the wire is brought near the output circuit of the stage being checked. Neutralization may be considered to be complete when a minimum indication is obtained on the meter. The sensitivity control, R_3, will be found useful in preventing overloading of the meter before the stage is brought close to neutralization.

Sound-Operated Relay

(Continued from page 38)

operate- and release-current values merely by adjustment of the cathode bias on the 6C5.

An Alternative Arrangement

More positive action may be obtained by the use of a second relay. Instead of opening the speaker circuit by means of one set of contacts on the first relay, these contacts are made to operate a second relay which in turn opens the speaker circuit.

When this system was used as a "commercial-eradicator" it was found that the microphone could be placed in the same room with the b.c. set which it controls if the gain on the amplifier is set low enough so as not to cause operation from the output of the speaker itself or by normal conversation. The best location in this case was found to be about four feet away from the b.c. set and not in a direct line with the speaker. In this position the relay would operate on a sharp whistle or clap from any spot in the room or adjacent rooms.

The device has proved to be a great boon and blessing to radio listeners too lazy to exert themselves but who, at the same time, wish that the radio receiver across the room would shut itself off for a few minutes until that long-winded commercial plug is over.

CORRESPONDENCE FROM MEMBERS

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

NOTES ON FIXED ARRAYS

1947 34th Ave., West, Seattle, Wash.

Editor, *QST:*

In connection with the article, "A Directive Antenna for the Lower Frequencies," by B. Penners, published in February *QST*, I believe it should have been pointed out that the formula given for the field pattern of the three-element array described holds true only if the current in the center antenna is twice that in each end antenna.

When the currents in all three elements are equal, the pattern becomes a function of $[1 + 2 \cos (a - d \cos \theta)]$, which has the following derivation.

The point of observation, P, in Fig. 1 is assumed to be at a distance much greater than the distance between the towers, d, so that the paths traveled by the energy radiated from the three towers are essentially parallel. For the sake of simplicity it will be assumed that the end towers are equidistant from the center tower. The space phasing between the towers is $d \cos \theta$, where d is the spacing in degrees and θ is the azimuth angle about the reference tower, E_1, with respect to tower E_3. The three antennas are assumed to be identical.

E_1 = field from center tower, used as reference point.

E_2 = field from one end tower at phase angle $a°$ with respect to E_1

E_3 = field from other end tower at phase angle $b°$ with respect to E_1.

F_p = vector field at point P.

$/F_p/$ = magnitude of vector F_p.

$$F_p = E_1 + E_2 \angle a - d \cos \theta + E_3 \angle b + d \cos \theta$$

Let $x = a - d \cos \theta$; $y = b + d \cos \theta$

$$F_p = E_1 + E_2 (\cos x + j \sin x) + E_3 (\cos y + j \sin y)$$

$$F_p = E_1 + E_2 \cos x + E_3 \cos y + j (E_2 \sin x + E_3 \sin y)$$

$$/F_p/ = [(E_1 + E_2 \cos x + E_3 \cos y)^2 + (E_2 \sin x + E_3 \sin y)^2]^{1/2}$$

$$/F_p/ = (E_1^2 + E_2^2 + E_3^2 + 2E_1E_2 \cos x + 2E_1E_3 \cos y + 2E_2E_3 \cos x \cos y + 2E_2E_3 \sin x \sin y)^{1/2}$$

$$/F_p/ = [E_1^2 + E_2^2 + E_3^2 + 2E_1E_2 \cos x + 2E_1E_3 \cos y + 2E_2E_3 \cos (x - y)]^{1/2}$$

$$/F_p/ = [E_1^2 + E_2^2 + E_3^2 + 2E_1E_2 \cos (a - d \cos \theta) + 2E_1E_3 \cos (b + d \cos \theta) + 2E_2E_3 (a - b - 2 d \cos \theta)]^{1/2}$$

When the currents in the towers are equal and phase angles of currents in end towers with respect to current in center tower are equal but opposite in sign.

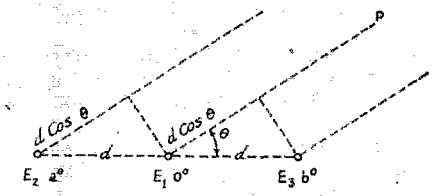


Fig. 1 — Diagram used in computing resultant field strength of three antennas at a distant point.

$$E_1 = E_2 = E_3 = E \text{ and } b = -a$$

$$/F_p/ = E_p = [3E^2 + 2E^2 \cos (a - d \cos \theta) + 2E^2 \cos (d \cos \theta - a) + 2E^2 \cos (2a - 2 d \cos \theta)]^{1/2}$$

$$E_p = E [3 + 4 \cos (a - d \cos \theta) + 2 \cos (2a - 2 d \cos \theta)]^{1/2}$$

$$E_p = E [3 + 4 \cos (a - d \cos \theta) + 4 \cos^2 (a - d \cos \theta) - 2]^{1/2}$$

$$E_p = E [1 + 4 \cos (a - d \cos \theta) + 4 \cos^2 (a - d \cos \theta)]^{1/2}$$

$$E_p = E [1 + 2 \cos (a - d \cos \theta)]$$

This results in the pattern of Fig. 2.

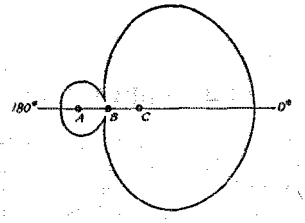


Fig. 2 — Pattern of relative field strength of a three-element array when the currents in the elements are equal, the element spacing is 90 degrees, and the phasing of the currents in the end elements is 90 degrees behind and ahead of that in the center element.

For the condition when the antenna currents are equal and the current in one end tower leads the current in the center tower by $a°$ and the current in the other end tower lags the current in the center tower by $a°$, the shape of the pattern is a function of

$$1 + 2 \cos (a - d \cos \theta)$$

For equal in-phase currents the shape factor is

$$1 + 2 \cos (d \cos \theta)$$

The resulting pattern is shown in Fig. 3.

When the current in the center tower is twice the current in the end towers and the phase

angles of the currents in the end towers with respect to the current in the center tower are equal but opposite in sign.

$$E_1 = 2E;\ E_2 = E_3 = E;\ \text{and}\ b = -a$$
$$E_p = [4E^2 + E^2 + E^2 + 4E^2 \cos(a - d\cos\theta) + 4E^2 \cos(d\cos\theta - a) + 2E^2 \cos(2a - 2d\cos\theta)]^{1/2}$$
$$E_p = E\ [4 + 8\ \cos\ (a - d\ \cos\ \theta)\ + 4\cos^2(a - d\cos\theta)]^{1/2}$$
$$E_p = E\,[2 + 2\cos(a - d\cos\theta)]$$

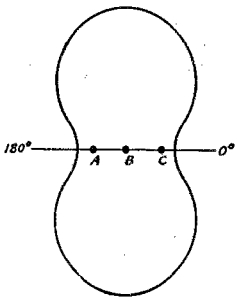


Fig. 3 — Pattern of relative field strength of a three-element array when currents in the elements are equal, the element spacing is 90 degrees, and the currents in all elements are in phase.

For the condition when the current in the center tower is twice the current in the end towers and the current in one end tower leads the current in the center tower by $a°$ and the current in the other end tower lags the current in the center tower by $a°$, the shape is a function of

$$2 + 2\cos(a - d\cos\theta)$$

For current a ratio as above but with zero phase angle the shape factor is

$$2 + 2\cos(d\cos\theta)$$

— *Everett G. Henry*

3224 16th St., N. W., Washington, D. C.

Editor, *QST:*

To avoid any possible confusion, I think that it should have been pointed out in the article describing the three-element array on page 40 of February *QST* that the formula applies only for the special case where the current in the center element is twice that in either end element. Since the procedure described for phasing the currents would apply almost equally well to the case where the current is the same in all elements, and since no statement to the contrary is made, it might be assumed that the formula given would apply in the latter case.

Mr. Penners unfortunately made an arithmetical error in his computations for Fig. 2, so that this pattern is incorrect. He forgot to add the quantity 2 in the formula in the instances of $\theta = 0$ and $\theta = 180$ degrees, so that his relative strength comes out as 0 instead of 2 in these directions. As a result, his Fig. 2 shows nulls for 0 degrees and 180 degrees instead of the value of 2. The computations for Fig. 1 and for the other values of θ are correct, of course.

— *Albert Preisman*

IT WASN'T SO BAD AT THAT!

EDITOR *QST*

SILENT KEYS APTLY PLACED AS SUFFICIENT REBUTTAL OF BACH SATIRE

— FRANCES K CAMPBELL W5IGJ

Boston, Mass.

Editor, *QST:*

In reference to the essay contributed by J. K. Bach, W4CCE/3, in the June issue of our beloved *QST*, kindly allow me to suggest a possible symptom: "Dementia praecox."

— *John J. Hizny, W8WFC–ex-K6OVN*

NICE TO DREAM ABOUT

165 Church St., Milton 86, Mass.

Editor, *QST:*

The May issue of *QST* contained an article about the ninety-foot "Speed King" antenna. I bet it had a lot of WERS operators wondering about cashing in their bonds after the war.

I wrote to Harco for information and received a very nice catalogue but no price list. So I inquired as to the price of the fifty-footer and the ninety-footer. I received a letter, stating that the forty-seven foot mast cost $362.00. Yes, I checked that decimal point again and again. . . .

So that's that, fellows. You can go back to sleep — but never dream that dream again.

— *Jim Lydon*

PS : Does anyone know what a fifty-foot telephone pole costs?

QST AIDS CIVILIAN DEFENSE IN INDIA

c/o The Commissioner of Police,
Bombay, India

Editor, *QST:*

. . . As the only amateur left in Bombay in a position to work for civilian defense — the few others having gone elsewhere in India where they were badly needed — I had a big job to do starting from scratch with little or none of the right material available.

Here *QST* played its part. Although the back issues were my mainstay, subsequent issues always seemed to come along with the answer to any particular problem that I happened to be up against at the moment.

I don't know whether that is because *QST* can be so versatile in every branch of the game, or whether it was just a small miracle for which I may thank the gods. But there it was — a problem, *QST* arrived, and with it the answer! Maybe it wasn't the whole answer, or even an answer at all, but only a suggestion that would turn our minds to a fresh track with the solution or a better idea at the end.

I would not be permitted to say what the outcome of all this has been. But I can say this: Wreck the telephone system and the power lines — our communications will still carry on, thanks in no small measure to *QST*. .

At the moment we have a problem that gives us headaches, heartaches and a grouse against the powers that be who force us to use 2.3 Mc. (that's right, 2300 kc.) for mobile use. Up to the moment we have not found a satisfactory answer to the antenna problem and, unless some kind heart can give us a tip in the right direction, I am afraid we'll have to carry on boiling our tea on the antenna loading coil.

— *S. M. Ferguson*

THE HAMS' "BIBLE"

APO 706, Unit 1, c/o Postmaster,
San Francisco, Calif.

Editor, *QST:*

Although the Army provides us with TOs (technical orders) covering information from how to place a tube in a socket to the actual operation of a transmitter, nevertheless a ham cannot get along without *The Radio Amateur's Handbook.* There is one in this South Pacific outfit from a few years back — 1938, to be exact — and inasmuch as half the pages are missing and it is so much in demand, it is high time we had a new one.

The Army instructions are satisfactory so long as everything is running according to Hoyle. But when something pops it is usually the ham who is called upon to fix it, and that is where his "Bible" comes into the picture. We amateurs over here feel the *Handbook* is playing quite an important part in this war, for every day some reference is made to it regarding a problem that has arisen while flying our many missions. . . .

— *Capt. D. Wesley Correll, W9FY*

HE JOINED THE MERCHANT MARINE

At Sea

Editor, QST:

At present I am serving as a radio officer on a tanker in the merchant marine. The ship is a fine one, and I am proud to be a member of her crew and thereby contributing, in some small way, to the war effort.

I would like to advise any member of our fraternity who is wondering where he may fit in and do a job for the U.S.A. to get the necessary papers and go to sea. The work is not hard (although very important), the food is wonderful, one's companions are interesting, and the opportunity for travel is unexcelled. There is some danger, of course, but there is danger in walking across the intersection at 42nd Street and Broadway, too. . . .

I have been a ham since 1936 and am certainly looking forward to the resumption of our prewar activities. Therefore I would appreciate it if you would add my name and call . . . to swell the list of amateurs who are serving the war effort, so that at the cessation of hostilities we can lose as little time as possible in getting back on the air.

I congratulate everyone on the staff of *QST* for putting out a magazine which is tops so far as I am concerned. . . .

— *James S. Sommerville, W9WHF*

CANDIDATES FOR POSTWAR O.R.S.?

Washington, D. C.

Editor, *QST:*

. . . In the June issue of *QST* you mentioned that a message was sent from the War Department Signal Center around the world in half an hour. Well, that time was beaten to a frazzle on Samuel F. B. Morse Day, when a message was relayed around the world by Army radio in 3½ minutes! This feat was performed before many government officials and Army officers, all of whom were properly impressed.

Incidentally, the trick chief in charge of WAR at the time was an amateur. In fact, only about two of the crew are not hams. . . .

— *T/Sgt. Warren C. Lathe, W3CJS*

"PATROLLING THE ETHER"

26th Weather Sqdn., Tactical Center,
Orlando, Fla.

Editor, *QST:*

In May *QST* you reviewed a motion-picture short called "Patrolling the Ether." Last week I had the good fortune to see it. It was indeed a pleasure to see such an enlightening picture, and I enjoyed it very much. . . .

— *Sgt. William E. Blumberg*

Pitman, N. J.

Editor, *QST:*

Well, OM, I just gave one of the biggest grunts of satisfaction in my life. I'm a film grinder or, to put it in high-class jargon, a projectionist at the local theater, and I've just had the pleasure of projecting MGM's "Patrolling the Ether." Believe me, I swelled with pride when the introductory title faded and I saw the credit given our fellow dit-dah artists. . . .

It made me think of my own kid brother, who is doing radio work in England with a field artillery battalion. The same kid brother who used to hang around my shack when he was twelve years old and listen with wonderment while I talked to other hams at the far ends of the earth. The same kid brother who pestered me till I helped him to become an amateur, too. . . . He received his license at the age of 13 under the call W3HRJ. . . . Now he is helping to do a gigantic job for those of us left here at home. . . .

W3IFT stopped in the projection room during the first show. He is another of the neighborhood kids who used to sit silent and big-eyed while I was on the air — another kid who deviled me until he, too, received his ticket. He is home for a few days while his ship lays over for repairs to damage received in battle. . . .

As to what is going to happen to amateur radio after the war — who knows? But let us for the present bend all of our efforts toward winning the war. In the meantime, let us walk softly and carry a very big stick. That big stick is our membership in our own organization and the favorable publicity we are receiving. . . .

— *Alfred D. Beckett, W3HEO*

OPERATING NEWS

CAROL K. WITTE, W9WWP
Acting Communications Manager

LILLIAN M. SALTER
Communications Assistant

Disaster Strikes Again. At this writing, we are reading newspaper reports of the devastating and unexpected tornado and associated storms which lashed communities in southwest Pennsylvania, West Virginia and Maryland, erratically spreading death and destruction. Included in the items are such statements as "electrical power was cut off in many sections . . . ," "severed communications and disrupted transportation made it difficult to determine the exact extent of death and damage," "wrecked communications and clogged roads kept some communities from reporting their casualties for hours."

Curiously enough, this story comes to our attention at the same time that we are receiving some scattered reports that "WERS in Podunk is folding up along with the local CD office," or "Medium City's WERS is suspended temporarily because of the weather and the pressure of other work," etc. Fortunately, such reports are rare and the majority of WERS licensees seem to be carrying on in very commendable fashion. We are especially proud of our coastal licensees, who are wisely aware of the fact that as long as the war exists there will be danger of token raids by the enemy, freak bomb devices or other possible menace contraptions.

The greater majority of inland WERS groups are functioning well, but it is in the inland areas where disasters such as the one mentioned above are most likely to occur, that we notice the lessening interest in WERS activity.

At the risk of being boresome, let us reiterate that *the maintenance of WERS as an active, prepared emergency communications system throughout the land is of utmost importance to national defense and security.* Until the amateurs return to the air, there will be no other means of disaster communications service for local communities.

For an especially detailed account of the ways in which WERS may assist in an emergency, we would like to call your attention to the subfeature article appearing in this department entitled, "Oakland WERS Fights a Fire." The importance of mobile units is clearly illustrated in this account, also. The operation of fleets of mobile units by licensees is always to be encouraged, for it is these mobile units which can often render the greatest service in time of disaster.

Drills Should Emphasize Problems In Disaster Operation. The maintenance of a vital WERS organization is up to the Radio aide, in large measure. It is through his ingenuity that certain practice incidents, which introduce problems and irregularities which might occur in an actual emergency, are made the subject of weekly test periods. It is his responsibility, or that of his delegated assistant, to see that all of the operators in his net can take over operation of the net control station, or station units with which they are unfamiliar, in an emergency.

In this connection, it might be well for the control station to have a record at hand of the various locations which are "dead-spot" areas as far as WERS communication is concerned, so that mobile units could be dispatched quickly and efficiently to strategic centers in time of emergency. A planned relay operation from unit to unit to control in "dead-spot" areas is advisable in some places. This information could be charted out, or placed on maps, for distribution among the mobile units of the licensee.

At this time, ARRL has placed with the FCC a proposal to expand and more clearly define the right of WERS to organize for disaster communication purposes, especially in communities where the local OCD has folded up. Latest reports are that the Commission regards the proposal in a satisfactory light, and it is hoped that we may bring you favorable news on this new extension of WERS Rules and Regulations at an early date. In the meantime, we urge every WERS group to maintain as much of the weekly practice period activity as possible, and to look ahead a little to the new possibilities for disaster preparedness operation.

—*C. K. W.*

Honor Roll

The American Radio Relay League War Training Program

Listing in this column depends on an initial report of the scope of training plans plus submission of reports each mid-month stating progress of the group and the continuance of code and/or theory classes. All radio clubs engaged in a war training program, or WERS groups conducting code and/or theory classes for their non-amateur personnel, are eligible for the Honor Roll. Those groups listed with an asterisk teach both code and theory. Others conduct only code classes.

* Adams (Mass.) High School Radio Club
Civil Air Patrol Squadron of Newport News, Va.
Civil Air Patrol Squadron of Poughkeepsie, N.Y.
* Pittsfield (Mass.) Radio Club
Queens Borough (N. Y.) WERS Code Class
Tucson (Ariz.) Short Wave Assn.

WERS of the Month

Long Beach, California

Each month under the accompanying heading we shall publish the story of an outstanding WERS organization as an item of general interest to all WERS participants. Contributions are solicited from any radio aide or WERS participant, whether he be an amateur or a WERS permittee. Descriptions of organizations which have already been featured in *QST* articles will not be considered. The story may describe the organization in general, how it came into being, how it was set up and how it operates; or it may describe some particular phase of the organization which makes it unusual or unique. Contributions should be brief (two or three typewritten pages, double-spaced, is maximum) and may include photographs if desired, although only one photograph will be printed with each story. Each story must be released for publication by the radio aide of the licensee, in writing. Address your contribution to the Communications Department, ARRL, and mark it: "For WERS of the Month."

THE story of the establishment of KGWE, the WERS network of Long Beach, Calif., is one fraught with difficulties and discouraging conditions. When the license finally was received, the KGWE net went into operation the next day, and has been performing dependably ever since.

It all began with the OCD announcement of the WERS program. W6RO was appointed radio aide by the local OCD council, and W6DZK was appointed assistant radio aide. All the administration problems had been placed in their hands, but, since the Associated Radio Amateurs of Long Beach had remained an active club after the war, it was not hard to recruit the members for WERS committees. Regular club meetings were abandoned in favor of the practice of calling committees together on short telephone notice. Practically 100 per cent attendance was obtained, and still is, on 48-hour notice.

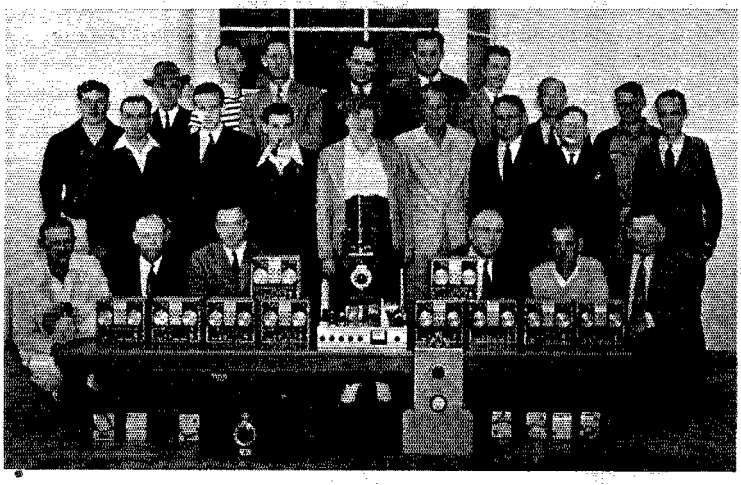
Of all the committees appointed, the technical committee proved the most energetic and resourceful. However, it would not be fair to overlook the noble efforts of the procurement committee, whose members were responsible for obtaining whatever equipment there remained available on the local dealers' shelves, in the local amateur shacks and in various local junkyards. All the equipment they were able to secure was deposited in the yard of the radio aide, where it became a "parts" pool for the technical committee to draw from. Needless to say, the procurement committee encountered many obstacles in their search. It was found that the previously held scrap-drive had been most successful and efficient in clearing out radios and parts throughout the city. Since there has been a good deal of war plant activity in the area, it was found that these plants were another drain on the equipment which local amateurs would otherwise have converted into use for WERS. The local aircraft companies, employing many of the local amateurs, had bought much of the old ham gear of these employees, who were only too glad to sell it for fear that it would all be hopelessly obsolete after the war.

After a year's labor, however, ten Abbott TR-4s were obtained, two crystal-controlled units were constructed, and eight composite installations were built. The majority of the antennas were of the delta-matched feed type, and a few of the extended double-Zepp type were used. A crystal-controlled frequency monitor for calibrating frequencies also was constructed. (This frequency meter tone modulates the plates of the oscillators so that it is possible to check the frequencies of the other transmitters while a superregenerative receiver is used.) In addition, thirty-one amateurs had their WERS operator permits and were ready to begin operating, which meant that the application for WERS license could not be put through without further delay. This was done on October 28, 1942.

After months of waiting for word from the FCC, on March 23, 1943, word arrived that the original application had been lost or misfiled, and a complete new application would have to be submitted. Then a duplicate copy was prepared, new photographs were made, and on May 25th, the FCC returned our application for further information. After these matters were cleared up, the FCC finally granted a license on October 8, 1943. It was received on October 12th, and as mentioned earlier in this article, the KGWE net went into operation the very next day.

We at KGWE are proud of our net. Although we encountered many obstacles prior to being licensed, we have felt that our hard work and painstaking methods were rewarded. All transmitters were placed at locations which had been proven by advance tests to be good operating points. Antennas have been erected on all fire stations throughout the city, in the belief that these stations undoubtedly would be centers of activity during an emergency. We did not organize with the thought of offering communication comparable with that given by the local telephone company. Our only object is to have units located at strategic points throughout the city, so that adequate communication may be had between various points at all times, and so that messages can be relayed to emergency headquarters at the time of any disaster.

— *Dwight Williams, W6RO, Radio Aide, KGWE*



This picture shows a representative proportion of the members of KGWE, the WERS net of Long Beach, Calif. Each one of the thirty-one operators is also a licensed amateur. *Left to right, first row:* W6KTS; Hawes, superintendent of alarms; W6DZK, assistant radio aide; W6DGY; W6OJV; W6HHU. *Second row:* W6KWI; W6LER; W6MOI; W6NZP; W6RSV; W6HPE; W6MK; W6FTN. *Third row:* W6ANN; W6EQW; W6AOT; Scott, communications officer for OCD; Lentz, chief of police; W6RO, radio aide; W6ARW, alternate director S.W. Division, ARRL; W6KEB; W6IF.

Oakland WERS Fights a Fire

FIRE, riding on a 75-mile-per-hour gale, swept through the hills in Oakland, Calif., in the early morning of December 9, 1943. Burning everything in its path, the fire became almost uncontrollable and the major part of the city's fire fighting personnel and equipment was called into action.

Control of one raging spot was scarcely under way before new fires were reported. Police and newspaper switchboards were swamped with calls as more than half the population of the city was drawn from its bed by fire alarms.

An emergency call was sent from the Oakland Defense Council control center to Lloyd A. Shellabarger, W6EE, the radio aide of KFMY of Oakland, for WERS assistance in communications. Although confined to his bed with an attack of influenza at the time, he succeeded in arousing five members of the local net, who responded immediately and took to the field to supply the much needed emergency communication facilities. These five men were: Lloyd C. Litton, W. D. Shattuck, K. G. Morrison, P. L. Coggeshall and Edgar L. Rockwood. During 6½ hours of operating, they handled 114 messages. Experiences of the operators are best told by the detailed reports of Litton and Coggeshall, who recounted their activities during that hectic day.

Litton, operating KFMY-20, reported that he was rudely awakened by a jangling telephone at 8 A.M. The snappy voice of Bill Shattuck reported that a big fire was raging in the hills close to the city, and urgently requested that Litton activate his unit and get to the scene of the fire — but fast.

With the speed of a P-38 in flight, Litton flew into action, and was soon en route, calling into the control center for specific directions. KFMY-34, with Morrison already on the air, could be heard shooting messages back and forth.

On arrival at the specified place, Litton was informed that the fire had shifted and was then further north. He proceeded to the new scene of action, where a fire department pumping unit crew hailed him like a long-lost friend and inquired anxiously, "Can you use that gadget to get us some hot coffee and food?" This was then followed by the information that they had been in action for quite a few hours, and were plenty hungry. A Red Cross canteen trailer unit had been dispatched to the area, but had never arrived. Litton succeeded in locating the unit, to the relief of all concerned, and it wasn't long before the firemen were consuming good hot coffee and doughnuts.

The Red Cross unit was very glad to see Litton and they asked him to make contact with Red Cross headquarters. Messages were handled concerning the location of the canteen unit, activities of the workers and amount of supplies. The whereabouts of certain officials were reported, and orders were given to others.

The place soon became "operations base," where fire department battalion chiefs and other officials exchanged information, directed the work of volunteers, sent in fresh crews and equipment, etc. In addition, KFMY-20 made a reconnaissance tour near the "front" with a fire chief, so that the needs could be quickly reported. Fortunately, the fire was being brought under control and no messages were found necessary. Permission then was secured from the control station to handle messages for individual Red Cross workers to their families, because it had been many hours since they left home.

As the fire was brought under control, night watches were set up, food and supplies were ordered, and the final message was dispatched to control, "Everything OK, situation well in hand." The units were then released to a stand-by on-call status.

Coggeshall had reported for his regular work that morning, but was soon summoned to operate KFMY-41. He found a location where KFMY-41 could relay for KFMY-34 to control, but immediately after beginning operation, KFMY-41 blew out three main fuses. It was found that the mike transformer had broken loose and was shorting out a high voltage lead. After this was fixed, two relay messages were handled from KFMY-34 before the fire in his section was brought under control. KFMY-41 and KFMY-34 were then assigned to an area near the spot where KFMY-20 was in the thick of the battle.

KFMY-41 was then situated at a spot which was being used for the headquarters of the Red Cross and Emergency Medical Service. Claude Christie, chief warden and coördinator for the Oakland Defense Council, and Dr. Dorothy Allen, chief of the emergency medical service, established their headquarters in the car and edited all further messages handled by KFMY-41.

During the three hours that followed, fifteen messages were handled — ten originated, four received and one relayed. A great many service messages also were logged. The activity then quieted down, and KFMY-34 took over in the area, while Coggeshall relieved Shattuck at control station for four hours.

At that time the wind had decreased in velocity, and the fire was brought under complete control. Arrangements were made for several WERS operators and mobile units to be on call during the night.

Other reports made by operators in the field, such as Edgar Rockwell, KFMY-78 operator, who was situated at Red Cross headquarters in Oakland, indicated that all the WERS operators had done an excellent job and had been of great assistance. Their first experience with real disaster had made all the participating personnel greatly appreciative of the experience which had been gained through regular drill periods and practice incident operations. Needless to say, the local WERS units were highly complimented by officials for their smooth functioning and invaluable aid in this emergency.

Ham Yarns

What is the most unusual experience you have ever had in connection with ham radio? Have you ever had a QSO that took place under peculiar circumstances, or that resulted in an exciting adventure? Have you ever been surprised, terrified, or highly amused at some incident that occurred during the good old days when you were operating your ham rig?

CD invites you to submit your story of the most unusual ham yarn you know of, whether experienced by yourself or a fellow amateur, for possible publication in Operating News. All stories should contain approximately 500 words, must be true, and must center about the subject of ham radio.

Each winning "Ham Yarn" will be published in this department, and the author may select a bound *Handbook* (Defense or regular edition), *QST* binder and League Emblem, Lightning Calculators, or any other combination of ARRL supplies of equivalent value ($2.00), as his prize.

All entries should be marked "Ham Yarns" and addressed to the Communications Dept., ARRL, West Hartford 7, Conn.

Shown here are, left to right, Bob Sweptston, radio aide of WJXC; E. H. Blyth, general service manager of the Ohio Bell Telephone Co.; Ralph H. Stone, director, Ohio State Council of Defense; Don Park; Dan McCoy, Ohio SCM and radio aide of WJTW, and V. E. Seeds, construction engineer for WJXC. The occasion was the presentation of an engraved plaque from the amateurs in Ohio to Don Park, for assistance in establishing WERS in the State of Ohio. (See *QST* July, 1944, p. 71.)

ELECTION NOTICES

To all ARRL Members residing in the Sections listed below:

The list gives the Sections, closing date for receipt of nominating petitions for Section Manager, the name of the present incumbent and the date of expiration of his term of office. This notice supersedes previous notices.

In cases where no valid nominating petitions have been received from ARRL full members residing in the different Sections in response to our previous notices, the closing dates for receipt of nominating petitions are set ahead to the dates given herewith. In the absence of nominating petitions from full Members of a Section, the incumbent continues to hold his official position and carry on the work of the Section subject, of course, to the filing of proper nominating petitions and the holding of an election by ballot or as may be necessary. Petitions must be in West Hartford on or before noon on the dates specified.

Due to a resignation in the San Joaquin Valley Section, nominating petitions are hereby solicited for the office of Section Communications Manager in this Section, and the closing date for receipt of nominations at ARRL Headquarters is herewith specified as noon, Tuesday, August 15, 1944.

Section	*Closing Date*	*Present SCM*	*Present Term of Office Ends*
Arkansas	Aug. 1, 1944	Edgar Beck	Aug. 17, 1944
North Dakota	Aug. 1, 1944	John McBride	Aug. 17, 1944
Western Mass.	Aug. 1, 1944	William J. Barrett	Aug. 17, 1944
Ohio	Aug. 1, 1944	D. C. McCoy	Aug. 17, 1944
Wisconsin	Aug. 1, 1944	Emil Felber, jr.	Aug. 17, 1944
San Joaquin Valley	Aug. 15, 1944	Antone J. Silva (resigned)	.....
Hawaii	Aug. 15, 1944	Francis T. Blatt	Feb. 28, 1941
Sacramento Valley	Aug. 15, 1944	Vincent N. Feldhausen	June 15, 1941
Oklahoma	Aug. 15, 1944	R. W. Battern	Nov. 1, 1941
Alaska	Aug. 15, 1944	James G. Sherry	June 14, 1942
Southern Minn.	Aug. 15, 1944	Millard L. Bender	Aug. 22, 1942
New Hampshire	Aug. 15, 1944	Mrs. Dorothy W. Evans	Sept. 1, 1942
West Indies	Aug. 15, 1944	Mario de la Torre	Dec. 16, 1942
South Carolina	Aug. 15, 1944	Ted Ferguson	Aug. 25, 1943
Western Fla.	Aug. 15, 1944	Oscar Cederstrom	Oct. 1, 1943
Idaho	Aug. 15, 1944	Don D. Oberbillig	April 15, 1944
South Dakota	Aug. 15, 1944	P. H. Schultz	May 18, 1944
Alabama	Aug. 15, 1944	Lawrence Smyth	May 22, 1944
Iowa	Aug. 15, 1944	Arthur E. Rydberg	May 26, 1944
Los Angeles	Aug. 15, 1944	H. F. Wood	July 1, 1944
Illinois	Aug. 15, 1944	Mrs. Carrie Jones	July 11, 1944
Eastern New York	Oct. 2, 1944	Robert E. Haight	Oct. 15, 1944
Virginia	Oct. 2, 1944	Walter G. Walker	Oct. 15, 1944
Northern Texas	Oct. 2, 1944	N. R. Collins, jr.	Oct. 15, 1944
New Mexico	Oct. 2, 1944	J. G. Hancock	Oct. 15, 1944
Santa Clara Valley	Oct. 2, 1944	Earl F. Sanderson	Oct. 15, 1944
Nebraska	Oct. 2, 1944	Roy E. Olmsted	Oct. 15, 1944
Kansas	Oct. 16, 1944	Alvin B. Unruh	Oct. 29, 1944

1. You are hereby notified that an election for an ARRL Section Communications Manager for the next two-year term of office is about to be held in each of these Sections in accordance with the provisions of the By-Laws.

2. The elections will take place in the different Sections immediately after the closing date for receipt of nominating petitions as given opposite the different Sections. The Ballots mailed from Headquarters will list in alphabetical sequence the names of all eligible candidates nominated for the position by ARRL full members residing in the Sections concerned. Ballots will be mailed to full members as of the closing dates specified above, for receipt of nominating petitions.

3. Nominating petitions from the Sections named are hereby solicited. Five or more ARRL full members residing in any Section have the privilege of nominating any full member of the League as candidate for Section Manager. The following form for nomination is suggested:

(Place and date)

Communications Manager, ARRL

38 La Salle Road, West Hartford, Conn.

We, the undersigned full members of the ARRL residing in the.....Section of the.....Division hereby nominate.....as candidate for Section Communications Manager for this Section for the next two-year term of office.

(Five or more signatures of ARRL full members are required)

The candidates and five or more signers *must* be League full members in good standing or the petition will be thrown out as invalid. *Each candidate must have been a licensed amateur operator for at least two years and similarly, a full member of the League for at least one continuous year, immediately prior to his nomination or the petition will likewise be invalidated.* The complete name, address, and station call of the candidate should be included. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon of the closing date given for receipt of nominating petitions. There is no limit to the number of petitions that may be filed, but no member shall sign more than one.

4. Members are urged to take initiative immediately, filing petitions for the officials of each Section listed above. This is your opportunity to put the man of your choice in office to carry on the work of the organization in your Section.

— *Carol K. Witte, Acting Communications Manager*

ELECTION RESULTS

Valid petitions nominating a single candidate as Section Manager were filed in a number of Sections, as provided in our Constitution and By-Laws, electing the following officials, the term of office starting on the date given.

Montana	R. Rex Roberts, W7CPY	June 1, 1944
Arizona	Douglas Aitken, W6RWW	June 15, 1944
Nevada	N. Arthur Sowle, W6CW	June 15, 1944
Maine	Grover C. Brown, W1AQL	June 15, 1944

In the Eastern Florida Section of the Southeastern Division, Mr. Robert B. Murphy, W4IP, and Capt. J. William Hazelton, W8UBN, were nominated. Mr. Murphy received 74 votes and Capt. Hazelton received 34 votes. Mr. Murphy's term of office began June 1, 1944.

The Month in Canada

QUEBEC—VE2

From Lt. L. G. Morris, VE2CO:

Lt. Bob Rowan, 2GO, has returned to Canada after having been on foreign duty since late in 1942. Bill Oke, 3AKO–ex-2AH, has been promoted from sub-lieutenant to lieutenant. "Mac" McAteer, 2EM, rushed home from Washington on learning that his infant son was seriously ill in Montreal. He received the good news that the crisis was past and that the child would recover. Doug Huestis, 2BU, has been promoted to the rank of acting colonel and posted from Ottawa to the East Coast, where he is in charge of the Atlantic Command signals organization. Lt. Jack Warr, ex-2EX, has returned from a three-month stay overseas, and is now stationed in Ottawa.

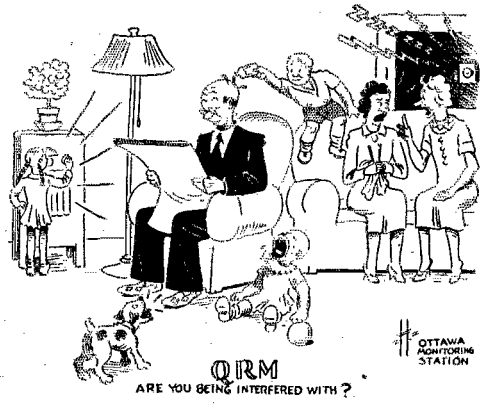
ALBERTA—VE4

From W. W. Butchart, VE4LQ:

George Marion, 4AEN, of Edmonton, returned to the city recently on a fourteen-day furlough. He is with the RCN and recently was posted to a fair sized "battle wagon" being commissioned in a U. S. port. He is a W/T and is very enthusiastic over his assignment. While he can't divulge any secrets about the equipment, he tells us that until one sees the radar and radio equipment on one of these ships "he ain't seen nuthin'!" George also reports that he meets Canadian hams quite often in his wanderings, and says that he has seen 4FK, Don Sutherland, of Calgary, who is on shore duty at Halifax.

4AKK, Bob Lamb, of Edmonton, who has been working at No. 2 A.O.S. as a radio technician, has taken a job with CFCN at Calgary. 4NU, Gordie Sadler, of Edmonton, until recently operating at No. 2 A.O.S. in Edmonton, has moved up to Grande Prairie, where he will be working at CFGP. 4HF, Ed Gilbert, of Tomahawk, who has been with No. 2 A.O.S. for three years or so, is going back to the farm at Tomahawk in order to help brother Howie. 4EY, Bill Careless, of Edmonton, keeps up his interest in "things radio," and may be seen browsing around BW's joint in his spare time. Seems to me it's about time to hear from AOZ, Slim Marsden, of Milo, again. How about it, Slim?

News seems very scarce this month, gang. If you don't get busy and forward news items this column will have to fold up, so how about it, OMs? 73, *Bill.*



AMATEUR ACTIVITIES

ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES — 3HFD received a letter from 3DQ, who is in India with the ATC. 3GSL, 2nd lieutenant in the Signal Corps, is instructor at Camp Hood, Tex. 3CBT bumped into 3QT while in England. 3CBT is now a full member of the ARRL. 3HFW is at Camp Crowder, Mo. 3ENX paid us a visit from the G.E. plant in Schenectady. We hear rumors that 3CHH will be back with us again. 3JAY is planning a new exciter unit. 3HFD finally is satisfied with his v.h.f. double super a.m./f.m. he has installed in the Lower Merion control center. OCD hq. in Easton has closed up but WERS continues to operate from another location. 3HRE reports that they are improving their equipment to facilitate statewide communication. 3DMQ got another 6-month respite from the draft board. 3FWH, at Camp Stewart, Ga., repaired four radio sets with a pen knife. He is better equipped now as 3GGC sent him a portable service shop. 3HXA got a letter from 3HJE with the following salutation: W3HXA de SU1HJE. Dick Hanak got his ham ticket and 2nd-class radiotelegraph ticket. He has sailed as radio operator in the merchant marine. 3JAY bought a new QTH with a lot of antenna space. 3HRD's landlord made him take down his rotary beam for television and f.m. so HRD bought himself a new place down the street and threatens to put a 40-foot tower on the roof. 3JBC of Camp Atterbury, Ind., bought two Vibroplexes. 3FQG has left Philco in favor of the merchant marine. 3FPE has a new QTH that is better for radio. 3HPK has a place in Springfield and is negotiating for more rhombic room. HPK is ex-2EYN/2FOO and has left DuPont in favor of Budd. 3GET is about to complete his postwar frequency standard. Lt.(jg) 4MS paid us a visit and gave us some very interesting sidelights on the W. Fla. gang. From him we learn that K6NYD was killed recently in the line of duty. 4MS had his YF, 4AXF, and his daughter with him. 9IGY and 3JKC discovered during their personal QSO that they used to live near each other in the ninth district. 3BES built GHM a portable code practice oscillator so that he won't forget the code while doing telephone work at Camp Crowder. 3IKB is working as an inspector for the Phila. Signal Corps stationed at RCA in Camden. He wants to hear from all the gang he used to QSO on 160 meters. 3JKH has moved from Ft. Knox to Camp Chaffee, Ark., where he is a sgt. in the 156th Sig. Co. He is trying to start WERS in Fort Smith along with a W7 and a W9. My thanks to those who contributed reports this month. 73.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — SCM, Hermann E. Hobbs, W3CIZ — Baltimore reports that they have 50-odd active WERS stations. Cumberland reports that the 4Fs and oldsters have built carrier-current rigs and thereby are able to pound a little brass. WERS is still under the leadership of L. R. Jenkins. The radio club suspended activities some time ago because of the loss of three-quarters of its members to the Army. Twenty hams showed up at the Washington Radio Club field day hamfest. The YRLR has nearly doubled its membership and will hold an election in the near future. A WERS tri-net council has been formed by WJWM, WJDC and WMDD. Membership consists of the radio aide, asst. radio aide, chief technician and chief of operations from each net. Meetings are held on the first Thurs. of each month and problems of the WERS of the Washington region are discussed. The following district radio aide appointments have recently been made: Silver Spring area: WMDD-1 control station, Edgar J. Roccati, with Mrs. Roccati assisting; Bethesda area: WMDD-2 control station, Ben Fullerton; Rockville, Gaithersburg and Sandy Spring areas: WMDD-4 control station, Alfred Christie, with Mrs. Christie assisting. Plans are being formulated to bring the personnel of the three nets together every three months at a general meeting to be sponsored by the Washington Radio Club. The committee consists of WJMW, WJDA, WMDD, the radio club and Mel Wilson. WMDD-13 serves as technical monitor station for the net and is under the direct supervision of the radio aide and asst. radio aide. New WERS permits: Lloyd Mowes, Rockville, Md.; Doris Day, Gaithersburg, Md.; Louise Jung, Silver Spring, Md., and Julis Hoke, Bethesda, Md. WMDD regrets losing Paul Thomsen as communications officer and Mac Williams as acting communications officer. Paul is still with us as a member. Mac recently accepted a new job which takes him to New York. Ed Roccati recently received his radiotelephone 1st-class ticket. Ben Fullerton is working on a new transmitter for report center installation. Location of a fixed station is restricted information. Operators should bear this in mind. Various WMDD stations are hearing WJGS-70, about 30 miles distant, and his signals vary from R-1 S-1 to about R-4 S-3 in the Silver Spring and Bethesda areas. Hats off to the Roccatis for their interest and efforts in trying to keep the personnel of the Silver Spring area active, to Julis Hoke for the fine job of operating at WMDD-2, acting net control station, and to "Micky" Mock, asst. radio aide WMDD, for the excellent technical and construction job done on WMDD-2.

SOUTHERN NEW JERSEY — SCM, Ray Tomlinson, W3GCU — Asst. SCM, ZI; Regional EC for So. N. J., technical radio advisor for N. J. State Defense Council, N. J. state radio aide for WERS and radio aide for Hamilton Twp. WERS, ASQ; EC for Somerville and vicinity, including Southbranch and radio aide for Hillsboro Branchburg Twps. WERS, ABS. ASQ reports that Irvington received its WERS license on June 8th. ABS reports that three restricted 'phone licensees have their WERS operator permits and have joined the Hillsboro Twp. organization. The Civilian Defense Council is going to turn its Sept. meeting over to communications, at which time an "incident" will take place to show the public what WERS can do. WERS demonstrations will be used to help maintain interest during Council meetings. Three more mobiles are being equipped and tested preparatory to requesting amendment of the license. A second "incident" demonstration now is being planned. ASQ reports efforts are being made to have other localities participate under WKPX. A meeting of all operating personnel of WKPX was held at the municipal hq. on May 31st, when some committee changes were made. GSP remains as chairman of the personnel committee with Carl Frank assisting; construction remains under GCU; antenna construction, installation and maintenance is taken over by Earl Van Horn and assistants; control center will be manned by ASQ, assisted by GSP or ITS, and ITS will be in charge of equipment maintenance. ASQ, assisted by GSP, has organized another class which covers both technical and code instruction and meets every Tues. evening, in one of the participating fire hq. to train more of the fire company's members for WERS permits. Hamilton Twp. has completed construction and is now ready to petition FCC for license amendment to cover 30 active units under WKPX. Bob Kulp, formerly of Signal Corps Labs. at Belmar, is now in England as a civilian radio engineer and writes via ZI, that he met ETX there. IIN was in town on a 7-day furlough recently. Elvin enlisted as Naval radio operator in Air Service and finished Naval radio school at Miami Beach, after which he was transferred to San Diego, Calif. When last heard of, AIR was in Washington, D. C. Alex McLees is now assigned to duty aboard one of Unk Sam's wagons as RM3c. IOU and AFA have accepted positions with Eastern Aircraft, Trenton. The address of Cpl. Wm. E. Bryce is APO 152, c/o Postmaster, N. Y. ZI's son may be reached as follows: Ed J. Raser, A/S, USNR, Room 9, Dorm. 23, NCTS, Cornell Univ., Ithaca, N. Y. BWF is now with Heinamann Electric Co., Trenton. JAG has signed up with the merchant marine as ensign. Cpl. Arthur G. Hassal's new address is APO 133, c/o Postmaster, N. Y. ASM is now working at Eastern Aircraft, Trenton, installing radio equipment. Lt.(jg) QL, USN, is back in the States and is stationed at Algiers, La., on communications duty. HAZ says GNU may be seen any evening "tearin'" down No. Broadway, Longbranch, on a bicycle. JJX, transferred from Chicago IBM to their New York offices, has taken up residence in New Brunswick. JKH writes that he has been transferred from Ft. Knox, Ky., to Camp Chaffee, Ark., and only three hams are there. Jerry is trying to get a WERS net started in Camp Chaffee. He asks the boys to drop him a line at: Gerard A. Baldorf, 156th Armored Signal Co., APO 412, Camp Chaffee, Ark. BAQ announced a brand-new baby YL. ZI, EED, CCO, ex-8BRJ and Gibson Brindley journeyed to the Old-Timers meeting at Hotel Martinique on June 7th. The DVRA held its annual doggie roast at Washington Crossing State Park June 28th. The South Jersey Radio Assoc. celebrated its 28th anniversary June 15th at the Birdwood Club, Haddonfield. Several old-timers were represented, including

3BO, one of the co-founders of the organization. The meeting was attended by a delegation from the DVRA which included GCU, ZI, EED, "Pop" Yoder, CCO and Vince Wagoner, ex-8BRJ. The motion picture, "The Telephone at War," loaned by the So. N. J. Bell Telephone Co., was enjoyed by all, and GYM entertained with a brief piano recital. GYM and BGP are transmitter engineers at WCAM, Camden. ILL was welcomed as a new member of SJRA. The SCM of So. N. J. joins with the membership of the DVRA in extending sincere sympathy to the family and friends of 8CMP, past-president of ARRL and former director of the Atlantic Division, who passed away at his home in State College, Pa., after many years of faithful service to amateur radio. 73, *Ray*.

WESTERN NEW YORK — SCM, William Bellor, W8MC — AQE spent 27 months since Pearl Harbor with Radio Intelligence of FCC in Md., Pa., Alaska, Ore. and R. I. He is now a chief operator at sea with the merchant marine. Plans are under way by the RARA for its annual picnic. DFN is still squeezing more efficiency out of 2½-meter equipment. AQE wants to give his regards to PLA and CSE. We hear that NEM, Sparky, has returned from the So. Pacific. He is now in civil service AAF, Rome Air Depot, as aircraft engine mechanic. His QTH is 420 N. Washington St., Rome, N. Y. He had an FB QSL from 5MN, SCM So. Texas, while at McCloskey Hospital, Temple, Tex. He met 5GHG on board ship coming to U. S. When last heard of, ALP was a sgt. in the Signal Corps. His QTH was 817 Sig. Post Svc. Co., Camp Crowder, Mo. EAJ is in the Navy. LUK is in Brownville, N. Y. SPE is in civil service and his QTH is 204 N. Fifth Ave., Long Branch, N. J. OMM is a lt. in the Signal Corps in Italy. DT reports that OMJ of Rome died on June 7th after an illness of only a few days. His amateur activities began in 1936 and he became well known on 160-meter 'phone. A new 1-kw. 4-band transmitter, together with his participation in all of the activities of the Pajama Club made him one of the best known 75-meter hams in the northeastern U. S. He received commendation for his efforts during the New York State floods of 1936. During 1940 and 1941 operating on 10 and 20 meters was his predominant interest. Where is SZB and BHW? TEX has finished construction of an FB WERS rig completely equipped for battery, mobile, a.c. duplex operation, etc. 73, *Bill*.

CENTRAL DIVISION

ILLINOIS — Acting SCM, George Keith, jr., W9QLZ — QWM has completed boot training at Great Lakes, pre-radio at Wright Jr. College in Chicago and is now at Del Monte, Calif., where he is getting more technical training in radio. His address: Harold E. Schrock, S1c (RT) Co. 5B7, Room 431, Del Monte, Calif. FNZ is at Naval Research Labs., Washington, D. C. MNR is code instructor at Scott Field. PUF is postmaster in Delavan. SXL still helps with the candy making at Beich. DXR has been doing some radio repair work as a sideline to his work in the special service division. Ivan says that the humidity experienced in the Pacific area gives the radio repairman something to worry about. FKH is stationed in Scott Field AACS School. Address: Pvt. Arthur J. Koda, 3505 AAF Base Unit, Section H, Brks. 750, Scott Field, Ill. VLT, with an XYL acquired May 28th, is living in Vallejo, Calif. Ray is giving Raytheon a lift with their job in this war. YXP is a major stationed at Danville. His brother, AMV, is running the farm single-handed and two other brothers are captains in the Dental Corps. Pvt. BIN is getting to be a real sharpshooter down at Camp Hood. The deadline for news for this column is the 15th of the month. Come on, gang, give! 73, *Geo*.

INDIANA — SCM, Herbert S. Brier, W9EGQ — WDV reports from India that the States come in well. SVJ has visited French and Dutch Guiana. UZW is now with a 155 MM Artillery Bn. in the Marines. CWY gets *QST* fairly regularly in Italy and they have several *Handbooks*. MVZ and the Gary gang are wondering where PUB is. EHT has moved his family to Pa. so they will be near the OM, who is at a Navy Gunnery Office in Washington. CTK is RT1C. WKN still doesn't know if he is in the Navy or not. RIG has bought a lot for his postwar home. EGV has succeeded in getting a blonde, a brunette, himself and a 6' 2" friend into his Austin at the same time. AOI of Blue Island, Ill., well known to many Indiana 160-meter hams, died May 16th. All the pallbearers were hams. FIC used his vacation from "Ma" Bell to paint his house. EBB complains that he reads both the *Bison* and *QST* in a short time and then must wait a full month. AB is envious and, I believe, skeptical, of the fabulous DX some stations cover on 2½ meters. He reports that Mishawaka had a full scale simulated emergency the other night in a tremendous rain storm. The personnel of WKBF went on a picnic. AB is unconvinced that, tube for tube, f.m. is superior to a.m. OOG was home on delayed travel time. He received a transfer from his job of teaching radar. MTL is not satisfied with the operation of his 2½-meter a.m./f.m. super for more than ten minutes at a time. HUV designed a six-element coaxial-fed beam for himself, then junked the idea. He reports that spending 24 out of 34 hours on a tractor gets one in the end. SNF reports that he is now p.f.d. — private for the duration. He is worried about the possibility of the postwar EGQ having a modulator. ANH reports that WERS in Terre Haute is finished. He is now manager for a wholesale radio firm, giving up service work for the duration. EMQ reports that C.D. has folded in Anderson but WERS is still going, and a radio club has been organized. Gary WERS now works directly with the city and the stations are being moved to various fire stations. 73, *Herb*.

KENTUCKY — SCM, Darrell A. Downard, W9ARU — Just mention 112-Mc. antennas to DFW and watch that wild look come into his eyes. The "two old men" at WJKK-22 donated a pint apiece to the Blood Bank last week. Anyone wishing to donate a "replacement" pint (90 proof or better), just give them a call. From "somewhere in England" URG sends home for his tennis shorts and some tennis balls. IFM reports that he is with Columbia U. Division of War Research, Box 271, New London, Conn. Tom Parrot built two 112-Mc. jobs and sold one on the East Coast and the other in the Southwest. AEN shows up every meeting with a new "Peterson Pot" job and tells the gang how they can be made out of tomato cans, etc. Who made that offer of a prize for the station that could copy WJKK-1? At this writing, JB, it's not so good Do you have an ARU antenna coupler for 112 Mc.? It brings 'em in louder. Forget that single turn and use about four turns ending the wire in the last turn. Bring out the other end and hook it on one of your feeders and see the results. Let's hear from you fellows in the services.

MICHIGAN — SCM, Harold C. Bird, W8DPE — 8FX announces that he has taken a position as radio operator on the Western States, and a 25-year dream has finally come true. 8UGR is still sending in construction stories to *QST*. 8FWU finally came through with a very nice letter and suggests that a resolution be adopted by the League that to qualify for SCM the prospective candidate should be able to copy 25 w.p.m. Pvt. Rus Sakkers, APO 322, c/o Postmaster, San Francisco, Calif., writes from the So. Pacific as follows: "Please let me know all the news of the gang whenever possible." He requests the names and addresses of you fellows in the Rockford and Bay City areas. 8UXS has been attending the APCO meetings. WERS: The Pontiac boys are continuing their school for operators. We have added 19 more operators to our WERS personnel through the medium of the school and those who are studying fundamentals of electricity are so doing to better their chances for a higher class of license. 8SCW is servicing radios somewhere for Uncle Sam's Air Forces. 8AKN is still working seven days a week so not much time for radio. Ens. 8VZZ is located in Florida. The DARA sends congratulations to K. B. Warner on completion of 25 years of service to ARRL. The League's Board of Directors has made a large appropriation to enable us to fight for our frequencies when the time comes. No other organization has fought, or will fight, for the rights of the amateurs like the ARRL. It is important to you that you back the League 100%. So let's back the attack, not only by buying War Bonds but by buying our membership-subscription to *QST* also. Good luck and 73, *Hal*.

WISCONSIN — SCM, Emil Felber, Jr., W9RH — at the last MRAC meeting of the season our only life member was present. Don's latest pastime is making gadgets on his South Bend lathe. Sam Tagart and Irv Jackson were visitors; also DTE and Robertson of the disbanded Kenosha Kilocycle Club. New members admitted to the club are: ROO, Joseph L. Bryson, Ens. Wm. Black and Sgt. James Fischer, the latter by remote control, as he is stationed in England. All members in the services are listed on our honor roll, and others away on civilian jobs are inactive members, therefore their names are not on the active list. However, due entry is made in the minutes of their presence. The MRAC Bulletin is now being sent to 80 of the gang. VD took candid shots of the Club's Jamboree at Gettelman's Rathskeller. LAD supplied sweet music with his portable. Leo Topolinski's new hobbies are now philately and the growing

of cacti. The WFMI WERS situation is in good shape. All units from 1 to 10, plus 17 and 20, National Guard Armory, Whitefish Bay, being the latest additions. Units 14 and 21 are being completed. Units 13, 18 and 19 are portable mobile. A successful demonstration of our WERS set-up was put on by Radio Aide NY, June 21st. Among those present were Frank L. Greenya, head of Milwaukee County Council of Defense and Police Chief Joseph T. Kluchesky. SYT was a visitor at home and is now stationed in the Chicago office. Capt. ZBP, Signal Corps, wrote from England and mentioned that he met Don Merten there. Comdr. SJH (MC) USNR, has been detached from the Glenview Naval Air Station for ultimate duty outside the U. S. Lt. ANA, USNR, is somewhere in the Pacific. Ens. Wm. W. Black, USNR, is located at the Bureau of Aeronautics. Cpl. Thomas McCormick dropped a card from Arizona. T/Sgt. FQO wrote from his new location near Philadelphia. 1st Lt. VKC, in the ATC, writes regularly from India. Sid found WCR running a GI broadcasting station in India. Pvt. John Holmes is now stationed in Calif. MUM, secretary of the radio club in Eau Claire, reports the club inactive. IXR, now located in Minneapolis and in the insurance business, wrote for the QRA of S/Sgt. G. H. McClaine. Mac reports that he and a few of the boys over there have rigged up an oscillator and a few bugs to keep up on the code. 4DVY, 5FMV, 9GSB and G8TD are in his group. He says G8TD had a nice receiver which was taken from the Jerries in Africa. One day when he had it going it burned up on him and blew the speaker right out of the set. YSZ writes that he has just returned from Arizona where he was on business in connection with tests for the Forest Products Lab. We want more news from the northern part of the State. *Emil.*

DAKOTA DIVISION

SOUTH DAKOTA — SCM, P. H. Schultz, W9QVY — Pierre has received its WERS license with the call KBXI. Seven operators are now lined up and there will be five more in the near future. Jerry Schul (LSPH) reports on the Yankton gang. He says that YFR is now in the Signal Corps in Mississippi. JMO is working for WNAX at Soo City and HJV is operator at WNAX in Yankton. He also services police radio for the city. ZBU visited at Eagle Butte and had a swell rag-chew with LLG and LCM. IYM is in Fresno, Calif., as civilian radioman at Hammer Field. CMJ is still at Chamberlain. Rumor has it that CJS is back at Bryant and again toting the mail for Uncle Sam. Lt. 9RNH K7IGA is now in Lubbock, Tex., training as a bomber pilot in the Air Corps. Thanks for the dope, gang. 73, *Phil.*

DELTA DIVISION

LOUISIANA — SCM, Eugene H. Treadaway, W5DKR — AOZ is doing double duty to help the war effort. CXQ visits GND often to rag-chew. GUK is a busy telephone man. FSX is making plans for 160 'phone. BPL enjoys Army life and is a veteran of World War I. IBL is a Navy radioman on a sub. A letter from FJW with the latest on the Monroe gang will be appreciated. FPO dreams of antennas. DKR wants to hear from each one of the gang. BMM is kept real busy. 9OLQ is in Lake Charles. AXU and HBY are on the job in Alexandria. 6IZV is a m/sgt. at Esler Field. 5JTU is a lt. and stationed in New Orleans. QH and DC: How about dropping a line on the Shreveport gang? CQF is seeing foreign duty. 2NXV is a/c at Selman Field. Lt. 8QQK is stationed in New Orleans. BSR is an old-timer in Lake Charles. 8OIZ and Lt. MAM are with the 61st Signal Radio Intelligence at Camp Polk. DRF is standing by in Holly Ridge. 3IOW is a t/sgt., APO 832, New Orleans. RR is a busy oil man. 4BMH is plenty busy in Slidell. IRT is on the job at WDSU. GLH does his bit at WWL. HIY is a s/sgt. in Maintenance Sec. No. 2, A.A.B., Alexandria. UK is working day and night in his radio shop. BLQ is a power man. 4HPF is a major stationed at Camp Polk. 9JGN gets his *QST* at Sulphur. Lt. DJF is at 336th Bombardment Group Hq., Lake Charles. HDN is working with the FCC. S/Sgt. 9ZWW is with the 6th Airways Comm. Sqdn. at New Orleans. 5GZZ is RM1c, USNR. CSD is a lt.(jg). 9QAK is a t/sgt. at Army Air Base, De Ridder. 2MMQ is a t/sgt. with 16th Fighter Control Det., New Orleans. HHT is a busy radio man. Capt. 9NZF is at Camp Polk. 9LWB is active in New Orleans with the U. S. Border Patrol. 7HKE is a cpl. at Barksdale Field. Maj. 4FCW is with the medical detachment at Camp Claiborne. 1KRO is a YL with the USN stationed in New Orleans. HUQ is a busy grocery man. Lt. 8OPG is at Army Air Field, Lake Charles. The SCM would like to hear from ACA. 3FPA is in the USNR stationed at Algiers. DWW is busy at KRMD. 73, *Gene.*

HUDSON DIVISION

NEW YORK CITY AND LONG ISLAND — SCM, E. L. Baunach, W2AZV — BGO reports that N.Y.C. WERS continues to grow, with 300 units and 550 operators at this time. V. Kubanyi, G. Schmitt and G. Brandt now hold Class B tickets. Brandt and Schmitt have gone into the services. LKP, JEL and JQ are very busy in N.Y.C. WERS. IN is coördinator of Bronx WERS. The Queens WERS net is conducting a code class under the supervision of T. Cosmas at boro control every Tuesday at 8 P.M. Queens WERS members are invited to attend. Contact your precinct coördinator for information. On June 4th the first contacts on 1¼ meters were made by several of the Queens gang. A number of units have been licensed for operation on 1¼ meters which will augment the 2½-meter band in Queens. At the June 7th meeting of the planning board, copies of the new operating procedure for N.Y.C. WERS were distributed to the precinct coördinators together with copies of the Oath of Secrecy to be signed by the personnel. DGJ is reported to be holding a better job at Sperry. BKZ has been taking pot shots at the rats in his Victory Garden. LFY is trying to eliminate the bugs from his new mobile pack set. S. Semel, operator at boro control, enters the Navy in July. OG celebrated his 20th wedding anniversary June 11th. Al is supervising operator for Queens net. DOG, Suffolk County coördinator, is busy getting things in shape for the WERS license but needs help. MZB is going to advanced radio school prior to going to sea aboard a destroyer. MTC is now a warrant officer in the Navy. His XYL, NFR, is with him at Norfolk, Va. KAP and his XYL, NFX, are in their new QTH in Forest Hills.

MIDWEST DIVISION

IOWA — SCM, Arthur E. Rydberg, W9AED — Sioux City is now licensed for WERS with the call KHRU. HCA is radio aide and UFL is secretary. The group consists of about 20 hams, commercial operators and aspirants for restricted operator permits. JIH reports that Cedar Rapids WERS interest is on the upgrade; more amateurs are becoming interested and restricted operator permit examinations are being given every two weeks. Emphasis is being placed on the use of dynamotors, vibrapacks and motor-generators and several of the group are pushing walkie-talkies. WQQ is enjoying the best operating results so far. Des Moines is still working on its WERS application. OLY says an HY75 makes a good doubler 56 to 112 Mc. Jerry Petranek, of Traverse City, Mich., says hello to the fellows in Cedar Rapids. He has been 9SEC and 3HWG and is now KH6SHS/W9. NMA is in the Navy, and is going to try for radio technical school. CCE has been teaching a radio class at Lenox College in Anamosa. UAD has left the merchant marine and has joined the Navy. UYW is now chief engineer at WOC. TWX is working part time at WSUI. PNK has enlisted in the Navy. AHP visited the old home town, AEP and DIB. JBY, in the AAC, is in the So. Pacific. 73, *Art.*

KANSAS — SCM, Alvin B. Unruh, W9AWP — GGK, CRT, USNR, who has just returned from the So. Pacific, would like the addresses of DEB and Lt. Comdr. Fred Baker. GGK expects to return to "that area" again in the near future. CIK writes from the So. Pacific. He is NCO in charge of the radio station and built two superhets, a transceiver and a 25-watt 'phone rig. He also installed a ground station with two 600-watters. KFH is radio-elect., USNR, and complains of the heat and moisture where he is stationed. Cpl. Marion R. Stephans, AAF, Salina Air Base, operator license only, requests the address of NNU, who he thinks is overseas with the Signal Corps. WBC, formerly with KGZC, Topeka police, joined the merchant marine. JTN is slated to join Boeing flight crew for radio-electronic flight tests. 5HHF/9 and 9DJL flew to Denver for radar school. BCY, also of Boeing-Wichita, returned from an air trip for the engineering dept. BSX, an M.D., is confining his operating to x-ray and diathermy. ABG, a m/sgt. in signal company, sends a new APO number. More mail is received from hams overseas than from the home gang. How about it? 73, *Abie.*

MISSOURI — SCM, Mrs. Letha A. Dangerfield, W9OUD — Mrs. SCB of Festus says the OM is in Egypt with an airline and attended the Egyptian Radio Convention. RHA passed all those courses at San Antonio and is

learning to fly PT-19s. QDQ is now permitted to state that he is located in New Hebrides. We can furnish the address of DDX, thanks to GLK, who has been in the So. Pacific with the Navy for 13 months and is expecting a 30-day leave. BIU has his wings and commission in the Air Corps and is being made into an instructor at Central Instructor's School, Randolph Field. He had his first leave in nearly two years and went hunting and fishing with OMG and ZAO. Pvt. Phelps of St. Louis is division technician in artillery at Camp Roberts and hopes to be sent to Fort Sill. He requested the addresses of GHD, AEJ and HXF. We sent him GHD's address in the Aleutians and asked KIK to obtain the others, and we learned that AEJ is radio operator, 2nd-class, stationed at Corpus Christi and that HXF was reported missing in July, 1943. NSU and mother are making out quite well as long as the wx keeps warm. KIK had no chance to use his WERS ticket as the government engineers were keeping him busy during the floods. FIR/FOR sends his regards to the boys in the Highway Patrol and tells us he finally talked SAP into joining the merchant marine. He has been in nearly every country and has joined hamfests at many out-of-the-way places and the subjects of discussion were always the same — the rigs which were about to be launched on Dec. 7, 1941, those proposed after the war, high power verus low power and how our bands will fare. Mail sent to his St. Louis home address will be forwarded by the XYL. BMS is up on the roof of the building at this writing soldering an extension on the antenna to conform with an alteration in the roof. OUD has a stack of letters to write to the boys which she promises to get at immediately. Might we suggest that you put your calls, ex or active, on your letters to help with reports? Best of luck and 73.

NEBRASKA — SCM, Roy E. Olmsted, W9POB — In the past month I received just two reports — both of them from men in the services. I should receive at least 20 reports from the home guard each month. Yes, I know, but the boys in Italy and France and England and on Guadalcanal also read this page, and they want to get all the ham news along with the home gossip. A post card will do. FLA writes a swell V-mail letter from sunny (?) Eyetie; he states that he is working in radio and gets a lot of pleasure from it. During the winter he taught a radio class with the *Handbook* as his text and achieved all objectives. He is now in charge of maintenance in a net of about 20 transmitters and receivers and only regrets that "ham" improvements are not allowed. QGE, who writes from Camp Gordon, Fla., says that he always wanted to be a "beauty-rest" paratrooper but the Army found that he had a degree of temperature in engineering so they put him to building bridges. A lot of talent wasted, I say, because Bob is the only amateur in this State who regularly worked on his second sub-harmonic. Arf. Let's hear from all of you. *Pop.*

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Edmund R. Fraser, W1KQY — The sympathy of the Section is extended to BCG, whose father passed away June 17th. BCG is one of Connecticut's ardent hams and a CBA official of long standing. Through an oversight JYE was omitted from the list of GB members in the armed forces. ASP, ex-CRM USN, has been discharged and is working in a defense plant in West Haven. FMV recently returned from a two-week business trip along the Atlantic Seaboard. NRV has been advanced to S/Sgt. ATH, BHM and IGT have polished off their camera lens and are putting them to good use. Harry Johnson, ex-SF, Branford radio aide, is recuperating from a nervous breakdown. BW is taking over his duties temporarily. CTI writes that Bob Mulqueen, WJQA operator, has enlisted in the Navy. WKAO is being heard using f.m. and putting in an excellent signal on TR-4s. WERS units have been experiencing skip conditions with distant units coming in louder than locals. WJLH-47, 61 and WKOB-14 of Guilford, Madison and New London respectively, report hearing WNYJ-150, WKLR and WKAE-1 consistently. WJLH-1 recently heard WNYJ-150 and WMHC-1 for the first time. WKOB-14, WKJA-7 and WJZA-5 were contacted direct by WJLH-1 during a recent Monday test period while relaying traffic. DBM, Middletown district radio aide, has returned from a two-week vacation, and is resuming duties along with his XYL. The WJLH operators have voted to discontinue Sun. test periods for the summer, concentrating their efforts on an increase of units and operators operating on Wed. During the Mon. test periods it was found that the state can be well covered in the event of necessity; messages have been relayed to all parts of the state in exceptionally good time. Regular and alternate routes have been set up and used. Links to R. I. and Mass. have been established. Your SCM has been observing WERS units in operation Mon. nights and wishes to compliment the operators at WJLH-1, 47, 61 and 65; WKNQ-1 and 4; WKAO-48; WMHC-20; WKBO-14; WKWG-62 and 70 on their efficient operating procedure. DGG has been kept busy building new receivers and transmitters for WKAO units. Considerable interest in the use of A-2 emission is being shown among the WJLH operators.

MAINE — SCM, G. C. Brown, W1AQL — HYH, communications officer for the State Guard, has done a lot of work in getting a WERS license. He states that the Guard now has 28 Abbott TR-4 transmitter-receivers and has maintained good contact on 2½ meters over a distance of 35 miles between Portland and Poland Springs. The state has been divided into two regions, all west of the Kennebec in region 1 and all east in region 2. It is planned to divide the TR-4 transceivers to cover all strategic points. Requisites for membership in the Guard are a WERS license and a ham ticket. Those interested should get in touch with HYH. BNZ is home on furlough; he has been supervising the installation of high-frequency equipment on merchant marine ships. QH, RM1c, has left on a newly commissioned ship for parts unknown. EBJ has joined the merchant marine. BPX has passed his 2nd-class radiotelegraph exam. Ex-BYI, chief electrician, USN, spent a recent shore leave at Saulsbury Cove with his family. UP's son is home after receiving a medical discharge from the Navy. 73, "*G. C.*"

EASTERN MASSACHUSETTS — SCM, Frank L. Baker, Jr., W1ALP — Watertown has its WERS license under the call WJZI. EAU, radio aide for Quincy, WJYM, reports that he has received quite a few WERS operator licenses. The following have new baby YLs: LID, IMS, BVL and JMY and his XYL, MUW. DJ and XYL are grandparents of a new grandson. They have two sons in the Navy. 3BPW has been working at M.I.T. LFF has been married for some time and has just joined the Navy. LNQ is still living in Milton and working in Cambridge. CLE is a lt. in the Signal Corps. EKG says he would like to hear from NBM. KJD says his brother, LZB, is now a s/sgt. in the Air Corps and is an instructor in S. C. DFS is now a lt. comdr. and is out in the Pacific. He was married recently. VA is working in Washington, D. C. The South Shore Amateur Radio Club in Quincy will hold its regular meetings through the summer on the first Fri. of each month at the Quincy YMCA. All hams are welcome. LID expects to go into the Army. IUQ sends a card from Bermuda and says he gets *QST* from another ham. KON and MJE are back in Md. again. MNH is still traveling around. FRO is working at Raytheon. MOH is in the Navy. LOS and his XYL and MPP went to Pelham and called on IDY and family. MPP still has her class in blinker and semaphore for Coast Guard Reserve. IIQ is now in England. MVF, RM3c, sends a letter from Salisbury, Md. JSM is working at Raytheon as an engineer, and has moved to a new QTH in Arlington. He has joined the State Guard and has WERS-SG license WMSB-19-20. GAG says that he now has an antenna up on the roof at the Mass. Public Safety Comm. at 18 Tremont St., Boston, and hopes to be able to work all units in Boston and other towns. AHP, EC and Fall River radio aide, reports that WERS is still going good with the operators that are left; he is now helping the State Guard to get their operators examined. IBF has been doing some traveling. Let's have some news, gang. 73.

WESTERN MASSACHUSETTS — SCM, William J. Barrett, W1JAH — AJ has moved to E. Mass., and has been working at Raytheon. Ralph reports that BXF is still at M.I.T. AZW says that BKG has joined CAP as communications officer. ICW is a s/sgt. at WAR. Pittsfield now has 45 WERS operators. Regular meetings are planned. NFF got a big surprise when he pulled up alongside MWE with a radio-equipped jeep on Guadalcanal. MWE is a radar operator in the Army, while NFF is in the Marines. Congratulations to Mr. and Mrs. KZS on the birth of a daughter. We extend our sincere sympathy to Mr. and Mrs. HAZ on the death of their son. GJJ reports that MVV is in the hospital at Great Lakes NTS and would like to hear from any of the gang. His address: Clayton Roberts, S1c (RT), Ward D, South MacIntire Disp., USNTS, Great Lakes, Ill. LUD and JAH are working on a WERS link between North Adams and Pittsfield, trying to find the best combination of locations to hurdle the intervening mountains. Inspection of the antenna at WJPG-1 after the winter, showed terrific corrosion. How about some news, gang? 73.

NEW HAMPSHIRE — SCM, Mrs. Dorothy W. Evans, W1FTJ — AWU and HOV were home on leave recently, NMB wrote us that he is now RM3c while NAZ is ART2c. MUW and JMY are the proud parents of a YL operator. Joanne Norma, born May 29th. LVG writes from overseas that he will answer any and all letters received. FTJ will be glad to give his QTH to anyone writing her. ILN is now a captain in the AAF and is getting a new assignment. KKQ writes us that she and 9RNO got together via land line recently. A letter from MXO tells us that he's having an FB time in a WAC training center! Ernie suggests that hams in the services write to the SCM once in a while with the latest dope. He also tells us that his brother is finishing a radio course in servicing and maintenance and expects to be a ham after the war. We just heard that KBU had a jr. operator born a few months ago! JCA tells us that he intends to be the first signal on the air when hamday rolls around again. He has just signed up for a course in engineering. Chuck and his YF stopped in to see the SCM on a recent visit to Concord. I quote from a card received from HJI: "Am still in Washington with N.R.L. Took time out to get a 1st-class commercial 'phone license. . . ." HOV informs us that he is now assigned as a radio officer in a tactical outfit. We hear via the grapevine that LIN is now CRM in the Navy. IJB has been promoted to the rank of t/sgt. Albert is in the So. Pacific. LKK, AUY, ILN, JCA have all visited us at Bow this month. JSL and YF are at their home in Derry, Les having been transferred from the West Coast. He is to attend an advanced radio school somewhere in N. J. We hear that LBJ recently returned from a two-month session at Veterans' Hospital and is to return to the Navy Yard for work. MMG tells us that he is seriously thinking of settling in Calif. after the war! FTJ wishes to thank the boys for writing this past month. Please keep 'em coming.

VERMONT — SCM, Burtis W. Dean, W1NLO — BD has resigned from the UVM faculty and has joined the faculty at Dartmouth College. Roy's new QTH is Wilder Laboratory, Dartmouth College, Hanover, N. H. He is training seven new operators at the S.G. unit at Norwich. The following members of Co. "E" in Barre have their radiotelephone permits and WERS licenses: Nelson Jenkins, Gene Guazzoni, Francis Zorzi, Mario Mikolitch, Kenneth LeRoy, William Roy and Louis Semprebon. Clarence Mathieu of Co. "H," Montpelier, also has a restricted 'phone permit and WERS license. MET and NJP would appreciate a word now and then from the gang. MET's new QTH is APO 133, c/o Postmaster, N. Y. C. GAE/7 took his Army physical the first of June at Butte, Mont., and qualified for limited service. KJG has been classified 2A. JRU and family visited KJG and friends in Morrisville. Bing's QTH is Box 56, Suffield, Conn. He sees JLF occasionally. MIH was home in St. Albans in May. Your SCM journeyed to Schenectady, N. Y., and got his radiotelephone 1st-class ticket. Ed Rybak (LSPH) has gone to work for Bell Aircraft. Ed is living at 49 Mansion St., Winooski. The engineering staff at WCAX has an SX-25; all they are waiting for now is the end of the war so that they can put WCAX's transmitter on 160 'phone. 2MBS, chief engineer for CBS in New England, visited HPN, LWN and NLO at Colchester recently. The BARC is sponsoring a hamfestette on Sun., Aug. 6th, at Bayside, Malletts Bay, Colchester, Vt., with bathing, boating, fishing, picnic lunch, soft ball game, ARRL club award code contest. LMO will speak on cathode ray radio direction finding. Bring the family. Registration fee 25¢. Kids free. 73, *Burt.*

NORTHWESTERN DIVISION

MONTANA — SCM, Rex Roberts, W7CPY — FEG reports a new YL. FGR and FTX are in Washington. FAM is still holding forth at Ronan. The Butte Club held a party at the home of EQM in honor of Mr. & Mrs. Jack Mackinder and Harry Baker. Harry and Jack are leaving for the Navy soon. The club is supporting the AWVS. They also report three new members since last month. EQM is building a new rig to be ready for postwar activities. EMF is remodeling a new home. AST spent a few days in the old home at Forsyth while on furlough from the Aleutians. ABT, "Doc," to us, passed to his reward June 20th. He was a grand old man and will be greatly missed when we resume activities. FGZ and CPY were callers in Kalispell recently. WERS activities are still up to par in Great Falls. 73, gang. *Rex.*

OREGON — SCM, Carl Austin, W7GNJ — HCW, RM1c, is back at his home for a short leave before going to Bremerton. Fred has been in the So. Pacific for two years. HLF reports Medford WERS is taking a short rest. He also mentions a new tower, all painted and ready for receiving work. FAL has a new ranch, but no juice for the RME 69 until after the war. After three years we hear from IKY, formerly of Klamath Falls. He worked for Boeing making wire harness, finally transferred to the assembly department and found himself installing harness which he formerly made. Turned down by the Army, he worked for a radiotelephone 1st-class ticket and made it. Ken Sawyer, RT1c, is back from the Pacific, headed for OTS. Ken had some fun running keying lines through coconut groves, after landing with the boys and getting the transmitter going quickly. Dick Ertle, RT2c, will be in charge of radio and other equipment on a boat. Olga Sandine, RM3c, is an operator at an air base on the East Coast. BVV is experimenting with "tin-can verticals"; he has made several tests of strength and stress and is going to try a hundred-footer, using quart oil cans. GNJ has about 30 feet of a tin-can vertical antenna in sections. M/Sgt. IBY, of Klamath Falls, is in Italy in charge of an aviation radio section and sends regards to the gang. 73, *Carl.*

WASHINGTON — SCM, O. U. Tatro, W7FWD — Ken Hager (LSPH) has finished radio training at Fort Riley and is visiting in San Francisco with his XYL, who also has finished code class instruction. They started their radio training with ORC classes at Olympia. IHJ writes that "Jerry" has been throwing shells in the vicinity of his tent on the Anzio beachhead, causing his "morning line-up" to disappear. With the aid of the medical boys they lowered the floor three feet and laid three tiers of sandbags all around outside and are now "able to practice in peace." AUI is in welfare work, but remains interested in amateur radio. HPG is doing radio service and repair for the Washington Co-op. EWM is a radio engineer for station KUJ at Walla Walla. BVO has a shop at Longview and is radio engineer for station KWLK. EHQ is now a full partner in the C & G Radio Supply Co. at Tacoma. He has a Victory Garden and makes a few recordings. 73, *Tate.*

PACIFIC DIVISION

NEVADA — Acting SCM, Carroll Short, Jr., W6BVZ — IAJ is now taking 18 weeks of advanced navigation at Hondo, Tex. TKV has received a medical discharge from the Navy and is expected back in Boulder City soon on his old job piloting government boats on Lake Mead. Lots of static on the b.c. band out here on the desert. In the good ol' days this would be 20-meter weather. DLA forwards the following information from the northern part of the State: QYK is in the Navy. CW is in charge of the Nevada State Police Radio System. UO is mayor of Yerrington. His son, GYX, is railroad agent at Hudson. PST is the agent at Minden. PAW is engineer in charge of the mine near Searles. QOC is at Ely and TNA at Reno. DLA says of himself, "Retired from railroad as manager and wire chief. Took over WU for duration and still at Carlin." 73.

EAST BAY — SCM, Horace R. Greer, W6TI — EC, QDE; EC v.h.f., FKQ; Asst. EC v.h.f., OJU; OO v.h.f., ZM. SAN writes that his tanker was torpedoed in the Indian Ocean in mid-March and he spent 3½ days in a lifeboat before being picked up. June 15th saw another WERS meeting at the Oakland City Hall. A continuation lecture on f.m. by Milt Winsby, No. 35, was the high spot of the evening. Meetings are held the third Thurs. of each month. TT bought the lot next to his home and you should see the Victory Garden. DUB is also a big-time farmer. GEA is digging out the basement to make more room for radio gear. EY is sorry that the softball season is over. TI is hunting DX on short wave b.c. stations, hi. JEE is working at Mare Island. HS is still in the Sunny South. IT is working at General Eng., Alameda. ZM reports that one of his daughters is now a WAVE. FFA is now at KPDA. QQH, RM2c, was awarded the Bronze Star Medal. IPK is temporarily in Florida at Ft. Lauderdale Beach Hotel. NZG is still in the East with W. E. Co. DEZ is with W. E. Co. in Long Beach. Lt. OCZ is on duty in the Pacific. Major QVI is stationed in San Rafael. HB commutes for Eimac between the San Bruno and Salt Lake plants. CBX is now a lt.-comdr., USN. LCT is doing specialized work at a secret point. ONQ and chief assistant VX have gone in for sailing in a big way. Let's win the war in '44 by buying more bonds. Another day closer to victory, "*TI.*"

SAN FRANCISCO — SCM, William A Ladley, W6RBQ — EC: DOT. 1NHN is now R2c. 9QWM is attached to primary radio school at San Mateo. 9GFF is studying secondary radio at Treasure Island. 9LGT reported to San

Diego as a Navy lt. May 6th. RBQ is busy on the Fifth War Loan Drive. Sgt. 9ICN, USMC, graduated with highest class honors from radio school at Treasure Island on May 27th and is being retained as a radio instructor. 6HLP sends in photos and news. His address is: 1st Lt. Arthur M. Monsees, APO 953, c/o Postmaster, San Francisco, Calif. EAR writes from Seattle. TYP is now RT2c. His address is: Arthur H. Child, RT2c, FPO, San Francisco, Calif. 9WWB (WLJH) is now a resident of San Francisco and employed by the So. Pacific as a train dispatcher. Buck expects to take an active part in WERS. A fine letter comes to hand from EAR, now back in Seattle from the Aleutians. HLP, now in Australia, hopes to get back to Hawaii. CIS has arrived safely at a So. Pacific Island base. K6TMM's address is M.S. Sgt. Lou Lentendre, APO 953, c/o Postmaster, San Francisco, Calif. KZP has accepted a position as radio technician with KYA. PDN writes that he is about to graduate from U. C. where he majored in physics. He will soon join the Navy and take a radio course. Fellows, how about more cards? 73, *Bill*.

ROANOKE DIVISION

VIRGINIA — SCM, Walter G. Walker, W3AKN — Maj. 4BC reports that he has been traveling all over the world with the ATC. He can be reached at: Hq. ATC, Washington, D. C., and would like to hear from the old gang. Col. 3HWJ is still at General Staff Command, Pentagon Bldg., Washington. Lt. Col. HZU is with ATC, Inspection Div., West Palm Beach, Fla. EFO was last reported to be stationed at Anniston, Ala. EEG writes that he has joined the ARRL. He is still working in Norfolk. EOP, former RM of E. Penna., writes that he is station engineer at WMBG. 8AQE, formerly with FCC but now a ship operator, dropped in to visit several days ago. 8AQE and 3NE recalled having worked each other on 40 in prewar days. GGP reports that IKT is now with the Signal Corps in India. When last heard from HJW and IIF were working together in Brooklyn for Raytheon Corp. Your SCM was carried back to the old days recently when the odor of frying transformers was wafted through the house. Inspection disclosed the power-pack for the EC monitor had gone up in smoke during my ten-minute absence from the shack. 73, *Walt*.

ROCKY MOUNTAIN DIVISION

COLORADO — SCM, H. F. Hekel, W9VGC — EHC reports from the Army Air Field at Great Bend, that he had a letter from NWQ, Robert Medlock, APO 503-1, c/o Postmaster, San Francisco, Calif. Frank Quiggin, Ex-6TPP, is now located in Denver with AT&T. HLJ is now a warrant officer, USN. He was a guest at the AAROD meeting held in May at the home of 3JIN. He has left for his new station, Radio Matériel, Navy Pier, Chicago, Ill. ODV is still with the Rocky Mountain Arsenal in Denver and was host to the meeting of the Electron Club May 14th. WYX took his family away back in the hills for a two-week vacation. 112 Mc. has broken wide open in Denver with WERS. TRR is planning a superhet using 9000 series tubes. Ex-9SNB, ex-7HEH, reported via air mail that several of his friends located him through this column. He reports the following: A former neighbor of his, ZDW, is in the So. Pacific on duty at a large hospital. VQZ is with Farnsworth Television & Radio Corp. CVN is with Vultee Aircraft at Santa Monica, Calif. TWQ was in England when last heard from. He has a civil service job with the Navy. The friends of CNL extend their deepest sympathy on the death of his father. WYX has leased part of the top of Squaw Mountain where he plans to build a laboratory for experimental work in radio for the National Forestry Service. 73, by *Heck*.

SOUTHEASTERN DIVISION

EASTERN FLORIDA — SCM, Robert B. Murphy, W4IP — To BYR: I wish you luck in your future undertakings. To Capt. Hazelton: You will be a great help to me in this work. To those who voted for me: Thanks, and I hope I will be able to fulfill your expectations. To those who voted for Capt. Hazelton: I hope to work very closely with him and win your hearts through him. To all of you: Drop me a one-cent government post card and let me hear from you each month. To those in Miami: Use the telephone, dig out some stuff and wake up this sleepy South. ALP of Tampa offers his aid. Wonder if I can get anything out of PEI. ES is all pepped up after a vacation trip to Nassau with the YF and Babs. ES says FGX/AWO is in Wilmington, Calif., with RMCA. EWX is a captain in the AAF and now is in England. VP7NA is an RAF medical officer in Toronto, Can. CO7CX has his daughter-in-law with him for the duration — his son is off to the wars. CO2OK and party are in Miami on a business trip. CO2MU will be here in August. ANP stopped by the house to look me over before he voted. HJQ, just back from the So. Pacific, served as communications officer on Halsey's staff, and is second in command at the radio school, Bedford Springs, Pa. Red and I were shipmates on the China Station back in 1922 and were brought together after 20 years through the pages of *QST* and by DVO of Tampa. ASR seems to be the only b.c. operator with a license now at WMFJ and is so busy he can write but one-word post cards. Col. DQW visited Tampa recently, following a stretch of duty in Iceland. AKJ spent a few days with his folks in Tampa before returning to the land of FFV. GEE is now a sergeant. FKB keeps the tank cars rolling in Tampa. DVO has purchased a new QRA complete with two Ma Nature sky hooks and a Victory Garden. GPP flys in New Guinea and Australia. There were pictures of ALP and ECJ in the Tampa paper recently. ECJ flys in England. DIN has gone North on business. ALP and DDM are active in CG Aux. Ole DES is back from Philly. AFU works days with TASCO and burns the midnight oil at presses between times. AQ is still with Bailey, Tampa, police radio and is doing OK. BYF sends in a fine report on Dade County WERS. He is busy getting the control moved to a new location on the roof of the Technical Education Building in Miami. The control transmitter is crystal starting on 20 and ending with an 815. Station receivers are a National 110 and a superregenerative job built by Lawrence Mennitt. The new license modification will give a total of 45 stations. The ham members at present are AFF, AJD, BYF, CFC, FTJ, GYZ, OK, EQQ and two LSPH. More ham operators are needed very badly in Dade County. BYF also reports that they are conducting a c.w. class every Wed. evening. In going through the PAA's shops the other day I met ETQ's YF. She is doing excellent work in the war effort on this side of the pond while hubby is in the services in England; both are doing detail work as radio technicians. CNZ is on vacation in Mt. Dora. DZH is working hard in the screen room of PAA's radio shop. COS, of National Guard and Knights of the Kilocycles fame, passed through Miami en route to Washington. He has been fighting Japs on the Burma Road. George is now a lt. col. in the Engineers. What about this Jacksonville district? Who wants to send me some reports? 73, *Merf*.

WESTERN FLORIDA — SCM, Oscar Cederstrom, W4AXP — MS dropped into the home town for a short visit, according to a report from DAO. Eddie is doing a fine job as an officer in the Navy. BCZ will be out of the section for some time. FIO has moved back to his home town, Birmingham, Ala., where he has a position in a radio station. Blackman is working on another code machine. The radio boys who live near AXP are stringing wire for a two-way code circuit using an audio oscillator to furnish the signal. AXP received the Purple Heart for wounds received in action in World War I. PE and AXP had a nice chat at PE's office. 73 till next month from *The Old Maestro*.

SOUTHWESTERN DIVISION

LOS ANGELES — SCM, H. F. Wood, W6QVV — The activities of the Los Angeles gang of WERSers have been gaining momentum, and it won't be long before the whole bunch is "set on frequency" and operating as a smooth unit. A great many thanks are due the "monitors" who are giving so much of their time and effort in getting every rig on the "beam" and patroling our portion of the spectrum. AM reports that KGWE is spending the second hour of each drill period in contacting and testing with "out-of-town calls." The gang, under RO, is very active on all drill periods and is to be commended on its set-up. No reports were received from the Inglewood or Los Angeles County groups, but their activities are well under way and Harlan Martin says that considerable expansion in the county organization is forthcoming. SSG reports that KIO passed away on May 12th. SYP writes to say that he recently met G2MN, Lt. Gordon, of the English Army, and they had a good long rag-chew. The lt. and a sgt. saw a woodpile and they dropped in to see if they could get a piece of wood mounting a u.h.f. antenna on a truck; one word led to another, and soon they found out they were "brother hams." ROE has been in the services for over two years, but instead of pounding brass he is waving flags and has learned to use the blinkers. You certainly can join the League; send

(Continued on page 74)

★ ★ ★

SPEAKING of post-war transmitters, did you ever watch a bunch of hens laying eggs? Each hen chooses her favorite nest, preferably the same nest that all the other hens have chosen. Having all chosen the same nest, they all decide to operate at the same time, and the resulting QRM is terrific. If you have ever heard eight hens perched on the edges of eight perfectly good empty nests and scolding the ninth who holds the coveted nest by squatter's right, you will agree that it is a darned asinine performance.

Most of you probably decided to design your post-war transmitter for variable-frequency operation long before we began worrying about hens, so forgive us if we press the point. Amateur bands were plenty crowded before the war, and they will be even more crowded after the war unless a miracle happens. One of the greatest helps in getting the signal through will be the ability to choose an operating frequency where there is minimum QRM, and having chosen, to move there quickly and easily.

This adds up to having a transmitter with a single tuning control, that will track over an amateur band like a good receiver. This presents several new problems, but they do not seem very serious to us. A stable, variable-frequency oscillator requires some nice engineering, but it is no more difficult than making an oscillator for a receiver like the HRO.

Ganging the various tuned stages together does not present a serious problem either, provided that there is a reasonable leeway in the tracking. This latter point is very important, and it may easily make the difference between success or failure. A transmitter in which each stage has to be adjusted to within a fraction of one per cent is almost impossible to gang.

The answer lies in allowing plenty of reserve power. Before the war, amateurs took pride in making the smallest possible tube do the job. The exciter was just strong enough to drive the buffer, and the buffer had just enough power to drive the final. This was all right so long as everything was kept in perfect adjustment, but if even one stage was slightly detuned, there was no longer enough power to drive the final. Well designed commercial transmitters have reserve power where it is needed, and amateurs would do well to copy them in this.

We understand the urge to push equipment to the limit, for there is more fun in getting the signal through with low powered equipment. However, a low powered signal at the right frequency is more likely to get through than a California kilowatt where the QRM is tight.

That post-war transmitter of yours is going to be a lot of fun. Don't buy yourself a thousand dollars worth of grief in order to save a few dollars on tubes and power supply. We'll be listening for you!

DANA BACON

Amateur Activities

(Continued from page 72)

your $2.50 to ARRL at West Hartford, Conn. A nice letter was received from the XYL of MFJ and she reports that Kenny is still going strong. Just missed seeing UQL, who left town the morning I returned from vacation. Mighty sorry, Frankie; please send us the new QTH. Best of luck to all. 73, *Ted.*

ARIZONA — SCM, Douglas Aitken, W6RWW — NEL had a session in the hospital with appendicitis, but is feeling fine again. MDD is with a repair unit in the Navy. FZQ has been transferred to Florida for advanced training. Ex-OJY is working for the TVA in Oklahoma. RPS is running a radio repair service at the Phoenix Airport. TYD, somewhere in England, has been promoted to 1st lt. NGJ and his XYL celebrate their 17th anniversary. OAS reports a top-notch WERS demonstration for the Sheriff's Reserve Unit, using a fixed control unit as well as walkie-talkies and 4 mobile units, taking the reserve members out in groups in the mobile units, as well as demonstrating at the control station. OAS wishes to thank all the gang for their part in the success of the show. JFO and TKL have their WERS licenses. In addition to classes already in progress, the Tucson gang reports a new code class for 17-year-old youngsters who will join the Air Corps. SOB and USC have moved permanently to Oregon. SBN graduated from the university and expects to answer call to the services immediately. QAP is still in So. America with Pan-American Grace. MLL has been under the weather again. NRP holds rating of RM2c in the Navy. GS reports that the Tucson gang will hold their "suds" party in his backyard. BFA expects to wind up his code classes for the Navy Primary Training School shortly. Wonder what's become of KOL, KMM, DFE, KFC, NRI, NVC, NXO, PQQ and RS. KWI still longs for Arizona. 73, *Doug.*

SAN DIEGO — SCM, Ralph H. Culbertson, W6CHV — Asst. SCM, 6APG. Lt. ACW, USN, stationed at North Island, reports that NSY is now a lt.-comdr. somewhere in the So. Pacific. BHF is back in radio business for himself. JHE is working at NAS, North Island. MBU, NUV, PAX and RME are working at Convair, S. D. JRM has covered all his gear with sugar sacks, has set up a machine shop in his old radio shack and is repairing reels for West Coast theaters. MHL, GCT, JUM and DHA are working for Navy Radio Matériel Office at Chollis Heights. Ex-FGU is now in charge of the radio shop for the San Diego City Police Depart. MMV is with the San Diego Gas and Electric Co. He reports KW and JMI are at Terminal Island, Long Beach. AKZ is at Sound Lab., Point Loma. RGY is still with Western Radio. APG and DUP are still hauling mail for Uncle Sam. Don't forget, gang, please send in a little news. 73, *Ralph.*

WEST GULF DIVISION

NEW MEXICO — SCM, J. G. Hancock, W5HJF — ZU/ZM has received his captaincy in the Signal Corps and still is stationed at Arlington, Va. HDN is now on the high seas with the merchant marine. Nat Hancock is trying to build a high-frequency converter for his b.c. receiver; he promises to give HJF some real dope on f.m. when Uncle Sam will let him come home to stay. Aren't any of you guys and gals doing anything? We all want to know what's cooking. Come on, get a post card off to me, doggonnit. 73, *Jake.*

OKLAHOMA — Acting SCM, Ed D. Oldfield, W5AYL — ALB inspects Signal Corps equipment at OCAD. DG pounds brass for the merchant marine. EFR is still making false teeth. FVU, at Hubbard Hospital, is rubbing knots out of the human body. BAT resides in N.Y.C. and is employed by Bell Labs. FYF works for "Uncle" in Washington, D. C. DRD is employed by American Airlines and recently married the YL. CVJ is helping the Army in the Mediterranean area. EHT died in Nov., 1942. AYO twists the dials for WKY. EMP is a real pusher for OCAD radio repair. JCW smears it on thick at OCAD radio repair. HNT is now residing at Wichita Falls, Tex. HQO continues pushing pills at Apache. EMJ does radio installation and check at OCAD. ERN is doing duty in a civilian capacity at Bruning, Nebr. FKF works for the Air Depot at Altus. ATO has taken to flying, and looking after his business between Mangum and Tulsa. AHD is plant manager at Altus. JBZ is entertaining the public with the flickers. HXH is still handling other people's money at the bank. HQO is president of the radio club in Independence, Kans. and is doing a *little wired wireless.* News is pretty scarce and I'm counting on you fellows to send some in. *Ed.*

Legend of Selden Hill

(*Continued from page 49*)

During 1942, Catherine Craig, private secretary to KBW, Louisa B. Dresser, *QST*'s editorial assistant, and Charles A. Service, jr., W4IE, ARRL assistant secretary, each spent several months in the old house, which by then had become almost an official Headquarters dormitory.

Mrs. Dresser was studying for her ham ticket at the time and had progressed so far in her code practice that, when she came to the Hill, Charlie Service installed a private line between rooms and conducted daily skeds. Not exactly DX, but a very effective method of simulating on-the-air QSOs.

The two representatives of Headquarters currently attempting to maintain the traditions of Selden Hill are the latest addition to the technical staff, J. Venable Fitzhugh, ex-W5VL, and the writer, who is temporarily filling a berth as Assistant Secretary. Unfortunately, our radio activity is, of necessity, confined to twirling the dial of an SX-28 and wishfully dreaming of what it would be like to pound brass in these hallowed precincts.

During the many years that Selden Hill has served as an unofficial League residence, its hospitality has been extended to amateurs from all parts of the world. A glance through the guest log reveals such calls as W6CUH, W6QD, W8JSU, W8KWA, VP4TO, OE1FH, ZL2JQ, and ZT1A. Opposite many of the entries are heartfelt words of appreciation for an enjoyable visit.

Radio experiments and operating were not the only activities that took place on the Hill. Most amateurs are rather versatile in their hobby interests, and the crew at League Headquarters is no exception. Ross Hull, in particular, went in for many extracurricular activities. He was highly talented in many fields and somehow managed to find time for an amazing variety of avocations. He had a fully equipped darkroom at the Hill where he exercised his interest in photography and turned out many of the *QST* cover pictures mentioned before. RAH was an expert telescope builder, and a corner of the cellar was reserved for mirror-grinding purposes. Some of the cold winter nights when radio work was not too pressing were spent by the crew on the Hill in watching the stars and adding to their knowledge of astronomy.

Ross Hull was also an accomplished amateur artist and musician. Probably the nearest approach to disaster the old house has ever seen, excepting only the New England hurricane of 1938, was the time when he purchased a grand piano and moved it into his second-floor living room. Anyone who is at all familiar with the colonial architecture of rural Connecticut knows that the pioneer builders designed their sturdy dwellings for maximum utility and wasted no more space than necessary on staircases and the like. In the struggle to get the piano up to the second floor, part of a stairway had to be torn out. Rilla Selden is not sure to this day whether it was the piano or the ever-increasing collection of trans-

(Continued from page 76)

mitters that made it necessary to shore up the sagging northeast corner of the house!

Outside activities on the part of the present crew are restricted to photography with a miniature camera and occasional practicing on a clarinet. Installation problems with the latter are not comparable to those encountered with a grand piano, although the effect on other members of the household can be even worse.

Having survived the storms of a century and the many vicissitudes of amateur radio, the old farmhouse appears to be good for at least another hundred years. Those who have lived there, even for short periods, have come to regard the place as "home," and so long as the doors at Selden Hill remain open it is certain there will always be one or two hams living there and continuing the traditions so ably established by their illustrious predecessors.

Splatter

(Continued from page 8)

N. D., in 1920, he later moved to Plymouth, Wis. He attended the Sheboygan Vocational School for a year and since then has been in business as a radio and electrical contractor. . . . **Lenore Kingston Conn, W2NAZ,** probably has had more experience than most people with the noxious nature of certain b.c. commercial plugs, being herself a veteran of the soap-opera studios. Thus the opinions implied on page 33 may be taken as unimpeachable. First affiliating herself with professional radio as one of NBC-Chicago's busiest young actresses, she has since played in stage, movie and television drama as well. Turning amateur in 1939, she got her first ticket as W9CHD and promptly became a confirmed c.w. addict, handling traffic and operating in AARS. She also became a charter member of YLRL, and then topped it all off with a radio romance. Marrying NBC-New York's engineer Joe Conn, W2MSC-ex-W2AOA, she renounced Chicago to join him in Gotham. For two years director of the New York City AWVS radio classes helping to train women for war service, she gave that up to follow the OM when he entered the Navy. Fortunately, his travels have been on land rather than at sea. Having plumbed the glamour of stage, screen and radio, recently a new ambition sprouted — to become a writer. Reporting for a newspaper in Clinton, Okla., where the OM is currently stationed, is helping the process along. . . . **Marvin H. Kronenberg, W2IJU,** at this very moment is, in all probability, swabbing down a deck somewhere in Uncle Sam's Navy. At any rate, when we last heard from him he was just on the verge of shoving off. That was at the end of a two-week vacation he'd allotted himself to fill in the interim — and, incidentally, in which to pound out for you the article on p. 9. Prior to answering the insistent call of the sea he worked as a radio engineer at the Camp Coles Signal Laboratory, Ft. Monmouth, N. J. He held

You remember him, the kid next door who tinkered with short wave radio. Well, he's in uniform now, calling his CQ from foxholes in Italy and steaming Pacific jungles. Maybe, he's a radio operator on a bomber ... perhaps, he's an instructor. Whatever it is, you can be sure that his knowledge and experience are serving to help build a wartime communications system. Yes, from the hams came ready trained instructors, operators and engineers at a time when skilled technicians were vitally needed.

The radio amateur will be back one of these days, back to his much-loved tinkering. He'll want new equipment to add to his short wave rig. . . . He'll be looking for a JENSEN speaker because he wants highest fidelity in music, code and voice reproduction. There is no finer acoustic equipment than JENSEN reproducers.

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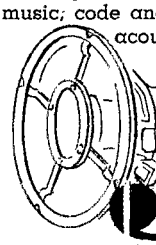

Jensen

RADIO MANUFACTURING COMPANY 6601 S. LARAMIE AVE., CHICAGO 38, U. S. A.

(*Continued from page 78*)

that job for three years, before that being employed at WNYC in New York City. He has held the call W2IJU since 1935, and also possesses a radiotelephone first and a radiotelegraph second. Whether it's swabbing or radio, the Navy can't lose on that bet!

Again with us this month is **G. Edward Hamilton, W9GSS** (p. 26), first presented in this column in May, 1943, p. 66. Bringing the biographical data there appearing up to date, W9GSS is now employed by National Union as measurements engineer in the research laboratory. Also back with us again is prolific **Frederick A. Long, ex-W3BSL** (p. 18), who appeared in Splatter in October, 1943, p. 8, and again in November, 1943, p. 84. To bring him up to date, he is currently director of television for the advertising agency of Batten, Barton, Durstine & Osborne, and, as an extra wartime activity, is writing instruction manuals on radar-type equipment for Hazeltine. And, of course, **Edward M. Noll, ex-W3FQJ** (Splatter, Oct., 1943, p. 8), continues his math series on p. 50.

...—

FEEDBACK

ON PAGE 40 of June *QST*, first column, 33rd line, the sign between 0.25 and 1.25 should have been an equals (=) sign instead of a plus (+) sign — even if the printer didn't think so!

In the diagram of the QSL-type transmitter on page 57 of the July issue, the shunt equalizing resistors necessary to match the heater current of the oscillator tube and the 25Z5s were inadvertently (!) omitted from the heater circuit.

If a 6L6 is used in the oscillator, an 85-ohm, 50-watt resistor should be connected across *both* 25Z5 heaters in series, or one 45-ohm, 25-watt resistor across *each* of the rectifier heaters. R_3 should be 65 ohms, 75 watts. If a 6V6 is used, a resistor of 325 ohms, 10 watts should be connected across both heaters in series, or a 165-ohm, 10-watt resistor across each rectifier heater. The series resistor, R_3, should then be 130 ohms, 50 watts. If a 6F6 is used, the shunting resistor for both 25Z5 heaters in series should be 125 ohms, 25 watts, or single resistors of 65 ohms, 25 watts across each heater. The series resistance, R_3, in this case should be 85 ohms, 50 watts.

Hams and the AACS

(*Continued from page 17*)

be found to constitute basic contributions to radio propagation theory.

And when engineering failed to supply an answer, they resorted to practical improvization. Such a time occurred when an AACS station received an urgent message for a flight of bombers winging their way along a route some hundreds of miles to the west — and the wayward ionosphere chose that particular moment to turn topsy-turvy, wiping out all signals from the west.

But the hams had the answer. There was a B-17 on the field, so they sent it aloft to 17,000

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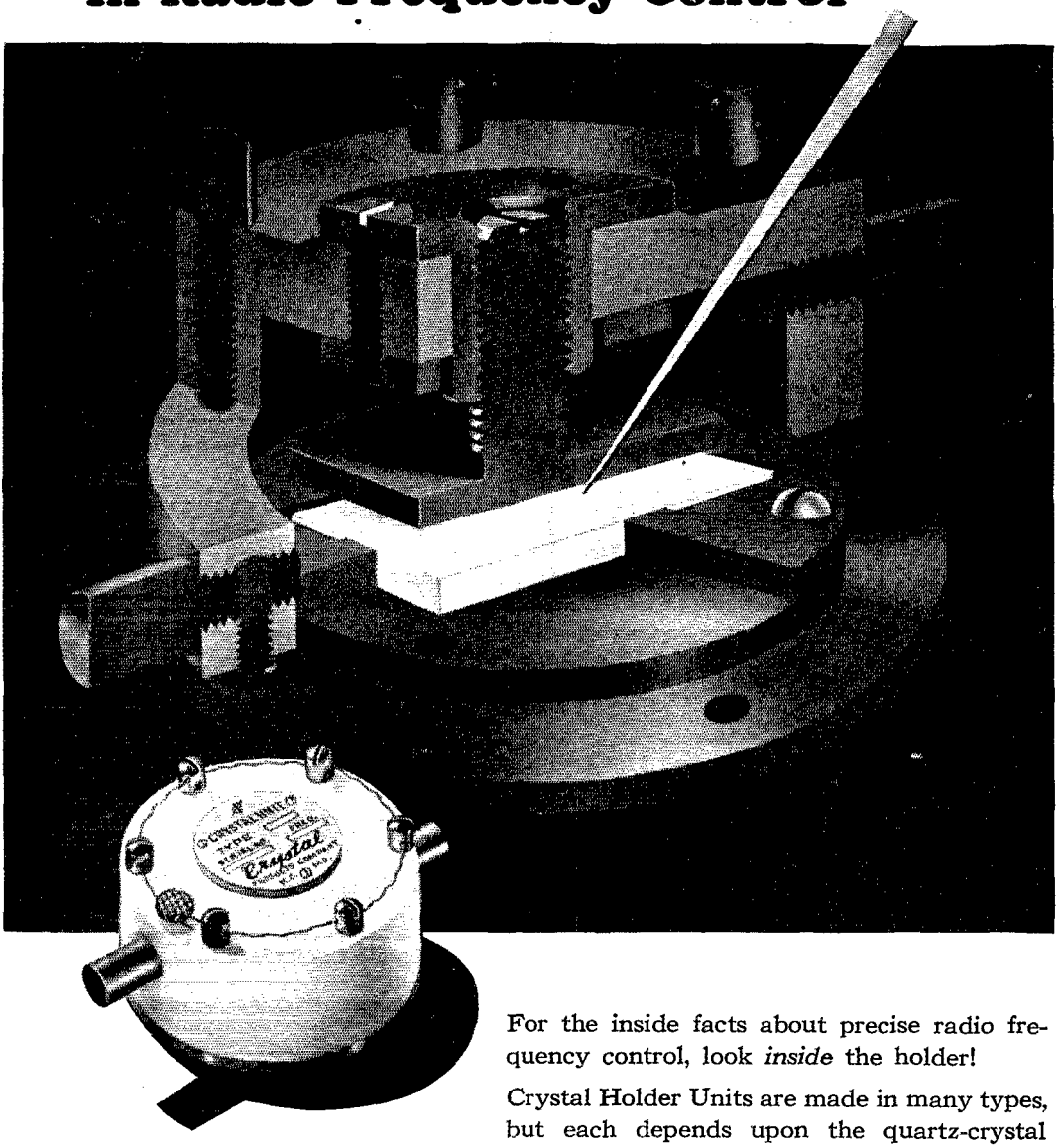

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(*Continued from page 80*)

feet, told the pilot to head west, and waited until the Fortress reached a point where the radio operator aboard could hear both the ferry flight and the ground station by direct-ray transmission. Thereafter the circling bomber simply served as a relay point until the vital traffic had been handled!

They Had the Answer

Those AACS hams just wouldn't be licked. There was one time, though, when the members of a certain crew became a trifle discouraged. They were a brand new outfit, sent to install a station at a far northern location. The men arrived ahead of their equipment, which was being flown up in a pontooned landplane.

When the gear finally arrived they unloaded it laboriously onto the dock, box by box, while the seaplane bobbed on the icy waves. The last item in the cargo was the main transmitter unit — the heaviest of all and the hardest to handle. Gingerly they slid it out of the hatchway to the gangplank leading to the dock. The planking writhed sinuously as they eased the bulky transmitter ashore. Then, at the last moment, chilled fingers slipped and the unwieldy framework toppled into the harbor.

The crew, was, to repeat, just a little discouraged. There was never any question about what they were going to do, though — that transmitter *had* to go on the air. Hardly pausing to berate their misfortune, two of the hams plunged into the freezing water and attached block and tackle to their submerged transmitter. While they climbed out, chattering and shivering, their mates hauled the crate out of the water.

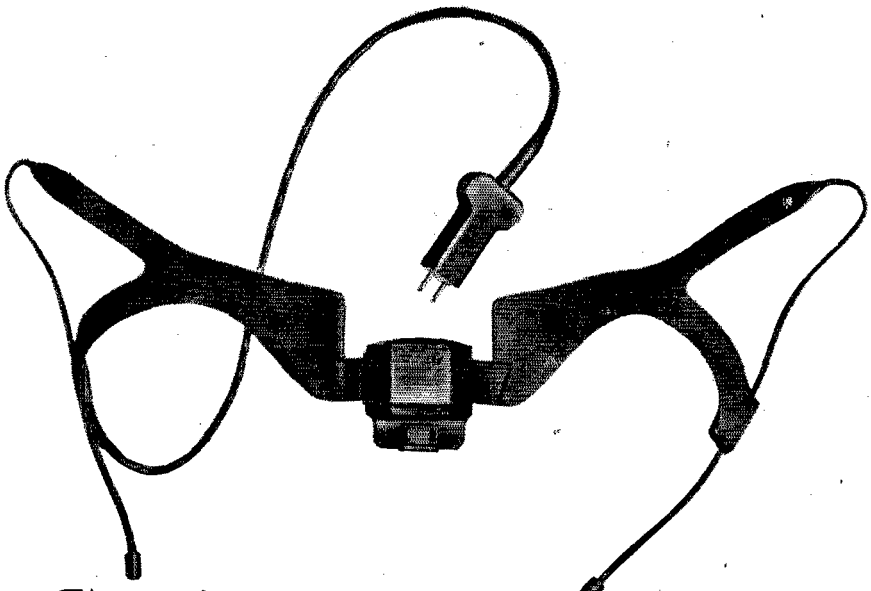
It took a while to get the rig thoroughly dried out and cleaned, of course — but that AACS station, like the others, went on the air according to schedule.

That was the spirit — the job had to be done. No AACS crew yet, however ingenious and versatile, ever figured out a reason good enough to justify failure to carry out an assignment. There were times in the Arctic when it was so cold even the Eskimos wouldn't venture out of their huts — but the AACS crews would be out there, working as usual.

No alibis accepted — and no "reasons." Least of all the excuse of lack of equipment. No antenna insulators? Use coke bottles. No solder? Tie the joint with string. No string? Use twigs, vines, anything — *but get it on the air!*

Somehow, somewhere, the answer would be found — even if it meant a surreptitious visit to the aircraft maintenance depot on the field to commandeer some wire or a special screw.

At times that technique worked in reverse, Certain AACS matériel, in turn, would be looked upon with equally envious eyes by other outfits. Not infrequently a supply officer, noting the arrival of a typewriter consigned to an AACS unit, would decide that it could be employed more usefully elsewhere — in his own office, perhaps. There wasn't much recourse for the hapless radio operator when such a miscarriage occurred.



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(Continued from page 82)

If he presumed to make hopeful inquiry about his waylaid typewriter, the supply officer's answer probably would be: "What typewriter? What do you need a typewriter for? Use a pencil!"

And that would be that.

Heat, Humidity — and Japs

Down under, the airways traversing the Pacific brought comparable problems and hazards, although of a different kind. In the South Pacific, in addition to the heat and humidity, there were Japs to fight as well. Dramatic reports on this aspect already have appeared as "Hams in Combat" stories in earlier issues of *QST*.[4]

The story of Army airways communications in this theater follows the general pattern of U. S. military preparedness before the Japanese attack on Pearl Harbor.

Back in 1940 the CAA began developing plans for a series of inter-island navigational aids in the South Pacific, coördinating the facilities of the Army, the Navy, the Coast Guard and the commercial aviation companies. By the end of 1941 a few stations had been completed and other installations were under way. On paper, it was an excellent program.

Then came Pearl Harbor. Jap operations in the Philippines and Dutch East Indies blew those paper plans sky high. On the major route originally projected, several points now were firmly held in enemy hands. In territory not actually enemy-held, the civilians operating the stations had been evacuated and replacement Army personnel was not available.

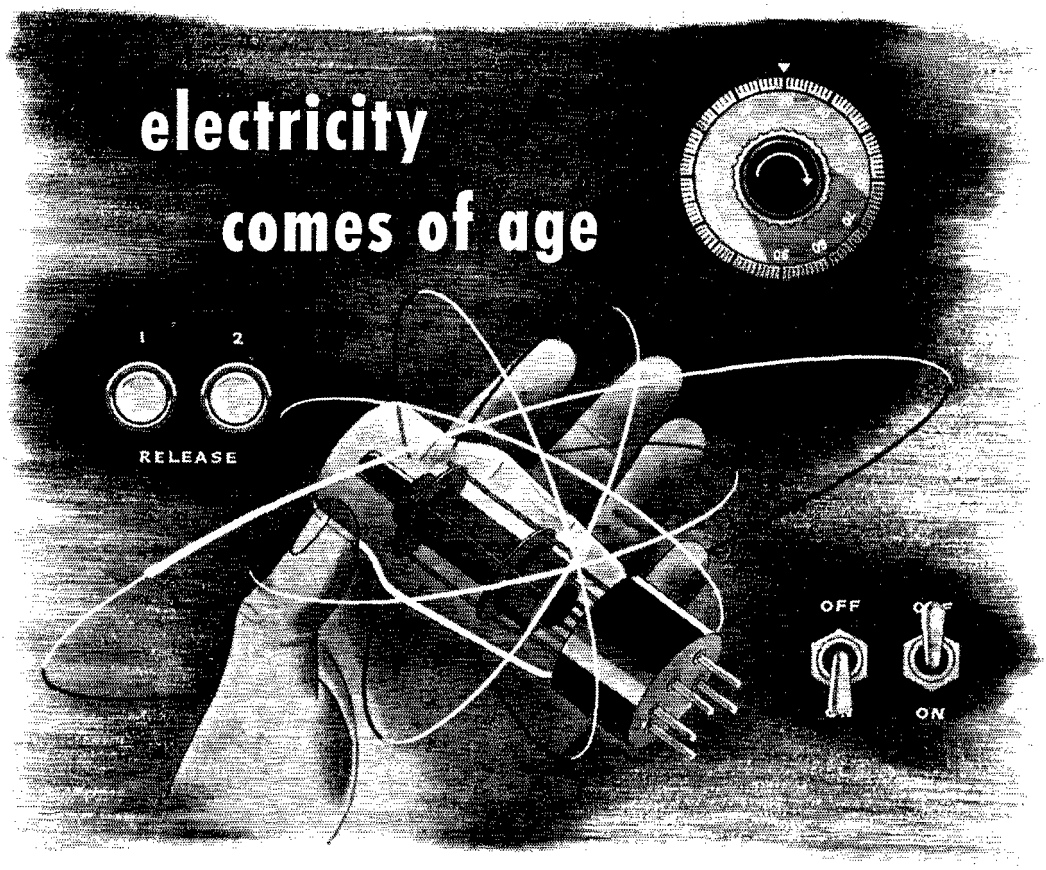
It was at this point where the overworked hams in the South Pacific AACS command displayed their worth. Unlimited tribute has since been paid them for their indefatigable ingenuity in adapting equipment for their needs — transmitters and receivers borrowed from other amateurs back home, from the Navy, from commercial operators, from any source whatever. So diligently did they labor that within six months after Pearl Harbor the major communications links required had been established between Hawaii and Allied bases in Australia and in the South Sea Islands. Their performance is one of the war's greatest achievements in the face of extraordinary vicissitudes.

AACS in Australia

It was originally planned that communications in the region embracing Australia, New Guinea, the Dutch East Indies, the Philippines and other islands in this area would be based on the Philippines. The first detachment of enlisted personnel to man the projected stations was, in fact, awaiting transportation to the Philippines the very day the Japanese attacked Pearl Harbor.

When the plans were redrafted to fit the new situation, Australia became the major Allied

[4] "Hams in Combat," *QST*, August, 1943, p. 19; Beardsley, "Radio Station on the Tokyo Road," *QST*, February, 1944, p. 49. Roberts and Dunn, "Henderson Tower," *QST* March, 1944, p. 44.



In the radio and electronic equipment serving the armed forces, electricity is performing new functions, and performing old functions more efficiently, through the application of electronic principles.

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DIVISION OF
GENERAL MOTORS

(Continued from page 84)

base in the Pacific. Plans were formulated for an airways communications system based on the Australian continent and near-by islands. The first months of 1942 were spent surveying the selected sites and organizing details so that the actual installation could go ahead as rapidly and efficiently as possible.

A standardized station building was evolved. More-or-less prefabricated, 20 × 76 feet in area and one story high, it housed operating rooms for both transmission and receiving, a code room, office, storeroom, washroom, kitchen, mess, bunk room for eleven men and quarters for three officers — a K-ration-sized substitute for home!

Because of local shortages of manpower, most of the physical labor of installing the stations was done by AACS personnel — uncomplainingly and efficiently. By the end of 1942 installation crews were at work in six separate locations in the Australian area, and some communications facilities were operating on a temporary basis.

Then General Mud stepped into the picture. Early and unseasonably heavy rains made a great morass of much of the Australian lowlands. Railroad tracks were washed out and other transportation facilities were completely disrupted. In one instance telephone poles for an indispensable cross-country line had to be dragged, one by one, through three and one-half miles of swamp by caterpillar tractor. Earlier, pier holes for this line, four feet square and nine feet deep, had been dug in the stiff Australian clay. When the rains came these holes filled in with heavy, sticky mud. Every one had to be dug again — all by squadron labor, in gruelling 15-hour workdays.

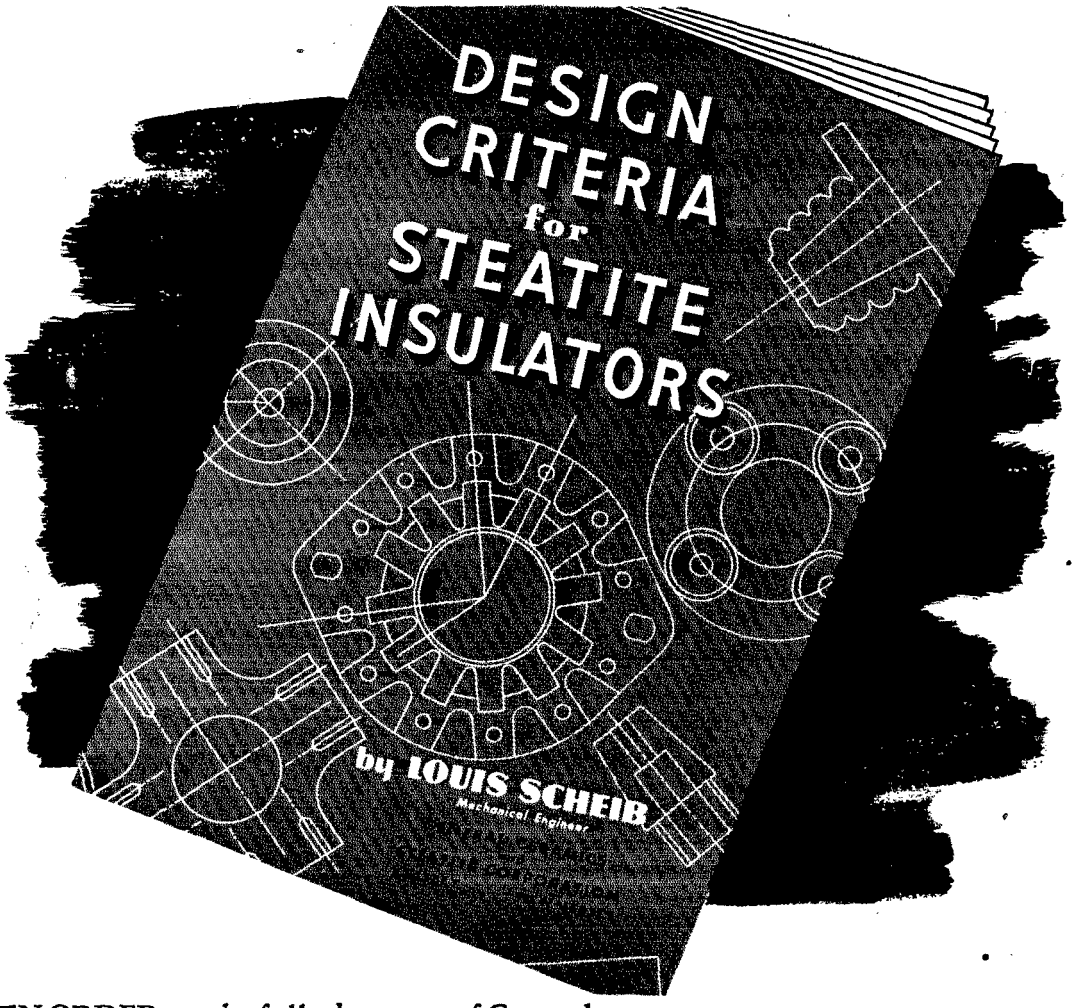
Serious technical difficulties also were encountered. Lack of electrical power necessitated installation of duplicate power units at most locations, and even where commercial power was available the Australian 220–250-volt supply required special adaptation to meet U. S. needs. Another complication was that the frequencies used by the RAAF varied widely from those in use by the AAF; and, since this was a joint operation, the AACS equipment had to be adapted to handle both sets of frequencies.

As though the extra demands of time for construction and installation were not enough, there was always the need for a constant security patrol because of the nearness of enemy units, the isolation of AACS locations, and the constant danger of attack or sabotage.

Nevertheless, the overworked and undermanned Fifth Squadron made great progress. By the end of February, 1943, all installations on the Australian mainland had been completed or were in the final stages of construction. Less than a month later communication on regular schedule was established with AACS installations in India and China, completing a chain of communications that circumscribes the globe.

AACS in Combat

As the Japs were driven back and forced to abandon their airdromes, U. S. troops moved in — and AACS crews moved right in with them.



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(Continued from page 86)

Stations were installed under all conditions of active warfare. Under the "scorched earth" policy practiced by the Japanese, power and communications facilities were completely wrecked. Entire new installations had to be made at each occupied airdrome — after first clearing away the débris.

In creating the required navigation and communications system in the South Pacific, the AACS was confronted with some of its most difficult problems. Infallible navigational aids and weather data were essential because of the great over-water distances and small landing targets — easy to miss in the frequent heavy winds and sudden storms characteristic of that region. A multiplicity of weather-data collecting stati ns was required and frequent bulletins had to be transmitted to pilots. Yet operation had to be snappy and efficient, to minimize the likelihood of interception by enemy ears.

The long hops which had to be covered with low-powered and often makeshift equipment made the job resemble nothing more than a glorified DX traffic net. To the hams it was, in many respects, the same kind of operating they had been doing all along. As a result, in the Pacific as in other theaters many an amateur won tangible recognition by raises in grade. The lack of qualified regular Army officers available for the AACS also resulted in the commissioning of the more experienced hams, a number of whom have become high-ranking officers in the present organization.

Illustrative of the spirit displayed in the Pacific theater is a two-page letter forwarded by the CO of an island station. It was written by an amateur seeking a dangerous special-duty assignment. The routine of handling the busiest operating trick at an important South Seas base had palled on him; even Jap bombing and strafing raids had become humdrum. Then he learned that a special mission was afoot, involving a dangerous penetration into enemy territory. He wanted to volunteer for it, and this letter was his application. He was over-age and his physical specifications were a trifle under par — but he wanted that job. Dismissing his age and physical condition, he offered to go up against the toughest and most rugged youngster in the outfit in any test the CO might devise. And then he stressed his operating ability, his first-aid experience, and — above all — the burning will within him to fight the Japs hand-to-hand for his wife and kids back home (who, he added, would want him to go).

The end of the story? Well, he got the assignment — and he got back, too. He's on another island in the South Pacific now, still warding and watching over Uncle Sam's Army airplanes.

Caribbean Chronicle

No one individual in AACS probably can be regarded as wholly typical of those whose ham experience has caused them to rise to the top. Major John E. Frizen, W9TQB, is an excellent example, however.

Johnny Frizen is one of those boyish-looking Air Force officers who cause one instinctively to look twice to verify the gold oak-leaf insignia —

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(*Continued from page 88*)

thinking they must be gold bars, instead. They aren't, though; they're oak leaves, and well-earned, too.

Frizen is and was a ham, but when war came his first ambition was to become a combat pilot. He was attending Wheaton College — where, incidentally, he was a prime mover at W9ZXR. After receiving his B.S. degree in physics in 1939, he entered the Army as a flying cadet. In 1940 he was sent to Maxwell Field for his final training.

Then — just as he could see himself pinning pilot's wings on his blouse — one of the transmitters on the field went temperamental. The maintenance crew couldn't seem to isolate the trouble. Ham-like, Frizen took a look at it one day — and fixed it. The commanding officer heard about the incident, took a look at the rig, took another at Frizen — and then and there appointed him post communications officer.

So Johnny Frizen was back in radio, after all. But he was a pilot, too, and the AACS needed a man like that. Before long he was placed in charge of AACS operations in Panama.

The transfer of fifty American destroyers to the British Navy in 1940 had given the U. S. the right to lease and build air bases in the Caribbean. These bases would serve two important purposes — as outposts for the defense of the Panama Canal, and as stepping-stones on an air transport route to South America and thence across the Atlantic and to the South Pacific. For that transport route, AACS stations were required.

The setting up and operation of those stations became Johnny Frizen's job. It was a case of starting from scratch and, at the outset, improvising, adapting, having little to work with or nothing at all. The best men to do that kind of job, of course, were hams — so Frizen set out collecting hams for his command. He gathered a small cadre of experienced men before leaving the country, with the understanding that more were to follow.

When the system got under way, however, he was unable to find enough men to keep the stations in reliable operation. Finally, after repeated failures in weather transmissions had been traced to serious undermanning, it was discovered that communications men assigned to the region were being intercepted and reassigned to other branches as soon as they arrived anywhere within the area of the Caribbean Defense Command. In one instance, of fifty men who had been sent to the replacement depot all but eighteen were assigned other duties before they reached the regional AACS headquarters! It need hardly be added that prompt action was taken to eliminate this practice.

Meanwhile W9TQB interviewed every radio man who came into the region, looking for hams — especially for hams with a technical knack. For operators they could make shift with GI-trained men, if they had to. But good maintenance men — the kind who could keep the often makeshift and haywire rigs on the air despite the insidious sabotage of the tropics — couldn't be trained in a school. But the hams always came

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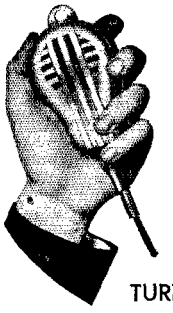

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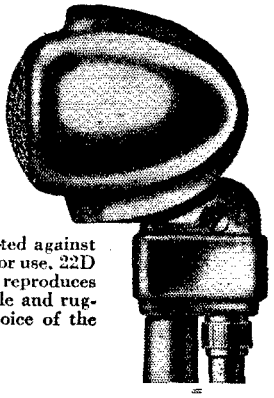

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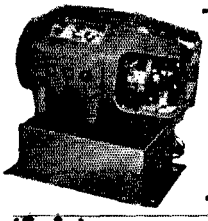

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(Continued from page 90)

through. When necessary they worked day and night, officers and men together — an intent, coördinated, competent team.

It was Army radio — but ham style. When the first of the new SCR 299 mobile trucks arrived, for example, it was a regular ARRL Field Day. Every man in the outfit — including even the few without ham tickets — clustered around to lend a hand. The crew chief — a traditionalist and a rule-book-man — stood around and read the instruction book. But the hams paid no attention to him. "They just went ahead and put the damned thing on the air," according to Frizen.

Early Vicissitudes

Not too much can be said even now of the improvization and the makeshifts necessary during that early period. Take crystals. All ground-station transmitters were, of course, designed for crystal control, but in those early months crystals were "on order" items more often than not. In a ten-channel rig there might be crystals enough on hand for three or four channels — but always the time would come when the crystal for one needed channel would be missing. And yet the contact must be made — Army planes couldn't wait for weeks or months until the right crystal could be procured. At such times not a few ham-band rocks lifted from the rig at home and carried along in a kit-bag saved the day — after being shaved to hit a military frequency, of course.

Or a GI crystal would on arrival proved to have shifted a little from the frequency stamped on the nameplate — just enough, perhaps, to bury the station under QRM from an adjacent channel. Regulations didn't permit unauthorized tampering with GI components — but, after all, operational traffic *had* to get through. A small bag of carborundum became a standard item of personal equipment.

Many another problem of a less conventional nature arose. One perennial hazard — in the Caribbean and elsewhere — was the maintenance work constantly going on around the field. An airport is never finished, and dredges and bulldozers have the disagreeable habit of slicing off underground control and keying cables to transmitter units on the edges of the field.

Perhaps the outstanding calamity of this kind was when the cable running from Albrook Field to the transmitter building across the bottom of the Panama Canal was cut by an overly industrious dredge. The cable could not possibly be replaced in time for the next sked. Feverishly the ingenious AACS hams rigged a small breadboard oscillator. With it serving as a relay transmitter at the control position, they set up a Super-Pro on the transmitting side and through it keyed the 3-kw. transmitter. Albrook Field was back on the air in time for the next schedule!

Among the other problems met — and solved — by Johnny Frizen and his crew of willing hams, although hardly in the same category because it was a constant affliction rather than an emergency, was the humidity.

There are only two seasons in that region,

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Major Frizen contended — the wet season, during which it rains constantly, and the dry season, when it rains only once a day. Perpetual maintenance was required to keep the gear dried out, even when using internal heaters. Bath towels were needed for the gear as well as for the men.

The humidity problem, incidentally, was further complicated by the low retail price of rum — 75 cents a fifth. At first the boys of the "Banana Net" (local colloquialism for the AACS network, subsequently renamed the "Rum Circuit") drank rum-and-coke, but for economic reasons this mixture was abandoned. Down in Panama, you see, while a shot of rum is only a nickel, a bottle of Coca-Cola costs a dime.

Another technical complication — encountered, it must be emphasized, only when the stations were on the air and functioning smoothly — was the fact that the cabarets in the city of San Jose boast what are reputed to be the most beautiful girls in the world. The reason this constituted a technical problem is that these girls drank nothing but "Blue Moons" (diluted Orange-Crush or colored water at a buck a throw) and usually had little command of English beyond three stock expressions — "Hello, Joe," "Buy me Blue Moon, Joe," and "Take it easy, Joe."

Despite such hardships the AACS fought the battle of Panama to a victorious conclusion — each of the men, it must be added, all the while eating his heart out with yearning for duty closer to active combat. In time many of them became high-ranking noncoms in stations scattered throughout the world, while others made OCS and are now commissioned officers with responsible assignments.

As for Johnny Frizen, in September, 1943, he was ordered to AACS Wing headquarters. When we were in Asheville he was just getting settled down behind a desk labeled inspector-general — an assignment literally of global proportions, the inspection division being responsible for inspection of every item of the diversified equipment in the hundreds of AACS stations of all kinds.

This past June Major Frizen began his second tour of foreign service, this time assigned to the African command. The AACS-ham tradition continues in the inspection department, however. Shortly after W9TQB took off for Africa Col. Farman announced the appointment of Major Dean Farran, W6DF, to the inspection staff. A veteran both as airman and ham, W6DF is rated as technical observer as well as a command pilot. His early radio inclinations were interrupted by World War I, in which he saw service as a flying cadet in the Air Service, subsequently being commissioned in the newly formed Air Corps. On being recalled to active duty in 1940, he served first with the Air Corps' Matériel Division and later with the Office of Flying Safety until his transfer to the AACS in June — yet another illustration of the invaluable combination of flier-ham.

Fable and Fact

Many a fabulous tale is told of the ingenuity and versatility of the hams in AACS, not a few

(*Continued from page 94*)

of whom have achieved almost legendary reputations. These are built by word-of-mouth circulation among the highly itinerant members of the System as they roam the world. Such a legendary character is M/Sgt. William E. Maddox, an AACS veteran. Originally from Louisiana, where he was W5DGV, and more recently one of the crew at K5AV, Sgt. Maddox first achieved fame in AACS circles by setting up a ham transmitter on a barren rock which was a key point on the Caribbean route and, single-handed, keeping it on the air for nearly a year.

Another Maddox legend concerns a Consolidated PBY Navy patrol boat which was forced down at sea some distance off the South American coast. Hastily boarding another PBY with some special d/f gear — his own ham version, hastily improvised — Maddox succeeded in locating the sinking PBY far out in the vast reaches of the Pacific. His ship arrived just in time to rescue the hapless crew of the rapidly submerging flying boat.

Maddox was one of Major Frizen's key men. Another was Sgt. — now Lt. — H. F. Whalen, W2AAP. There is a story concerning the three of them which illustrates the ham approach in entertaining fashion.

The trio was flying a C-78 cargo plane over the Central American hump to Albrook Field in Panama. It was not exactly a pleasure jaunt, even at the start. The weather was not good; in fact, it was raining a tropical cloudburst. The ceiling was only a decimal point above zero. But they weren't doing badly, and before long the coffee-grinders on the C-78 had whirled them to within a couple of hundred miles of Albrook.

Then it happened. The rain through which they were flying soaked through the ignition harness, and one engine went out. Frizen, who was piloting, could not induce it to respond again. They would have to make a forced landing.

Treacherous country down there for such a landing, but none of the three exhibited much concern. It was all part of the game — and they had always been lucky.

Their luck seemed to be holding, too. Ahead, as they peered down through the beating rain, was a small cleared field. A bit tight for a C-78 — but a field. Frizen took her down fast, planning to enter the grass-covered meadow at tree-top level to take maximum advantage of its length. The ship lost altitude sharply, wheels just touching at the edge of the cleared space.

It was a nice landing — almost. Frizen had missed just one detail. That was a barbed-wire fence running through the field. The idling prop on the one remaining engine chopped through the barbed strands and the wire began wrapping up around the hub before he could cut the switch.

They got out of the plane and looked the situation over. There was, obviously, only one course — to call for help. The only trouble was that the aircraft radio transmitter was out of order.

While they were still in flight — soon after the take-off, in fact — the transmitter had quit. A

(Continued from page 96)

major burn-out, Maddox had reported after checking up; nothing they could fix in flight. Frizen had shrugged that off. Airplanes had been flown without radio before — although, as a matter of principle, he didn't approve of it.

And now here they were — a wrecked airplane, no radio, hundreds of miles from anywhere. Frizen looked over the surrounding terrain. The tropical downpour had left knee-deep pools of water standing in the surrounding woodland, spaced by islands of sticky muck and mud. Glumly, he and Maddox set out to find help.

They roamed for miles through the swampy jungle, plodding through the muck and mud. Finally they came to a railroad bed. They followed it until they reached a small hut which housed an isolated telegraph office.

A lone operator was on duty — or nominally on duty, at least. To cope with his solitude, he had got drunk — placidly, expansively, gregariously drunk. Frizen asked the operator to send a telegram to Albrook for them.

The bibulous telegraph operator was full of sympathy. He would, of course, be delighted to assist them — but first they must have a drink. He could do nothing for them until they had had a drink. Realizing that the situation called for application of the good neighbor policy, they complied. Some time later, when the requirements of Central American hospitality had been fully satisfied, the message was filed.

Frizen and Maddox bade their benefactor farewell and cheerfully started trudging back to their wrecked aircraft. While still in the dripping caverns of the jungle they heard the sound of an idling airplane engine. They speculated, puzzled. Could Whelan have got the port engine going? Hardly seemed possible. But the only alternative — that the rescue plane had already arrived — was even more improbable. They hurried faster.

When they emerged from the foliage bordering the meadow they saw an Army transport from Albrook Field beside the C-78. As they stared, Whelan came toward them — deadpan, but with a flicker of humor quirking his lips.

"What's up?" Frizen demanded. "How did that ship get here?"

"I called the field and asked them to send it, sir," Whelan replied.

"How the hell could you call the field on a dead transmitter?"

"I didn't," Whelan admitted. "Not on the dead transmitter. After you left I remembered that little Collins 40-watt ham-band rig back in the cargo for the replacement depot. I hauled it out and hooked it up to the emergency genemotor in the ship, and gave Albrook a call."

It was as simple as that. A little ham transmitter, 40 feet of twisted-pair for an antenna, a receiving genemotor for power, a microphone. . . .

"They came back on the first call, too," Whelan added proudly.

Frizen began to laugh. "Damn it, Whelan," he said, "you're still just a ham at heart." Then he added, more soberly, "And thank God for it!"

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WANTED: One Vibrator pack, in good condition, care of G. R. Wisbey, 1902 Crown Ave., Norwood, Ohio.

WANTED: Hadley plate transformer 411; also Hadley 410; Thordarson T-19P56 or UTC S-45. D. L. Pastell, 9071 Carkeek Drive, Seattle 8, Washington.

SELL: same as new National NC-200 Receiver with matching speaker, $175; practically new, 1600 watt power supply, CHT 15P20, 15C41, 15C50 parts, two 249R rectifiers and voltmeter, mounted two heavy rack-panel units, $150; 500 watt supply, 1200 to 2000 volts, UTC parts, submounted 13 × 17 pan, two 866A tubes, $50; double low-voltage supply, UTC parts, variable 300 and 500 volts, with tubes and mounted 12 × 17 heavy pan, first class at $35; compact triple supply mounted in de luxe PA case, multiple plate, filament and bias voltages through plug-in shielded cables, regulated low voltage, Stancor parts, used few hours, includes 2-866 jr, 5Z3, 80, VR105, VR150, $80; transmitter unit less meters and modulation transformer, mounted on 10 × 24 chassis, CW or suppressor modulated, tubes include 6J7, 6C5, 6V6, 6L6, RK25, RK28, several coils, parts worth $75; Guthman model U10 frequency-meter, same as new at $25. All items boxed, f.o.b. R.R. Olmsted, W9POB, Wauneta, Nebraska.

WANTED: Johnson 100FD20 condenser. "Band W" 80TVH coil and swinging link assembly. Will pay top price. H. Counts, W8CUO, 510 West University Avenue, Champaign, Illinois.

WANTED: 1 meter 15 amps, 1 meter 15 volts, both D.C.; 1 meter 150 volts A.C.; 1 D.B. meter; 1 D.C. volts meter, 600 volts. These meters must be 3" square type. Any meter that can be shunted or multiplied to the above figures will be considered. Will pay any price within reason. ALSO: 1 Hickok Traceometer complete with cables and instruction. This equipment urgently needed in conjunction with the war effort. Lt. James Wooldridge, 98 Oak Street, San Francisco 2, Calif.

RARE OPPORTUNITY offered to right man, maintaining radio equipment used in crystal factory, and experimenting in new equipment. Responsible position, fullest opportunities. Good pay. Essential work. Ramsay-Young Labs, 1790 First Avenue, New York City 28. Tel. Atwater 9-1520.

SELL: NC100XA Receiver, in excellent condition. Complete, with tubes. 10 in. Rola speaker, $150. Norman Hamm, YMCA, 316 Huntington Ave., Boston 15, Mass.

CRYSTALS: Prompt delivery on those dependable time-proven Eidson crystals in the 100-10,000 kilocycle range. New units available for Police, Aircraft, Marine, etc. ALSO repair and regrinding service. Send for folder L-5. "EIDSON's", Temple, Texas.

WANTED: Wireless record player. Good condition. W9BNP, J. M. Dean, Lexington 16, Kentucky.

WANTED: *How To Pass U. S. Government Examination*, by Duncan & Drew; one ARRL *License Manual* 1931 to 1936. Write to Morris Tichenor, 4007 Magnolia St., New Orleans, La.

METER SCALES: Volt-amp-ohmmeter scales for 3" Weston, Jewell, Tripplett. Descriptive circular. Dealers inquiries invited. CRYSTALS: Marine, Police, Aircraft, 1600-8000 kilocycles. Send specifications for quotation. Fast delivery. NEBEL LABORATORY, 1104 Lincoln Place, Brooklyn 13, N. Y.

WANTED: Hallicrafters S-27 or G.E. JFM-90. FM receiver. STATION WHAS, Louisville, Kentucky.

SOLDIER wants all wave radio, small enough to carry when shipping. Contact my home. Mrs. R. G. Chichester, 4652 McNeil Avenue, Norwood, Ohio.

WANTED: Communications receiver. Prefer Hallicrafters or Howard. Home recorder. Top prices. Robert Gellerman, 518 Prospect Ave., Cloquet, Minnesota.

WANTED: Low priced, used 2½ meter transceiver. Tubes, power supply. Morton Bardfield, Brinsley St., Dorchester, Mass.

SWAP OR SELL: 5AP4 tube, unused; Philco Signal Generator; ten-tube UHF Superhet; 1.5 KVA lightning-damaged transformers (6600 volt winding easily removed for rewinding without disturbing two good 110V windings). WANTED: Laboratory instruments, apparatus, test equipment, any condition. C. Littell, Jr., 308 West High St., Piqua, Ohio.

WANTED: First class licensed operator. Permanent position offered in local network station. WCLO, Janesville, Wisconsin.

Index to Advertisers

All of the above advertisers are coöperating with the A.R.R.L. to permit publication of an editorially adequate *QST* during this period of war rationing of paper. Using less advertising space but at higher rates, they continue their customary support of *QST*. Some are using smaller space in each issue and some are using space only every second or third issue. Of the latter, those whose advertising does not appear in this particular issue are indicated by the ** above.

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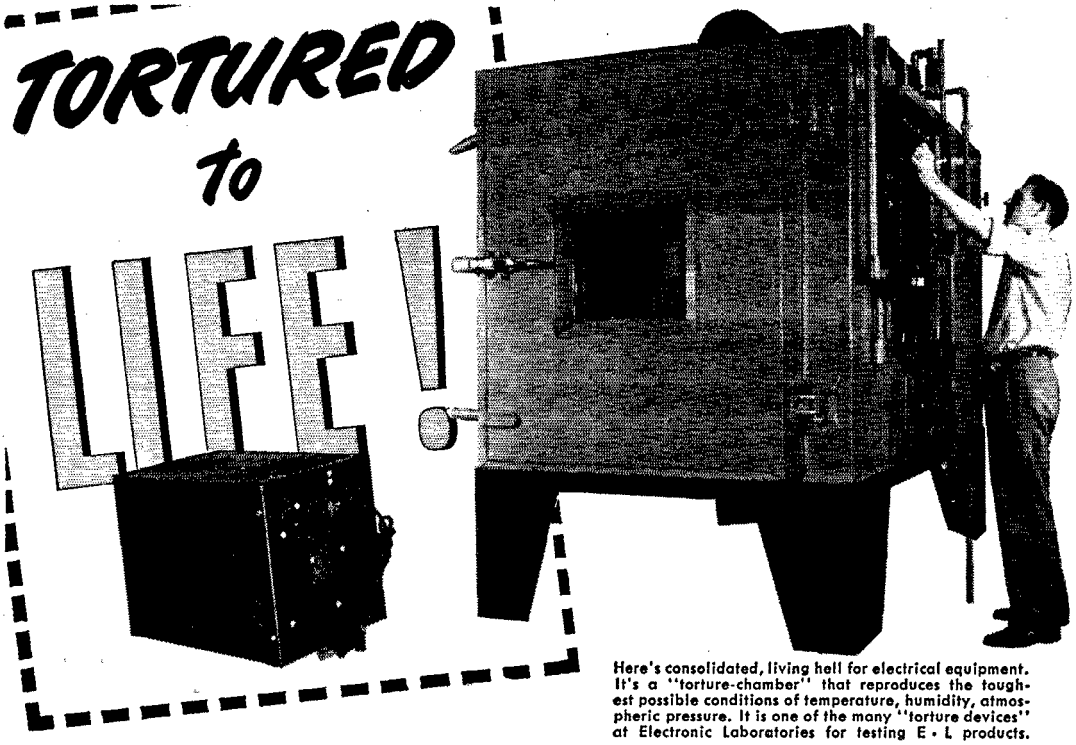
TORTURED to LIFE!



Here's consolidated, living hell for electrical equipment. It's a "torture-chamber" that reproduces the toughest possible conditions of temperature, humidity, atmospheric pressure. It is one of the many "torture devices" at Electronic Laboratories for testing E·L products.

THE HARDEST PART of an *E·L* Power Supply's life is being born. Because then it must survive tests that make its actual service-life a bed of roses by comparison.

E·L Power Supplies have to prove their guts in temperatures more extreme than Siberia's cold or Sahara's heat . . . at altitudes higher than the Himalayas and lower than the Dead Sea . . . in dust storms . . . in salt spray . . . in humidity worse than a Solomons swamp! Severe operating conditions all, yet intentionally exaggerated in tests at Electronic so that *E·L* Power Supplies may live longer in actual service.

If you have power supply needs of converting low voltage to high voltage, obtaining a precisely regulated power output from a varying power input, or anything else, however tough — let Electronic's engineers help you find the answer.

Your problem may be radio . . . motors . . . lighting. *E·L* engineers are familiar with them all . . . and many other applications as well! They are at your service for consultation!

Only *E·L* VIBRATOR POWER SUPPLIES Offer All These Advantages:

1. **CONVERSION**—DC to AC; DC to DC; AC to DC; AC to AC.

2. **CAPACITIES**—Up to 1,500 Watts.

3. **VARIABLE FREQUENCIES**—A power supply may be designed to furnish any frequency from 20 to 280 cycles, or a controlled variable output within a 5% range of the output frequency.

4. **MULTIPLE INPUTS**—For example, one E·L Power Supply, in quantity production today, operates from 6, 12, 24, 110 volts DC or 110 volts AC, and 220 volts AC, with a single stable output of 6 volts DC.

5. **MULTIPLE OUTPUTS**—Any number of output voltages may be secured from one power supply to suit individual needs.

6. **WAVE FORMS**—A vibrator power supply can be designed to provide any wave form needed for the equipment to be operated.

7. **FLEXIBLE IN SHAPE, SIZE AND WEIGHT**—The component parts of a vibrator power supply lend themselves to a variety of assembly arrangements which makes them most flexible in meeting space and weight limitations.

8. **HIGHEST EFFICIENCY**—E·L Vibrator Power Supplies provide the highest degree of efficiency available in any type power supply.

9. **COMPLETELY RELIABLE**—Use on aircraft, tanks, PT boats, "Walkie-Talkies," jeeps, peeps and other military equipment, under toughest operating conditions has demonstrated that E·L units have what it takes!

10. **MINIMUM MAINTENANCE**—There are no brushes, armatures or bearings requiring lubrication or replacement because of wear. The entire unit may be sealed against dust or moisture.

Electronic LABORATORIES, INC.
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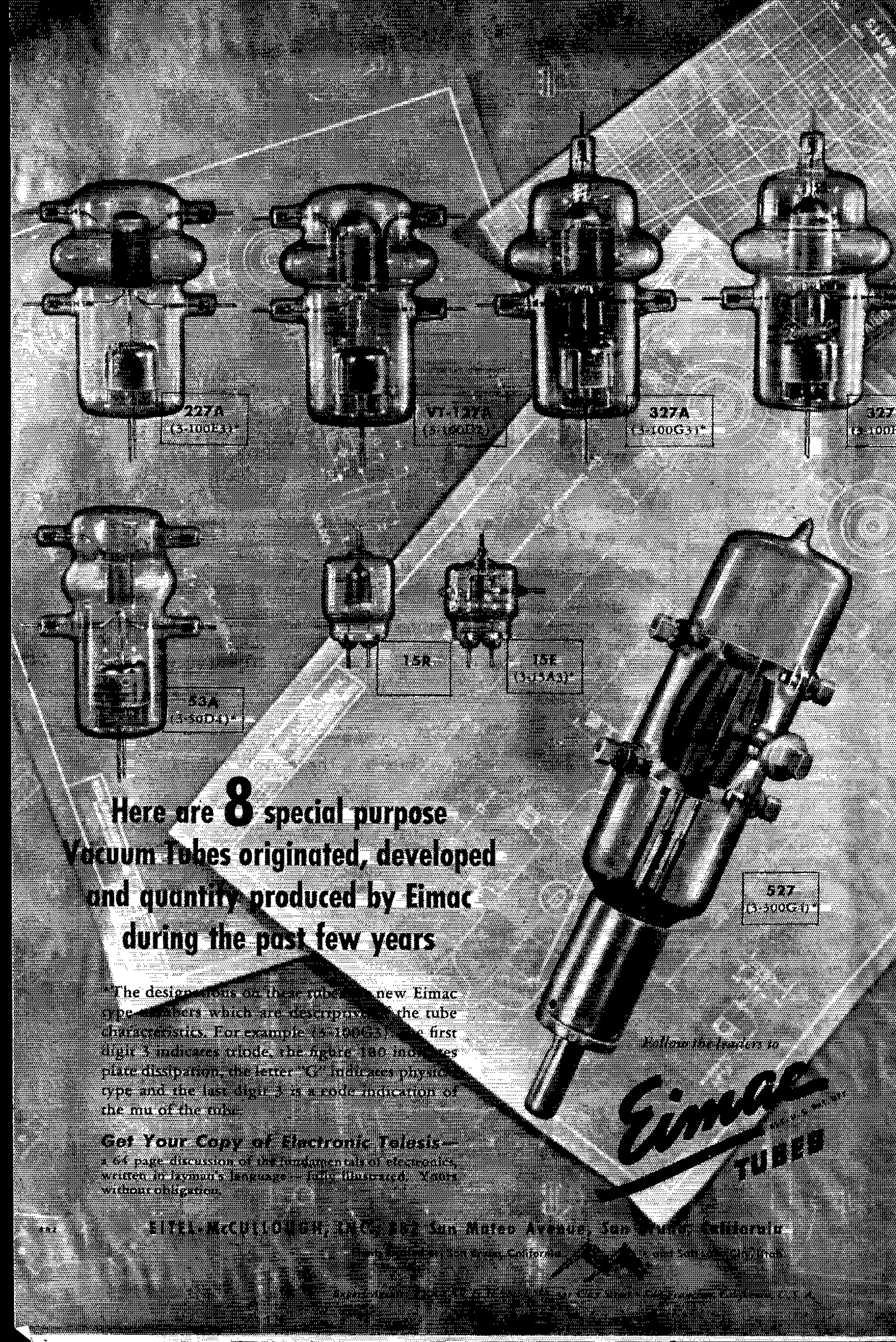
E·L ELECTRICAL PRODUCTS—Vibrator Power Supplies for Communications . . . Lighting . . . Electric Motor Operation . . . Electric, Electronic and other Equipment . . . on Land, Sea or in the Air.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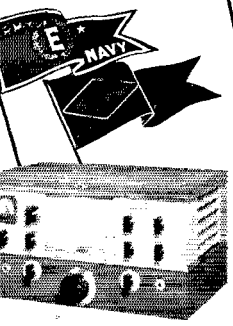


"NATIONAL" HELPED MAKE HISTORY IN "THE FLIGHT OF THE FUTURE"

It was "National" all the way in the Constellation's air-ground communications in her record breaking* flight from Los Angeles to Washington! National RCK-1 receivers were used at both take-off and landing. And from coast to coast, TWA check-points monitored her flight on their NC-100 equipment.

TWA's mighty Queen of the Air has gone to war. But the lessons learned in her prophetic flight promise even greater feats for postwar passenger transport. New Constellations will flash through the skylanes, checked and guided, then as now, by National air-ground equipment.

NATIONAL COMPANY, INC.
MALDEN MASS, U. S. A.

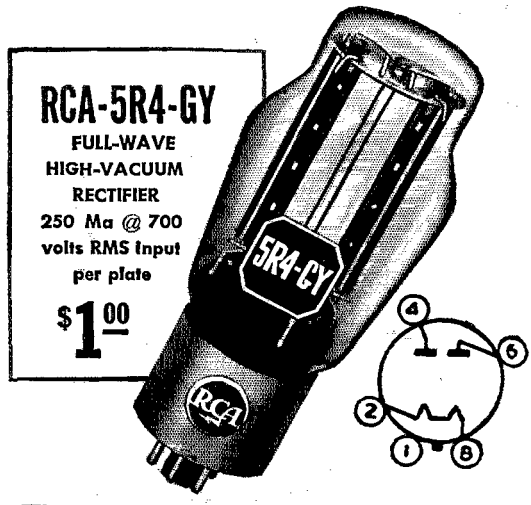
*6 hours, 57 minutes and 56 seconds

NATIONAL RECEIVERS ARE IN SERVICE THROUGHOUT THE WORLD

Are you acquainted with these

RCA HIGH-VALUE RECTIFIERS?

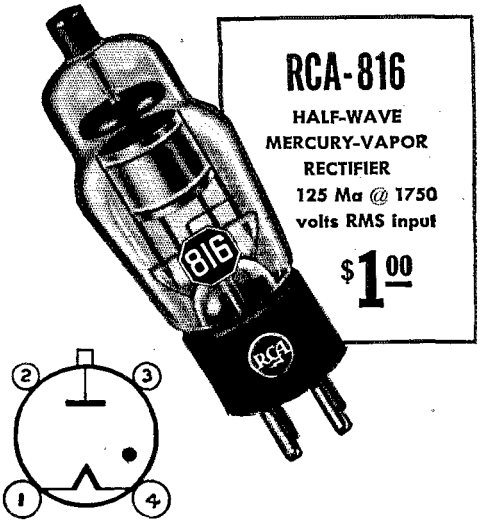
FOR power supplies for low- and medium-power stages of transmitters, and for other electronic apparatus, these two RCA rectifiers fill a real need. Both are sturdily built to give dependable, low-cost service.



RCA-5R4-GY

FULL-WAVE HIGH-VACUUM RECTIFIER
250 Ma @ 700 volts RMS input per plate

$1.00



RCA-816

HALF-WAVE MERCURY-VAPOR RECTIFIER
125 Ma @ 1750 volts RMS input

$1.00

The Magic Brain of all electronic equipment is a Tube . . . and the fountain-head of modern Tube development is RCA.

TECHNICAL DATA

	5R4-GY	816
Fil. Volts (A. C.)	5.0	2.5
Fil. Amp.	2.0	2.0
Max. Overall Length, inches	5-5/16	4-11/16
Base	Micanol; Med. Shell Octal, 5-pin	Small 4-pin
Cap	——	Small
Mounting: Vertical	Yes	Yes — base down only
Horizontal	With pins 1 and 4 in vertical plane	No

MAXIMUM RATINGS
(Design Center Values)

	5R4-GY	816
Peak Inverse Volts	2800	5000
Peak Plate Milliamperes	650 per plate	500
Average Plate Milliamperes		125
For Condenser-input Filter	250 max. @ 1400 volts*	
	150 " @ 1800 " *	
For Choke-input Filter	250 " @ 1500 " *	
	175 " @ 1900 " *	
Warm-up Time, Seconds	10	10

*RMS plate-to-plate input value

RCA

RADIO CORPORATION OF AMERICA

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