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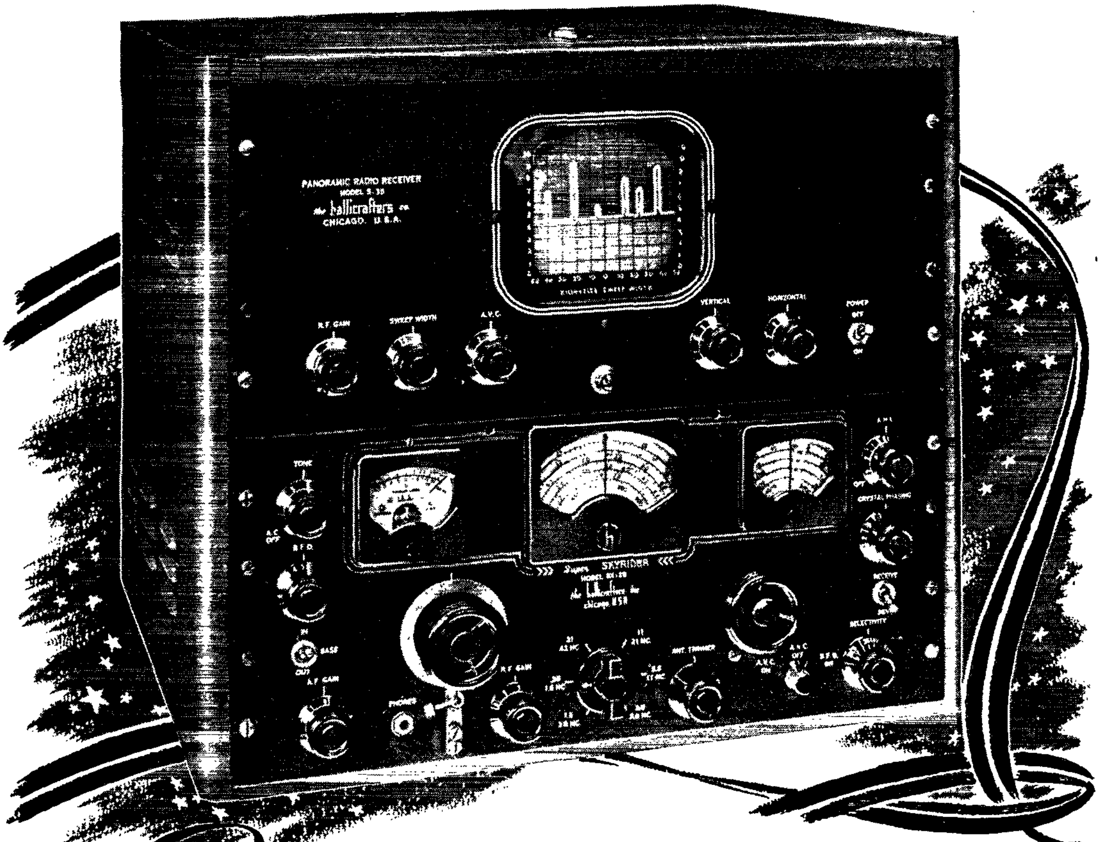
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AUGUST 1942

VOLUME XXVI

NUMBER 8

★

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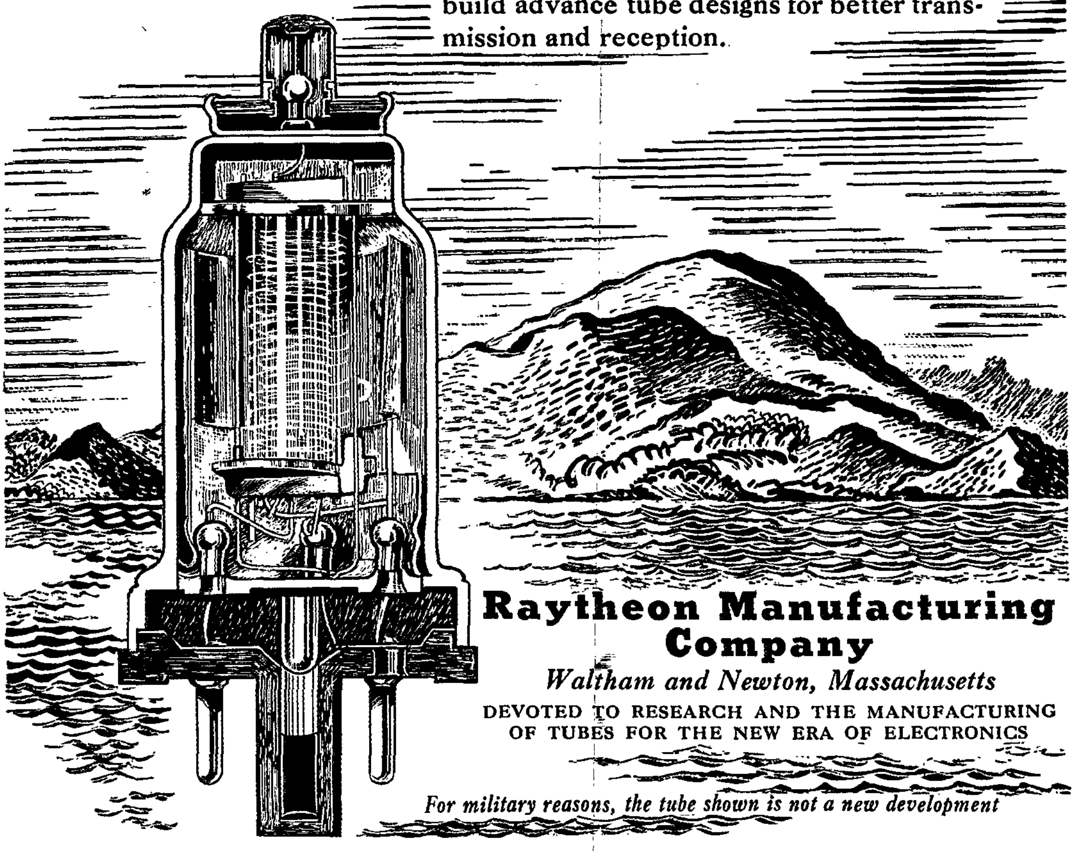

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Reports Invited. All amateurs, especially League members, are invited to report communications activities, training plans, code classes, theory-discussion groups, civilian-defense building or planning each mid-month (16th of the month for the last 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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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.

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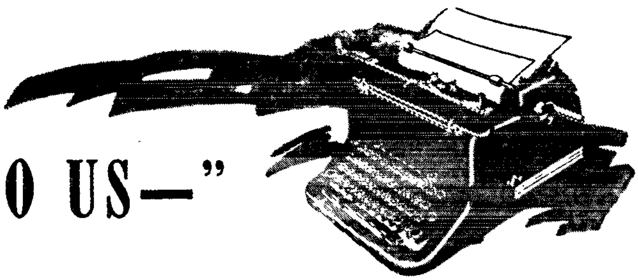
"IT SEEMS TO US—"



REGISTRATION DAY

If you're inclined to feel that there are too many kinds of registration of apparatus going on, we know just how you feel. First there were those AARS questionnaires for the information of the Signal Corps, and then came ARRL asking you to register apparatus with us for sale to hot spots that needed it in the war. And now comes FCC with an order that makes it compulsory for us all to step forward immediately and file a description of the old rig, get a certificate, and "conspicuously affix" it.

This is a wartime communications-security measure and, when you understand that, you will appreciate the need for the action and will comply without grumbling, despite the need to make one more filing. It is not an attempt to seize our apparatus. It does not prevent sales or freeze prices, nor require dismantling or sealing, nor prevent our tearing down or rebuilding. It does give the administration knowledge of the whereabouts of communications equipment and of changes in its ownership and location and possession, so as to reduce the possibility of its falling into the hands of our enemies and being used against us. That is important and understandable. We are sure it will have willing amateur coöperation.

The text of the order and some comment thereon are to be found in this month's "Happenings." If you have retained possession of your own transmitter it is at once apparent what you do: you write for a blank, make a filing, receive a certificate, affix it. Except in this simple case, however, it isn't always apparent just what should be done, and the subject perhaps rates some discussion, particularly considering that we're all going to have to help our fellow amateurs quite a little before the job is successfully completed. So let's look at some of the other cases:

If you have a station license but haven't got a transmitter in your possession, either your own property or another's, you simply report that fact by letter or post card to FCC. If you own a transmitter but haven't it with you because you're away from home, while the rig is back in the home shack in the care of your family, or if you've put it in the custody of a friend or perhaps lent it to a training school, you theoretically don't have to do anything — because it is somebody else's obligation to report it. Nonetheless, it would be a smart idea to report the facts to FCC. Moreover, if you carry an adequate description of your set in your head, you ought to help whoever is in custody of your apparatus by yourself writing for the forms, filling them out, and sending them for signature and filing by whoever has "possession." This will be particularly important if it's your parents or wife or in fact anybody without the technical knowledge to describe your tube line-up, and so on. If you have left your transmitter with another skilled amateur or with a university that has technical men who can be relied upon to fill out the forms, we recommend that you at least acquaint them with their duty to make a filing, since otherwise they may not hear of this order. If you're living away from home and can't remember the details of your gear well enough to describe it, perhaps you have a good ham friend back home whom you could ask to help your folks (or whoever has possession) in making the filing. Trustees for club stations should make application for all the transmitters in the club station. An amateur who has lent his sender to the club shack does not have to make a filing, since he is no longer in possession, but he should make sure that the trustee does register it, since he may later wish to reclaim it and would then be in possession of a "hot" rig.

So much for those who read *QST* and hear about the order. What of our buddies who are serving in VK or GI or with the Fleet, and who simply went to war and left the radio stuff at home with the folks? Well, there's only one answer: we who're still home must take on the responsibility. It's the least we can do for our fellows in the services or working away from home on essential war jobs. If we don't, the parents or wife may be outside the law through no fault of their own. It's a duty, then, if you know another ham who is away from home, to take the initiative and assist his relatives-in-possession to make the necessary return to FCC. This is particularly an opportunity for ham clubs to perform a real service. Every radio club ought to look after the apparatus of its absent members and the absent friends of members. And in general we all should do what we can to spread the news and lend a helping hand, so that all our transmitters may be reported in and registered.

HELP US TO HELP

In a June editorial we told you of some of the things Headquarters is doing to help in the war effort. As the summer wears on, the seriousness, the urgency and the extent of the calls made on us are increasing. We need more data. The raw material for the services rendered by our bureaux is the registrations you fellows make with us: of the apparatus you're willing to sell or of your personal availability for a war communications job — operating, technical, industrial, administrative.

In this issue we're repeating our own apparatus-registration form. Don't confuse this with the FCC requirement to register; it has no association with that. Ours is a bureau to tell the fighting arms and other government agencies where they can get stop-gap factory-built receivers and transmitters in a hurry. You'd be surprised at the jobs some ex-ham gear is doing! Or would you? At any rate, we need more, more, more. Look up that blank and act.

Same way about men and women for jobs. Particularly in W1-2-3 we can help any ham not in essential work to a better and more important job in radio, and we seek more registrations from those areas. In the Middle West and South, things have moved a bit slower because of the handicap of distance in reporting for interview or employment, so there are still a few names on tap. But not many, and the good ones will soon be moving. If you're available, write us for a blank or follow the style of the form in December *QST*.

Unless you're going into the armed services, don't dispose of your self-powered 2½-meter gear. You and it are both needed in CDC communications in the WERS, wherever you are in civilian life in this country. Check in with your Emergency Coördinator — information in last *QST*.

K. B. W.

★ SPLATTER ★

OUR COVER

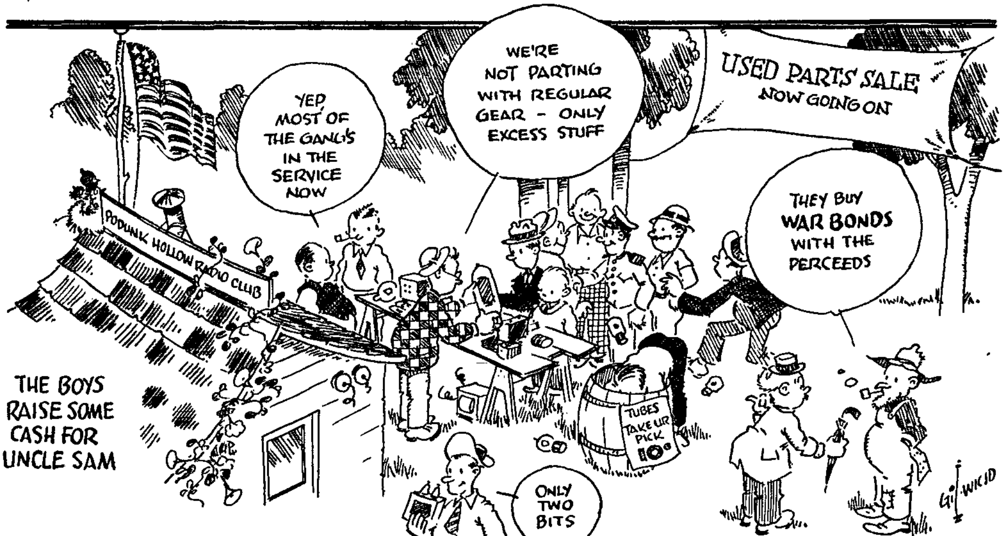
This month we take a sweeping bow in the direction of the Civil Air Patrol — an outfit that really does things. Communications Officer Al Jackson, W1NI, Pilot Bob Spellman and their Culver Cadet are all members of the Hartford CAP squadron. The radio gear is, of course, that described beginning on the adjoining page.

• • • —

BE A CLAM, HAM

We hams have even more reason than most to keep our traps shut these days. It is simple fact that the most secret devices in use or being developed for use in the war have to do with radio and electronics. Because of that, a lot of us

(*Continued on page 74*)



Communications Equipment for Private Aircraft

Simple Transmitter and Receiver for CAP Work

BY DON H. MIX,* W1TS

The Civil Air Patrol is the aircraft-pilot and aviation-enthusiast section of OCD, undertaking volunteer patrol and ferry service for the Air Forces. Many amateurs have joined CAP to help provide rapid two-way communication between control center and observation aircraft, so necessary for effective reconnaissance and sub spotting.

Strictly a civilian volunteer enterprise, the CAP finds difficulty in many cases in securing adequate equipment for its ships. This article has been prepared to give amateur CAP members a start in constructing suitable gear from the usual amateur parts. We do not represent that this equipment is the acme of aircraft design, but you can be certain it will do a swell job of substituting while commercial gear is serving military aircraft.

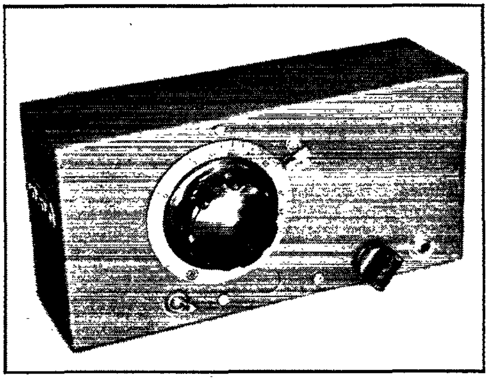
ONE of the branches of the civilian defense organization is the Civil Air Patrol, in which private aircraft pilots provide their planes and services for patrol work and other duties relating to civilian defense. The communications section of this organization offers still another opportunity for amateurs to contribute invaluable assistance to the war effort. Two-way radio installations are now required in all private planes, except for limited test or training flights. Since little apparatus is available from other sources, amateurs are being depended upon to a great extent for equipment, as well as for filling the posts of operator-observers. For hams who like to mix their radio with a little aviation, the job is a natural.

Under the present arrangement, the planes transmit on an authorized frequency of 3105 kc. and receive instructions from airport transmitters operating in the 200- to 400-kc. band. Since the required range is only about 40 miles, the gear need not be highly complicated. In designing the units shown in the accompanying photographs, an attempt has been made to keep the construction as simple as possible, both to make the job of assembly easier and to keep down the cost of components where funds may be limited. Realizing that the usual variety of amateur parts is no longer available, b.c. replacement units or parts which may be most easily obtained from a community junk box have been suggested. For this reason, no attempt has been made to duplicate the ultra-compact units of some commercial models which require special components.

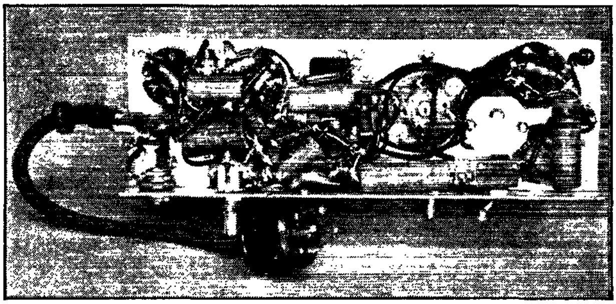
* Asst. Technical Editor, *QST*.

The Receiver

The receiver circuit arrangement shown in Fig. 1 was chosen, after tests with several experimental models, as one best filling the requirements of maximum headphone signal from a minimum number of tubes in a receiver of small dimensions. It is a simple 4-tube superhet with a single i.f. stage. A 6K8 and an inexpensive dual b.c. replacement tuning gang are used with coils which are standard items of manufacture to cover the required receiving range in the converter stage. The single 6K7 i.f. stage operates at 456 k.c., rather than at a higher frequency which would be preferable from the standpoint of image suppression, because the transformers and coils are more generally available for the lower frequency. A 6Q7 is used as the combined



The receiver is housed in a standard chassis box 5 × 10 × 3 inches with the bottom plate as the rear cover. The audio gain control and headphone jack are to the right, with the relay toggle switch to the left. The tuning dial is fitted with a lock for fixed-frequency operation. Input terminals are to the left.



Bottom view of the receiver. The oscillator coil is in the short shield can immediately to the left of the series padder condenser. Small components are tucked in wherever space can be found.

diode second detector and first-stage audio. A 6J5 is used in the output stage which feeds the headphones. To keep the number of components to a bare minimum, only an audio gain control is provided. Since the receiver is intended to be used in conjunction with the transmitter, it is designed to operate from the 6-volt storage battery and vibrator power unit supplying the transmitter. The toggle switch, *S*, is provided for the purpose of controlling, through the spare wire in the supply cable, a relay which can be made to turn on the heaters and vibrator pack.

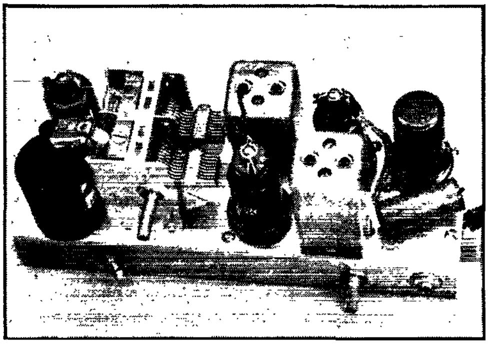
Receiver Construction

The components are laid out to fit into a standard steel chassis, 10 inches long, 5 inches high and 3 inches deep. They are mounted on a second chassis which may be made from any sheet material available, although aluminum is most easily worked. A piece 8⅞ inches long and 4¼ inches wide is bent along one side to form a standing edge 1⅛ inches high. While there is adequate space for the parts mounted on top of the chassis, care should be taken to lay them out evenly so that undue crowding at any point will not be necessary. Holes 1⅛ inches in diameter are cut for the four tube sockets and also under the input-coil assembly, while half-inch holes under the i.f. transformers will suffice for the leads. Half-inch holes should also be drilled under each of the stator terminals of the tuning condenser.

The oscillator-coil assembly requires some alterations to make it fit under the chassis. The coil unit is removed from the can and the fixed parallel padder eliminated. By pressing the top end of the wood-dowel form against a soldering iron, the impregnating wax is softened until the windings may be moved down close to the terminal base. The shield can is cut down to a depth of one inch. The coil unit may be remounted by transferring the spade mounting screws or by forming tabs during the process of reducing the size of the shield can. An alternative method is to use long machine screws and spacers. The shield can itself may be fastened to the chassis by means of a screw through the hole in the top of the can. It is mounted directly beneath the tuning condenser. The series padder, C_{18}, is mounted on short spacers immediately to one side of the shield can. The parallel padders, C_6 and C_{19}, are soldered in place between rotor and stator at the top of the gang condenser where they may be reached for adjustment.

Before wiring in the small components, the toggle switch, audio gain control and headphone jack should be mounted at points along the front edge of the chassis where they will not interfere with tube sockets. The jack must be insulated from the chassis. A soldering-lug terminal strip should also be provided as an anchorage for the power-supply cable. Since the receiver may be subjected to considerable vibration in use, it is a good idea to use lockwashers under all assembly screws or nuts. The remaining small components, consisting of fixed resistors and condensers, are supported by their leads and are tucked into the nearest available space. If the arrangement shown in the photographs is followed, a small space will be left on top of the chassis at the right-hand end which may also be used for condensers or resistors if suitable space cannot be found underneath. Wherever there is any danger of bare leads shorting, they should be covered with short lengths of spaghetti tubing. Care should be exercised in making all soldered connections mechanically solid so that they will not work loose under vibration.

Large clearance holes should be drilled in the metal case for the tuning-condenser shaft, the toggle switch, the gain-control shaft and the



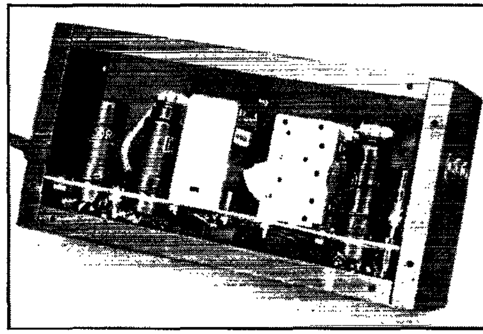
The receiver is built as a unit, independent of the housing, on a chassis 8⅞ inches long, by 3 inches wide, by 1⅛ inch deep, bent up from 1/16-inch sheet metal. The 6K8 converter tube and the input coil are to the left of the dual tuning condenser. To the right are the i.f. amplifier, the 6Q7 diode-triode and the 6J5 output stage.

headphone jack. The last three are not fastened to the case but simply protrude through the clearance holes. A National ODL dial lock is fitted to the tuning dial to provide a means of locking the dial in place when "riding" a control-tower signal. A small terminal strip for input connections is mounted on the left-hand end of the case. 'Phone tips with flexible leads are fastened to the back of the strip. The tips plug into the tip jacks in the end of the chassis so that the chassis may be removed easily for servicing. Half-inch holes should also be drilled in the case immediately above each of the two trimmer condensers on the gang condenser, C_4 and C_5, and one also directly below the adjusting screw of the series padder, C_{18}, underneath the chassis. The right rear edge of the case is notched so that the short 4-wire power cable can pass out through a rubber grommet fitted into the notch. The bottom plate of the chassis, which serves as the back of the case, consequently may be removed without disturbing the cable anchorage.

Before placing the receiver in the case, a piece of thin cardboard or heavy paper should be cut to fit inside the bottom of the case to ensure against accidental grounding of any protruding terminals underneath the chassis.

Tuning the Receiver

Preliminary tuning adjustments may be made more conveniently before the receiver is placed in the case. A calibrated test oscillator is highly desirable if the band limits are to be set with accuracy, since there are no stations in continuous operation near the edges. If a test oscillator is not available, any radio serviceman should be able to line up the receiver within a few minutes,



Rear view of the receiver mounted in the housing. Pin jacks are provided at the right-hand end of the chassis for making removable connections between the input terminals in the housing and those of the chassis.

following the usual procedure. In a pinch, a broadcast receiver may be used to line up the receiver if the factory settings of the i.f. transformers have not been disturbed. In this process, the unshielded aircraft receiver is placed close to the antenna lead of the b.c. receiver. With the b.c. receiver tuned to 656 kc. (200 plus 456), and the tuning condenser of the aircraft receiver set at maximum capacity, the series padder, C_{18}, should be adjusted until the swish of the oscillator is heard in the b.c. receiver. With the b.c. receiver tuned to 856 kc. (400 plus 456), and the tuning condenser of the aircraft receiver set at *minimum* capacity, the parallel padder, C_6, should be adjusted until the swish of the oscillator is heard on the b.c. receiver at 856 kc. The series and parallel padders will each require slight additional readjustments until the frequency of the oscillator in the aircraft receiver falls at 656 kc.

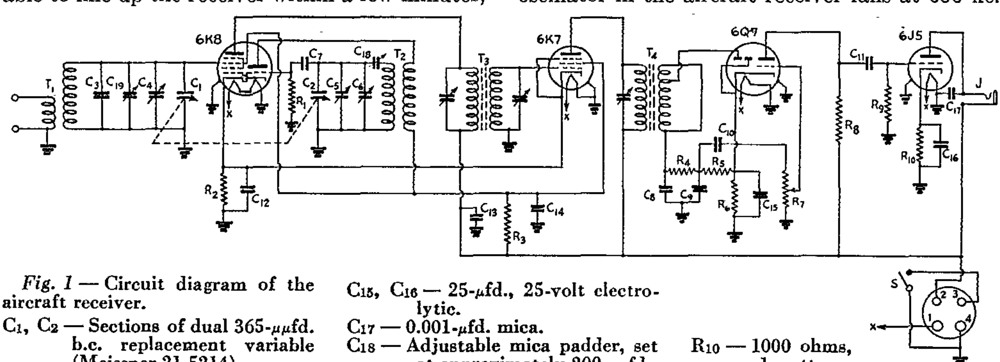
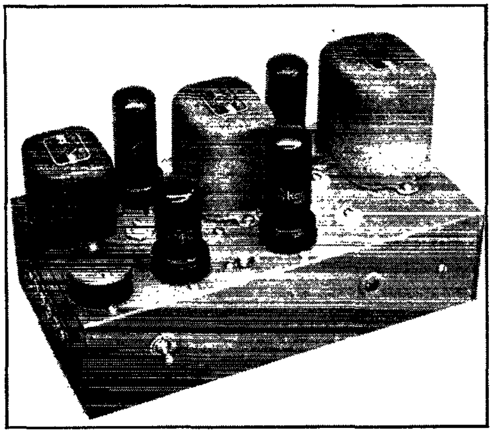


Fig. 1 — **Circuit diagram of the aircraft receiver.**

C_1, C_2 — Sections of dual 365-μμfd. b.c. replacement variable (Meissner 21-5214).
C_3 — Fixed padder, included in T_1 unit.
C_4 — Adjustable mica padder, included with C_1.
C_5 — Adjustable mica padder, included with C_2.
C_6 — Adjustable mica padder, 125 μμfd.
C_7, C_8 — 100-μμfd. fixed mica.
C_9 — 0.001-μfd. fixed mica.
C_{10}, C_{11} — 0.01-μfd. paper.
C_{12}, C_{13}, C_{14} — 0.1-μfd. paper.
C_{15}, C_{16} — 25-μfd., 25-volt electrolytic.
C_{17} — 0.001-μfd. mica.
C_{18} — Adjustable mica padder, set at approximately 200 μμfd.
C_{19} — Adjustable mica padder, 30 to 50 μμfd. maximum.
J — Open-circuit jack.
R_1 — 50,000 ohms, ½-watt.
R_2 — 150 ohms, 1-watt.
R_3 — 20,000 ohms, 2-watt.
R_4 — 50,000 ohms, ½-watt.
R_5 — ¼ megohm, ½-watt.
R_6 — 3000 ohms, 1-watt.
R_7 — ½ megohm, variable midget.
R_8 — 0.1 megohm, 1-watt.
R_9 — ½ megohm, ½-watt.
R_{10} — 1000 ohms, 1-watt.
S — S.p.s.t. toggle switch.
T_1 — Airplane-band antenna coil (Meissner 14-030).
T_2 — Airplane-band oscillator coil (Meissner 14-1032).
T_3 — Compact i.f. transformer, 456-kc. input (Meissner 16-16662).
T_4 — Compact i.f. transformer, 456-kc. output (Meissner 16-1663).
All sockets are Amphenol type MIP.



The 'phone-c.w. transmitter for CAP work, showing the adjusting screws for audio gain, oscillator tuning and amplifier tuning. The neutralizing-adjustment control is behind the 6V6.

with the tuning condenser set at maximum capacity and at 856 kc. when the condenser is set at minimum capacity.

With an antenna of sufficient size to pick up some noise connected to the receiver, the mixer trimmer, C_{19}, may now be adjusted for maximum response. After a beacon signal in the band has been tuned in, the i.f. transformers may be peaked up. The small trimmers, C_4 and C_5, in the mixer and oscillator circuits may be used for the slight final adjustments which may be required after the receiver has been placed in the case.

Tests have shown that i.f. image interference is negligible under normal operating conditions. With a large antenna on the receiver located within a few miles of a high-power b.c. station, the image may appear, but with the shorter antennas to which aircraft installations are limited, no trouble should be experienced.

The Transmitter

The transmitter, which should be no stranger to anyone who has built a small rig for 75 meters, consists of a 6J5 triode crystal oscillator driving a 6V6 neutralized Class-C amplifier. The 6V6 is connected as a triode for the sake of simplicity. The amplifier is plate modulated by a 6N7 Class-B amplifier driven by a second 6N7 with the two triode units connected in parallel. Input is provided for a single-button carbon microphone.

The circuit, which is conventional in most respects, is shown in Fig. 2. Parallel plate feed is used in both oscillator and amplifier, and the two stages are coupled capacitively. The oscillator plate tank circuit is grounded through C_7, rather than directly, to permit the use of series grid feed to the amplifier. This arrangement is recommended to reduce the possibility of low-frequency parasitic oscillation in the amplifier stage. The output circuit is designed to couple to a quarter-wave trailing-wire antenna with one side of the output connected to the frame of the plane.

Provision is made for either c.w. or 'phone operation. For c.w. work, the amplifier is keyed and the toggle switch, S_2, should be opened to cut the plate voltage from the modulator tubes. For

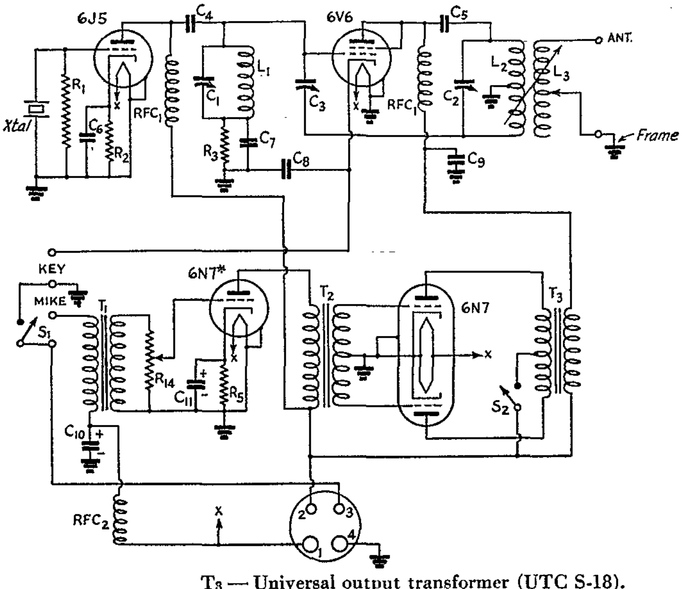


Fig. 2 — Circuit diagram of the CAP transmitter.

C_1 — 100-$\mu\mu$fd. air trimmer (Hammarlund APC-100).
C_2 — 140-$\mu\mu$fd. (Hammarlund MCS-140).
C_3 — 25-$\mu\mu$fd. air trimmer (Hammarlund APC-25).
C_4, C_5 — 0.001-μfd. mica.
C_6, C_7, C_8, C_9 — 0.01 μfd.
C_{10} — 500-μfd. electrolytic, 12-volt.
C_{11} — 25-μfd. electrolytic, 25-volt.
L_1 — 44 turns No. 22 d.s.c., close-wound, 1-inch diameter.
L_2 — 30 turns No. 18 d.c.c., close-wound, 1½-inch diameter.
L_3 — 15 turns No. 18 d.c.c., close-wound, 1½-inch diameter, tapped every third turn.
R_1 — 0.1 megohm, 1-watt.
R_2 — 300 ohms, 1-watt.
R_3 — 25,000 ohms, 1-watt.
R_4 — 0.5-megohm midget volume control.
R_5 — 1200 ohms, ½-watt.
RFC_1 — 2.5-mh. r.f. choke.
RFC_2 — 8-mh. r.f. choke.
S_1 — Push-button switch on mike.
S_2 — S.p.s.t. toggle switch.
T_1 — Mike transformer (UTC S-6).
T_2 — P.P. Class-A input transformer (UTC S-2).
T_3 — Universal output transformer (UTC S-18).
All sockets are Amphenol type MIP.
* 6N7 speech amplifier tube sections are connected in parallel.

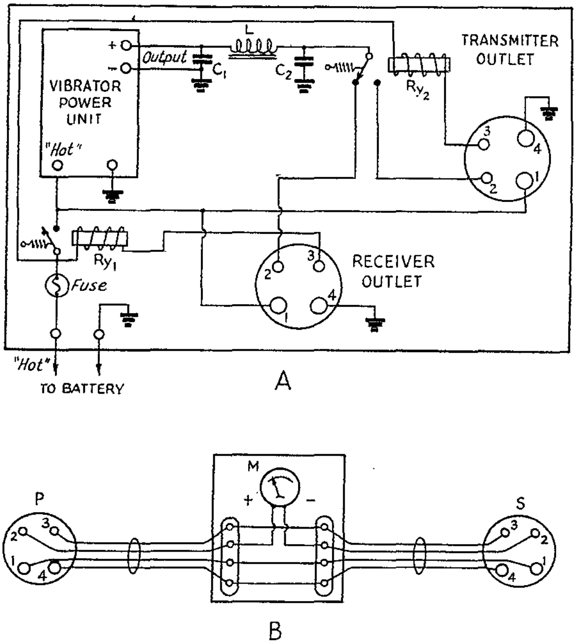


Fig. 3 — A — Diagram of power-supply unit, showing cable output connections for transmitter and receiver, and switching system.

The vibrator pack is a standard 300-volt, 100-ma. unit. C_1 and C_2 are respectively 8-μfd. and 32-μfd., 450-volt electrolytics, while L is a 10- to 12-henry, 100-ma. filter choke with a d.c. resistance of not more than 100 ohms. Ry_1 and Ry_2 are s.p.s.t. and s.p.d.t. relays operating from 6 volts d.c.

B — Method of connecting meter unit in transmitter power-supply cable. M should have a scale of 150 ma. P is a plug to fit the socket on the power-supply unit, while S is a socket to fit the power plug on the transmitter chassis.

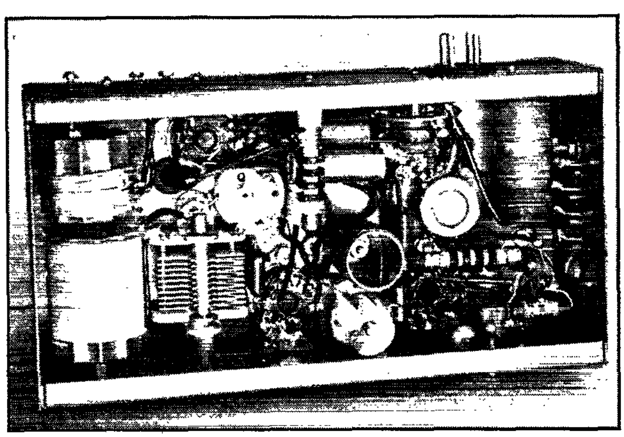
'phone, the key circuit is closed. Microphone voltage is taken from the battery through a filter consisting of C_{10} and RFC_2 to eliminate noise on the carrier. The push switch, S_1, operates a relay which switches the output of the vibrator pack from transmitter to receiver. This switch is located at the microphone and is not included in the transmitter unit. An antenna change-over relay may also be operated from this switch.

Transmitter Construction

The transmitter unit is assembled on a standard steel chassis 10 inches long, 5 inches wide and 3 inches deep. All r.f. components, with the exception of the crystal and tubes, are mounted beneath the chassis, while the audio transformers occupy most of the top. One and one-eighth-inch holes are required for the four octal tube sockets and the 5-prong crystal socket, while the power plug at the rear requires a 1¼-inch hole. The rotor of the amplifier tank condenser, C_2, is insulated from the chassis by mounting the condenser on National polystyrene button-type insulators set in half-inch holes in the top of the chassis. The other variable condensers have insulated mountings. Since the transmitter operates at but one frequency, all tuning adjustments are made by screwdriver. Additional half-inch holes are required in the top of the chassis next to each transformer for the terminal leads, while still another is required in the front edge of the chassis for screwdriver adjustment of C_2. All of these are lined with rubber grommets. The shafts of C_1, C_3 and R_4 require ⅜-inch clearance holes. Cut-outs are needed for the key and microphone terminals at the left end of the chassis and the output terminal strip at the rear.

L_1 and L_2 are mounted under the chassis with machine screws and spacers in the positions

(*Continued on page 116*)



Bottom view of the transmitter. C_2, L_2 and L_3 are to the left with C_3 above and to the right of C_2. C_1 and L_1 may be seen at the center of the chassis.

Planning WERS for Your Community

Practical Details of Civilian Defense Communication Service

BY JOHN HUNTOON,* W1LVQ

In early June the Federal Communications Commission announced, under the name "War Emergency Radio Service," plans for amateur participation in community defense communication in the event of enemy air raids.[1] Many of us amateurs keeping the home fires burning had been waiting for that announcement, since it was to allow us to employ our particular skill in civilian defense. The way is now open. In states on both coasts, in particular, every municipality possessing attraction for enemy bombers should immediately plan to make use of WERS.

We expect the ARRL Emergency Corps, led by its Coördinators, and the affiliated radio clubs to become the nuclei of War Emergency Radio Service organization. Coördinators and clubs have already been given a plan of action, which is briefly outlined here for the benefit of amateurs in communities where there is no club or EC:[2]

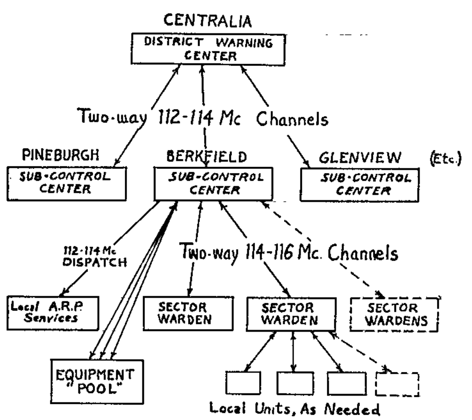
1) If you have not already done so, tactfully determine who is the communications officer of your Citizens' Defense Corps. Contact him at his convenience, to tell him briefly of the newly-formed WERS and that he shortly should receive a bulletin on it from OCD headquarters. Tell him in general terms what you and your amateur group can do for Defense Corps communication. Leave your name and address.

2) Call a meeting of all local amateurs, and invite CDC communications people as well. Describe the setup of the WERS. Ask their coöperation in carrying out any plans local OCD officials may set up.

3) At the meeting, and subsequently, take inventory of 2½-meter equipment available or under construction, and of operating personnel and hours available with particular reference to the Wednesday and Sunday test periods. Register non-members in the AEC so you will have the complete dope. (Plenty of registration forms on tap at Hq.)

4) Ask the group to select two or possibly three persons to be recommended for the post of radio aide, so that the local Defense Corps communications officer may have some candidates when the time comes for appointment.

5) After the meeting, transmit to CDC people by letter a summary of the information gathered at the meeting, so they will know what can be counted on.



A possible setup of communications channels in an air-raid warning district, under one license, following suggestions by OCD. For space reasons, only one of each unit is shown sub-divided here.

The selection of two (or three) prospects for the post of radio aide is at the request of the Washington OCD office, which has mentioned the matter in its own bulletin. It is well to keep in mind the thorough requirements for the job of radio aide: He must be licensed, of course, and of proved loyalty and integrity. His technical radio qualifications should be good. Probably the most important point is leadership and administrative ability, enabling him to carry out supervision of all radio units of the licensee, the provisions for monitoring, inspection of equipment, frequency checking, log-keeping, etc.

The OCD Setup

For control, communication and air-raid warning purposes, the Office of Civilian Defense plan of organization is based fundamentally on what is known as an *air-raid warning district.* Such a district usually contains several hundred square miles — say, for example, an area 20 or 25 miles square — and its boundaries were originally chosen in terms of telephone toll-line organization. Somewhere near the center is a *district warning center,* usually a large city. At this center, air-raid warning and other signals are received from regional information centers, which derive their instructions from the Army defense commander. The d.w.c. has the duty of relaying certain of these signals and information to other communities in its warning area, known as *subcontrol centers.* And, through its communications facilities, the warning district's defense-corps staff will arrange for allocation of apparatus for fire-fighting, road clearance, etc., in the event of a heavy air raid concentrated only in parts of the area. The warning districts have been

* Acting Communications Manager, ARRL.

[1] Details, and the text of WERS regulations, appeared in July *QST.*

[2] If there be no EC in your community, at your group organizational meeting arrange to suggest one or two good prospects to your Section Manager (address on page 12).

laid out by the Army (the whole United States is thus parceled out) and the Army maintains communications from the regional information center (where the big "boards" are) down to each d.w.c.

The Washington communications office of OCD, in promulgating the WERS, hopes for the establishment of nets based on these warning districts. It wishes the station license for the entire district to be held by the city in which the d.w.c. is located, with subnumbers assigned in blocks to other cities in the area. In the fictitious example shown in the diagram, Centralia is the d.w.c. of its area; it holds the license for the entire warning district, blocks of subnumbers being distributed to its communities as shown.

This calls for a communications setup differing but slightly from individual community plans. It will mean an organizational meeting of amateurs in an entire warning district to plan for facilities and operators, and to select several good candidates for the job of radio aide to act *for the entire area.* For ease in administration, probably he should be located in the d.w.c. city. It will be his duty to coördinate the plans of local communities in his district with those of the d.w.c., arrange for the tabulation of equipment and operators in the area licensed, negotiate the intercity agreements required by Sec. 15.62 of the regulations and otherwise assist in preparation of the license application, and retain supervision and responsibility for the system. In actual practice, of course, he will rely heavily on assistants in each community — who, though they may be titled "radio aide" by the local groups, will have no official status in the FCC license. He may delegate authority to responsible local amateurs to check frequencies, inspect equipment, etc., in local groups. (It may here be said that the entire state of Massachusetts, under its public safety council, is organized for WERS on the basis of air-raid warning districts and is progressing rapidly. We hope to have a more complete story on that group next month, as a typical system.)

Facilities

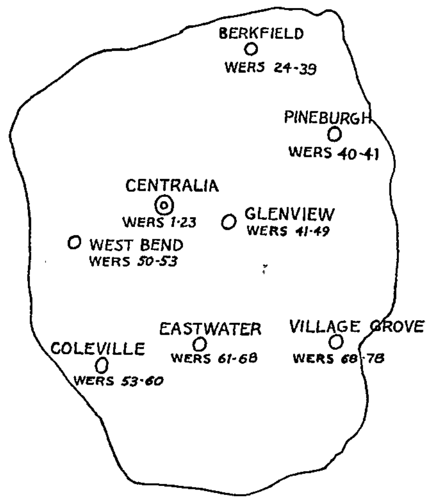
OCD hopes that the following communication channels will be provided within warning districts:

1) Two-way single-frequency communication in the high-stability 112–114 Mc. range with each of the communities (subcontrol centers) in the area.

2) A one-way channel in the 112–114 Mc. range from each subcontrol center for dispatch purposes. It is intended that perhaps a dozen receivers would be continuously monitoring this channel, set up in fire stations, police stations, demolition-squad headquarters, first-aid stations, etc., to carry dispatching orders to these ARP services.

3) Two-way spot-frequency communication in the 114–116 Mc. range between a subcontrol center and its various sector warden posts.

4) Two-way spot-frequency communication in the 114–116 Mc. range between sector wardens and any mobile or other units under their jurisdiction.



Fictitious air-raid warning district map, showing what might be the allocation of subnumbers depending upon the size and communications requirements of individual communities.

5) Two-way spot-frequency channels available for use by portable-mobile units constituting a "pool" of equipment which may be dispatched to a point of unusual enemy bomb damage under an "incident officer."

An average community (subcontrol center), then, might have the following equipment under this plan: a stable transmitter and superhet receiver for communication with the district warning center; a high-stability transmitter for dispatch work; a similar transmitter and receiver for its own net-control purposes; and a number of fixed and mobile transceivers stationed at sector-warden locations and other strategic points. Needless to say, a goodly number of operators will be necessary for full operation! This is the ideal situation, of course; when less apparatus and fewer operators are available radio aides will have to do the best they can with what they have — adding later as they can.

Communication with the warning-district center is important, since WERS can then take over district air-raid warning signals and other traffic if the need develops, and is assured of prompt notification should the WERS be ordered closed by the regional defense commander. Wherever possible, then, we urge the organization and licensing of WERS by warning areas; the holding of an amateur meeting for the entire district; and the choosing of several radio-aide candidates —

Notice

At least one State Guard unit has attempted 2½-meter operation without first securing a WERS license from FCC, apparently believing their semi-military status entitled them to do so. For the benefit of amateurs who may be State Guard members, so they will not be guilty of violation of WERS regulations, we publish this warning: the FCC license and FCC operator permits *are* required!

We desire also to remind all WERS licensees that the Army commander in each defense area (there are four in the U. S.) has supreme power in his area, including the right to shut down radio stations of all classes and at any time. The silencing of broadcast stations does not necessarily mean that civilian-defense radio is silenced, however; any order closing down WERS will mention the service by name and will come to the OCD District Warning Center, with which every WERS net should be in touch.

—•••—

OCD is presently considering a new enlistee classification in its Citizens' Defense Corps, to be known as "communications." Heretofore, amateurs wishing to join local CDC units have found no suitable section for their talents and were able to attach themselves only to the general staff. But a communications section is now promised, with its own insignia. If you join CDC immediately, arrange for assignment to the general staff until the new section is formed.

all this as well as individual community meetings for local plans. In any event, the individual community should keep in close touch with its d.w.c. on any district plans being promulgated.

All warning districts are not yet fully organized, however, and many communities will lag behind others in preparation. Rather than await a stalemated warning-district license application, then, we suggest that if an individual community is *alone* ready to go under WERS rules, it apply for its own license. Its outline of organization should include long-range plans of eventual consolidation with other communities of the district under the warning center, which can be accomplished by cancellation of individual licenses and the issuance of a new, single license for the entire district.

Application Forms

Concerning the details of the application itself (which may be executed only by an *instrumentality of government* such as a town, city or county), page 2 requires a complete list of equipment intended to be used, something in this manner:

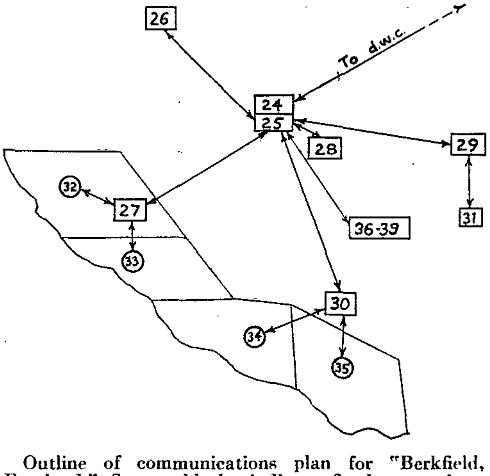
Unit No.	*Manufacturer*	*Type or Model*	*Input*	*Type of Emission*	*Fixed, Portable or Port.-Mobile*
1	Composite	—	23	A3	Fixed
2	"	—	18	"	"
3	Harvey	UHX 10	10	"	Portable
4	Abbott	DK3	1	"	Portable-mobile
5	"	"	"	"	"
6	"	"	"	"	"

and so on.

Suppose our district warning center has eventual plans for 23 units but only 17 are complete. While no ruling has been made, it is believed the applicant (assuming he is applying for several cities) could properly fill out the equipment list numbers 1 to 17, mark numbers 18 to 23 "reserved for future use," and continue with 24 as the first unit number for the next community (Berkfield, in our example).

Page 3 of the station application requires some technical data on the equipment itself and on methods used to keep it in good operating order; see another article in this issue for technical considerations. Page 4 will be troublesome in many cases, since if an antenna for a fixed station is located within 5 miles of an airport or established airway, 3 copies of a special FCC/CAA form must be executed. This is a

(*Continued on page 114*)



Outline of communications plan for "Berkfield, Faryland." Square blocks indicate fixed transmitter units; circles show mobile stations. In actual practice, this sort of diagram should be drawn on a detailed street map of the city. Unit 24 furnishes communication to the district warning center, while 25 acts as control for the sector warden net of 26–30. Unit 31 is a fixed station attached to sector station 29. Units 32–35 are portable-mobile, in this instance assigned to strategic industrial areas of the city, and their boundary lines of normal operation are shown in outline. Units 36–39 constitute the "pool" of equipment available for immediate dispatch to enemy bombing "incidents."

Technical Aspects of the WERS Regulations

Transmitter Stability Data and Suggestions for Frequency Measurement

BY GEORGE GRAMMER,* W1DF

UNDER the rules governing the War Emergency Radio Service, a number of specifications must be met by the apparatus used for civilian defense communication. Those of most concern deal with the stability of transmitters and means used for measuring frequency. At first glance the stability requirements seem to be rather formidable. Sec. 15.25 of the rules states, for example, that transmitters operating in the band 112–114 megacycles "must be capable of maintaining the operating carrier frequency (without readjustments) within . . . [*a band width of*] 0.1 of one per cent," and that those operating in the 114–116-Mc. region similarly must maintain frequency within a band width of 0.3 per cent. As we interpret this wording, the specification means that a transmitter nominally operating on 113 Mc., for instance, can be considered satisfactory only so long as its wanderings do not carry it over a total frequency range greater than 0.1% of 113 Mc., or 113 kilocycles. This is not the same thing as a deviation of 0.1%, which would mean that the transmitter could shift frequency 113 kc. in either direction. The phrase "band width" just cuts the tolerance in half.

Performance of Typical Transmitters

Although undesired frequency modulation has been the subject of much discussion in pre-war amateur u.h.f. work, relatively little attention has been paid to carrier drift, which is the thing aimed at in Sec. 15.25. Consequently when this rule was made part of the regulations it was necessary to find out just how stable or unstable the average amateur 112-Mc. transmitter was in this respect. Obviously the thing to do was to measure some of them, and the results of these measurements are shown in graphical form in Fig. 1. A number of manufactured and homemade units were measured, those tested being representative of one or another type of equipment. To get a fairly comprehensive picture, the general testing procedure adopted was first to warm up filaments for five minutes (in the case of transceivers, the warm-up was carried out with the switch in the "receive" position), then to throw the carrier on, using a dummy antenna to simulate actual conditions under load, and let the transmitter run for ten minutes, taking frequency deviation readings at regular intervals. This test was considered to represent an extreme case, since in WERS work there will be no opportunities for ten-minute lectures. Of greater interest is the performance under conditions where filaments are continually kept hot but the transmitter is on for not more than a minute or so at a time, with equally short intervals between transmissions. Therefore after the ten-minute run the carrier was switched off for a minute, then on for a minute, readings being taken of the initial frequency on coming back and the final frequency on switching off, then repeating this procedure until four complete cycles had been covered. Then the carrier was switched off for fifteen minutes — the period marked "X" in the chart — and the filaments left on. At the end of the 15-minute period the carrier was again switched on and off alternately during one-minute intervals for four more cycles. The transmitter under test was then shut off completely and allowed to cool down to room temperature. When completely cool (the cooling period is indicated by "Y" in the chart) filaments were switched on again and an instantaneous frequency reading taken as soon as they were up to operating temperature, following which a 5-minute filament warm-up period again was allowed. Four cycles of one minute on-and-off completed the run, the whole procedure requiring something of the order of two hours or more of frequency check under conditions which we felt were as variable as would be encountered in practice.

Actual frequency checking was done by means of a 112-Mc. superheterodyne receiver especially calibrated for the purpose and continuously checked against a thoroughly warmed-up crystal oscillator using a low-drift crystal. The accuracy of measurement is considered to be 0.01% or better. No allowance is made for this factor in the curves, nor for other factors which will be discussed later.

The curves of Fig. 1 are plotted in terms of per cent frequency change with respect to the initial frequency at the beginning of the whole test. The initial frequency in each case was approximately 112 megacycles. The point of interest is the total percentage deviation, which is given by the extreme limits of the curves. Curve A, taken on an Abbott TR-4 transmitter-receiver having an HY-75 oscillator, is probably typical of low-power transmitters using tubes built for u.h.f. work and operating with fairly low-*C* tank cir-

* Technical Editor, *QST*.

cuits. The maximum drift in the ten-minute run was very slightly over 0.03%, with a tendency to reverse direction after about 5 minutes of continuous operation. The tube construction and relatively efficient operation tend to minimize drift, since a stable operating temperature is reached rather quickly. The curves for the one-minute on-and-off runs show larger variations for the reason that the frequency changes very rapidly for a few seconds after first switching on, and in these data the frequency was measured as nearly as possible at the instant of switching on. The "curves" in this case are merely lines connecting the frequencies at the beginning and end of the

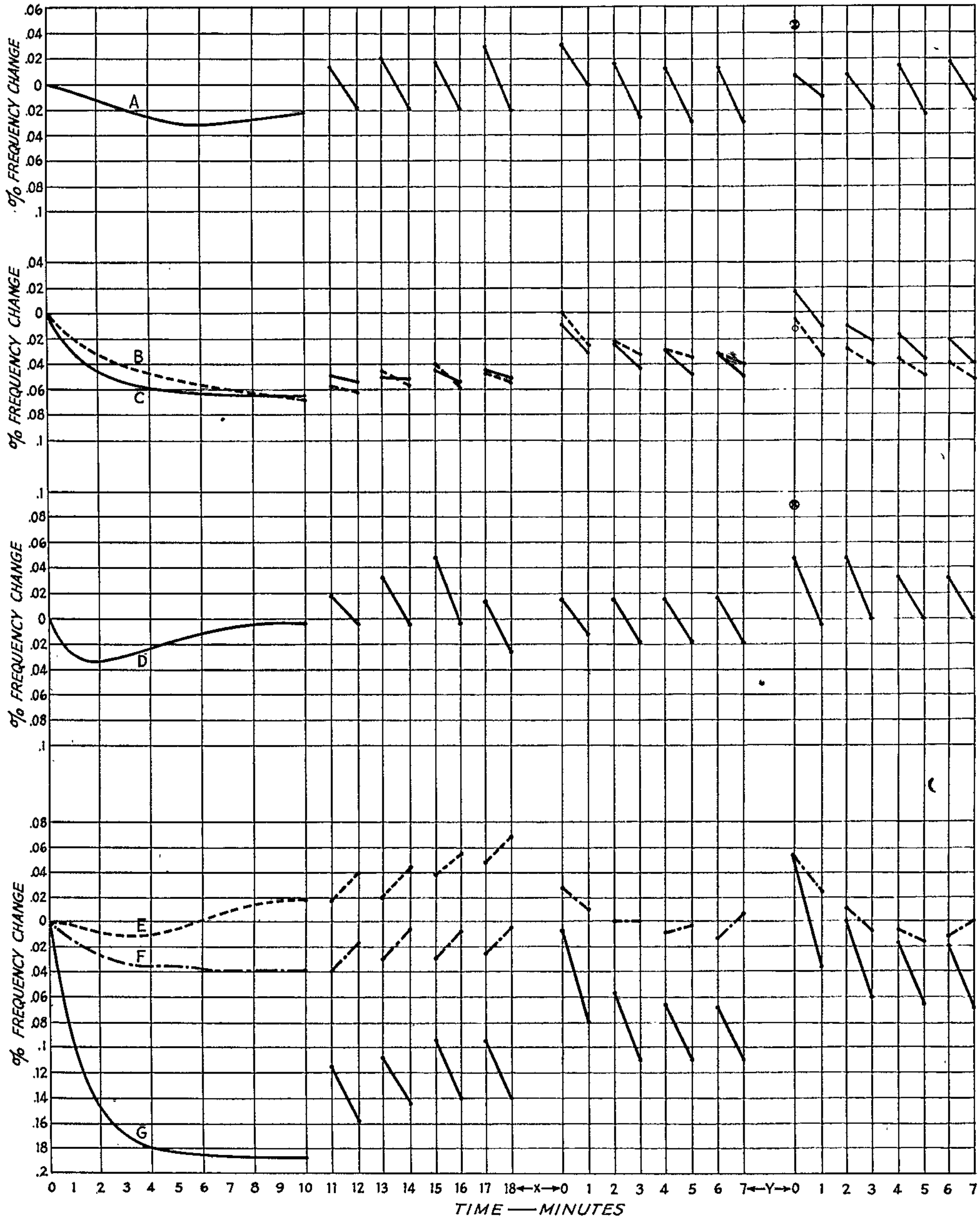


Fig. 1 — **Chart showing performance of various types of oscillators in drift tests.**

one-minute period; actually, about 90% of the frequency change occurred in the first few seconds, the carrier remaining fairly well fixed at the final frequency for most of the minute period. The circled X at the beginning of the last on-off cycle (after the cooling period) represents the instantaneous frequency measured as soon as the tube was hot enough to function; at the end of the five-minute warm-up period the frequency had shifted to the beginning of the solid curve for the first minute of the last on-off period. Neglecting this point, on the basis that there would always be a warm-up period of at least a few minutes before actual operation, the maximum deviation band in this test was 0.06 per cent, well within the limits for operation in 112–114 Mc.

Curves B and C were taken on two of the "horse-shoe" oscillators described in December, 1941, *QST*. These circuits are quite high-*C* in order to reduce frequency modulation, and use 6V6GT tubes, which are of course ordinary audio power amplifiers. For these reasons the operating efficiency is rather low compared to what can be obtained with low-*C* circuits using u.h.f. tubes. Consequently more heat must be dissipated for the same input. The total drift in the ten-minute run is larger than in the case of the type of circuit represented by curve A, but for a given temperature the oscillator holds frequency better than the low-*C* circuits. This is shown by the one-minute on-and-off runs, which show relatively little variation from start to finish. In the last on-off cycle (after the cooling-off period) the oscillator represented by the solid curves was put through the cycle without any five-minute filament warm-up period, while the oscillator represented by the dashed curves had the normal warm-up. The small circle represents the instantaneous frequency (with no warm-up) of the latter oscillator. The maximum deviation band for one oscillator over the whole run is somewhat less than 0.07% and for the other a little over 0.08%. Since actual practice probably will be short, snappy periods of transmission, the last two on-off cycles no doubt represent typical operating stability more accurately; in this case the maximum deviation for one oscillator is 0.05% and for the other a little over 0.06%, the latter being the one tested without warm-up. This type of circuit also is usable in the 112–114-Mc. region.

Curve D is for another low-*C* oscillator using an HY-75 oscillator tube. The actual unit was an Abbott MRT-3 transceiver. Like the transmitter of Curve A, to which it compares in circuit although not in power input, the drift in the ten-minute run is relatively small. However, on short-period transmission there is a fairly large initial drift, most of which occurs in the first fifth or so of the one-minute transmission. The "instantaneous" check after the cooling-off period in this case gave the point shown by an encircled X, which shows that some initial warm-up before transmission is necessary. Neglecting this point, the total deviation over the entire run is 0.08%. If only the last two on-off cycles are considered, this reduces to somewhat less than 0.07%. Purely as a transmitter, then, this type of circuit also can be included in the 112–114-Mc. group.

However, there are other factors that must be considered in the use of transceivers. If a transceiver is to be used for general reception it must occasionally be tuned to some other frequency than that on which the transmitter is supposed to operate, assuming that it has a fixed frequency for transmission in the 112–114-Mc. region. Depending upon the bandspread and the type of dial, reset accuracy then comes into the picture, and tests have shown that in the average case this may introduce a frequency deviation varying from 0.05% to 0.15%, even when considerable care is used. For "fixed frequency" operation there is also the well-known tendency toward "walking" when two transceivers are in communication, with the result that in the course of a contact the frequency tolerance might well be exceeded unless the signals are strong enough to obviate the necessity for touching the dial during reception. It can be said, therefore, that the type of oscillator circuit of which the MRT-3 is representative is satisfactory for 112–114 megacycles if it is used solely for transmission, but that transceivers had better be used only in the 114–116-Mc. section of the band.

Curves E, F and G are dry-battery operated portable outfits, E being a dry-cell tube pack transmitter-receiver of very low power and F and G two Abbott DK-3 transceivers. The transceiver which gave Curve G had new "A" and "B" batteries, while the one which resulted in Curve F had batteries which were considerably below rated voltage. The set with new batteries showed the greatest frequency variation, although the total band is less than 0.3%. Poor voltage regulation of the old batteries apparently has a compensating effect which causes a frequency change in the opposite direction to normal drift from heating. In any event, this type of equipment would be used only for the short-range communication contemplated for the 114–116-Mc. section of the band, as described in another article elsewhere in this issue. From the present tests there seems to be nothing to prevent its use for this purpose.

In making these measurements it was of course impossible to include any tests on an actual antenna. A poorly-constructed antenna system, free to swing around in a breeze, can have a very marked effect on the frequency of an oscillator coupled to it. With a substantially-constructed antenna and feeder system these detuning effects can be reduced to a minimum. It is also advisable to avoid too tight coupling to the antenna system, since loose coupling helps reduce the detuning effect. It is difficult to estimate the possible deviation which an antenna might cause, but with suitable precautions it seems reasonable to believe that it can be reduced to the point where it will not appreciably increase the deviation bands measured on a dummy antenna.

Another factor is that of regulation of the plate-supply voltage. Since all self-excited oscillators show some frequency change with change in plate voltage, it is obvious that this regulation must be reasonably good. In this respect the high-C oscillators have a distinct advantage, since the change in frequency from this cause is much less than that observed with low-C oscillators. In most cases the plate-supply voltage will be fairly constant over an operating period of several hours, even when a storage-battery supply is used, because the time during which the battery will be called upon to deliver plate power should be relatively small compared to the time when filaments alone are on.

The time factor is one which should not be neglected. The tests described above determine short-time stability with fair accuracy, but long-time stability obviously can be measured only over a period of weeks or months. We do not believe, however, that the intent of the regulations is to oblige the transmitter, once adjusted, to maintain its output frequency forever within the specified limits without readjustment. It seems reasonable that occasional readjustments can be made as required, during the process of regular frequency checking called for by the rules.

Frequency Measurement

In connection with frequency determination, two requirements must be met. Sec. 15.25(b) says that the emissions from the transmitter must be confined within the band in which operation is authorized. This is a familiar stipulation to amateurs, since it is the rule under which we have operated for many years. If the possible error in frequency measurement is known or can be estimated reasonably well, the rule simply means that the transmitter frequency must be set far enough inside the band limits to make sure that the possible error in measurement does not result in out-of-band operation. That is, with a frequency-measuring device known to be accurate to within 0.2% the transmitter should be set at least 0.2% of 112 Mc., or more than 224 kc. inside the low-frequency edge of the band, *as indicated by the frequency-measuring device,* provided it is desired to work as near the edge as the equipment will permit.

Rule 15.26 could be a serious stumbling block. It says, "The measurement of transmitter frequencies . . . shall be of sufficient accuracy to assure operation within the maximum deviation permitted under Sec. 15.25." Now there is no sense in trying to measure a molecule with a yardstick, and there is no simple and inexpensive means of measuring frequency in the u.h.f. region which does not have an inherent uncertainty greater than the 0.1% which is the maximum deviation band allowed transmitters operating in the lower half of the band. It has been our experience with Lecher Wire measurements that accuracy within 0.1% is obtainable *if* the measurement is made with an auxiliary indicating instrument such as a sensitive crystal detector and milliammeter so that very loose coupling can be used between the wires and the oscillator. But it requires careful work, and even then the accuracy is short by a factor of 10 or so of that required to measure a transmitter deviation band of 0.1%. The only set-up which seems capable of meeting this requirement literally is the kind we used in making the measurements previously described — a crystal standard plus a carefully calibrated receiver of the superhet type. Such things are not to be bought — and certainly aren't to be found in every amateur's junk box.

A strict interpretation of this rule would effectively hamstring WERS operation before it ever got a chance to get started. Since there would have been no point in setting up the service under requirements which could not possibly be met, we can only assume that the intent of the rule is to separate the sheep from the goats, so to speak, among transmitters, and to insure in-band operation of either type of set. It is perfectly possible to measure the *difference* between two quantities without knowing the absolute value of either. For example, if two carriers beat with each other to give an audio-frequency difference, the beat frequency can be measured by some such simple means as comparing the tone to a piano note and getting the frequency of the note from an appropriate table, and the measurement will be equally good no matter what part of the r.f. spectrum the carriers may be in. Similarly, with fairly simple frequency-measuring means it is possible to determine with reasonable accuracy the deviation of a carrier from its original frequency even though the absolute frequency cannot be determined precisely. In the present case this can be done by using Lecher Wires, for instance, to calibrate a bandspread receiver by determining the band edges and enough points in between to enable drawing a calibration curve. Smoothing out the curve will result in a calibration sufficiently accurate for determining deviations even though the exact frequency cannot be determined within a few tenths of a per cent.

A set of Lecher Wires used with an auxiliary indicating device of good sensitivity (see *QST* for October, 1941, page 18) can be rated to have an accuracy within about 0.1%. Without such an indicating device the accuracy will be lowered somewhat, since it is necessary in such a case to use closer coupling to the transmitter or receiver,

(Continued on page 112)

HAPPENINGS OF THE MONTH

TRANSMITTERS MUST BE REGISTERED

DCB recently requested FCC to arrange for the registration and control of all apparatus capable of being used in radio transmission. Detailed FCC regulations for the registration of diathermy apparatus were issued some time ago. FCC has now issued two orders of immediate concern to amateurs and experimenters, and requiring, between them, the registration of every transmitter capable of use in an amateur station.

The first order, No. 99, applies to every person or organization in possession of a transmitter who does not hold a station license for its operation. The second order, No. 101, applies to every amateur station licensee in possession of a transmitter and to every other person or organization in possession of a transmitter that is the property of an amateur station licensee. Both orders require applications for registration from the persons in actual possession of transmitters, and not from the owners unless they also possess. The reason for this is that FCC is interested in who has got the apparatus and in where a particular transmitter came from; and the Commission also recognizes that many owners of transmitters are away from home and that the application will have to be filed by somebody else. In this month's editorial we comment on the reasons for the orders.

In both orders a transmitter is defined as a device designed for the transmission of communications by r.f. It does not include phonograph oscillators, test oscillators, signal generators or wired-radio systems. However, if there be any doubt whether a piece of equipment should be registered, it by all means should be. There is no penalty for registering equipment which FCC may feel is not a transmitter but there are penalties for nonregistration — including confiscation of the equipment. It is far better to register than not to register. The purpose is to get a record of all equipment that might be used for enemy communications if it fell into improper hands. ECOs are transmitters. Transmitters without power supplies should be registered. So should apparatus which is not in working order but is capable of being easily restored to working condition. To be on the safe side, even a power amplifier should be registered. Transmitters in a partially-disassembled state, with vital parts missing, theoretically need not be registered; but if there is room for anyone to claim that that piece of gear is a transmitter, it had better be done — a note can be appended to state that the rig is not in operating condition. Power supplies not in association with a transmitter need not be registered.

The forms for applying for registration are to be obtained from any field office of FCC or from the head office at Washington. There must be a separate form for every transmitter, so in writing the Inspector you should state the number of blanks needed. Remember to count your portable and mobile sets. The forms are not the same under both orders, so state under which you come: Order 101 if the gear belongs to an amateur with a station license still in effect, Order 99 if it doesn't. The amateur application blank requires tube line-up and currents, block diagram and word description. In the case of a factory-built transmitter of well-known make, it will not be necessary to answer Questions 5(b) and 5(c) but full data must be given for amateur-built jobs. When the forms are completed, they are to be mailed direct to FCC at Washington. If found in good order, FCC issues a nontransferable certificate, about 3 to 8 inches, which must be "conspicuously affixed" to the transmitter. If the rig is transferred, sold, assigned, leased, stolen, loaned or torn down, the registrant must report full particulars to FCC within five days, returning the certificate. The certificate therefore shouldn't be "affixed" by shellac or glue; cellophane scotch tape should prove satisfactory. If the transmitter is moved to a new location, the Commission must similarly be notified within five days, which results in the issuance of a new certificate. Any new owner coming into possession of a registered transmitter must similarly apply to FCC for a certificate within fifteen days.

Attention, you amateurs who have let your station licenses expire! Attention, unlicensed experimenters! Order No. 99, effective June 8th, requires you to apply by June 28th for a certificate of registration for each transmitter in your possession. (The date for compliance possibly will be extended.) If you have not complied at the time you read this, we urge you to do so at once.

Attention, licensed amateurs and others having custody of transmitters owned by licensed amateurs! Order No. 101, effective June 19th, requires you to apply, not later than August 25th, for the registration of such transmitters in your possession. *See this month's editorial for further suggestions.*

Attention, amateurs having a valid station license but neither owning nor possessing a transmitter! You must report that fact to FCC at

Washington by August 25th, also giving your present address; and must report future changes of address. A post card will do. (Theoretically, if you own a transmitter but have given it over to another person's custody, you don't have to report at all; but we think it would be a good idea to report the facts to FCC by card or letter, saying that the other person may be or should be looked to for registration application. That way you're sure to be in the clear on FCC's records.)

As to WERS, here's the way it looks to us: the WERS regulations do not relieve the ham of any of his obligations under the amateur order, No. 101. So, if a ham sells or lends his equipment to a municipality for WERS use, he must notify the Commission of the transfer within five days and return his registration certificate. The situation is a little more complicated for the municipality. *If a municipality has a WERS license,* it is not required to register under either Order 99 or 101 any transmitter which it has listed in its application for its WERS license or any application for modification of that license.

If the municipality has no WERS license, then it is governed by Order 99 or 101, even though it holds or acquires equipment which it plans to use for WERS purposes. For example, if it purchases a transmitter outright from an amateur, it is in the same position as any other person in the possession of an unlicensed transmitter and must register such transmitter under Order 99. If, on the other hand, the municipality borrows the transmitter from an amateur, it must register that transmitter under the provisions of Order 101, which applies to a person in possession of a radio transmitter which is owned by a holder of an amateur radio station license.

For fuller information, here is the text of

ORDER NO. 101

At a session of the Federal Communications Commission held at its offices at Washington, D. C., on the 19th of June, 1942,

Pursuant to the authority conferred upon it by Order No. 4, dated April 16, 1942, of the Defense Communications Board; IT IS ORDERED, That

(a) every holder of an amateur radio station license in possession of a radio transmitter and

(b) every other person or organization in possession of a radio transmitter which is owned by a holder of an amateur radio station license

apply for registration of such transmitter with the Commission (if such transmitter is not registered under FCC Order No. 99) in accordance with the following provisions:

(1) "Radio transmitter" as herein used means a device designed for transmission of communications by radio frequency energy. This Order is not intended to include phonograph oscillators, test oscillators, signal generators and wired radio systems.

(2) Every person now in possession of a transmitter required to be registered under this Order shall apply for such registration not later than August 25, 1942. Every person who, at any time after the date of this Order, comes into possession of a transmitter which is required to be registered hereunder, shall apply to the Commission for a Certificate of Registration within 15 days after obtaining such possession or by August 25, whichever is the later date.

(3) Application for registration shall be made on forms furnished by the Commission and such forms shall be obtained from the Federal Communications Commission in Washington, D. C., or from any of its field offices.

(4) Individual application must be made for each transmitter to be registered and each transmitter must be separately registered. All requests for application forms should state the number of transmitters to be registered.

(5) All application forms should be returned to the Secretary, Federal Communications Commission, Washington, D. C. (*Not to any field office.*)

(6) If, upon receipt of an application for registration, the Commission finds that sufficient and reliable information has been furnished, it will issue to the applicant a non-transferable certificate of registration for each transmitter.

(7) The registrant shall be responsible for having the certificate of registration conspicuously affixed to the transmitter for which it is issued. No certificate shall be destroyed, obliterated or altered in any way without the authority of the Commission.

(8) If a transmitter for which a certificate of registration has been issued is transferred, sold, assigned, leased, loaned, stolen, dismantled, destroyed or in any way removed from the possession of the registrant (holder of a certificate of registration), he shall notify the Commission thereof within five days thereafter, furnishing a statement as to such loss, disposal or disappearance and furnishing the name of the recipient of the transmitter if such person is known to the registrant. In such case it shall be the duty of the registrant to return the certificate of registration to the Commission unless it has been stolen or destroyed.

(9) The registrant shall notify the Commission, within five days, or by August 25, 1942, whichever is the later date, whenever the transmitter registered is moved from its registered location to another location.

(10) Any transmitter required to be registered under this Order and for which there is no valid registration certificate outstanding shall be subject to closure and removal by the Commission.

(11) The following transmitters shall not be subject to the registration provisions of this Order:

Transmitters, the operation of which is authorized under a Commission station license other than an amateur radio station license.

Transmitters in the possession of the United States Government, its officers or agents, or which are under contract for delivery to the United States.

IT IS FURTHER ORDERED, That every holder of an amateur radio station license who neither owns nor has an amateur radio transmitter in his possession shall so report to the Commission, in writing, and shall notify the Commission of his present address not later than August 25, 1942; and further, he shall notify the Commission, in writing, within five days of any change of address.

MORE OPERATOR RELAXATIONS

FCC in its Order No. 91-B has made still another relaxation in operator requirements, this time on behalf of small broadcasting stations. It is now provided that a Class IV broadcasting station on a local frequency "may be operated by a holder of a restricted radiotelephone operator permit which has been endorsed by the Commission to show the operator's proficiency in the operation of the particular station concerned, as ascertained by certification of the first-class radiotelephone operator in charge of the station, on condition that in a technical emergency such operator shall not attempt to make any adjustment, but shall immediately shut down the station, and on further condition that the restricted radiotelephone permittee shall show proficiency in radiotelephone theory as ascertained by examination not later than 6 months after the date of the above endorsement."

Aeronautical stations are similarly short of

Radio Apparatus for War Use

ARRL, 38 La Salle Road, West Hartford, Conn.:

I'll sell the apparatus listed below at the prices stated, for use in the war, condition guaranteed as stated, securely crated or properly packed, delivered to transportation agency in my city.

....
Date *Name* *Call*

....
Street Address *Telephone Number*

....
City and State

Factory-Built Transmitter. Manufacturer: .... Model No. .... Operates from .... -volt mains at .... cycles. Rating: .... watts c.w., ... watts phone. Input or output watts? .... Frequency range: .... to .... kc. Includes coils for .... bands. Includes crystals at .... kc. Auxiliaries included: ....

Alterations made by me .... Is rig home-assembled from a kit? .... Wiring done by .... Date acquired: .... Cost $.......... Condition: .... My price f.o.b. cars, $..........

Factory-Built Receiver. Manufacturer: .... Model No. .... Batteries or a.c.? .... Cycles: .... Separate power supply? .... Does price include it? .... Freq. range .... to .... kc. Plug-in coils for .... bands. Other auxiliaries included: .... Date acquired: .... Cost $.......... Condition: .... Alterations made by me: .... My price f.o.b. cars, $..........

Factory-Built UHF Gear. Describe in general form as above. Attach extra pages if necessary. State band, whether xmtr, receiver or transceiver, type of power supply.

....
....
....

Factory-Built Frequency Meter. Manufacturer: .... Model No. .... Operates from .... supply. Cost $.......... Condition: .... Remarks: .... My price f.o.b. cars, $..........

Extra Meters, not included in above equipment. Taking one line for each, state make, model, type, range, condition, price: ....
....
....

operators, particularly code operators in stations using c.w. or i.c.w. Another FCC modification permits the holders of first- or second-class radiotelephone licenses or restricted radiotelephone permits to act as radiotelegraph operators in these stations, provided the permit or license has been endorsed to attest the holder's ability to handle Continental at 16 code groups per minute, or better, and with an operator of higher grade in charge of the maintenance of the station apparatus.

EXECUTIVE COMMITTEE MEETINGS

FOLLOWING is an abstract of the actions of the Executive Committee of the League during the past year between Board Meetings, as ratified by the Board at its recent meeting, here published for your information by order of the Board.

Meeting No. 169, Aug. 1, 1941. Authorized Asst. Secretary C. B. DeSoto to sign checks on behalf of the Secretary from Aug. 11 to Sept. 22, 1941.

Meeting No. 170, Nov. 3, 1941. Examined nominations in regular autumn elections, determined eligibility of candidates, ordered eligible names listed on ballots. In cases where there was only one eligible candidate, declared him elected without balloting. Ordered further solicitation for alternate director in Southeastern Division. Affiliated eleven clubs.

Meeting No. 171, Dec. 20, 1941. Canvassed balloting in regular autumn elections, determined and certified the winners.

Meeting No. 172, Jan. 31, 1942. Examined nominations for alternate director in Southeastern Division, declared William P. Sides, W4AUP, elected without balloting, as only eligible candidate. Affiliated seven clubs. Authorized Asst. Secretary C. B. DeSoto to sign checks on League depositories on behalf of the Secretary.

Meeting No. 173, April 13, 1942. Examined nominations in special election in West Gulf Division, declared W5NW and W5AJ elected respectively director and alternate without balloting, as only eligible candidates. Affiliated six clubs.

D.C.B. CHANGES ITS NAME

A LOT of the old "defense" organizations are now "war" organizations. On June 15th the President changed the name of the Defense Communications Board to Board of War Communications.

The office of the Coördinator of Information has been divided, its functions relating to propaganda broadcasting being transferred to the new Office of War Information, while the remainder has been streamlined into an important military organization now known as Office of Strategic Services.

TELL US?

IF YOU are registered with our Personnel Bureau as available for a war-time radio job and have since accepted such employment or otherwise become closed to further offers, please advise us so that we may know that you are no longer available.

If you have registered gear for sale with our Apparatus Bureau and have since disposed of it, please advise us so that we won't be holding out false hopes to prospective purchasers.

A post card will do in either case. Thanks.

GORDON CLOCKS WANTED

THERE is need in the war effort for Gordon Specialties Company 24-hour radio clocks, not now available in sufficient quantities but many of which must be in amateur shacks. Uncle really needs them. If you're willing to part with yours, drop a post card to the ARRL Apparatus Bureau at West Hartford advising condition and what you'll take for it.

A.R.R.L. APPARATUS BUREAU

THERE is a shortage of radio apparatus. Military and essential civilian services frequently cannot let vital tasks wait upon the delivery of radio apparatus on order, and so are looking around for factory-built amateur apparatus. The ARRL Apparatus Bureau, as announced in April *QST*, page 16, receives registrations from amateurs who are willing to dispose of their factory-made gear as a patriotic act, centralizes the information, and turns it over to the dozens of inquiring government agencies — some of whom are often in a terrible hurry. The ARRL is not buying apparatus; this is simply one of the services we are maintaining to assist the war effort.

The need is growing more and more imperative as time passes. It is a matter of patriotic necessity to locate some equipment for the urgent enterprises that won't wait. If you are willing to sell some of your apparatus, list it on the form on the preceding page (or reproduce the form if you do not wish to cut your *QST*, or write us for a blank) and file it with us at once!

The need is for standard manufactured equipment. While there is as yet practically no interest in our homemade transmitters, howsoever good, because each is a unique creation, there is some call for transmitters that have been assembled and wired from standard, well-known kits; so a place is now provided for that kind of apparatus. Do not list anything you are likely to need in WERS work, particularly self-powered 112-Mc. gear.

Disposing of equipment now not only helps the war effort but gives you money to buy War Bonds. Thus safely salted away, you will have the money to buy new and more interesting gear when the war is over. Shoot us the dope!

And please notify us when any registered apparatus is sold, so we may take it off the list.

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.

100 Centimeters and Down

A Review of Microwave Technique

BY ROBERT F. SHAW,* W3AOC/WLMB

In Two Parts — Part II**

The first part of this article, in July *QST*, dealt with the newer types of tubes used for centimeter-wave work. This second part is concerned with a new kind of tank circuit which is finding application at the higher end of the u.h.f. spectrum.

We are accustomed to thinking of tank circuits in terms of coils and condensers — i.e., lumped inductance and capacity, with the inductances and capacities of tube elements and connecting wires small in comparison to those of the circuit elements. Furthermore, we think of a condenser as having only capacity and no inductance, and of a coil as having only inductance and no capacity, although it is generally recognized that coils do have distributed capacity, and one circuit at least — the TNT — made use of this fact to help provide an "untuned" grid circuit. At frequencies up to about 30 Mc., or even higher, these assumptions are pretty well justified by the facts, but as the frequency goes up, it becomes increasingly difficult to localize the effects of capacity and inductance, and we find tube elements and connecting leads forming an important part of the tank circuit. Finally the point is reached where these things not only contribute an important part to the inductance and capacity of the tank circuit, but become so large in dimensions in comparison to the wavelength that standing waves begin to appear and the phase relationships in the circuit are disturbed. At the same time, the condensers and inductances intentionally introduced into the tank circuit, as distinguished from stray capacities and lead inductances, also become large in relation to the wavelength, further upsetting phase relationships.

Just how this comes about may be seen from Fig. 4. Here is shown a portion of a sine wave, representing a standing wave on a circuit element. It is seen that the difference of r.f. potential across a circuit element 1/20 wavelength long (we might take, for example, the length of the wire in a small coil) is only about 1/4 the maximum r.f. potential; this represents about the maximum that can be tolerated if we want the usual relations of tank-circuit inductance and capacity to resonant frequency to hold true. Increasing the length to 1/10 wavelength causes the r.f. potential difference to become over 1/2 the maximum, and for 1/8 wavelength the difference is nearly 3/4 of the maximum. These represent the worst possible conditions; the relation of the element in question to other parts of the circuit may reduce the effect, and it must also be realized that such measurements as "1/10 wavelength" cannot be taken too literally in dealing with such irregularly-shaped components as tuning condensers. Still, the idea should be apparent. It should be noted that instantaneous phase differences occur even if there are no standing waves, because of the finite velocity of propagation of r.f. currents along conductors. As for the effects of improper phase relationships on the operation of a tube, it is sufficient to state here that normal operation is impaired; it is impossible to go into the exact reasons for this fact here. (It might be well to note that the foregoing remarks on differences in phase over parts of a circuit element are to be considered taking the element by itself, and not as part of a resonant circuit; there is a phase difference of 180 degrees between the ends of the coil and condenser in a push-pull amplifier tank circuit,

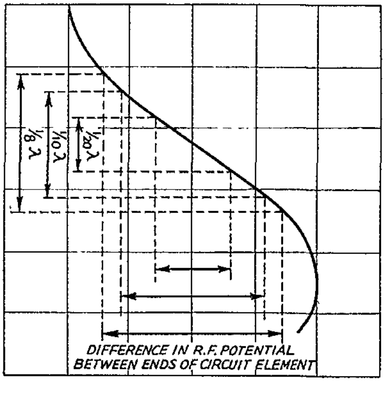


Fig. 4 — Phase difference of r.f. voltage at opposite ends of a circuit element of a size comparable to the wavelength.

* 5818 N. 13th St., Philadelphia, Pa.
** Part I appeared in July, 1942, *QST*, p. 25.

but this is not because of the physical dimensions of the individual elements.)

As in the case of electron transit time in a tube, there is a way out of the difficulty — if the trouble can't be eliminated, find a way to use it to advantage. Thus the use of resonant lines as circuit elements came about; in this way it is possible for tube elements and leads to form part of the line, and standing waves occur in the position where they do the most good. The idea is by no means new; Phelps and Kruse[25] used it in designing a ¾-meter oscillator in 1927. Since that time it has become common practice on 5 meters and below, and many articles on the subject have appeared in *QST* and elsewhere.[5, 26–31, 45] Good results have also been obtained with lumped circuit elements by keeping the size down.[32, 33] One of the most interesting applications of lumped elements is the "Peterson pot" oscillator.[34, 35]

Cavity Resonators

At frequencies above about 1500 Mc., however, even tuned lines leave much to be desired. So long as conventional tubes are used, lines probably form the best type of tank circuit, because without their use it is difficult to get away from the effects of tube leads, but in the case of velocity-modulated tubes it becomes possible to take advantage of a different type of resonator — the so-called cavity resonator or "hohlraum." As its

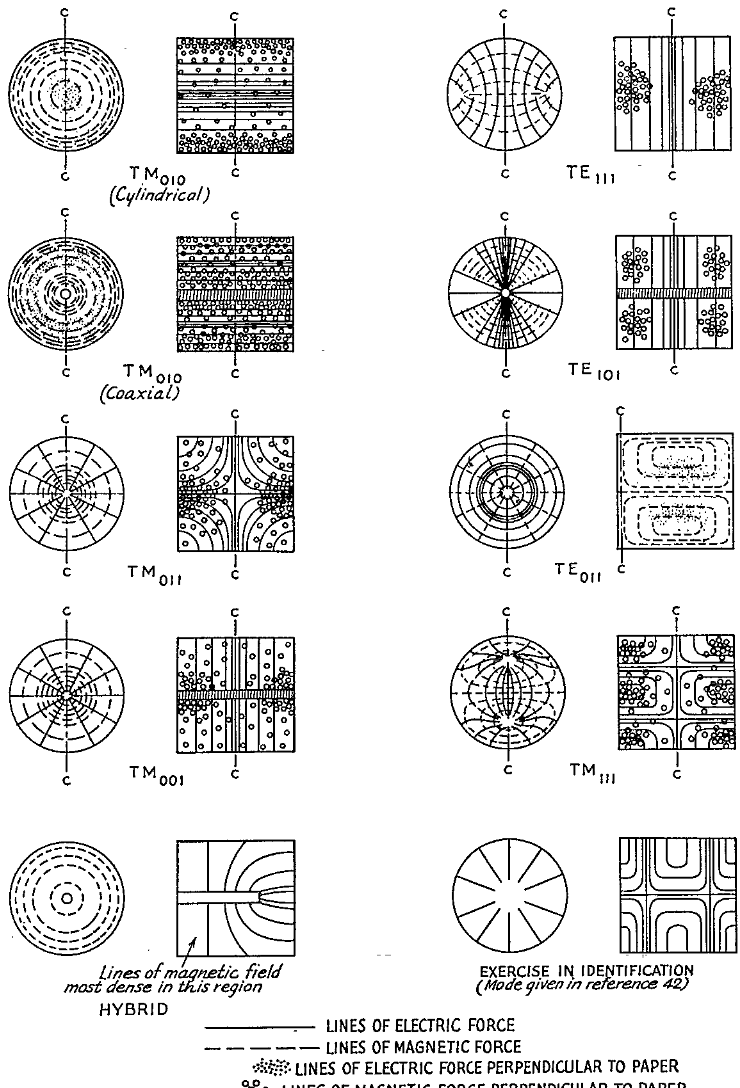


Fig. 5 — Field configurations in several typical cavity-resonator modes. Drawings show cross-sections perpendicular to and through the axis of the resonator respectively. Lines C-C show the point at which the cross-section in the other figure of each pair is taken.

name implies, this is a hollow shell made of some conducting material; when in operation, standing waves are set up in the interior, the frequency being determined by the physical dimensions of the cavity and the method of excitation. Here we have a perfectly shielded circuit, with very low losses and consequently high Q, and well adapted for use with velocity-modulated tubes.

It has been known for a long time that a cavity with walls of conducting material has certain resonant frequencies of oscillation, but not until comparatively recently was it suggested that such a resonator might be used in a vacuum-tube oscillator circuit. In 1938 Hansen [36] published an article in which he gave the results of calculations of the resonant frequencies, effective inductances and capacities, Qs, and other constants of spherical, cylindrical, and square-prismoidal resonators, and since that time numerous other articles have appeared,[37–40] including one by Barrow and Mieher [41] in which information on a number of different modes of oscillation in each of the two principal types of resonator is given, with the results tabulated in a very convenient form.

The two principal types of cavity resonators in use at present are the cylindrical and the coaxial, the former simply a section of circular cylinder with both ends closed, and the latter similar but with a center conductor connecting the two end plates. In many practical applications a sort of hybrid type is used, in which the center conductor is slightly shorter than the outer cylinder, leaving a small gap between the end of the center conductor and one end plate. It is this type which is used in the klystron; here the center conductor is hollow and has the outer end flared so it curves outward to meet the outer cylinder wall. Resonators of other forms, some with comparatively small physical dimensions even at low frequencies, have also been described by Barrow and Schaevitz.[42]

Since standing waves are set up in the cavity when it is excited at its resonant frequency, the lines of electric and magnetic force will form regular patterns. As stated before, there are a number (theoretically infinite) of modes of oscillation, each having its individual pattern of lines of force. For practical purposes we are interested only in the lower modes; some of these have been plotted in Fig. 5. Lines of electric force are represented by solid lines, lines of magnetic force by dashed lines. It will be noted that the lines of electric and magnetic field are everywhere at right angles to each other; this is a fundamental characteristic of the electromagnetic field.

The different resonant modes are conveniently divided into two groups — those in which there is a magnetic field transverse to the axis of the cylinder (TM or transverse magnetic modes), and those in which there is an electric field transverse to the axis (TE or transverse electric modes).* The particular mode in a group is indicated by subscripts — the first showing the number of full-period variations of the radial component of the electric field encountered in going around the circumference of the cylinder, the second showing the number of half-period variations of the angular component encountered in passing along a radius, and the third showing the number of half-period variations of the radial component encountered in passing along the axis from one end to the other. If there is no variation along one of these paths, the corresponding subscript is zero. A little study will show how this works, and enable the reader to write down the proper subscripts after inspecting a new pattern.

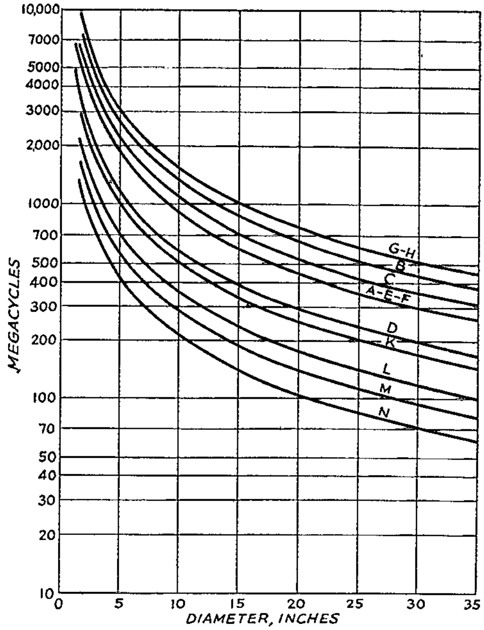


Fig. 6 — Dimensions of cavity resonators. Curves A to H inclusive are for resonators whose lengths are equal to their diameters, although in case D the diameter may be changed without affecting the frequency if the length is held constant, and in cases A and B the length may be changed if the diameter is held constant. The Q, however, will be changed in each case. Curves K to N inclusive are for hybrid type resonators in which the diameter is 1.22 times the length. All coaxial resonators have the center conductor one-seventh the diameter of the outer cylinder. Curves G and H coincide; A, E and F lie very close together.

A. Cylindrical, TM_{010}
B. Coaxial, TM_{010}
C. Cylindrical, TM_{011}
D. Coaxial, TM_{001}
E. Cylindrical, TE_{111}
F. Coaxial, TE_{101}
G. Cylindrical, TE_{011}
H. Cylindrical, TM_{111}
K. Hybrid, 50%
L. Hybrid, 80%
M. Hybrid, 94%
N. Hybrid, 98%

(Percentages refer to length of center conductor compared to length of outer cylinder.)

* Note that the so-called TM_{001} mode also has a transverse electric field; it might be called "TEM" or transverse electromagnetic.

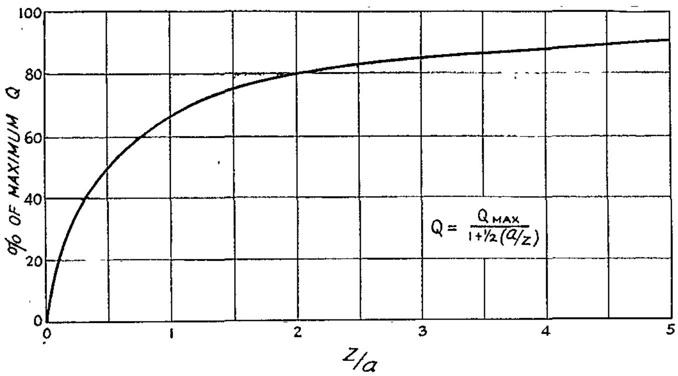


Fig. 7 — Effect of shape of cylinder on Q for cylindrical resonator without coaxial center conductor, TM_{010} mode. Z is length of cylinder and a radius.

The resonant frequency of a cylindrical cavity depends on two things — the radius of the cylinder and its length; if the resonator is of the coaxial type, the radius of the inner conductor must also be taken into account. The exact calculation of resonant frequencies for the different modes is covered in the articles already referred to; their values for the modes illustrated in Fig. 5 are shown graphically in Fig. 6. The lowest frequency at which waves of a given type can be excited — the cut-off frequency for the given mode — is a function of the diameter, and may be found in Table I. From this may be found the wavelength of waves of any frequency higher than the cutoff frequency for that mode; the wavelength is given by

$$\lambda = \frac{c}{\sqrt{f^2 - f_0^2}}$$

where λ is the wavelength in meters, c the velocity of light in meters per second, f the actual frequency in cycles per second, and f_0 the cutoff frequency in cycles per second. If frequencies are expressed in megacycles and the wavelength in centimeters, the formula becomes

$$\lambda_{cm} = \frac{30{,}000}{\sqrt{f^2 - f_0^2}}$$

From the above formula it is apparent that the wavelength used may be quite different from the wavelength in free space for frequencies near the cut-off frequency. Having found the wavelength, we get the length of the cyclinder for resonance from the fact that this length must be an integral number of half wavelengths. (For the TM_{010} mode the cutoff frequency and the resonant frequency are identical, so the wavelength becomes infinite.)

If, in the particular mode under consideration, the electric field is constant along either the radius or the axis, the resonant frequency is independent of that dimension. Thus, for the TM_{010} mode as noted above the resonant frequency does not depend on the length but only on the radius, being identical with the cutoff frequency, and it appears at first glance that we could use a cylinder whose length is very small compared to its radius — a sort of hollow pancake-shaped affair. As far as the field is concerned, this would work all right, but it so happens that the Q depends on the ratio of length to radius in the manner shown in Fig. 7, and such a pancake resonator would have high losses. On the other hand it is seen that little is gained by increasing the length beyond a point where it is approximately equal to the diameter. It is for this reason that the values shown in Fig. 6 are based on resonators of this proportion, except as noted.

It has been shown by Barrow and Mieher [41] that the resonant frequency of the hybrid type resonator (TM_{00p}) varies over quite a range as the center conductor is withdrawn; with it completely withdrawn the resonator becomes a perfect cylindrical type, working at the TM_{010} mode. Here we have a convenient means for tuning; the frequency can be varied from that of a perfect cylindrical TM_{010} resonator to a much lower value — from 317 Mc. down to about 100 Mc. in a typical case.

Coupling to resonators of the cavity type may be accomplished in either of two ways — a small loop may be inserted in such a position as to surround some of the lines of magnetic force, or a small straight wire may be placed so that it lies along the lines of electric force. The rod should be so placed as to coincide with the lines of electric force, while the loop should be placed so as to surround as many lines of magnetic force as possible, but its dimensions should be kept small compared to the wavelength. The position of the coupling loop will determine to some extent which mode of oscillation is excited, since that mode will tend to be most prevalent which has the

TABLE I
CUTOFF FREQUENCIES

Mode	*Cylindrical*	*Coaxial*
TM_{010}	9050/d	13,150/d
TM_{011}	9000/d	13,120/d
TM_{111}	14,400/d	15,140/d
TE_{011}	14,400/d	15,200/d
TE_{101}	....	6650/d
TE_{111}	6900/d	....
TM_{001}	....	0

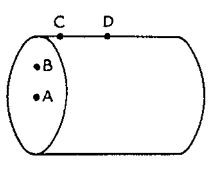
Frequencies are in megacycles; the diameter d is in inches. Coaxial resonators have center conductor one-seventh the diameter of the outer cylinder. Example — for a cylindrical resonator 10 inches in diameter, the lowest resonant frequency that can exist for the TE_{111} mode is 690 Mc. Note that in the TM_{010} case the resonant frequency is equal to the cutoff frequency for a resonator of any length.

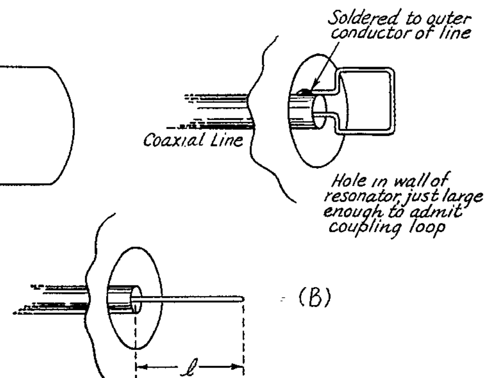
maximum number of magnetic lines of force passing through the loop, but different modes may be excited for the same position, depending on the frequency of excitation. Positions of coupling loops and rods for various modes are shown in Fig. 8. Coupling is assumed to be made through a concentric line, with outer conductor connected to the wall of the resonator and center conductor extended into the interior or bent around to form the loop. The theory of coupling to cavity resonators has been worked out in detail by Condon.[43]

Calculations of resonant frequencies have been worked out by assuming the walls of the resonator to be perfect conductors, but it has been verified experimentally that the results are valid for those constructed of ordinary materials. Barrow and Mieher,[41] for example, found that the resonant frequencies they measured experimentally agreed to within less than one half of one per cent with the theoretical values; they used galvanized iron for the outer walls of the cylinder. Of course the losses will be somewhat higher with metals of lower conductivity than copper, but with sheet copper almost unobtainable these days, most of us will be forced to use other materials for our experimental work. At the lower frequencies, to which we will have to confine our work for the present in order to make use of available tubes, the dimensions become rather large, but the large cans in which grocers buy such things as lard and pretzels should work fairly well. Cubical resonators can be constructed out of sheet metal. Even metal screen may be used if the mesh is not too coarse. The use of coaxial rather than perfect cylindrical types is suggested in order to keep the size within reasonable limits at the lower frequencies.

There are many other subjects in the field of microwave technique which cannot be covered here because of limitations of space. For example, there is the matter of receivers; but in the first place, little has been published on this subject up to the present time, and secondly, so long as we are not permitted to engage in communication we can gain more by experimenting with oscillator circuits and the like. Then there is the subject of antennas, and here we find another departure from conventional designs — instead of the usual directional arrays of half-wave elements and such, it is possible to use metal horns, giving sharply directional radiation patterns without the difficulties of arranging, supporting, and feeding a multitude of elements. A note on this subject has already appeared in *QST*[44] and we hope to present some practical details at a later date. The material in the present article, however, should

Fig. 8 — Methods of coupling to cavity resonators. Positions referred to in table below are shown at (A). At (B) are shown methods of inserting loops or rods through wall of resonator. The length *l* or dimensions of the loop should be kept down to about 1/20 wavelength.





Mode	*Type*	*Position*	*Orientation*
Cyl. TM_{010}	Loop	B	X
	Rod	A	Z
Coax. TM_{010}	Rod	B	Z
Cyl. TM_{011}	Loop	B	X
	Rod	A	Z
	Rod	D	Z
Coax. TM_{001}	Loop	B	X
	Rod	D	Z
Cyl. TE_{111}	Loop	A	X
	Rod	D	Z
Coax. TE_{101}	Loop	B	X
	Rod	D	Z
Cyl. TE_{011}	Loop	D	Y
Cyl. TM_{111}	Loop	C	X
	Rod	B	Z
Hybrid	Loop	B or C	X
	Rod	A or B	W

Orientations — W, parallel to axis, at end nearest gap; X, in plane through axis; Y, in plane perpendicular to axis; Z, in direction of electric field (in all above cases this represents rod extending straight into resonator at point designated).

be sufficient to enable the experimentally minded amateur to engage in some work on wavelengths below one meter and become familiar with some of the vagaries of these centimeter waves. For example, someone might try to design an oscillator using a standard tube and cavity tank circuit.

Most of us, at one time or another, have raided the kitchen cupboard for oatmeal boxes on which to wind our tank coils. Now it looks as if the time might not be so far off when we will again raid the kitchen in search of materials for our tank circuits — but this time it will be coffee cans and cracker tins instead of oatmeal boxes. And possibly even the garbage can will find its way into the shack to form the tank circuit of that new ¾-meter rig!

(*Continued on page 110*)

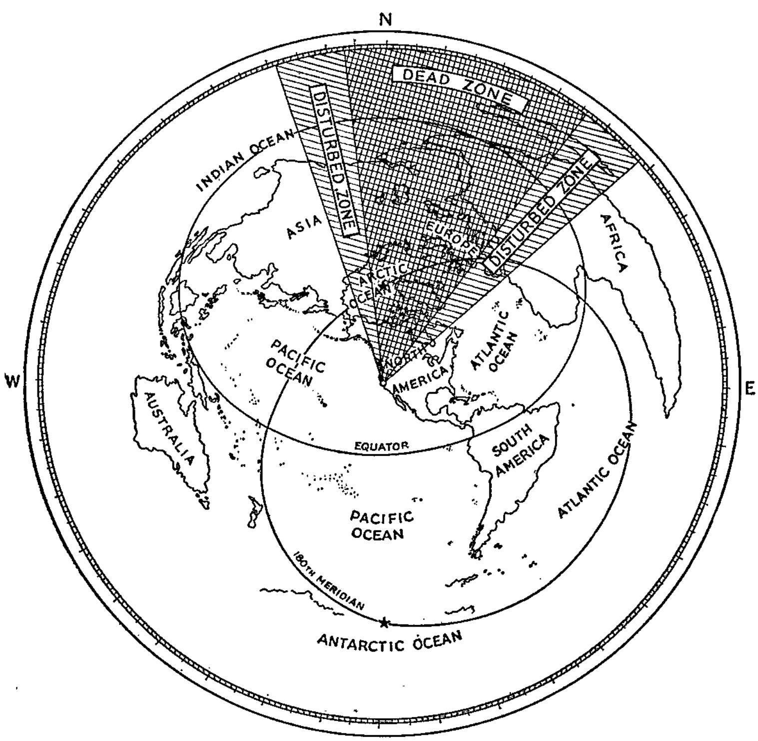
World-Wide High Frequency Communications Patterns

Influence of Magnetic Conditions in 1942

BY DR. E. DILLON SMITH,* W3PZ

UNDER war conditions the chief interest of the amateur, so far as communications are concerned, is the audit of the radio spectrum. However, it is not always possible to hear all those stations which are transmitting on the several frequencies. Except for the physical limitation of auditing the whole radio spectrum, in general this is due to one of three things: (1) operating frequency of the transmitter, (2) the diurnal or daily effect, and (3) the terrestrial magnetic influences. The first two are beyond any control on the part of the amateur; there remains only the terrestrial magnetic influences. Of course the reason why these influences are of interest to the amateur is because certain zones or sectors of the world will be found generally dead, while other zones are only occasionally heard.

Since the functioning of high frequency circuits is known to be closely related to the geographical distribution of terrestrial magnetic activity, it is well to understand the effect of magnetic storms on stations which are likely to have uninterrupted commercially-acceptable reception. But since the work of evaluating the magnetic variables[1] relating themselves most closely to a change in the reliability of high frequency communications circuits is a laborious one, it should here suffice to summarize the re-



* Arlington, Va.

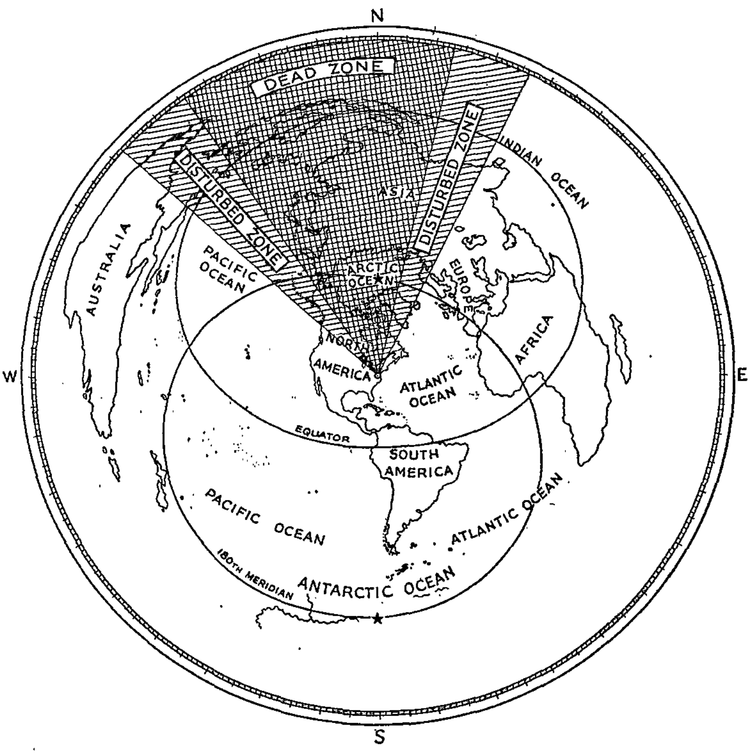
[1] *Proc.* IRE, 24:455, March, 1936.

sults of such an investigation as applied to estimates for the year 1942.

Magnetic variables are classified as of two types — vertical and horizontal. Since it is known that the vertical intensity ranges of terrestrial magnetism are not of predominant importance in controlling high-frequency communications, one need be concerned only with the horizontal intensities. Experience has shown that severe circuit disturbance results when the recorded horizontal magnetic intensity is defined as 100 gammas over a 6-hourly period, while a moderate disturbance is defined as one of 60 gammas. By plotting the observed horizontal intensity range against the latitude of the observing station, such as San Juan, P. R., Tucson, Ariz., Cheltenham, Md., and Sitka, Alaska, data can be secured to construct world communication charts for estimates of reliability of world-wide high frequency communications.

the dead zone are disturbed zones, where such zones correspond respectively to severe and moderate circuit disturbances. Thus, these charts clearly show that reception of signals at Washington from, say, Siberia is not commercially reliable, while a fair degree of reception would be expected at San Francisco. Unlimited reception would obviously result if the receiving station were located at a point where the shadow from the magnetic disturbances would not encompass a zone in which the transmitter were located.

Specifically, the charts were constructed by drawing about the north magnetic pole, located at approximately 96° west longitude and 71° north latitude, mean circles of 17° and 30° radius corresponding to estimated mean horizontal magnetic disturbances of severe and moderate intensities. Depending upon the azimuthal chart, lines were drawn from Washington or San Francisco tangent to each side of the flattened ellipses.



The two azimuthal charts of the world, one centered at Washington, D. C., and the other at San Francisco, California, show graphically the result of such investigation as applied to estimates for 1942 as adjusted for sunspot activity. The communication areas denoted on these charts indicate a dead zone approximately centrally located to the north, while adjacent to each side of

In conclusion, it should be pointed out that, while signals occasionally will be heard from transmitters located in the dead zone, under the conditions to be expected during the year 1942 the probabilities are such that commercially reliable reception cannot be expected from stations situated in or near the shaded zones as defined above.

QST Visits the Noroton Training Station

How Navy Radiomen Are Made

BY CLINTON B. DE SOTO,* W1CBD

THE young sailor at the head of the row caught our attention almost the moment we pushed through the swinging classroom doors.

"Next is the tactics and procedure class," the lieutenant had told us. "Here's where you'll see the boys get their first real workout under actual operating conditions."

Eyes intent, the youngster watched the white paper climbing over the typewriter roll. He was just a few weeks past 17. At least, that's what his enlistment papers said. You wondered a little -- but then, the Navy is pretty careful. . . .

The headphones fed signals to his ears, and his fingers traced them on the typewriter keys. Thump . . . thump . . . thlump-thump. . . . At 12 words a minute the letters fell slowly into place.

We looked around the room. Down the rows of scarred hardwood tables with their inset "mill wells" threescore other whiteclad students sat copying. Some were almost as youthful as this youngster we'd first noticed, but more looked in the early twenties. Here and there was an older fellow — 30 or 35.

The one thing they all had in common was that look of intent concentration on their faces — that, and their shipshape whites, and the fact that they were all members of the radio code class at the Noroton Heights (Conn.) U. S. Naval Training Station.

We had come to visit the station at the invitation of its commanding officer, Capt. William Baggaley, USN (Ret.).

"Not the biggest, but the best." That's what the Navy had said about the Noroton school. And so we had gone to see for ourselves. Taken in tow by our old friend, Lt. (jg.) Donald C. S. Comstock, W1MY, the chief instructor, we'd watched the beginners, the touch-typing class, an advanced group coördinating visual and aural reactions with the aid of the Trans-Lux screen, another class taking high-speed press. Now we were in the tactical room where the would-be Navy radiomen got their first taste of actual operation under naval procedure.

The chief radioman at the instructor's table watched the automatic tape transmitter as it pulsed smoothly along. After a moment he reached over and snapped the switch on the Hallicrafter's Marine alongside the table. As the tubes warmed a babble of low-frequency code piled into one side of the split headphones each student wore. Carefully the chief regulated the gain until the oscillator's auto keying just lifted itself above the babble.

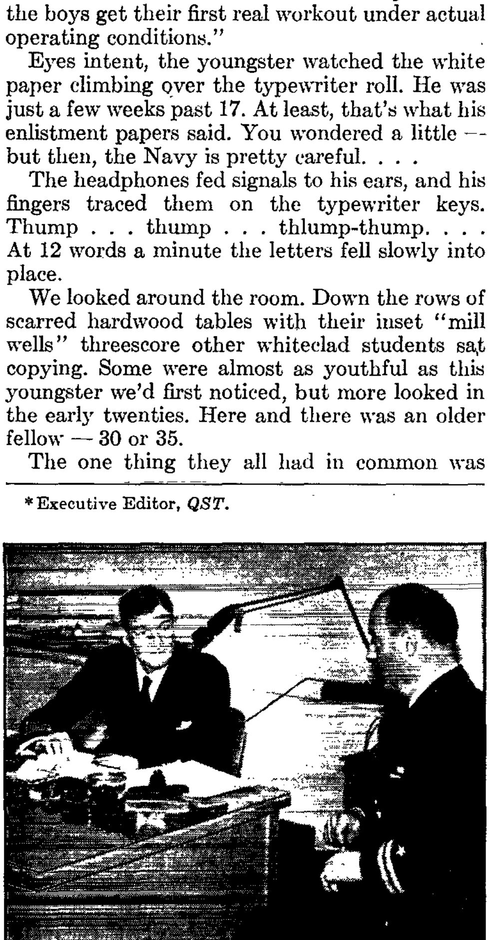
Copying through QRM — tough, but all in the day's work in actual operating. Most of the boys plodded right on. Some hunched themselves a little tighter in their chairs, fingers jerking up like high steppers in a pony chorus as they punched the keyboard — deliberately, one punch a second or thereabouts.

Then the CRM lifted the "press" tape he was transmitting and reached for the key. "Watch this," he said quietly.

"NDRP . . . NDRP . . ." the key began to chant. We looked around for the position marked NDRP. It was the fresh-cheeked youngster who looked as though he were playing hooky from a sophomore high-school class.

Now he looked as though he wished he were back. His right hand seemed frozen, like the expression on his face — his arm powerless to move over to the key to answer the call. For a long second we watched, fascinated. Then the youngster pulled himself together, reached grimly for

*Executive Editor, *QST*.



Capt. William Baggaley, commanding officer of the U. S. Naval Training Station at Noroton Heights, is seen here (left) conferring with his assistant, Lt. Roland Haines. Lt. Haines was three times U. S. national amateur squash tennis champion. Official U. S. Navy photograph.

the key. Sweat glistened on his upper lip. Fingers shaking a little, he answered his call. . . .

"Buck fever," Lt. Comstock said later. "A lot of them get it. Funny, eh? — you wouldn't believe it. Still, I suppose it's no wonder. Remember how you felt when you had your first ham QSO?"

Yes, that was the answer. It was the youthful radioman-to-be's first QSO. He was the operator aboard a destroyer in a fast-moving naval patrol squadron in this drill simulating actual naval operating procedure, and this was his first call from the squadron leader. The fact that the call came from across the room instead of over miles of heaving sea or that it came through cabled annunciator wire instead of a radio circuit made no difference. It was his first QSO!

Noroton Uses Original Teaching Methods

That this first QSO and the attendant chills and fever came in a schoolroom rather than on active duty at sea is one of the reasons why the Noroton school is turning out the finest radio operators the Navy has ever had. It is the understanding of such fundamental principles of psychology that has brought Noroton recognition as the best naval training school in the country, and has caused its curriculum to be copied widely for operator training courses.

An obvious point in training, you say? Well, it might seem obvious to a ham. In fact, it was — for it was largely hams in the Naval Reserve, under Capt. Baggaley as the only regular navy officer, who created the Noroton course from scratch.

But it wasn't always obvious. Have you heard about the products of the quickie courses in World War I, for example? How they turned those lads out of school the minute they had demonstrated they could copy code from a classroom buzzer and sent them out to sea? How they stood watches from one shore of the Atlantic to the other — lads who had never worked another station in their lives? Many of them never did, either, except to send a desperate SSS or SSSS when the enemy had struck and there was no more need for radio silence. And — whisper it, even now — it's God's blessing that some of them never had to do that, because some of them hardly knew which handle to turn on the weird contraptions they were given for transmitters to put them on the air. And if you think we're exaggerating, ask some of the real old timers!

But that's not happening in this war. They're turning out *radio operators* at Noroton and the Navy's other schools — men who can walk out of school and onto shipboard and hold down a watch like veterans.

Well — almost like veterans, most of them. Some are better than others, of course, and even the best find they've a few things yet to learn when they get into active service. But in general they do know their stuff. They know how to copy

Hams comprise the officers training school staff. At left, Lt. Bannie Stewart, W4CE, officer in charge of the Officer's Training School at Noroton Heights, with Ensign Stuart D. Cowan, W2DQT, instructor at the officers' school. Official U. S. Navy photograph.

Licensed amateurs at the Noroton school: (*Standing, l. to r.*) W8GWY, W2DQT, W1MY, W1ZL, W4CE, W9BP, W3SB, W2IXE, W2ISJ, W8GZS. (*Kneeling*) W2JBX, W8WNI, W2JYM, W2MBD. (*Front*) W8LOU, W1MOP, E. V. Egley (operator's license only), W1NLY, W2NRS, W. J. O'Connor (operator's license only), W8VYX. Official U. S. Navy photograph.

Master control room for the code instruction classes. The output from four separate oscillators can be fed independently through the switchboard to the various classrooms. This centralized tape control greatly expedites instruction. Tape pullers, phonograph turntables for use with recorded lessons and spare equipment can be seen on the shelves at left. Official U. S. Navy photograph.

solid at 18 w.p.m. through murderous interference — genuine interference, taken right from the air. They know traffic-handling procedure under the complex Navy system and the fine points of network operation as good as an ARRL Trunk Line member. (Well — almost as good. Good enough to qualify as an alternate, at any rate — hi!) They know how to tune their rigs, and how to improvise if something goes wrong.

In short, they come as close to having the equivalent of a ham's experience as could any product of a concentrated 120-day course.

And here we emphasize that we're talking about the present product of the Noroton school. These aren't V-3 reservists taking a refresher course or hams with a background of operating learning the Navy's way of doing things. These are youngsters from the factories and the farms and filling stations, most of whom have had no prior radio experience whatsoever. With nearly a third of all the licensed hams in the country already in uniform, the ranks of qualified amateurs have been pretty well exhausted as far as naval recruiting is concerned. The thousands of additional radio operators that are needed are being sifted from the miscellaneous pool of recruits gathered at the general naval training stations. The fact that the training courses now being given at Noroton *do* make good radio operators out of these boys in four months' time stands as an amazing tribute to the U. S. Navy and the American ham.

School Established in 1940

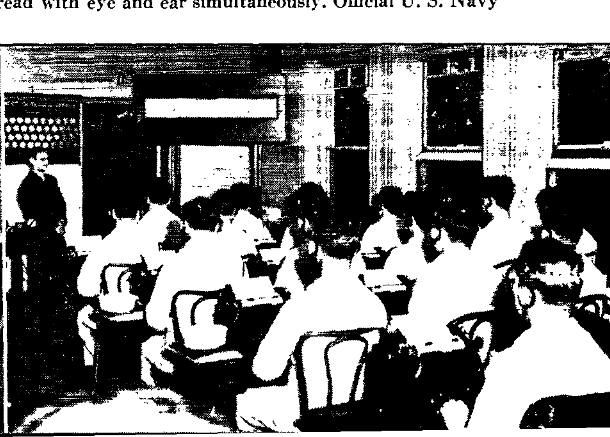
The story of this accomplishment begins in September, 1940. It was then that Capt. Baggaley and a group of reserve officers received their orders from the Bureau of Navigation to proceed to Noroton Heights, Connecticut, and there set up a naval radio training station.

They had just one month in which to put the school in operation. All they had to start with was a collection of old brick and frame buildings which for three-quarters of a century had housed the Fitch Home for Veterans. The old soldiers had been moved to an immaculate new home up near Hartford, and the State of Connecticut turned the vacated buildings over to the Navy.

Built in 1865, the structures showed the effects of their 75 years of use — to put it mildly. The first thing to be done, therefore, was to have the buildings renovated. Then complete equipment had to be procured — every item, from bilge to topmast. Dishes. Bunks and bedding. Office equipment. Hardwood code tables, dozens of them — with a typewriter well, key and multiple wiring at each position. The galley was still equipped with stoves and iceboxes, which helped solve that problem — or so they thought, until the cork insulation fell out of the ancient iceboxes when they opened the doors.

Incredibly enough, when the month was up the job was practically complete. All the equipment

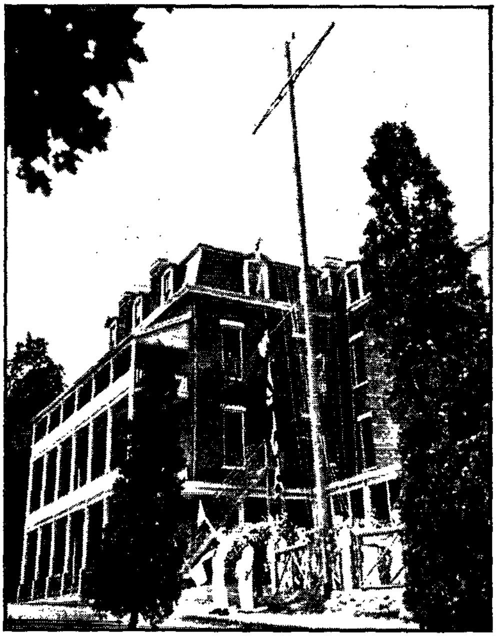
(*Left*) Lt.-Commander Boyd Phelps, W9BP, in charge of the communications school and executive officer on the station, with Lt. (jg) Donald Comstock, W1MY, chief instructor at the school. (*Right*) Synchronizing visual and aural perception with the Trans-Lux screen. Typed copy is projected on the large screen while the text is sent in synchronism on an automatic transmitter. Students read with eye and ear simultaneously. Official U. S. Navy photographs.



required to house and feed and care for the prospective class of radiomen was on hand — with one exception. The Sunday before the first class arrived there was a final check-off of the inventory list — and then consternation. The silverware had not arrived! They scoured the neighborhood; they drove into New York; and before the day was over they begged and borrowed enough silverware to equip the class when it arrived.

On the educational side the preparations were somewhat less complete. There was no blueprint by which to set up a school like this; no standard course of study had been provided. Much of the equipment that was required had to be improvised — and that was where the junk-boxes in the shacks of the hams on the staff did their part!

None of the men who set up the school were professional teachers. Capt. Baggaley, the commanding officer, was a line officer who had spent most of his life on sea duty; in Turkey and throughout the Near East as a destroyer commander, after the last war, then three cruises in China — that was the pattern. The other officers, reservists, came from a variety of civilian occupations (including, we cannot refrain from mentioning, that of assistant communications manager of ARRL — in the case of our own Lt. (jg) Everett L. Battey, W1UE).



Visual signaling instruction. Both semaphore and the international flag code are here seen in use at one of the flag-hoist masts. The Navy needs men who know both radio operating and visual signalling. Official U. S. Navy photograph.

Perhaps it was this very lack of professionalism that made the school successful. At any rate, BuNav can pride itself on having chosen ably in selecting men to set it up. Capt. Baggaley may not have known how to teach radio, but he did know men. The men whose jobs it was to teach radio knew radio — and, knowing it, they found ways to teach it.

To some extent it was a matter of trial and error. One of the things they did, for instance, was to give a form to each student who completed the course, with instructions to have it filled in by his commanding officer one month after going on active duty. The form asked questions designed to show up deficiencies in the instruction the student had received.

They learned a lot from the answers to this form. They learned a lot from the individual students, too. At the outset each student was analyzed as a separate problem. Then groups and classifications were set up, as similarities began to appear. The relative success of various methods upon different individuals in similar classifications gave clues as to the most effective methods of teaching.

Gradually the course took form. It was done by ham methods, by cut-and-try, by constant experimentation, by a persistent dissatisfaction with the best thus far accomplished — and therefore it worked.

Fortunately, most of that first class were hams, and that made the job a lot simpler. In fact, during the first few months the place resembled nothing more than a perpetual ham convention. Lt. Bannie Stewart, W4CE, now in charge of the officer's school, recalls how the number of amateurs in the school was impressed on him early in his stay. Standing in conversation out-of-doors

Tactics and procedure class. (*Left*) Instructor's position. Instructor is squadron leader, simulating actual operating drill. Signals from the marine receiver are fed into the circuit to give the students experience in operating through actual interference. (*Right*) Each student is theoretically on shipboard, the operator aboard a destroyer in a patrol squadron of three sections. Traffic is handled back and forth exactly as on a regular watch at sea. Official U. S. Navy Photographs.

late one night, a flashlight in his hands, he idly thumbed out CQ. Immediately, from darkened dormitory windows all around the grounds, answering flickers of light came like a hundred busy fireflies.

Ham *esprit de corps* was high, too. When Lt.-Commander Boyd Phelps, present executive officer on the station and in charge of the communications school, first arrived he was met at the gate by a massed crowd of students who greeted him with concerted yells of "Hiya Bee Pee!" — the appellation associated with famed W9BP throughout the ham fraternity.

There was still a good deal of that spirit left when we visited. After all, half the members of the staff still are hams — including the executive officer and second in command, Lt.-Commander Boyd Phelps, the well-known W9BP. Then there are Lt. Percy W. Moor, W3SB, the First Lieutenant; Lt. Bannie L. Stewart, W4CE, in charge of the officers' school; Lt. Perce B. Collison, W2IXE; Lt. (jg) Donald C. S. Comstock, W1MY, chief instructor at the communications school; Lt. (jg) Carlton A. Weidenhammer, W1ZL, chief code instructor; Ensign Stuart D. Cowan, W2DQT, instructor in the officers' school; and Carpenter Archie Bunting, W2ISJ. And, too, there are CRM Frank B. Fucile, W8GZS, and CRM Malcolm P. Robertson, W1BPN, instructors in procedure and tactical operation; CRM Raymond E. Jenkins, W8GWY; CRM David F. Kaarman, W1DBW and CRM W. H. Gove, jr., W2BZJ, all assistant instructors, and CRM Jim Fowley, W9CRY, Compool instructor, who has an unusual and valuable knowledge of procedure used by American and British warships, convoys and merchant shipping.

Of course, our own Lt. (jg) Everett L. Battey, W1UE, was no longer there, having moved on to broader fields at Washington. We missed Lt. (jg) Robert L. LaVielle, W9ELL, and other old friends who had been on the staff for a time and who also had moved on.

But still there was enough ham representation to make it seem more like a hamfest reunion than a stern-visaged military establishment.

Even after December 7th the hams at Noroton continued to chew the rag. They simply used the intercommunicator system at the school — a very special one involving keys and buzzers instead of microphones. With their usual penchant for abbreviation the hams called it the "P" system. Anyway, it was no trick at all to get as many as fifty answers to a CQ on the "P" network in the old days.

That's the kind of interest and enthusiasm that made the Noroton school what it is to-day.

From Boot to Radioman

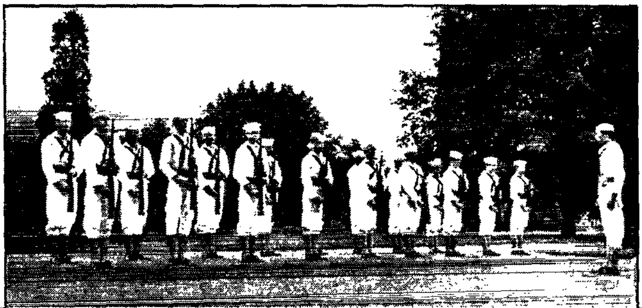
And now, to get a picture of the functioning of the school, let's try to follow the experiences of a typical young recruit who has just finished his six-weeks training course at a boot school and got his assignment to radio duty.

He's probably not a ham, although he may have hung around ham shacks and radio stores long enough to have a pretty good idea of what ham radio is all about. And then again, radio may have been only the third or fourth choice in the list of preferences on his enlistment questionnaire. He may have wanted to become an aviation mechanic or a gunner, and radio may not mean too much to him. But because the shortage of radiomen is so acute, the powers that be passed over his first and second choices and sent him to radio school.

And now here he is — one of the class of 160 to 170 young seamen sent to the Noroton school each month. Off the train at Noroton, which is a

(Continued on page 88)

It's not all radio! (*Top*) A platoon from the duty company goes through the manual of arms at the energetic commands of a senior student. (*Left*) You bet it's good — and there's plenty of it, too.



Mess is a big event of the day, and the men fall to with full appreciation. (*Right*) At "Lights out" the students have clean, neat bunks in which to turn in. Official U. S. Navy photographs.

Easy Lessons in Cryptanalysis: No. 2

BY JOHN HUNTOON,* W1LVQ

Jim Bremer raced down Elm Street and cut across the empty corner lot to the Wilson's back doorstep. He unfolded a sheaf of papers with one hand while punching the doorbell with a finger of the other.

"You're late, young fella," was Ed Wilson's greeting.

"I'm sorry, Ed. I was helping the school club collect scrap rubber until six-thirty, and Mom wouldn't let me start for here until I'd finished supper."

"Well, I'll accept that excuse," Ed smiled. "Let's go downstairs and get started. What luck did you have with the cryptograms I gave you last week?"

"Shucks, they weren't so tough. Here are the solutions. What do we do tonight?"

"Well, Jimmy, I think we'll spend the next few sessions learning some elements of substitution, so you'll see where it fits into the cipher picture. We can take up more complex material of all types when you're a bit more advanced. Pull up that chair and let's get started.

"You'll remember[1] that in a substitution cipher, letters of the plain text are replaced by others of our selection. Right here, for convenience's sake, we'll need some sliding strips of wood with English alphabets printed on them. Like these: see, I've printed certain alphabets on paper strips glued to the wood ones. The simplest set is two standard alphabets. We can set **A** equal to **e**:

a b c d e f g h i j k l m n o p q r s t u v w x y z
W X Y Z A B C D E F G H I J K L M N O P Q R S T U V

or to any other letter, which allows us 25 different alphabets."

"The small letters represent plain text and the capitals represent cipher substitutes — right?" Jim broke in.

"Check. It's convenient to follow that practice in all analysis so one doesn't get confused. Now, using this enciphering alphabet to write the word **rationing,** we would get **NWPEKJEJC.** There is also a standard *reversed* alphabet — this slide here:

a b c d e f g h i j k l m n o p q r s t u v w x y z
Z Y X W V U T S R Q P O N M L K J I H G F E D C B A

— which may also be set in any position. We call it a *reciprocal* alphabet since at any setting if, for example, **A = d,** then **D = a.** At such a setting, the word **rationing** would become **MDKVPQVQX.**

"These are standard alphabets. A little more complicated is the *mixed* alphabet, with letters in no particular order. It may be secured by any number of methods, but for the purpose of convenient arrangement between communicating parties it is usually derived from some key. A keyword is selected, such as **majordomo;** repeated letters are dropped, leaving **MAJORD;** and from there the remaining letters are written in alphabetical order, giving us this enciphering alphabet:

a b c d e f g h i j k l m n o p q r s t u v w x y z
M A J O R D B C E F G H I K L N P Q S T U V W X Y Z

and upon enciphering our old friend **rationing** we get **QMTELKEKB.**"

"Ain't it wonderful?" Jim broke in.

"Quiet, you! Now, the cipher we've talked about so far this evening is known as *simple substitution,* since every plain text letter is represented by but one cipher letter. We have several methods of attack, and we usually try the simpler ones first since they take the least time.

"Notice our first standard-standard alphabet; placing **A** equal to any plain text letter simply means that every letter of the cipher text will be offset by a certain amount. Any text so enciphered can be easily solved by a process known as 'running down the alphabet' — meaning that a segment of cipher text is written down with similar cipher groups below it, each advancing one letter of the alphabet. Remember **NWPEKJEJC?** Watch:

N W P E K J E J C
O X Q F L K F K D
P Y R G M L G L E
Q Z S H N M H M F
R A T I O N I N G

"An encipherment by our reversed alphabet may be solved in this manner, but only after the cryptanalyst has re-enciphered the unknown text by a reversed alphabet set at any position. In the case of **MDKVPQVQX,** we re-encipher it with the reversed standard alphabet I mentioned earlier and get **NWPEKJEJC** — which happens to be the same as our previous text segment and can of course be solved in the same manner."

"But suppose a mixed alphabet is used?" Jim asked.

"Then we get into some fun. Our attack is based principally upon a knowledge of the

* Assistant Secretary, ARRL.
[1] Huntoon, "Yhpargotpyrc Ni Detseretni?", *QST*, May, 1942.

mechanics of the English language — the frequency of letter-occurrence, the appearance of digraphs and trigraphs and doubled letters, the vowel-consonant relations, probable words. In simple substitution a frequency count of the cipher text will show equivalent English percentages but with the individual letter-occurrences attached to letters other than **etoanirslh,** etc. A message enciphered by our **majordomo** alphabet, for example, would yield high-frequency letters **RTLMKEQSHC.** We simply have the problem of determining which represents which."

"Easy, huh?"

"Don't be sarcastic. It's not so hard, if you go about it the right way and take care in your work. The first thing to do with all new ciphers is to make a frequency count. Here's one from *The Cryptogram,* slightly difficult because of its short text and yet made easy because the word divisions are already shown:

TO PTCLIKES BI BE ACPN VKEE INWH PTCLWQK TO NKWLI WHY NTVBHKEE. SKI BH AS XWVJE BI EKKAE IT AK INWI INK QLWPK TO QTY BE BH PTCLIKES.

What can you do with it?"

"Make a frequency-count first," said Jim. And in a few moments he had a chart looking thus:

A	𝍷𝍷𝍷𝍷	N	𝍸 𝍷
B	𝍸 𝍷𝍷	O	𝍷𝍷𝍷
C	𝍷𝍷𝍷𝍷	P	𝍸
D		Q	𝍷𝍷𝍷
E	𝍸 𝍸 𝍷	R	
F		S	𝍷𝍷𝍷𝍷
G		T	𝍸 𝍷𝍷𝍷𝍷
H	𝍸	U	
I	𝍸 𝍸 𝍷	V	𝍷𝍷𝍷
J	𝍷	W	𝍸 𝍷𝍷
K	𝍸 𝍸 𝍷𝍷	X	𝍷
L	𝍸	Y	𝍷𝍷
M		Z	

"There are 103 letters," Jim mused, "and the **aeiou** percentage is 10, **lrnst** 24, **jkqxz** 17 — so that's no go. But let's see . . . the five high-frequency letters **KEITB** make up 50 per cent and the next five **WNHLP** make up 28 per cent for a total of 78, while **FGMRU** totals zero. That means simple substitution, with certain letters equaling English percentages, doesn't it, Ed?"

"Things point that way. Keep going."

"Seems funny for me to be doing the talking, but here goes: I make a tabulation of contacts by high-frequency letters with lower-frequency letters such as **ACJOQSVXY,** thus:

KAE	**VJE**	**ES–**	**TVB**
–AK	**TO–**	**–SK**	**WVJ**
TCL	**WQK**	**AS–**	**–XW**
ACP	**–QL**	**–VK**	**TY–**
	–QT		**HY–**

which gives me contacts as follows:

K 5, **E** 3, **I** 0, **T** 5, **B** 1, **W** 3, **N** 0, **H** 1, **L** 2, **P** 1,

and shows that probably **K, E, T,** and **W** are vowels, while **I, B, N, H, P** are consonants."

"Notice the **KK,** and **EE,** Jimmy; you remember that doubled consonants are almost always flanked by vowels, and vice versa. So it is unlikely **K** and **E** are both vowels."

"Thanks for the hint, Ed. Well, **K** is the more definite vowel, so I'll think of **E** as a consonant, or skip it temporarily," Jim determined.

"Right. Now since we know the word divisions we can best attack this cipher by *word patterns.* The short words, and longer ones such as **VKEE** and **EKKAE,** are good ones. Try **EKKAE** — see what English word can fit its requirements of consonant-doubled vowel-consonant, and another the same as the initial letter. **KK** probably is **oo** or **ee, aa** being unnatural. **E** should be one of the high-frequency consonants **lnrst,** and **A** any medium frequency letter such as **hdcmpfw.** We can make a table like this:

E	**K**	**K**	**A**	**E**
t	**o**	**o**	**h**	**t**
n	**e**	**e**	**d**	**n**
r			**c**	**r**
s			**m**	**s**
l			**p**	**l**
			f	
			w	

"Teeth — there in the second line!" exclaimed Jim.

Ed roared. "Afraid that won't fit, m'boy — it would be **teeht.** See any others?"

Jim wrinkled a youthful brow. "Ummm . . . how about **seems?**"

"Good possibility; let's try it. It makes the **KEE** of our other pattern words **ess,** which is encouraging. **VKEE** is probably **less,** and **NTVBHKEE** something-**ness.**"

"Hey, wait! Let me work it. If **E** is **s, BE** must be . . . well, it can't be anything but **is, as** or **us,** but we said **B** was a consonant."

"We were probably wrong; these contact tests are simply indications to give us some kind of start, and shouldn't be considered inviolate," Ed pointed out.

"Okay. Hmmm. . . . The only thing fitting **BI BE** is **it is,** unless it's **at as,** which is unlikely. Let me try **INWI,** assuming **I** is **t:**

I	**N**	**W**	**I**
t	**r**	**a**	**t**
	h	**u**	
	d	**o**	

(*Continued on page 49*)

ON THE ULTRAHIGHS

CONDUCTED BY E. P. TILTON,* W1HDQ

Well, the name of this department won't have to be changed after all! After months of impatient fretting over the seemingly needless delay, we now have the way cleared for renewed activity by the announcement of the WERS plan. There won't be any friendly chats, hours on end of testing on a new beam or hair-raising sessions when the band is open; there'll be no DX Contest, Sweepstakes, or UHF Marathon; it won't even be amateur radio in name or form, but WERS does represent a chance for all of us who are not already in uniform to make a definite contribution to the war effort. We know now just where we stand, what we can or cannot do. We're all on the ultrahighs, now — let's go!

Our network of DX listeners on the "FM" band is expanding. We now have reporters in enough widely separated points so that a fair idea of the prevalence of sporadic *E* over the country as a whole may be obtained. And some interesting facts are coming to light, particularly as to the possibilities for DX work on 56 Mc. in sections of the country that were not represented in the five-meter DX picture. Though the power output of most f.m. stations is considerably above that of the best of the stations on 56 Mc., the receiver side of the picture just about balances things up. The antennas used for f.m. reception ordinarily are not anything fancy, and the receivers are certainly (with very few exceptions) no match for the highly-sensitive jobs used in amateur work. All things considered, observation of the f.m. band should give us a pretty fair idea of the potentialities of the five-meter band in a given locality.

Up in North Anson, Maine, W1ARV reports DX as follows: May 29th, 11 A.M.: W55M, Milwaukee; W47P, Pittsburgh; W51C, Chicago, and a station in Cleveland — all heard for about two hours with good strength. W55M was heard again that evening between 8 and 9 P.M. On June 5th W47NV, Nashville, Tenn., was heard at 4 P.M. Between 8 and 10 P.M. W67C and W51C in Chicago, and W55M were heard. Signals were strong, but bad fading was general on this date. W43B, Boston, and W39B, Mt. Washington, were both below normal. June 10th was the best, to date, with the band open for nearly 12 hours starting at 11 A.M. Twenty stations were heard, with the following identified: W45CL, Columbus, Ohio; W47NV; W51C; W67C; W59C; W41MM, Mt. Mitchell, N. C.; W75P and W47P, Pittsburgh; W45E, Evansville, Ind.; W3XO, Washington, D. C., and W2XMN, Alpine, N. J. W75P, W59C, W67C, W55M, W47NV, and W45D were heard on June 20th, between 7 and 8:30 P.M.

In Philadelphia, W3BES found June 10th a red-letter day, with W51C, W59C, W67C, W45D (Detroit), W55M and W39B coming in between 7 and 8:35 P.M.

Down in Waco, Texas, W5KLC was hearing f.m. signals from 1:35 P.M., June 10th, until 8 P.M. on the 11th, with Chicago, Detroit, Columbus, New York, Alpine and Nashville coming through. With this as a sample, W5KLC says that, though hitherto he has been principally interested in low-frequency work, he would like to get back on the air to see what goes on on Five during one of these sessions.

No W4 ever worked W6 on Five, yet Nashville is heard all over the country on the f.m. band. W6SLO, Tucson, Ariz., heard them on seven of the twenty days that the band was open in May and early June. Neal's log follows: May 7th, 7–8 P.M. — W45V, W47NV; May 12th, 8:15 P.M. — W47NV; May 13th, 7:30 P.M. — W45V, W47NV; May 14th, 1:15 P.M. — W47NV; at 8 P.M. several broad signals, apparently aurora effect, unidentified; May 15th, 12:30 P.M. — KALW, San Francisco, two stations in Detroit, and W51R, Rochester; May 20th — W51C at 1 P.M. and W47NV at 8; May 25th, 12:15 P.M. — KALW, with W2XMN coming through at 8; May 26th, 7 P.M. — W47NV; May 28th, 12:30 P.M. — KALW, very strong, several weak signals at 7:30; May 29th, 7 P.M. — weak signals, unreadable; May 31st, 11:30 A.M. — W45BR, Baton Rouge, La., KALW; June 1st, 11:55 A.M. — KALW; June 2nd, 12:30 P.M. — W45BR, W47NV; June 5th, 7 P.M. — W45BR, W47NV, strong; June 8th, 7 P.M. — two weak signals, unreadable; June 9th, 7 P.M. — W45BR; June 10th, 7:30 P.M. — W43B, Boston, strong, with several other weak signals; June 11th, 12:30 P.M. — W53PH, Philadelphia, and another station in the same city; June 12th, 7 P.M. — W47NV.

W7CIL, Salem, Ore., is handicapped by the lack of f.m. stations within local or even normal-skip range. He checks the police stations around 32 Mc., and guesses from the condition of this range whether he will hear any f.m. signals or not. K45LA, Los Angeles, is heard most frequently, but at present they are often not on the air at times when the band appears to be open. K45LA and police DX were heard on May

*329 Central St., Springfield, Mass.

13th, 7:50–9:30 P.M.; on May 16th, 4:30–5:05 P.M.; May 19th, 4:15–4:30 P.M., with strong police sigs around 11 A.M.; May 25th, 8:15–8:55 P.M.; June 5th, 4:15–6:15; and June 7th, 7:45–8:55 P.M. May 20th and 23rd, June 5th, and June 10th looked like days on which things might really have happened on Five. Commercial harmonics were heard in the five-meter band on June 5th and May 23rd. On May 20th, W43B and another East-Coast station were heard, with W47NV coming through strong on June 10th. W1-W7 and W4-W7, no less!

While on duty at WEBQ, Harrisburg, Ill., W9EID monitors the f.m. band. Weak fading signals were heard on June 8th between 7:30 and 8:15 P.M. On June 10th W43B was very strong between 7:30 and 8, with W67B coming in at good strength, and W2XMN somewhat weaker. The f.m. band opened at 6 P.M. on the 11th, with W43B, W2XMN, and W8XAD very strong. W51R and W67B were also heard, the band dying out around 8 P.M. W1DLY/9, Prairie du Sac, Wis., heard W2XMN on June 4th, at 9:45 P.M.

Collection and correlation of data on skip DX is something of a task. The effort involved will have been highly worth while, however, if we are able to keep an unbroken record of the occurrence of this phenomenon during the period when we are off the air. The records kept by Mel Wilson, W1DEI, go back to 1935. A vague idea of the work he has put into this project may be drawn from a glance at the number of reports he has analyzed since then. The score: 31 reports in 1935, 157 in 1936, 406 in 1937, 2500 in 1938, 3100 in 1939, 5100 in 1940; a total of 11,300, with 1941, as yet incomplete, running to over 6000 more! With known solar periodicities running up to cycles of 23 years, this sort of thing can be carried almost indefinitely. A fairly complete record through at least one eleven-year cycle is highly desirable.

And just when did this business of DX on Five actually start? There are reports in ancient issues of *QST* of long-haul work on "five meters" back in 1926, but there is some doubt about the actual frequency used in this instance, we believe. Recorded instances of actual two-way communication date back to the spring of 1935, but even these early contacts were held in doubt by those who figured that they just weren't possible. Your conductor, for instance, was unable to convince a soul that he actually heard a W8 in June, 1935, until several two-way contacts were verified and reported in *QST!* Perhaps our early experiences on Five deserve a careful review. Maybe there have been other incidents like the one reported below by W6BHM, who got nowhere trying to convince even our own Ross Hull that he'd heard transcontinental DX on Five!

1210 Hill St., Dunsmuir, Calif.

Editor, *QST:*

With our activities practically at a standstill, I thought it might be interesting to recall a story which was, at the time, way back in 1933, stranger than fiction.

At that time five meters was in its infancy. I had built a streamlined receiver, employing a 224 with base removed, air-flow coils, super-hi-loss tuning condenser and all the latest innovations advanced at that time.

Day after day I combed the band looking for signals. But alas, the band was silent as a tomb. Only the occasional frying splutter of loose connections interrupted my vigil. Then one day late in April this monotonous watch was awarded by the reception of a signal. I maneuvered with frenzied desperation, as the signal was weak and nearly below the QRM level of the nearby clucking chickens. "Whoops — lost him. Bad hand capacity. Better try turning the dial with the eraser end of my pencil. Ah, that's better!" For now, above the R9 pounding of my heart and the QRN from my hissing, gasping breath, I copied these immortal letters: V V V DE W1FEX W1FEX.

The ordeal was too much. My stored-up energy and enthusiasm exploded like a bursting bomb. When I had regained control of myself, I was running around the shack with my prize receiver dangling from the headphones and swinging back and forth from my head like an aweighing anchor. Needless to say, W1FEX was not heard anymore that day. However, a letter to W1FEX brought a reply that not only was he on at that fateful hour but on 5 meters, too.

The details were jointly forwarded to *QST*, but their reply had a decided damping effect on my enthusiasm. "It is certainly very surprising to hear of your reception of what appears to be a commercial harmonic on five meters," was the reply I received from Associate Editor Ross A. Hull. "You will pardon me if I appear to be a bit of a 'Doubting Thomas,' but are you sure your transmitter was not running at the time reception occurred? Probably you know that all sorts of dizzy signals can be heard when there is an oscillator running in the same room."

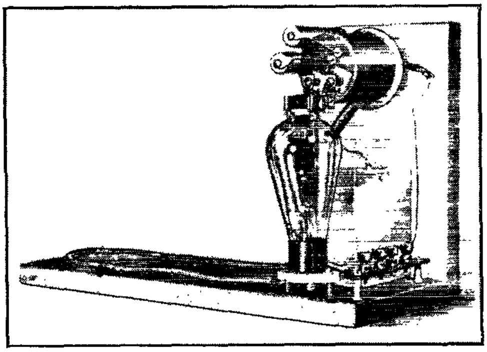
Commercial harmonic, indeed! Time has proved such reception was not only possible but an actuality. Just a few years later five-meter reception across the Atlantic was accomplished, and transcontinental QSOs are a matter of record.

It is with these facts that I claim the first transcontinental reception on five meters.

Therefore, gentlemen, I ask not for your apologies, but when my call is mentioned, please speak with reverence.

73.

— *Wally Bowles, W6BHM*



The 224-Mc. rig of W3VX, Westville, N. J., uses an 834 at 25 watts input. The tank circuit is a "Peterson Pot." Gear of this type may well see service under the WERS plan for emergency communication.

Our experimental "feeler" on the subject of aerology as a substitute for active status in amateur radio has brought a variety of responses.

That there is considerable interest in the subject of weather and its relation to u.h.f. radio is certain. Whether this column can be the means of expression and advancement of this interest depends upon whether sufficient material is forthcoming from readers to warrant maintenance of a paragraph or two in this department each month to be devoted to comments and observations.

Several letters have been received asking for articles covering the angles of the science of aerology which have direct bearing on radio conditions. These we will attempt to provide from time to time. Others have asked for information as to where in *QST* such material may have been written up, and for more references that will provide material for study. In *QST* this means two articles by Ross Hull, one in October, 1935, and another in May, 1937, devoted to air-mass bending of u.h.f. waves. Mel Wilson's "Five-Meter Wave Paths" in August and September, 1941, is valuable. W1AIY, a long-time amateur meteorologist, suggests "Why the Weather" by Dr. Brooks, whose work at the Blue Hill Observatory is well known to those who were active on Five in the days of W1XW on 60.5 Mc.

W1ARV, in a fine location atop a hill in North Anson, Maine, is becoming interested. He logs weather conditions, in detail, in connection with observations of the signals on the f.m. band. This is fine, particularly if there are stations well beyond the visual range in the direction from which weather normally comes. In the East, for instance, air-mass characteristics and a fair guess at tomorrow's weather can be readily drawn from careful observation of the signals from two or more f.m. stations; one or more to the southwest, and others to the north or northeast. Combine these observations with frequent checks on barometric pressure, wind direction, temperature, cloud formations and movement, and possibly relative humidity and dewpoint, and you'll soon find yourself developing a reputation as a weather prophet. What's more important, you will have discovered a use for radio which you never dreamed of a few years back.

Information continues to come in from fellows who have been shifted around the country by war conditions. Here are recent additions to the "Who is Where" department:

Merlin Berrie, W5HTZ, who helped to put Oklahoma on the five-meter map, is now in the Signal Corps and is stationed at Fort Monmouth, having recently arrived from Camp Crowder, Mo. He met several amateurs at Camp Crowder, and more up at Monmouth, but so far he has come in contact with none of the fellows up in this part of the country that he contacted on Five last summer.

W6OVK, missing the chance to work some more W1s this summer, has come East to meet them in person. He is now in Boston working as a research engineer on a government project about which publicity is not given, these days. His new address is 1699 Cambridge St., Apt. 24, Cambridge, Mass.

Harold Kaye, W2KKE, "that portable-mobile guy," would like to get word around that he is now located at Elkins Park, Pa., doing engineering work on radio and electrical systems for military aircraft. Harold is disappointed in the disregard for proper microphone technique on the part of his recently arrived junior op. It appears that volume comes first in the young man's modulation, quality last! The new address is 806 Elkins Ave.

During a recent blackout at the University of Connecticut Extension School course in radio communication a whistled "CQ de W1LAL" raised plenty of QRM in the form of answers from W1MGT, W1AFB, W1LOP and a ham from Central America. MGT says that W1MPB is now on the high seas, having graduated from the Merchant Marine School at Boston, and W1BYN is now a top sergeant at Bradley Field, Windsor Locks, Conn., teaching radio. W1LAL is doing civilian work (transmitter maintenance) for the Signal Corps.

Cryptanalysis Lesson

(Continued from page 46)

— which makes **that,** of course; and **INWH** is . . . **than.** Shucks, it's easy, Ed."

"Yes, and it's getting late, too. Here's your homework, pal. See you Monday."

VJKUQ PGKUU KORNG YCKVW PVKNP GZVOQ PVJXX

0688 1004 806298 93781 948 742917 89372 65 986 0451

—···—

Certainly enjoyed EEEYB ETUGE YORED TEIDA EYKEO DBEXX

— *W3JAS.*

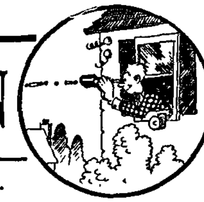
ADYYUW ESPPYC-CESBBREA ANTTME YQQ QMWWRE; BEMVVRE VMMK, VYQQ FSTNNO PMCCQR. SQQ ARRD MKK ACNTTM YUU. WNJJQR PRRE; XYTTNB, VSQQ SAQRRB

— *The Cryptogram*

JXFJUBEBIF OPGTFSXOBD USSTSPIEOU IMPVTTJNEJ FENFDFDFUP FGUEPSIOIO NJIBNIBZFJ BSFOFFMOGO OTIEUUUBJT BUFGIFINSQ SGBSFFPFFB JSSPFNVSBD PPUNBJHJOF ONPUSOITEP PUGIUHJPUG GIUFIMSOIP UFICGJIFFO IBFPSGBXBF FJGTPFTJJH NSJPNPNUSS BDSNUGFIBF UPFPIUOUMB FNXGFIZIMN SFBUFFGFBQ JGSIBXPFSP BJFFSPSBFP MSSXUSNSGF **TBIMTUMS

— *W9IUN*

EXPERIMENTER'S SECTION



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

PROJECT A

Carrier Current

We have *QST* rigs and find no trouble in getting all over town (two miles in all directions) on both c.w. and 'phone (Sanford, Fla.). Some noise, but sigs go through and we are keeping the fist in shape. — *W4HGO, W4HXM and Lloyd Boyle, LSPH ("Licensed since Pearl Harbor").*

I want to report successful operation with the *QST* carrier-current transmitter and converter. We have S9 reports up to five miles. I am now sending tape transmissions to a couple of friends for code practice, and hope sometime to have a regular code-practice class on 180 kc. — *Kenneth Roegner, Tacoma, Wash.*

At a recent meeting of the Spokane Radio Operators' Club, it was decided that "wired wireless" would be our project. — *Thos. J. O'Brien, jr., Sec'y.*

At the motorboat races held in Columbus (Ohio) recently, W8JTW and W8OVB used wired wireless over a power line to maintain communication from the judges' boat to the drivers' pits. A frequency of about 180 kc. was used. The power line paralleled a p.a. extended line for most of the distance and the rest of the distance was made up of rubber-covered lamp cord with part of it under water. The total distance was about one-half mile and about 350 feet of light cord was used. No traces of interference to radio or p.a. was noted and communication was one hundred per cent. Loudspeakers were used on both ends, even through the terrific noise of outboard motors. W8OVB used a Meissner Signal Shifter with about half rated input and a Philco receiver with long-wave band. W8JTW used an antique superhet and 6L6G oscillator with 6F6 modulator. Both used push-to-talk switching. — *W8JTW.*

Just a line from one more ham up to his neck in 60- to 70-hour work weeks. In spite of these hours, W6UCW, myself and a neighbor have all found time to obtain some good results on 160 kc. with wired radio. 'Phone, c.w. and i.c.w. are being used over a distance of 1½ miles airline. The line distance is unknown, since no one has had the time to trace it. Signal strength is R7 carrier on 'phone, R9 on c.w., while noise levels vary from not bad (R2) to terrible (R9 plus).

The current input to the line at W6MEP varies from 0.1 to 0.3 amperes with different line conditions with no change in the oscillator input of about 12 watts. Modulated oscillators seem unsuccessful because of their inability to take high modulation levels. Rigs of the m.o.p.a. type will be necessary to get best results on 'phone. For many reasons we believe 'phone should not be used, and that operation should be confined to c.w. and i.c.w. Also, it seems to be an excellent medium for training new operators at all times, since licenses are not required, giving anyone interested an opportunity to receive practical training. Even the line noise is similar to common static; in fact, I think much of it might be.

Efforts are being made to interest more of the 40 or 50 amateurs in Burbank to try carrier current. To date, there seem to be only three of us, but we like it. — *W6MEP.*

I have just completed a satisfactory QSO on wired wireless with W8DFN, who is located about 1½ miles away by power line route. Both of us received 579X reports, using around 40 to 50 watts each. Our equipment is that described in *QST* for March.

We started at 8:00 P.M. and continued until 9:00 P.M. By that time our signals were too weak to copy solidly. Evidently, as more lights were switched on along the lines, our signals were by-passed to ground. This leads me to believe that most successful contact will be made during daylight hours. We will make more tests along this line, by attempting to contact at later hours, when some families have retired. Perhaps it may be better after 10:00 P.M. or thereabouts.

Using my old choke-modulator in series with the B + to my oscillator, I was heard on 'phone at W8DFN. He gave me a meter reading of S4 on his SX28. No frequency modulation was noticed, as he had his crystal in the circuit and heard my voice clearly. The greatest problem is intermittent heavy line noise.

If there are any radios in the house, the ground wire should be disconnected from them. In my case here, there was a grounded receiver downstairs, and every time it was turned on my transmitter became too heavily loaded. When the load was again lightened to same input as before, the lights in my shack no longer flickered, indicating that a lot of r.f. current was evidently being shunted to ground. As soon as I removed the ground from the b.c. set, everything was FB.

W8RDX, on the opposite side of the city, has heard me in the daytime, rather weakly but readable. He is located on the opposite side of a power substation. However, he doesn't have a transmitter going yet. W8DFN and myself hope to get the fellows on our side of the city interested. He and I intend to QSO every Monday, Wednesday and Friday between 7:30 P.M. and 8:30 P.M. E.W.T. It sure is swell to pound brass again, and boy — is my sending poor! A little of this wired wireless, however, will bring back that old fist of mine. — *Roy Woollacott, W8WIF.*

W2IHP is making tape transmissions daily at 5:30 to 6:30 and 10:00 to 10:30 P.M., EWT, on a crystal-controlled frequency of 160 kc. The tape alternates Vs and "W2IHP." He is anxious to receive reports from anyone hearing him.

PROJECT B

Light Beams

THOSE fellows interested in communication by means of beams of light might be interested in a mirror which can be obtained from the Central Scientific Co., 1700 Irving Park Road, Chicago, Ill., for $3.65. It is 16 inches in diameter, will produce well-defined images and is listed as No. 85407 concave mirror. It is already in use to pick up light from automobile headlights. The light is focused on a photoelectric cell to actuate a relay for illuminating roadside advertising. The focal spot is sufficiently small (about ½ inch) for most PE cells. The Manhattan Electrical Bargain House, Inc., 120 Chambers St., New York, has for sale precision parabolic mirrors in 11-, 30-, 36- and 60-inch sizes. However, these are quite expensive, ranging in price from $15 for the 11-inch size to $125 for the 36-inch size.

It is possible that by using some of our modern sources of light, such as an electric arc or a type H6 mercury-vapor lamp (a very intense source of light) and a light gate such as described by W1ANA in *QST* for June, communication over considerable distances could be accomplished using the simple selenium[1] cell with a battery and headphones as a pick-up. It would also be interesting to see what could be done using such a cell with vacuum-tube amplification. — *W3IYR.*

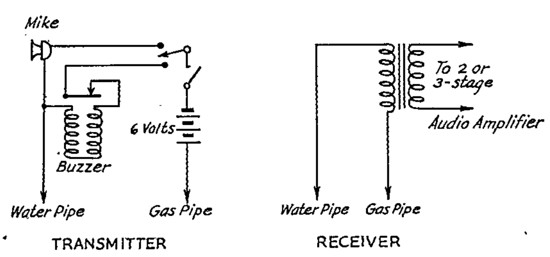
PROJECTS C & G

Audio-Frequency Induction & Earth-Current Communication

IN 1934, when the writer and two friends were trying to learn enough code to take out amateur tickets, it was felt that some method of communication between the three houses would be very beneficial. As the houses were all on separate streets a wire 'phone line was ruled out, so the next thing to be considered was earth-current telegraphy as used during World War I. A survey of literature on the subject revealed that fairly long earth bases were necessary if long distances were to be covered. This was rather discouraging, because the three proposed stations were in houses in a residential area and space was not available for setting up the long earth bases pointing in the appropriate directions. However, one fact emerged; if one earth base of the transmitter were linked to one earth base of the receiver by means of a good conducting path, much greater ranges could be covered. The water pipe would serve for such a path. Any why not use the gas pipe system as a path connecting the other bases? In fact, why not use the water- and gas-pipe systems as the earth bases? Earth bases used in the war had an average resistance of several hundred ohms but the water-gas pipe base was found to be only two ohms approximately. With these facts in mind, the simple system shown in Fig. 1 was set up and communication immediately established between the three houses, one 100 yards away and the other 500 yards away.

At first, the receiver consisted of the audio stages of the short-wave set with the gas-pipe base hitched onto one of the grids, similar to the scheme proposed by W1NEI in the April *QST*, but it was found that better results were obtained using a high-ratio transformer, such as a voice-coil transformer, at the input. Telephony was next tried as our code at that time was very erratic! Perfectly readable 'phone was possible just by substituting a telephone-type microphone for the buzzer in Fig. 1.

Since this satisfied our immediate needs, no further development was done, but it is



Simple earth-current communications system described by GM8FM. The receiver input transformer is a speaker to voice-coil unit.

[1] It is doubtful that selenium's slow response would be sufficient for voice communication, although it might be used successfully with telegraphy. — ED.

evident that much greater distances could be covered if the outgoing speech were amplified and several watts of audio were fed into the earth base through a voice-coil transformer. This practice is rather frowned upon by the gas companies. If there is no gas pipe available, it ought to be possible to use the earthy side of the mains, feeding through a condenser and providing a filter to cut out any supply-frequency interference. A certain amount of interference was observed in the system used due to stray currents from a.c. lines and also from a traction network. Street cars a mile and a half away could just be detected in the background. Some trouble may be expected due to the signals breaking through on broadcast receivers if much audio is fed into the earth base, if there is any signal pick-up between the earthy side of the mains and the broadcast receiver earth.

This system outlined above is by no means ideal, but it should provide a means of communication in suburban areas where no garden space is available and where all the stations are within a 500-yard radius. The snag, of course, is that only one station can work at a time unless the notes differ; in fact, some of the notes could be supersonic, of the order of 20 kc., although a reduced range may be expected using frequencies of this order.

The writer would be interested to hear from anyone who decides to develop this idea. — *Jas. H. Shankland, GM8FM.*

PROJECT D

R.F. Induction Fields

Use of r.f. induction fields for communication seems to be overshadowed by the interest in projects capable of a longer range, such as carrier current. However, we have a few active experimenters and some others who are interested in locating neighboring experimenters with whom they can work. Among the latter are Irwin Scollar, 1895 Morris Ave., The Bronx, who has a 550-kc. rig working and is going to the lower frequencies. Buddy Norwood, W5KOB, of 802 N. McKinney, Ennis, Tex., is equipped for c.w. and 'phone and wants someone to work with. Irving D. Perry, 172 Division Ave., Summit, N. J., is interested in both Projects A and D.

One of our most indefatigable experimenters is Roy C. Stegemiller, W9BAY. With a crew of Chicago Heights cohorts he has been working an induction net regularly for some months past. The Rev. Hugh C. Crouch of Brighton, Mich., has rather an elaborate set-up with a 6SJ7 e.c.o. impedance-coupled to a 6F6 power amp., modulated by 6SJ7-6SF5-45, which he is using to good effect.

It begins to be apparent that, apart from certain specialized applications such as a short-distance circuit without linking wires of any kind, the chief interest in r.f. induction fields lies in the remote control applications rather than communication. We invite comments and contributions on this phase of the problem. R. W. Mayo, 2329 Storm St., Ames, Iowa, is using lambda-over-2-pi for remote control of a 28-inch model of a U. S. Navy PT-type torpedo destroyer on Lake Laverne on the Iowa State College campus. And J. B. Carlisle, 507 E. 13th, Dallas, is a "juke-box" repairman with considerable experience in commercial remote-control systems who would like to exchange circuits and experiences in this field.

PROJECT E

Acoustic Aircraft Detection

Those who are doing experimental work with acoustic aircraft detectors may be interested in looking up some of the articles which are included in the following list of references submitted by Devereaux Martin of Radburn, N. J.:

Stewart, "Location of Aircraft by Sound," *Phys. Rev.*, August, 1919.

Ely, "Aircraft Detectors and the Antiaircraft Problem," *Franklin Inst. Journal*, June, 1929.

Paris, "Binaural Sound Locators," *Sci. Progress*, Jan., 1933.

"Direction Finding by Sound," *Nature*, July 15, 1936.

PROJECT F

Supersonics

Regarding your Project F on supersonics, outlined in May, 1942, *QST*, it seems to me that one of the most sensitive detectors for this work would be the so-called sensitive jet. In most cases for demonstration purposes this sensitive jet consists of a glass tube drawn down to a fine aperture and piped with ordinary illuminating gas. The lighted flame serves as a visible detector of supersonic waves. Filing the tip of the jet will produce increases and decreases in sensitivity for certain frequencies. Inasmuch as it is the jet itself, and not the flame which is sensitive, it occurred to me that it might be possible to focus a small intense beam of light through the center of the jet, or through one edge right near the orifia, and allow the light beam to fall on a slit and then possibly through an optical system onto a photoelectric cell.

Inasmuch as I do not have time to try this experiment myself, I am passing it on to you and your associates. I would be more than pleased to hear from you as to how this works out. Fortunately, a very good source of intense supersonic waves is the end of a short steel bar, say a piece of drill rod, ½ to 1 inch in diameter and a foot or so long, clamped between knife-edge supports at its center. One end of it rests against a small fiber bakelite disk, which is revolved by a small motor. The opposite end of the bar serves as a projector, or point source of intense bar sound. Most of the difficulty at these frequencies lies in being able to concentrate and direct the sound energy. Small tapering funnels, built of metal, seem to offer the best possibilities. A Galton whistle, or other similarly built whistle, should prove an interesting source of supersonic waves.

— *Lloyd W. Root, Instructor in Physics and Math., Lawrence College*

Those who are looking for reference material on the subject of supersonics will be interested in Publication No. 221 of the *Publications from the Graduate School of Engineering,* Harvard University, Cambridge, Mass. This bulletin contains a group of three papers by George W. Pierce and Atherton Noyes, jr.

In response to the request in the June issue for reference material on the subject of supersonics, E. G. Roberts suggests "A Textbook of Sound" by Wood, published by Macmillan Co.

W3IYR would like to hear from anyone who knows where inexpensive parabolic sound reflectors may be purchased.

W3EZJ suggests the book "Supersonics" by Wood, published by Barnes & Noble, 105 Fifth Ave., New York. He also recommends the magazines *Physical Review, Review of Scientific Instruments* and the *Journal of the Acoustical Society of America* all of which have carried articles on supersonics from time to time. Additional references may be found in *Scientific Abstracts* which gives brief summaries of scientific papers published throughout the world.

W3IVZ, W3IYR and W4HYR suggest the section, "Supersonics — A Survey," by Mayberry in the *Electronics Engineering Manual,* published by McGraw-Hill.

PROJECT H — *Microwaves*

The main idea in back of the establishment of this new project, devoted to microwave technique, is to provide a "meeting-place" for those of us who still like to play around with u.h.f. gear — even though we are not permitted to try it out in actual communication. The vast possibilities of the microwave field deserve our attention for future reference. In laboratories the country over, gear that makes one's eyes pop out is being built and tested. When this war business is over there's going to be plenty doing on frequencies that most of us have never dreamed of. It behooves us all to be learning something of what it's all about.

We need not divulge any military secrets in digging into this field. Though there has been little amateur interest in the frequencies above 116 Mc., information on the subject has been available for years. The two-part article, "100 Centimeters and Down," now appearing in *QST* points the way to a more complete knowledge of microwave history and modern practice, insofar as such material has been published in various technical journals; and in June *QST* John Reed, W6IOJ, described acorn-tube oscillators which will perform on frequencies up to 800 Mc. But what about those of us who have no Klystrons or 825s, and whose stock of machine tools consists of a screwdriver, a pair of pliers, and a dime-store soldering iron? Is there anything in this microwave business for us?

We think there is, definitely. Lots of questions remain in most minds that can be answered by a few simple but highly-interesting experiments that are not beyond the scope of the "kitchen-table mechanic." At what frequency do filament lines become necessary in an oscillator? What is a Barkhausen-Kurz oscillator? A Kozanowski oscillator? How does one go about receiving frequencies above 300 Mc.? The maximum frequency obtainable with standard tubes when used in these oscillator circuits will be something of a surprise to many of us. Commercial installations were running 852s on 500 Mc. years ago (at a few watts output, per pair) while an early page in the photo album at W1AIY shows a 400-Mc. transmitter using a pair of de-based CG-1162s in a Kozanowski oscillator and a Barkhausen-Kurz receiver using a 199. This gear is dated May, 1934! Superhets used for blind-flying experiments on 700 Mc. were described in *QST* years ago. These are certainly not military secrets. Yet how many of us understand the fundamentals involved?

Finding information may require a bit of digging. Reflecting the current lack of interest, recent issues of the various amateur magazines and handbooks are not much help. But *Handbooks, QST* and *Proceedings* of the IRE for some years back may suggest a line of attack. As a hint, cylindrical-plate tubes such as the HK24 and HK54, 35TG, 75T and countless others now collecting dust in idle rigs should be ideal for experiments with positive-grid oscillators.

Undoubtedly there has been quite a bit of experimental work of an amateur nature going on

(*Continued on page 88*)

WE'VE got proof of this! Pvt. Emanatian, ex-2JKS; Pvt. Watt, 9HYQ; Cpl. Strobo, 9YKL, and RM3c Coulombe, 1MVG, are all in radio work for Uncle Sam. So far, no information on any Volts, Ohms and Amperes being In the Service — but we have hopes.

COAST GUARD

LAST month the Marine Corps appeared in this column and this time we have the honor to present four names in the Coast Guard. Can we have some more? Albee, 9OZL, enlisted last January and is located at Fort Tilden, N. Y.; Schoneman, 9FBV, is at Wilmette, Ill.; RM2c Weber, 6JOH, is lucky to be near home at Fort Funston, Cal.; and RM3c Munro, 8WRK, is based at Cleveland, Ohio.

FIELD ARTILLERY

FIVE good amateurs report in: Lts. Langford, 5GVV; Wells, 5HLD; and Palmblad, 5CYM (the latter Corps Area Communications Officer), are with the 189th F. A., while Cox, 5FSJ, is battalion communications chief op and Ransome, 5JSQ, is third op with the 343rd F. A. From the 55th F. A. Battalion, chief instructor, "D" Battery, Sgt. Johnson sends us a list of radio instructors who got their start as amateurs: Lts. Klein, 6RIY, and Brown, 6NJI; Staff Sgts. Littlewood, 9WEN, and Lewandowski, 9SZZ; Sgts. Rogers, 6RNV; Harris, 6SHK; and Gerking, 7BZS. With the 191st F. A., Master Sgt. Slater, 4IHG, serves as regimental communications chief. Capt. Daly, 9ZRA, is on foreign duty. Capt. Hoover, 5CEB, is instructor on the staff faculty at the artillery school, Ft. Sill, which Pvt. Christ, 9ALU, is attending. Lt. Miles, 4EZH, is stationed at Ft. Jackson, S. C.; Pfc. Kobyra, 2MVN, is serving as radio operator at Madison Barracks, N. Y.; and Pfc. Bartz, 9MYG, is a radio technician at Ft. Knox. Fucetola, 2OHN, at Ft. Hancock, N. J., is worried for fear the war will produce a large crop of YL ops. Swell! Why not?

NAVY

MANY of you fellows write us you're in the Navy now, but fail to mention rank, rating or job. We want to give credit where credit is due, but lacking specific information all we can do is say you are among those present. Here you are. Ensign Alyosius, 1JYJ; Brandenburg, 9HZY, radiolocator work; Carter, 9VFW, in New Orleans; RM2c Christie, 9MPR; Fontaine, 1LXQ; CPO Fowler, 9CKY, instructor; McKissick, 9LCA; RM2c Lieh, 9PHC, operator; Miller, 2LAO, operator; and Owen, 9EFG.

Ens. Bisby, 6NCO; RM1c Zwoster, 9GFG, and Perry, 9SJT, are in Hawaii. The 15th Naval District, C. Z., has five good hams in Lt. Burns, 9COA; Lt. (jg) Trego, 9WKC; Ens. Spencer, 5INL; RM1c Morgan, 9MRS; and RM1c Warren, 4DHL. How do you like C. Z. static by now?

A real old timer is heard from in Lt. Cmdr. Scott, 8WV, in radio since 1910, who is stationed in the Office of Naval Operations; Lt. Cmdr. Reinartz, 3IBS/3USN, another old timer and Ens. David, 8GD, are both in Naval Communications; Lt. Cmdr. Zobel, 2NMC, and Lt. (jg) Chace, 6BBW, are in the Bureau of Ships; Lt. Soucek, 6TAM, is in the Bureau of Aeronautics and RM1c Olsen, 7BMX, is a student at the Naval Research Labs; all Washington, D. C.

Three Millers are at the Brooklyn Navy Yard, Air Station and Receiving Ship: Ervin, 9BPO; Donald, 2MQB, and Herman, 2OOU/3IAY, respectively. We hope Herman has finally got that transfer into radio work. Bray, 9YNW, has an operator's trick at Tutuila, Samoa, and Jacques, 7FYN, at Dutch Harbor, Alaska.

Lt. Dosland, 9TSN, ARRL Central Division Director, has just been transferred to the Oxford (Ohio) Naval Training School as commanding officer. Millikan, 9SEO, and Peterson, 9ZRW, are reported at Great Lakes. Ens. Newman, 1GEH, is stationed at Portsmouth, N. H., and RM2c Baker, 4CQX, at the Naval Hospital, Portsmouth, Va., reports eye trouble and the possibility of having to leave the Navy. Hard luck, OM, but there are plenty of civilian radio jobs open for good men.

Others along the eastern seaboard in Navy work are Lt. (jg) Haight, 2LU, communications officer Third Naval District, and Lt. (jg) Stone, 2DDE, also in the same office; Lt. (jg) Riley, 1LPT, at the Naval Training Station, Norfolk; and Lt. Pillsbury, 1EAL, who left for the Indoctrination School, Quonset Point, R. I., some months ago. RM1c Parnell, KE6SRA, reports he is a student at MIT; RM3c Aznoe, 6PJV, is assigned duty at the submarine base, New London; and ARM1c Garside, 1KUJ, is a reservist with an air scouting squadron on the East Coast. RM2c Tomaselli, 1MOA, has been transferred from sea to shore duty at Portland, Me., and advises the whereabouts of the following, who were his buddies on patrol: CRM Giddis, 1ABG, shore station, Boston; RM1c Wheeler, 1QW, at sea, and RM2c Currier, 1APE, at Squantum Air Base.

On the West Coast, Lt. Fritschel, 2MCL, was called to active duty in April and is a radio instructor; Ens. Heaps, 9SRP, is on duty at the Bremerton Navy Yard; Ens. Mayer, 3FND, is on the instruction staff at the Radio Material School, Treasure Island; and Lt. (jg) Mealer, 6AK, and Ens. Harlow, 5CVO, are stationed in the Radio Materiël Office, Mare Island. Brown, 7JAI, reported he was in "boot camp" at San Diego and not getting radio work, probably because he is not of age. Any other fellows having similar trouble? CRM Nyerdeck, 9IMV, is assigned radio duty at the Port Blakely (Wash.) Naval Station.

We are advised that Lts. Edgerley, 1BOO, and Homsher, 3AXR, were entertained in England by A. D. Gay, G6NF, president of the Radio Society of Great Britain. Mr. Gay hopes other American amateurs will communicate with the Society on arrival in Great Britain. See Overseas Directory, page 33 June *QST*, for address of foreign radio societies.

OVERSEAS DIRECTORY

***W**ireless Institute of Australia,* New South Wales Division, extends an invitation to amateurs of the United Nations on service, who may visit New South Wales, to attend its general meetings held at Y. M. C. A. Buildings, Pitt Street, Sidney, on the third Thursday of each month. Phone Chairman Priddle, VK2RA, at BW6006, or Secretary Ryan, VK2TI, at FX3305.

ARMY, GENERAL

MONTHLY, the list of amateurs assigned duty outside the United States grows, and though we cannot mention their locations we take pleasure in listing their names. Post office addresses can be supplied in most cases if you would like to QSO a friend. To date, we know of the following departures: Pvt. Atkinson, 4HKZ; Staff Sgts. Ball, 8OII; Brawley, 9GYZ, and Herndobler, 9RNY. Pvt. Ingling, 8SVI; Pvt. Johnson, 8TOS, and Pfc. Kubiszewski, 8VBP; Pvt. Kuriyama, ex-K6BKN, writes that the following hams are now in the same regiment; Warrant Officer Pa, K6LBH; Lt. Lau, K6GAS. Technical Sgt. Morioka, K6LMU; Staff Sgt. Maertens, K6SSB; Pfc. Saito, K6NWF, and Pvt. Hamamura, ex-K6. Elsewhere Major St. John, 2MTW; Technical Sgt. Schmidt, 9DDD; Pvt. Teague, 4GXG, and Lt. Terzian, 6ONO.

Once again, fellows, please send full information on yourself. Rank, rating, call, type of duty, etc. So many of you write us incomplete data and let us guess the rest. It will be held confidential, if you so request, but we do want to keep as *complete* a file on you as possible. Here are some in the Army: Capt. Young, 9HCC; Lt. Collier, 9CWI; Staff Sgt. O'Kulich, 2NAR; Trout, 9NNA, Pfc. Grzesik, 1KXJ; Raser, 3ZI; Harney, 9SVZ; Williams, 9BNB, and Wonsowicz, 9DUT.

From Pine Camp, N. Y., Corp. Kester, 9ZNC, writes that he, Sgt. Latta, 8NVJ, and Tech. Hayslett, 8VBB, have been engaged in radio installation work in armored cars, and Staff Sgt. Tidd, 8WKG, has left them to attend officers' training at Ft. Monmouth. Pvt. Brown, 9JRK, is also at Pine Camp but in a different assignment. Major Schreiber, 9YIK, is in the QM Corps at Camp Berkeley, Tex. Lt. Gross, 8WME, has an interesting assignment at Houlton Army Air Field and advises there are a number of amateurs directly and indirectly under his command. Lt. Smith, 8JBU, is in the War Department Bureau of Public Relations, Washington; Lt. Miller, 1IIQ, is with the 4th Communications Squadron; and Lt. Stewart, 1PX, is on the staff and faculty of the QM School, Camp Lee, Va. Both Shivers, 4CLF, and Stahl, 9HVZ, are attending radio operator school at Camp Chaffee, Ark., and Pvts. Barrett, 6LLJ, and Ferguson, 8NPF, are at Camp Crowder, Mo., where Pvt. Norman, 5DQS, is an instructor.

Through an error, 2MYY, Staff Sgt. Donovan, 113th Infantry, appeared in an article in the June issue as being one of the YL gang. A correction of this appears on page 66 of the July issue. Just make sure no lingering doubt still exists, we repeat. 2MYY is very much of a he-ham and if you guys try to date him, be prepared to lose a few more teeth.

Sgt. Matthew, 6TNN, holds down a trick at the Army radio station, Montgomery, Ala.; Pvt. Broude, 9DGD, wears cotton in his ears at Aberdeen Proving Grounds, Md.; and Pvt. McCarthy, 8MON, is an M. P. at Camp Hulen, Texas. How-cum not in radio, OM?

Thomas C. Groat, RM2c, W8TMH, on duty at Great Lakes N. T. S., recently received the Distinguished Service Award of the U. S. Junior Chamber of Commerce from Police Chief Crichton of Lincoln Park, Mich. The award was for conceiving and constructing a two-way police radio system for the Lincoln Park force. Official U. S. Navy photograph.

How Recordings Are Made

No. 2 — The Recorder

BY CLINTON B. DE SOTO,* W1CBD

In the first article of this series[1] the general principles of disc recording were discussed — basic methods, the common systems in general use, and their application. It is time now to take up the actual equipment used for making instantaneous recordings.

Fundamentally, a recorder is nothing more or less than a precision lathe. It consists of a true-running, perfectly-balanced turning head, a cross-feed mechanism and a cutting tool.

Of course, in the recorder the headstock is called a turntable and the cutting tool is a stylus, but the difference in names doesn't alter the kind of work performed.

Equally important are the associated motor and drive mechanism and the audio power amplifier. In fact, each element of the recorder has an important role to play in the ultimate performance as a unit. We shall consider each in turn.

Cutters

The recording process begins with the cutter. This is the instrument that translates dynamic sound into static grooves in the wax (or equivalent) disc. The part that actually does the engraving is the stylus, while the associated mechanism that drives the stylus is called the cutting head.

As with microphones and headphones, both electromagnetic and piezoelectric crystal cutters are currently used. In the past magnetic cutters have been preferred, especially for high-quality professional work, but the crystal cutter has become a strong competitor in recent years. Among the low-cost types, particularly, the crystal cutter excels in the handling of wide variations in sound level, and usually gives better results in the hands of the less-skillful operator.

The stylus in a magnetic cutter is attached to an armature suspended vertically between field coils which are energized by the output from an audio power amplifier. Audio variations in the fields of these coils cause the armature to vibrate from side to side. The rate of vibration varies with the power delivered to the field coils.

Low-priced cutters resemble converted pick-ups, as shown in Fig. 1-A. High-grade magnetic cutters use a laminated armature suspended on knife-edge bearings, with two or three balancing

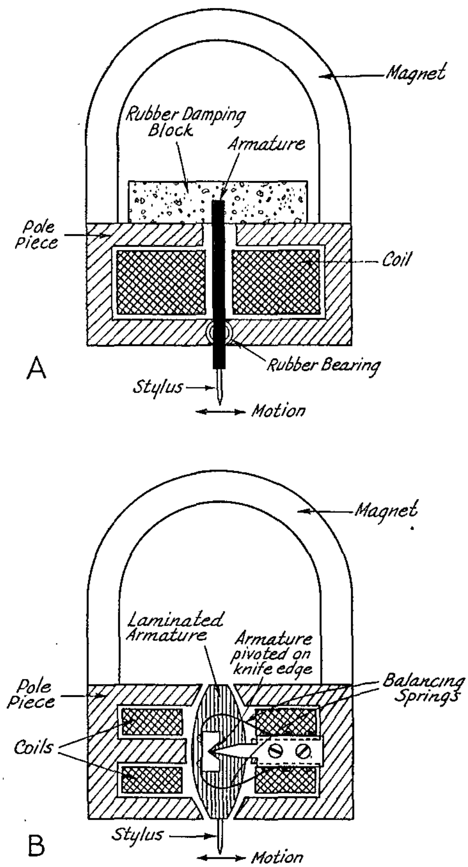


Fig. 1 — Typical magnetic recording heads.

(A) Simplest type of magnetic cutting head. The armature is suspended in rubber, with a stiff bearing at bottom and flexible damping block at top. Armature vibrates between upper faces of pole pieces in response to alternating current in coils, pivoting on lower bearing. Resulting motion is imparted to stylus, which engraves the record. Damping pad overcomes natural resonance of cutter, flattening unwanted peaks but also limiting high-frequency response.

(B) Typical form of balanced armature-cutter. Laminated armature is pivoted in the center with a knife-edge bearing on a milled V block, centered by light balancing springs. Magnetic action occurs between both upper and lower faces of pole pieces. Armature pivot block is suspended in axial bearings of rubber, viscoloid or other mechanical resistance material, providing damping which limits excessive low-frequency amplitude without injuring high-frequency response.

*Executive Editor, *QST*.

[1] "No. 1 — Principles of Disc Recording," p. 30, *QST*, July, 1942.

springs, as in Fig. 1-B. The pole pieces are made of high-permeability alloy.

The precision with which the armature bearing is made largely determines the minimum power required for satisfactory engraving, while the maximum power that can be used is limited by the level at which magnetic saturation of the field occurs. The range between these points establishes the amplitude or volume range of the cutter.

The stylus in a crystal cutter is actuated by the mechanical deformation or twisting tendency of a thin, elongated section of piezoelectric crystal when electrical voltage is applied to it. There is no mechanical action except the stresses in the crystal itself. Since the structural details are therefore less critical, crystal cutters capable of good performance can be manufactured more cheaply than the magnetic type.

Rochelle salt (sodium potassium tartrate) crystals are used because of their greater activity (nearly 1000 times that of quartz, according to the Brush Development Co.). This activity is greatest at room temperature (72° F.), decreasing in either direction until with extreme heat or cold it is very low. If placed in a temperature greater than 130° F. the crystal permanently loses its activity.

Typical crystal cutters require voltages of 75 to 120 across an impedance of perhaps 50,000–100,000 ohms. This compares with the peak power of 1 watt or so required for driving magnetic cutters (the impedance of which may be anywhere from 8 to 500 ohms).

As was pointed out in the previous article, stylus motion must be restricted to one plane. It is common practice, therefore, to incorporate a vibration damper on high-grade cutters, to suppress vertical motion. This is usually some form of dash-pot filled with oil or glycerin, or a counterbalanced weight or spring device, which serves to damp out vertical vibrations without introducing unwanted stiffness or friction.

The Stylus

The cutting tool, or stylus, may be made of several materials. Steel, stellite and sapphire are commonly used. At least one manufacturer offers a special alloy of precious metals in the platinum group. The inexpensive stylii ordinarily used in home recorders are made of steel, carefully cut, rounded and polished. Stellite, a cobalt-chromium alloy used in machine tool manufacture, is widely employed for instantaneous work. The better cutting heads used in making electrical transcriptions are equipped with polished-jewel stylii, usually made of sapphire which, being next to the diamond in hardness, is highly wear-resistant.

A steel cutting needle ordinarily has a useful life of about one-half hour, during which time it will cut a groove over a mile long. Stellite can be used from 2 to 10 hours (depending on the record coating used and the permissible distortion) and platinum alloy 3 to 5 hours, while sapphire is good for from 5 to 25 hours. Steel stylii, costing only a few cents, are replaced when they are worn out. Stellite and sapphire can be resharpened (a critical job usually left to the manufacturer). The maximum number of resharpenings depends on wear and the condition of the point, of course, and may be anywhere from 2 to 10 times.

Not only do the more costly stylii have a longer life but they make better recordings. A good sapphire cutter is quieter than steel by 6 db. or more.

Regardless of the material, the tip of the stylus must be carefully shaped, rounded off to the correct radius and given a high polish. The degree of this polish controls the smoothness of the groove walls, which in turn determines the amount of surface noise in playback. The shape and polish of the stylus also determines the degree of friction encountered in engraving and therefore affects the fidelity.

As shown in Fig. 3, a correctly-shaped stylus is a round-nosed cutting tool with an included

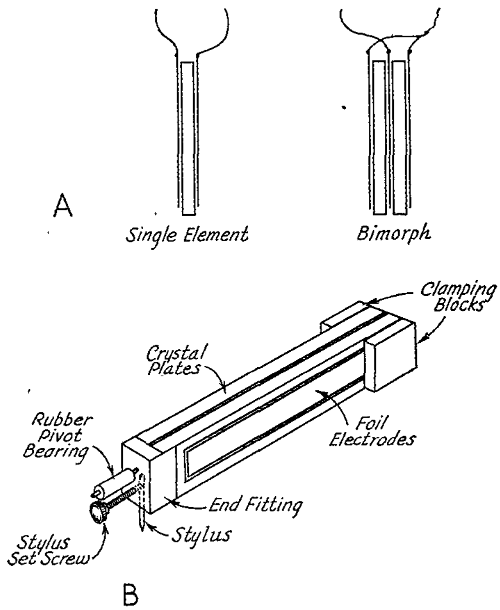


Fig. 2 — (A) Low-priced crystal cutters are made with one "twister" (shear) plate, as at left. Higher fidelity, greater amplitude range and smaller temperature variation result from cementing two plates together to form "bimorph" element, at right. Foil or graphite electrodes are used to provide electrical connections to plates.

(B) Typical crystal cutter assembly with bimorph element. Twister plates are clamped with stiff pads at support end, free end pivoting in the flexible bearing along the twisting axis. Voltage applied across the plates causes mechanical deformation at 45° to mechanical and optical axes, moving stylus from side to side (for lateral recording).

angle of 88–90°, the nose radius averaging 0.0015–0.002 inches. The use of a back rake angle of from 2 to 5° (usually negative, although positive rake occasionally works out best in individual instances) is preferred practice to prevent tearing or hogging.

In setting the rake angle, it must be remembered that it is the angle of the cutting face of the stylus to the blank that is important — not that of the cutting head. Most heads have provision for setting this angle, in the form of a hinged pivot or slotted bracket with setscrews. In cheap recorders it may be necessary to bend the stylus shank to get the correct angle. The angle can be checked by aligning the face of the cutter and its reflection on a smooth blank; the two will, of course, form a straight line when the cutter face is exactly vertical.

The depth of cut is an important adjustment. The customary groove depth is 0.002–0.003 inches. It may be checked either by measuring the thread or chip from a test cut with a micrometer, or by observing the relative area of "land" and groove under a microscope, using a standard feed. The proportion should be as shown in Fig. 3. If the cut is too shallow poor tracking will result, the pickup tending to slide across the record, while a cut that is too deep will increase the danger of overcutting and breaking through the walls of an adjacent groove on loud passages. The stylus may even break through the coating on the blank into the hard base. The deeper the cut the greater the surface noise.

The depth of cut is adjusted by a device regulating the height of the cutting head. This may be either a spring or a movable counterbalance, adjusted by a thumbscrew or setscrew on the head.

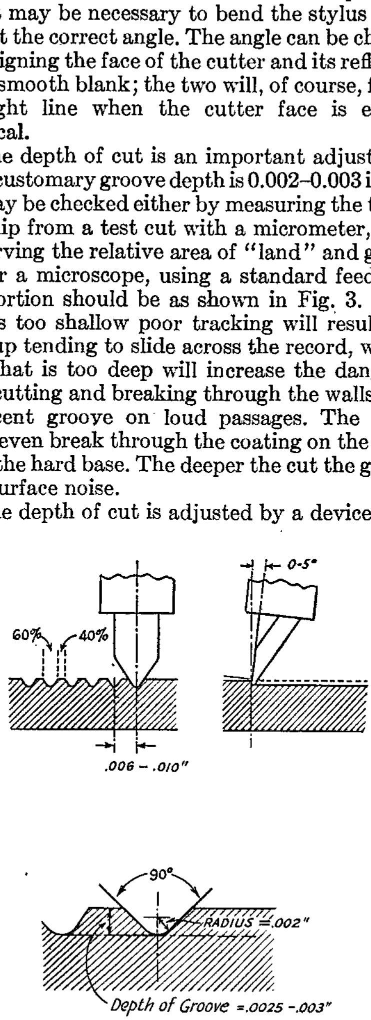


Fig. 3 — **Illustrating correct groove formation, stylus cutting angle, and stylus tip outline. Good stylii, when examined under the microscope or "shadowgraph," have carefully-ground points shaped as shown. Stylus material must be very hard and highly polished to cut cleanly without tearing, producing a smooth groove with low surface noise. Tip pressure when cutting may reach 20 tons per square inch.**

Turntables and Motors

Since sound is based on frequency and frequency is directly related to speed, it is vital that the record be turned at a fixed, unvarying, known speed in both recording and reproduction. Because of the greater load encountered when engraving than in playback, it is even more important that the recorder turntable and its associated drive have a uniform, steady speed. If the motor slows down when the stylus bites into the blank, for example, the actual recording speed will be somewhat less than the standard. Then, when the recording is played back, the motor will speed up under the lighter drag of the pickup, and all the frequencies will be higher than in the original. Even slight variations in speed during recording due to variations in stylus loading with frequency and amplitude will cause distortion and result in reproduction that is not true in certain frequency ranges.

The speed regulation must be better than 0.3 per cent or the variation will be apparent to the trained musical ear in the form of "wows" (audible changes in pitch resulting from momentary changes in speed). Good instantaneous recorders are constant to 0.2 per cent or better, while the proposed "wow factor" standard for electrical transcriptions for broadcasting is 0.1 per cent. Good speed regulation is particularly important at 33 r.p.m. because of the decreased groove speed.

Another factor of importance, particularly in broadcasting where actual program time must be known to a few seconds, is that of speed accuracy, or total playing time. The recommended standard is 0.5 per cent. A typical medium-priced recorder is guaranteed for 0.4 per cent, while the best professional outfits achieve about 0.2 per cent, or less than 2 seconds error in 15 minutes playing time.

Turntable vibration causes an objectionable low-frequency noise or rumble with a dominant frequency under about 500 cycles. It is often this factor that limits the amplitude range of the cheaper recorders, since the vibration noise or flutter amplitude may be only 40 or 45 db. below average signal level. In good-quality portable units such noise is held to −50 db. or better, while with heavy professional installations it is down 60 db. or more. Turntable vibration also causes cross-modulation effects on the higher frequencies, contributing to waveform distortion.

A good turntable is a massive circular plate, usually made of cast aluminum with a heavy steel shaft running in a bronze sleeve bearing and a ball thrust bearing. The turntable is covered with a thin rubber pad, and has a center pin (diameter 0.2835 inches) to locate the blank.

The turntable itself should be carefully cut and balanced to run true and level. Generally speaking, the bigger and heavier it is the better the performance. Massiveness implies freedom from warping and mechanical distortion, while weight provides the flywheel characteristic necessary for constant speed.

Basically, of course, the turntable speed depends on the driving motor, and it must therefore be of a constant-speed type. Since most recording motors run on a.c., the synchronous type seems a logical choice. In practice, however, the fact that a synchronous motor is inherently a "hunting" device that oscillates around a mean frequency with torque variations within each cycle makes it undesirable for the purpose, unless a very heavy flywheel or elaborate damping methods involving elastic (spring) couplers are used. Synchronous motors are now found only in the most expensive machines, where there is no objection to the auxiliary equipment required, or in the cheapest outfits where the smallest possible motor must be used.

Most present-day recorders make use of ordinary induction-type motors of sufficient power ($\frac{1}{20}$ to $\frac{1}{4}$ h.p.) so that the regulation is virtually unaffected by the cutter load. Speed is held relatively constant by a mechanical fly-ball governor or equivalent device.

Turntable Drives

A variety of methods may be used to couple the motor to the turntable. Commercial equipment is usually built around either of two methods: friction rim-drive with or without idler wheels, and gear drive. Direct drive from special low-speed motors is used in a few professional assemblies, while belt drive, although rarely used in manufactured recorders, is a favorite of the home constructor.

A well-made gear drive is among the most satisfactory. With carefully-cut helical gears, preferably made of fibre or laminated bakelite, running in an oil bath, excellent performance can be obtained, especially during the early life of the machine. A disadvantage of gear drive is that when the gears wear the turntable will take advantage of the resulting play and tend to lag or lead the motor, but in a well-made assembly this doesn't occur until after hundreds of hours of successful operation. Another disadvantage is transmission of motor vibration to the turntable, resulting in the troubles discussed above. The actual coupling to the drive must be "soft" and the turntable bearing solid and carefully suspended.

Next in popularity — and increasingly used, even in the best professional apparatus — is the rubber-wheel rim drive. The simplest application of this method is a small rubber wheel, mounted on the motor shaft, which bears against the turntable rim. The advantages are extreme simplicity and economy; the disadvantages a tendency toward slippage, flattening of the rubber wheel where it rests against the rim when not in operation, and the difficulty of regulating pressure for reliable driving. Some of these disadvantages can

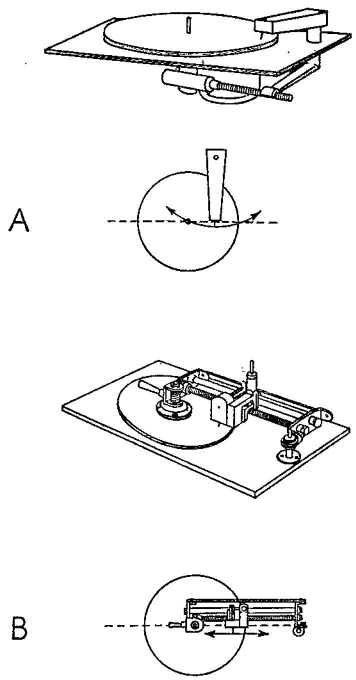


Fig. 4 — Basic feed mechanisms.
(A) Underdrive tangent type, in which the cutting head is attached to a follower arm driven by a long leadscrew geared to the turntable shaft. Stylus cutting face is at correct angle with respect to groove direction only at center of recording space. Tangent error can be minimized by using long arm to increase radius.
(B) Straight-across overhead feed with leadscrew driven by spindle through worm and gear. Cutter riding on guide rail and driven by half-nut on leadscrew travels in straight line across record, maintaining constant angle and eliminating tangent error.

be minimized by equipping the turntable with a rubber rim and using a steel motor wheel. Still another variation is the introduction of a rubber idler pulley between the motor wheel and rim, which helps to iron out vibration and speed irregularities. This method is commonly used on 2-speed turntables, where the simple shift of a lever reverses a large and a small idler wheel to give either 78 or 33 r.p.m. Where no idler pulley is used, a steel step pulley may be employed.

All of the friction-drive systems require careful adjustment of driving pressure to minimize slippage, speed changes, "wows" and transmission of motor vibration.

Probably the best arrangement for the home builder is the use of a heavy-duty motor of more

(*Continued on page 104*)

U.S.A. CALLING!

ELECTRONICS TRAINING GROUP

The top-notch amateur performance in this show is probably in the Electronics Training Group of the Army Signal Corps. Many of our best hams are now in England studying the latest secret u.u.h.f. stuff in communication, aircraft warning, etc. Not only classroom study but field experience and combat conditions. Although the Group is large, it is expanding and needs many more officers for its all-important work. You need a degree from an accredited college, either in electrical engineering or in science with an electronics-physics major. If you have that, and are between 16 and 46 years of age and can meet the physical requirements for unlimited service as prescribed for a reserve officer, you'll be welcomed with open arms into the ETG. Second lieutenancies immediately, some to go abroad and some to go to school here.

This service, we can tell you, is hot stuff. The recruiting of its personnel is the special concern of ARRL President George W. Bailey. Write him direct, with full particulars on yourself, for application forms and further data.

ARMY SPECIALIST CORPS

You radio men who haven't been able to get into the Army because of age, physical disqualifications, or dependents: now's your chance. The Army Specialist Corps is mobilizing and there's plenty of room for technically-trained radio, telegraph and telephone men. Men with experience in ultrahigh-frequency, television, speech recording and amplifying equipment, operation and maintenance of teletype, telephone and radio are especially needed. The Specialist Corps officers wear uniforms identical to Regular Army with the exception of a maroon band on the sleeve, and observe the same military courtesies and customs. This civilian army will be used to relieve troop-age officers now in administrative duties for active command in the field.

Physical disabilities are usually no bar to service. The Signal Corps has adopted a policy whereunder former officers who have been disqualified for physical disabilities, but who are technically qualified for duty in the Signal Corps, will be offered commissions in the Army Specialist Corps. If you got turned down before, try again.

Write to Army Specialist Corps Headquarters, War Department, Washington, D. C., or to Mr. Bailey.

PATIENCE, PLEASE

We are informed that the items on the Army Air Forces in June *QST* resulted in the receipt in Washington of over 2000 letters of application and inquiry. Since every one of these is an individual matter, requiring special handling, a nice jam has been created and it is taking time to analyze the letters and get off the answers. We have been requested to ask you to be patient a little while, as an answer will be got to you just as quickly as possible.

Much the same thing is true of several other kinds of applications. All the war offices are groaning with overloads. Sometimes it takes them several weeks to get to your case but they are all doing the best they can, so QRX.

WOMEN TECHNICAL AIDS

Many government agencies, both in Washington and in the field, are seeking technical and scientific aids to do research and testing. Applications from men are no longer accepted by the Civil Service for these vacancies but there is urgent need for eligible women who have completed two years of college, with courses in mathematics. Duties are to perform subprofessional and scientific work, conduct tests, make appropriate calculations, etc.

The basic pay is $1800. A senior appointee receives $2000, assistants $1620, juniors $1440. The details may be seen at your post office in Civil Service Announcement No. 133.

MARINE CORPS

College graduates with degrees in electrical or communication engineering or electronic physics are wanted for AWS duty in the Marine Corps. Two years of college engineering and satisfactory practical experience will qualify many. Depending on age and experience, appointments range from second lieutenant to major. The Commandant, U. S. Marine Corps, Washington, will receive applications; but if you are uncertain about your qualifications you may write to Mr. Bailey for personal advice.

High-school graduates not eligible for commission may receive appointment in the initial rank of staff sergeant, for aircraft warning maintenance duty. Age limits, 19 to 35. Valuable training, pay from $72 to $122.50 per month, with everything found. General communications service in the grade of private is available in the Leathernecks for radio amateurs who did not graduate from high school. For appointment in these enlisted ratings, apply to the nearest Marine Corps recruiting officer or by letter to The Commandant, U. S. Marine Corps, Washington. If you need advice, write to Mr. Bailey.

SHAVETAILS FOR THE A.W.S.

THINK how good those gold bars would look on your shoulders! The War Department has authorized the Signal Corps to give commissions as 2nd Lieutenants to graduates of accredited colleges with electrical engineering or physics majors, *direct from civilian life.* Following a brief interval of basic military training, these lieutenants are assigned to new Signal Corps schools for advanced training on radar equipment in the Aircraft Warning Service. If you are an EE graduate or the equivalent, write to the Chief Signal Officer, War Department, Washington, giving full particulars about yourself, and if your other qualifications are up to the mark, you've got an opportunity to wear those gold bars for the Signal Corps.

F.C.C. MONITORING JOBS

THE Radio Intelligence Division of FCC's engineering department still has positions open as radio operator in the monitoring establishment. Skilled hams are particularly desired. For jobs in continental United States the beginning salary is $1800, running up to $2000 with service. And up to $2300 for positions in outlying territories and possessions. The operators are eligible to promotion to Assistant Monitoring Officer at $2600. See Civil Service Announcement No. 203 at your post office.

The Field Division of FCC also has vacancies for Assistant Intercept Officers at a salary of $2600 for duty in continental United States.

RADIO & RADAR REPAIRMEN

AMATEURS! Commercial radio operators! Radio repairmen! The War Department has issued special authority so that you can enlist directly in the Signal Corps instead of being enlisted unassigned. Now you'll be sure that your pet avocation or vocation, as the case may be, will be used to best advantage in the service to your country. Your local recruiting office should be able to give you the dope, but if you want further information, write to the Chief Signal Officer, War Department, Washington.

If the local recruiting office doesn't know that possession of an amateur license gives the right to voluntary enlistment in the Signal Corps, send a telegram to Mr. Bailey.

RADIO ENGINEERS

THERE continues to be a great need for engineers of all types and particularly radio engineers. The Civil Service appoints engineers to important war jobs in numerous government agencies. The basic engineering appointment pays $3800 a year but there are six grades reaching from assistant at $2600 to head engineer at $6500. Completion of a four-year engineering course in a recognized college, and professional engineering experience, are necessary; additional experience may be used for any education lacking.

The details are to be found in Civil Service Announcement No. 173 at any first- or second-class post office. Appointments will be for the duration of the war and no longer than six months thereafter. There are now no age limits.

The Signal Corps is no longer appointing its civilian radio engineers direct. All Army civilian appointments are now made through the Civil Service's division of civilian personnel, which has been informed of the numerous needs of the Signal Corps. There are such Civil Service offices in every major city. This refers to engineers; appointments as civilian mechanics are still handled direct by the Signal Corps in many cases.

FOR THE GALS!

THE WAAC (Women's Army Auxiliary Corps) has completed, for the time being, its recruiting for officers in the female uniformed army, but it is planning for future expansion. Don't lose hope; keep in touch with your recruiting office. Classification boards will take down your qualifications and education; and your preference as to where you want to serve will be given consideration in your assignment. Radio operators may be needed sometime in the future. At present, switchboard operators and teletype operators for the Signal Corps are being considered. As the program progresses, more of you radio hams will be wanted. So be sure to give full information to your local recruiting officer!

SCHOOLS FOR COMMISSIONS

IF YOU'VE been in the Army for three months, and want to serve in the Signal Corps, you may make application to attend the Signal Corps Officer Candidate School. Primary quali-

BAILEY'S ADDRESS

Many items in this department advise that you "Write Mr. Bailey." This is W1KH, League President, Secretary of the Committee on Scientific Personnel of the Office of Scientific Research & Development — which passes upon the technical qualifications of specialists needed for many jobs and is in position to give advice to amateur inquirers. The address:

GEORGE W. BAILEY
2101 Constitution Ave., N. W.
Washington, D. C.

fication: leadership! Technical qualifications desired but not essential. The War Department believes that the selection of the great majority of officers from the enlisted ranks is the most democratic and effective method. To make it really democratic, you privates will have to make the most of the offer yourselves. Ask your commanding officer about the Signal Corps Officer Candidate School, and your chances of becoming an officer.

NAVY A-V(S) COMMISSIONS

Although commissions in most branches of the Navy are temporarily hard to get, the Navy is still taking applications from candidates for commission as Aviation Volunteer Specialist, if they have an electrical-engineering degree or its practical equivalent. The duties of these officers relate to the installation, maintenance and operation of radar gear. See also the item on page 23 of June *QST*.

Those interested should exchange particulars with Mr. Bailey.

★ BOOK REVIEW ★

***Radio Handbook Supplement* (Companion to The Amateur Radio Handbook).** Published by the Inc. Radio Society of Great Britain, 115 High Holborn, London, W. C. 1. 160 pages, illustrated. Price, 2/6. (60¢).

Now and then we hear of a book of fact that reads like a novel, but this is probably the first technical radio volume ever published that is as exciting as war fiction. This is because the RSGB *Handbook Supplement* was written by men stained with the smoke of battle primarily for the use of their comrades in arms. When you find aerial design specified in terms of fine-gauge wire for the inconspicuousness needed to foil saboteurs and fifth columnists, rubbed in mud or passed through a smoky flame to eliminate that gleam in the eye of an enemy bombardier, and even erected without insulators because of their ready identification — well, then you have something that far transcends the conventional radio text. And that's but an isolated example. From the extraordinarily useful and specialized chapters on fundamentals and mathematics, through the excellent treatment of cathode-ray oscillographs and radio direction finding and plotting, to the "service operators *vade mecum*" and the data appendices, the *Supplement* is an example of concentrated value. The suggestions for foresighted improvization — shooting trouble without instruments, repairing trouble in everything from accumulators (yes, that means storage batteries) to i.f. coils, without facilities — alone make it that.

— *C. B. D.*

Strays

Sam: "Come on, Ham; join the ARRL."
Ham: "'Fraid I can't; not this week."
Sam: "Aw, come on, be a support."

— *The (N. C.) Arc*

25 YEARS AGO THIS MONTH

There is no great difference in atmosphere between *QST* for August, 1917, and this August's: the issue is filled with articles and editorials on opportunities in the service and on the need for amateurs, letters from fellows who are on military duty and prophecies of the brilliant future that lies ahead of amateur radio after the war. The Navy, recruiting for the Naval Coast Defense Reserve, writes a special *QST* article on "What the Naval Reserve Offers the Men of ARRL," announcing the establishment of a special radio operators' school at Columbia University. Bill Woods, the famous 9HS, writes the first of his "Dear Eddy" letters to the Editor:

It is 1 A.M. and I am sitting — as I did almost every evening last winter — at my wireless set with the 'phones on. However, in this case it is not my set but is the Marconi station at Manistique, Mich., recently taken over by the government, call letters WMX. I am a first-class electrician, radio, USNRF, and am on the mid-watch — from midnight to 6 A.M. The station is in a [deleted by censor], and as I look out the window at the old moon, I can almost believe that I am home in my own little radio shack and waiting to hear 2AGJ call CQ. There is a good fire in the stove, QRN is absolutely nil, and there is no QRM at all. Believe me, OM, it is some night for distance. . . .

Lt. H. D. Hayes, USN, is in charge of all auxiliary receiving stations on the Pacific Coast. E. M. Sargent's beautiful amateur station in San Francisco is one of these, and is giving a good account of itself, attested by its ability to copy 600-meter Japanese coastal and coastwise spark stations.

Walter S. Lemmon (now of WRUL fame) describes "Double Coplanar Antenna Systems" wherein, instead of using one antenna and a ground connection, two horizontal antennas are used at the same height, but of different length and spaced at an angle of more than 90° to each other. In spark operation, stronger signals and sharper tuning are obtained than with an earth.

The Old Man reports "A Rotten Dream," which seems to be largely a matter of internal-capacity effects induced by a large section of mince pie. S. Kruse's classic on Masts ("As a general proposition, the mast of an amateur is a lie") describes 60- and 70-ft. skyhooks made of 2-inch corrugated rainpipe or down-spouting.

The station description this month is on 2PM in New York City, owned by Faraon & Grinan, the latter well known in recent years as VP5AA. The editor says it is "probably the most efficient station in the whole East." It has a 1-kw. motor-generator, bearing a synchronous rotary, a United Wireless coffin, 10 copper-plated Telefunken leyden jars and a Clapp-Eastham oscillation transformer. R. I. Harry Sadenwater has measured the decrement at 0.09. The station has been in direct communication with 9ZF in Denver!

A Course in Radio Fundamentals

Lessons in Radio Theory for the Amateur

BY GEORGE GRAMMER,* W1DF

No. 3—Resonant Circuits

IN PERFORMING experiments on resonant circuits, the subject of the third installment of the course, more equipment is needed. It is necessary to have a source of radio-frequency voltage, for which purpose a combination crystal and self-controlled oscillator is used. This in turn must have a source of power for the heater and plate of the tube. The units shown in the photographs differ only in a few details from similar equipment to be found in practically every amateur station, and if an oscillator and power supply already are available there is nothing to prevent their being adapted to the purpose. A third necessity is a vacuum-tube voltmeter, since ordinary instruments are not suitable for r.f. measurements. One which is adequate for the purposes of these experiments can be constructed from a few resistors and condensers, in addition to a small receiving triode. Power for the voltmeter can be taken from the oscillator supply.

Oscillator

The oscillator shown in the photograph, Fig. 1, is a conventional pentode circuit when crystal is used, and is converted to a TNT by plugging in a grid coil and grid condenser in place of the crystal. A breadboard is used in preference to a metal chassis because in most cases apparatus constructed especially for this purpose will be for more or less temporary use. There is, therefore, no special justification for the additional labor which metal-working would entail. Besides, it isn't always possible to get the chassis size wanted in these times. The plate tuned circuit of the oscillator is parallel fed, which is advantageous in that no d.c. voltage appears on either the coil or condenser. The plate coil specified in Fig. 2 should be about the right size for most of the experimental work, but in one or two cases shunt capacity of leads may reduce the tuning range to the point where a slightly smaller coil would be desirable. It is therefore suggested that the coil be tapped about 5 turns from one end and provision made for shorting out the 5 turns when required. Alternatively, a separate coil having 25 turns spaced to make the length 1¼ inches may be used. A pair of output terminals is connected directly across the tank for set-ups which require a fairly high r.f. voltage. Provision also is made for link output.

For crystal control, any crystal in the 3.5-4-Mc. band can be used. For tuned-circuit frequency control, the "untuned" grid coil, which has a grid blocking condenser incorporated in the coil form, replaces the crystal. The number of turns on this coil should be adjusted so that the oscillator output voltage is substantially uniform (without load) over as much of the 3.5-4-Mc. band as possible. Other wire sizes may be used provided this requirement is met.

Power Supply

The power supply, Figs. 3 and 4, uses an ordinary replacement transformer with an 80 rectifier and condenser-input filter. Any supply which delivers about 250 to 300 volts at 75 to 100 milliamperes will do. The voltage divider incorporated in this supply enables continuous adjust-

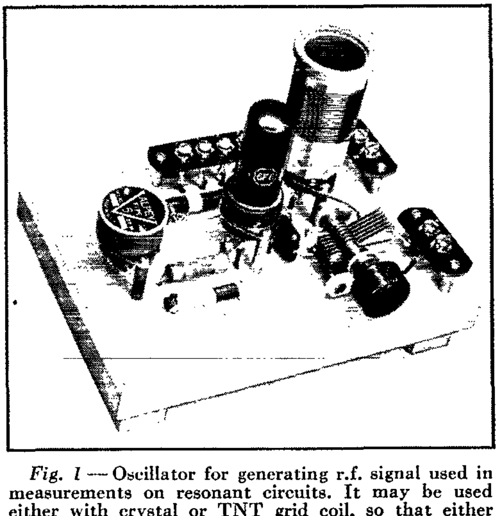


Fig. 1 — Oscillator for generating r.f. signal used in measurements on resonant circuits. It may be used either with crystal or TNT grid coil, so that either fixed or variable frequency may be obtained. The socket at the left, occupied by the crystal in this photograph, also is used for the grid coil. The breadboard measures 6 by 8½ inches. Power supply connections are brought out to the rear terminal strip. The terminals on the strip in the lower right-hand corner are connected to the ends of the plate tank circuit; the other two-terminal strip is for link output.

* Technical Editor, *QST*.

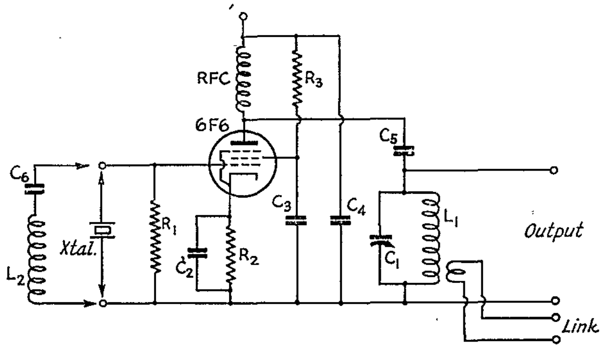


Fig. 2 — Oscillator circuit.
C_1 — 100-$\mu\mu$fd. variable.
C_2, C_3, C_4 — 0.01-μfd. paper.
C_5 — 0.002-μfd. mica.
C_6 — 500-$\mu\mu$fd. mica.
R_1 — 0.1 megohm, 1 watt.
R_2 — 400 ohms, 1 watt.
R_3 — 10,000 ohms, 10 watts.
L_1 — 30 turns No. 20 enameled, close-wound on 1½-inch diameter form (see text).
L_2 — 45 turns No. 30 enameled, close-wound on 1½-inch. diameter form
RFC — 2.5-mh.r.f. choke.

ment of the output voltage from zero to the maximum voltage of which the supply is capable. The output filter condenser is connected to the output terminals rather than to the voltage divider so that the condenser can act as a by-pass when the supply is used for audio work. A similar divider can be added to any existing supply, of course. A regulated tap, using a VR-150-30, and delivering 150 volts under loads varying from zero to about 20 milliamperes, is included. A switch is provided in the rectifier output so that the d.c. voltage can be shut off when adjustments are made, while keeping filaments hot.

V.T. Voltmeter

The vacuum-tube voltmeter need not be accurately calibrated, since absolute values of voltage need not be known. However, it is essential to know *relative* voltage values, and a preliminary voltage calibration therefore is necessary. It is desirable to have a voltmeter with a scale as nearly linear as possible, and also one which has high input impedance since the accuracy of measurement of voltages in resonant circuits will be impaired if the voltmeter takes appreciable energy. For these reasons a feedback-type triode voltmeter is used. Selection of the proper cathode resistor sets the voltage range; in the present case approximate ranges of 10, 30 and 100 volts are provided when the plate-circuit milliammeter has a full-scale range of 1 milliampere. The universal test instrument can be used for measuring the plate current.

The circuit of the v.t. voltmeter is shown in Fig. 6. It is simply a tube biased nearly to cut-off so that the positive cycle of an a.c. voltage applied to the input circuit will cause the plate current to increase. Under ideal conditions the increase in plate current will be proportional to the applied voltage, and in practice this linear relationship is very nearly achieved. Some initial fixed bias is applied to the grid by means of the voltage divider consisting of R_5 in series with R_6; R_6 is in the cathode circuit and the drop across it biases the grid negatively. Additional bias is provided by the cathode resistors R_2, R_3 and R_4. The lower the resistance used here the greater the sensitivity — that is, the higher the plate current reading for a given voltage applied to the grid. The higher the resistance, the greater the input voltage range which can be handled; the linearity also is improved with high resistance.

The voltmeter should be calibrated against a d.c. source. The transformerless supply described last month is quite suitable for this purpose. Connect its negative output terminal to the ground terminal of the v.t. voltmeter input and the positive terminal to the grid side, then vary the output voltage over a suitable range and take readings of the voltmeter tube plate current for each applied voltage. The test instrument can be used to measure both current and voltage by switching it back and forth from the plate of the voltmeter tube (when it should be used as a 0-1 milliammeter) to the input terminals of the v.t.

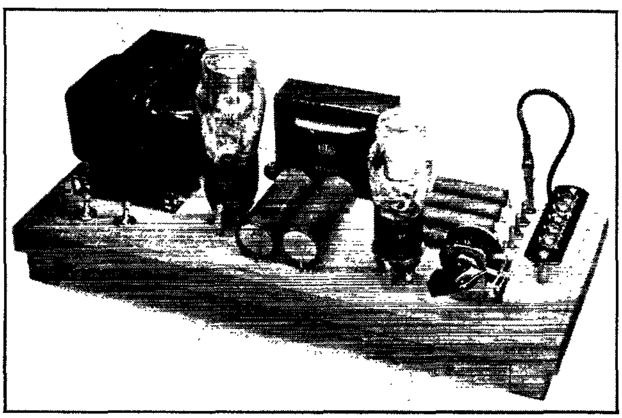


Fig. 3 — The power supply unit. Mounting of parts closely follows the circuit diagram of Fig. 4. The baseboard is 6 by 14 inches. Voltage divider taps are machine screws projecting through the baseboard just to the left of the terminal strip. The variable section of the divider is mounted on a metal bracket at the right front.

voltmeter (when it should be used as a d.c. voltmeter of appropriate range). When enough data have been taken, plot curves showing plate current against grid voltage for all three values of cathode resistance. A typical chart is shown in Fig. 7. The calibration is linear on the two higher ranges except near the low end of the scale, where there is a small departure from a straight line.

The value of the bias resistor R_6 may require some modification for tubes of slightly different characteristics. Its resistance should be high enough to bring the plate current almost, but not quite, to zero when no voltage is applied to the input terminals. Should the plate current be zero at first trial, R_6 should be reduced in resistance until the plate milliammeter shows a small indication — between zero and a few hundredths of a milliampere.

Changing the plate voltage has the effect of shifting the curve up or down on the graph, but if the *increase* — not the actual value — in current with applied input voltage is considered, the calibration is not changed appreciably. However, with higher plate voltage the plate milliammeter may go off scale near the upper end of the range, while lower plate voltage will cut down the maximum grid input voltage which it is possible to handle without overloading. The regulated tap on the power supply of Fig. 4 provides a constant voltage of suitable value.

Condensers C_1 and C_2 are r.f. by-passes and tend to build up the plate current to a value which indicates the peak voltage of an applied r.f. wave. C_3 is a similar by-pass for audio frequencies across the cathode circuit. Whether or not the instrument reads peak voltage is not important in the present application, since we are interested in relative voltages. In making r.f. measurements it will be sufficient to assign the measured voltage a value equal to the d.c. voltage which gives the same plate current reading. C_4 is an r.f. by-pass on the heater circuit.

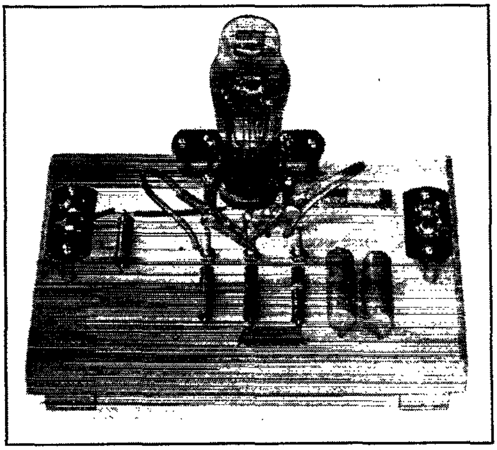


Fig. 5 — Vacuum-tube voltmeter for r.f. measurements. It has three ranges, 10, 30 and 100 volts. Input terminals are at the left, power supply terminals at the rear, and meter terminals at the right. The three cathode resistors are in the front center, with machine-screw terminals projecting through the board to serve as connection posts. The flexible wire at the left connects to the 1-μfd. by-pass condenser (one of the old flat metal-can type) which is mounted underneath the baseboard. The right hand flexible lead connects to the tube cathode. When making r.f. measurements the 1-μfd. condenser is disconnected.

Circuit Board

It is convenient, although not wholly necessary, to have a "circuit board" arranged somewhat as shown in Fig. 8. Variable condensers can be fastened solidly to it, as can also one coil. The other coil is left free for varying coupling when both are used. In the unit shown in the photograph, the coils are wound on ordinary mailing tubes and are mounted on small pieces of Presdwood or thin wood (so the free coil will sit still and not topple over) by miniature stand-off insulators. The variable condensers should have a maximum capacity of 250 $\mu\mu$fd. or more to give ample experimental range; old broadcast condensers will do quite nicely. The small condenser at the left is for capacity coupling when needed.

A half-dozen or so 6- to 8-inch lengths of flexible wire with alligator clips at each end will be convenient for changing circuits. There is no permanent wiring on the circuit board shown; all connections are made by means of such clips.

Calibrated Receiver

Relatively few tests can be made on r.f. circuits without measurement of frequency. It is assumed that every amateur will have a receiver with 80-meter bandspread and that he has cali-

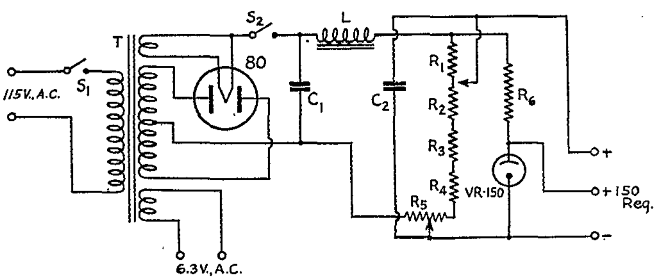


Fig. 4 — Power supply circuit.
C_1, C_2 — 16-μfd. electrolytic, 450 volts.
R_1, R_2, R_3, R_4 — 5000 ohms, 10 watts.
R_5 — 5000-ohm wire-wound potentiometer.
R_6 — 10,000 ohms, 10 watts.
L — 10 to 15 henrys, 100 ma.
T — Replacement or similar transformer to deliver 250 to 300 volts d.c. from filter at 100 ma. (350 volts a.c. each side center tap); with 5-volt and 6.3-volt filament windings.
S_1, S_2 — S.p.s.t. toggle.

brated or can calibrate it to reasonable accuracy. Calibration methods are described in the *Handbook* and need no repetition here. Once a half-dozen or so calibration points are obtained a smooth curve can be drawn through them to give

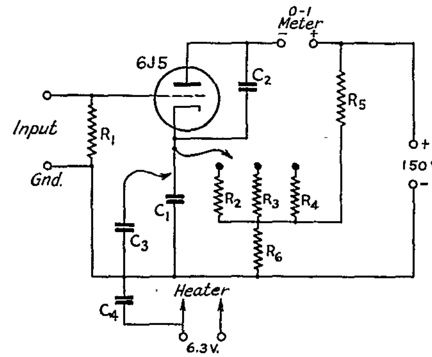


Fig. 6 — V.t. voltmeter circuit.
C_1, C_2 — 0.1-μfd. paper.
C_3 — 1-μfd. paper.
C_4 — 0.01-μfd. paper.
R_1 — 5 megohms.
R_2 — 3000 ohms, 1 watt (10-volt scale).
R_3 — 25,000 ohms, 1 watt (30-volt scale).
R_4 — 0.1 megohm, 1 watt (100-volt scale).
R_5 — 50,000 ohms, 2 watts.
R_6 — 3000 ohms, 1 watt.

accurate-enough indications for the present purpose. It will be sufficient to read to 10-kc. intervals.

Problems

The answers to the problems given last month are tabulated at the end of this installment. It should be noted that these are given, with one exception, to "slide-rule accuracy," which means in general that the accuracy is within ½ to 1 per cent. This is quite satisfactory for most purposes, since the quantities entering into the calculations usually cannot be measured with an accuracy better than a few per cent. However, slide-rule accuracy is not good enough in those cases where the difference between two large but nearly equal numbers must be found, since an inaccuracy of a fraction of a per cent in either or both of the quantities may cause the difference between them to be inaccurate by a quite large percentage. This case arises in resonance problems, where the total reactance is the difference between two large and very nearly equal reactances. It is illustrated by Question 7, Assignment 6, where the results vary by nearly 8% depending upon the value used for π. Such problems should be worked out "long-hand" or with the aid of tables of logarithms having enough places to eliminate uncertainty in at least the first two significant figures in the result. Of course, the limitations of measurement again preclude the possibility of obtaining highly accurate results in practice, but we can ignore this factor in working out the problems.

Finally, our attempt last month at correcting the impedance formula in the first printing of the *Handbook* (footnote 1, page 55, July *QST*) did not come off very well. Somewhere between the typewriter and the printed page the radical sign which should have been over the right-hand part of the equation disappeared. With a brief prayer for the whole-hearted coöperation of typists, compositors and proof-readers, we try again (and we hope for the last time!):

$$Z = \sqrt{R^2 + X^2}$$

ASSIGNMENT 8

Study *Handbook*, Section 2–10, starting page 33. Perform Exp. 15.

Questions

1) What is "skin effect"?

2) If a current of one ampere flows through a series-resonant circuit having a resistance of 10 ohms and inductive and capacitive reactances of 500 ohms each, what is the applied voltage? What voltage appears across the terminals of the inductance? Across the terminals of the condenser?

3) When is an ordinary radio circuit resonant?

4) Describe the operating characteristics of a series-resonant circuit; of a parallel-resonant circuit.

5) Define the quantity *Q*.

6) An inductance of 10 microhenrys is used in a parallel-resonant circuit tuned to 7 megacycles. If the coil has a resistance of 3.5 ohms at this frequency, what is the *Q* of the circuit? Losses in the condenser may be neglected. What is the parallel-resonant impedance of the circuit?

7) A resistance of 5000 ohms is connected across the circuit of Question 6. What is the new value of circuit *Q*? What is the equivalent resistance introduced in *series* with the coil by the shunt resistor?

8) How may the *Q* of an unloaded circuit (one in which all the energy supplied to the circuit is consumed in the circuit itself) be increased? If the circuit is parallel-resonant and is shunted by a fixed value of resistance, how may the circuit *Q* be increased?

9) In the circuit of Questions 6 and 7, what values should the inductance and capacity have, to give a circuit *Q* of 25 when the circuit is loaded by the shunt 5000-ohm resistance?

10) Plot a curve showing the values of inductance required to tune to 3.5 megacycles with any value of capacity between 50 and 250 μμfd.

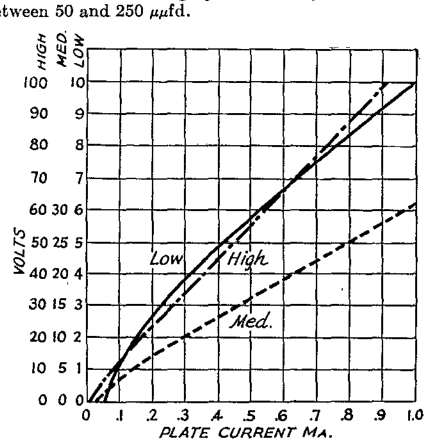


Fig. 7 — Typical d.c. calibration curves for the vacuum-tube voltmeter of Fig. 5.

11) Neglecting coil resistance, plot a curve showing the variation in Q of the circuit in Question 10 as the L/C ratio is varied, when a resistance of 10,000 ohms is connected across the circuit. Plot in terms of the capacity in use. Plot a similar curve for a resistance of 5000 ohms.

12) What is the resonant frequency of a circuit consisting of a coil of 30 microhenrys and a capacity of 60 $\mu\mu$fd.?

13) A resonant circuit is formed by a 50-$\mu\mu$fd. condenser and a coil of 10 microhenrys. The latter has a resistance of 2 ohms at the resonant frequency.

a) What is the resonant frequency of the circuit?
b) What is the Q of the circuit?
c) What is the parallel-resonant impedance of the circuit?
d) If one volt at the resonant frequency is applied in series with the circuit, what voltage will appear across either the coil or condenser?
e) If 250 volts at the resonant frequency is applied in parallel with the circuit, what is the equivalent series voltage, corresponding to the series voltage in (d), acting in the circuit? What then is the current circulating in the parallel-resonant circuit? What is the line current (see Exp. 14)? What is the ratio of circulating current to line current, and what circuit quantity does it equal?
f) A resistance of 8000 ohms is connected across the parallel-resonant circuit. Find the new value of circuit impedance. (Use the ordinary formula for resistances in parallel, since the impedance of the tuned circuit alone is a resistance at the resonant frequency.) If the impedance of the tuned circuit alone were neglected in determining the new impedance, would the error be appreciable? What would be the per cent error caused by neglecting the impedance of the tuned circuit alone if the inductance and capacity had the same values but the coil resistance was 40 ohms?
g) If 250 volts at the resonant frequency is applied across the circuit with the 8000-ohm resistor in shunt (assuming the original coil resistance of 2 ohms) what is the circulating current in the circuit? What is the line current? What is the new value of circuit Q?

14) A resonant circuit to operate at 14,200 kilocycles is to be loaded so that the effective parallel impedance will be 4000 ohms. Assuming that the coil resistance will be negligible (that is, nearly all the energy will be dissipated in the load, not in the coil itself) what inductance and capacity should be used to give a Q of 15?

15) If a voltage of lower frequency than the parallel-resonant frequency of a circuit is applied, what type of reactance does the circuit exhibit? Which branch of the circuit carries the greater current, the inductance or capacity? What are the conditions when the applied frequency is higher than the resonant frequency? Compare with a series circuit.

16) What is the piezoelectric effect?

17) What is meant by the term "loaded circuit"?

18) Two coils, one having an inductance of 15 microhenrys and a resistance of 5 ohms, and the other an inductance of 9 microhenrys and a resistance of 3 ohms, are available for use in a circuit to operate at 7500 kc. Which will give the greater selectivity?

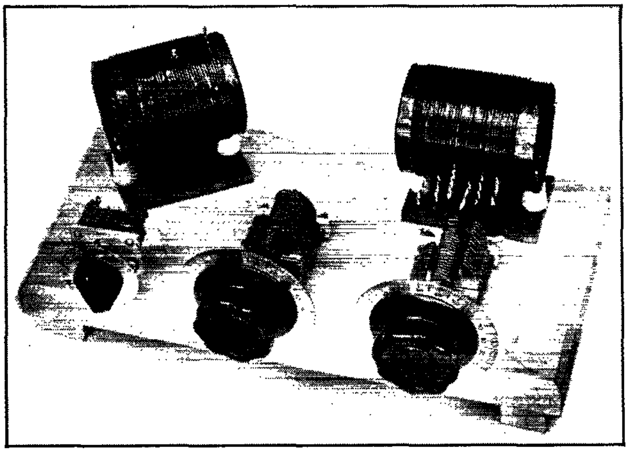


Fig. 8 — A circuit board such as this is convenient for making up various types of resonant circuits. The tuning condensers are 250-$\mu\mu$fd. units; any condensers having this or higher capacity will be satisfactory. The coils, wound on mailing tubes of 2¼-inch outside diameter, have 35 turns each, tapped every 5 turns, with turns spaced to occupy a total length of 2 inches. The wire is No. 18. The small condenser at the left is for coupling purposes and may have a maximum capacity from 10 to 25 $\mu\mu$fd.

19) If the Q of a coil having an inductance of 100 microhenrys is found to be 125 at a frequency of 2000 kc., what is the effective r.f. resistance of the coil?

20) What capacity is necessary to tune the coil of Question 19 to 2000 kc., and what will be the parallel impedance of the circuit?

ASSIGNMENT 9

Study *Handbook*, Section 2-11, starting page 35. Perform Exps. 16–20, inc.

Questions

1) Name six ways in which radio-frequency energy may be transferred from one resonant circuit to another.

2) What is meant by "critical coupling"?

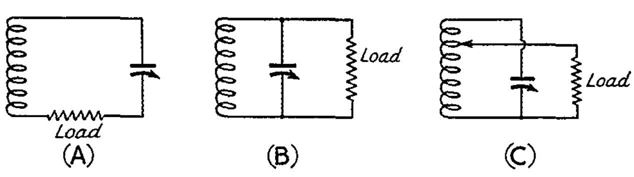
3) What happens to the effective series resistance of the primary circuit when the coupling to the secondary circuit is increased? What is the effect of increasing coupling on the parallel impedance of the primary circuit? On the overall selectivity of the two circuits?

4) What is mutual inductance?

5) On increasing the coupling between two circuits it is found that the primary is thrown off tune. What is the cause?

6) Define coefficient of coupling.

7) A 600-ohm load is connected to a resonant circuit which in turn is coupled to the tuned plate circuit of a transmitter operating at 7100 kc. If the secondary circuit must have a Q of 10 to obtain sufficient energy transfer, what values of inductance and capacity must be used (assuming negligible losses in the coil itself) in the secondary circuit if the inductance, capacity and load are connected in series? Would these values be practicable at this frequency? If the secondary circuit is parallel-resonant and is shunted by the 600-ohm load, what values of inductance and capacity should be used to obtain the required Q? Suppose a condenser of only half this capacity was available; what could be done to obtain sufficient coupling?



8) Assuming that a variable condenser having a maximum capacity of 200 $\mu\mu$fd. and a minimum capacity of 30 $\mu\mu$fd. is

available to tune the secondary or load circuit, indicate which of the circuits, A, B, or C in the accompanying diagram (page 67) should be used to couple to the primary if the secondary circuit must have a Q of 10 for adequate energy transfer, when the load resistance has the following values: 10, 20, 70, 150, 600, 2000, 5000 ohms. Find the value of capacity which should be used in each case, and also the value of inductance necessary to tune to resonance in each case.

9) What is a low-pass filter? How may such a filter be constructed?

10) What are the distinguishing characteristics of a high-pass filter?

11) What is the purpose of shielding? What type of shield eliminates or reduces electrostatic coupling?

12) What materials are satisfactory for magnetic shielding at audio frequencies? At radio frequencies? Why cannot the same materials be used for both purposes?

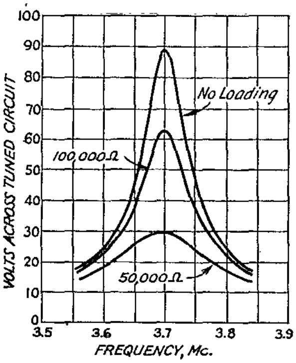


Fig. 9

13) What happens to the inductance of a coil when it is enclosed in a shield? What is the effect on the Q of the coil? What determines the magnitude of these effects?

14) What is a band-pass filter? Describe a simple form of band-pass filter.

15) Describe the principle of operation of the bridge circuit.

16) How would you arrange two coils to obtain the highest possible mutual inductance?

ASSIGNMENT 10

Study Handbook Sections 2-12 and 2-13 beginning page 39.

Questions

1) What is meant by the term "standing wave"?

2) What is the wavelength in meters corresponding to a frequency of 3500 kilocycles? What is the wavelength in feet?

3) What is the shortest length of wire in free space which will be resonant at a given frequency?

4) Describe the construction of a concentric line.

5) How is the current distributed along a wire a half wavelength long at the frequency at which it is excited? What is the current distribution if the wire is one wavelength long?

6) Describe the impedance characteristics of a folded quarter-wavelength line.

7) Why can a concentric line be built to have higher Q than a tuned circuit which operates at the same frequency?

8) What is radiation resistance?

9) What beat frequencies are produced when currents having frequencies of 2000 kilocycles and 2450 kilocycles are mixed in a circuit suitable for the production of beats? What beats are produced if the two frequencies to be mixed are 3900 kilocycles and 1500 cycles? 7150 kilocycles and 7149 kilocycles?

10) What is meant by ground potential?

11) When are by-pass condensers necessary?

12) What requirement must a by-pass condenser meet to function properly?

13) What is the purpose of a choke coil, and what requirements must it meet with respect to the characteristics of the circuit in which it is used?

14) A by-pass condenser is to be used to shunt r.f. current at a frequency of 14.15 megacycles around a circuit having an impedance of 6000 ohms. What value of capacity would be suitable?

15) A 500-ohm resistor is to be effectively by-passed for 100-cycle alternating current. What value of capacity is required?

16) Direct current is to be fed to a radio-frequency circuit which has an impedance of 2500 ohms at 3600 kilocycles. What inductance should the choke coil have? (In actual practice, the impedance of the choke coil would be affected by the distributed capacity of the coil, but this need not be considered in the problem.)

17) A 15-henry inductance is being used as a choke coil through which direct current is being fed to an a.c. circuit which has an impedance of 4000 ohms at 500 cycles. Is this value of inductance adequate? Would it be adequate if the frequency were 60 cycles?

EXPERIMENT 15

Resonant Circuits

Apparatus: The oscillator, power supply, vacuum-tube voltmeter, test instrument, circuit board and the calibrated receiver are needed for this experiment, together with two 1-watt resistors, 50,000 and 100,000 ohms. Use the full output voltage of the supply (250 to 300 volts) on the oscillator, which is operated with the coil in the grid circuit to give variable frequency.

Procedure: Connect a condenser and coil on the circuit board in parallel, and connect the input terminals of the v.t. voltmeter across the parallel circuit. Set the oscillator frequency to about 3700 kilocycles as determined by the receiver calibration (keep the gain low so that the signal is weak enough to give a good zero-beat indication) and bring the oscillator and tuned circuit near enough to each other to get a good v.t. voltmeter indication when the circuit is tuned through resonance. A reading of nearly full scale (on either the 30- or 100-volt scale) should be obtained when the circuit is resonant at the oscillator frequency. Once the relative positions of oscillator and circuit to give such a reading have been determined, do not move either unit. Should one or the other be accidentally moved, recheck to obtain the same maximum reading at resonance before going ahead.

Using all the turns in the coil, set the condenser to resonance. Then vary the oscillator frequency in steps of about 20 kc., taking readings on the v.t.v.m. each time, until the frequency is sufficiently far from resonance to bring the v.t.v.m. reading down to the low end of the scale. Do not touch the tuned circuit in the meantime. Take readings on both the low- and high-frequency sides of resonance. Then connect the 100,000-ohm resistor across the tuned circuit and repeat the measurements over the same frequency range. Finally, follow the same procedure with the 50,000-ohm resistor across the circuit. When the run is complete, convert the plate-current readings to volts by means of the v.t.v.m. calibration curve and then plot a curve showing the voltage across the circuit against frequency.

Typical results of such measurements are shown in Fig. 9. The voltage is highest at resonance, dropping off with frequency on either side at a rate determined by the losses in the circuit. These losses are highest with the lower values of parallel resistance, hence the resonance curves of the loaded circuit become progressively less sharp as the loading is increased (parallel resistance lowered). Since the coupling to the oscillator is not changed during the run the voltage induced in the circuit also remains unchanged, but the voltage rise at resonance decreases with loading, indicating that the Q of the circuit is decreasing.

Using a smaller number of turns on the coil, repeat the experiment, plot the data, and compare the curves to those obtained with the whole coil. Take a series of such data with different values of inductance. When the inductance is changed, change the position of the coil, if necessary, to get the same maximum value of voltage at resonance without load, or else convert the new readings to the original scale by multiplying each value by the ratio of the original maximum voltage to the new maximum voltage.

If some low-resistance 1-watt units are available (50 to 200 ohms) the experiment can be varied by taking readings similar to those described above, but with the low-resistance units connected in series with the coil and condenser instead of in parallel. In such case connect the v.t.v.m. across the condenser. When plotted, these readings can be compared to the curves obtained with the parallel resistors, in which case it will be observed that the higher values of series resistance give curves comparable to those obtained with the lower values of parallel resistance. If the losses in the circuit itself are small compared to the loss in the connected resistor,

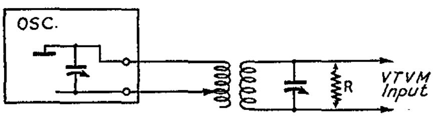


Fig. 10

the relationship between parallel resistance and equivalent series resistance can be found from the formula

$$Z = \frac{X^2}{R}$$

where Z is the resistance actually connected in parallel and R is the equivalent series resistance. Conversely the impedance of the circuit can be found when the series resistance R is known. Calculate the values from the experimental data obtained.

EXPERIMENT 16

Inductively-Coupled Circuits

Apparatus: Same as for Exp. 15, with the addition of 25,000- and 10,000-ohm 1-watt resistors.

Procedure: Set up the oscillator for crystal operation, but remove the plate coil and connect the free coil on the circuit board in its place, using flexible leads. Set the plate voltage tap on the power supply for about half voltage (between R_2 and R_3, Fig. 4). Connect the fixed coil on the circuit board in parallel with the nearest variable condenser, using all the turns on the coil. Connect the v.t. voltmeter across this circuit. The general arrangement is shown in Fig. 10.

This experiment involves varying the coupling between the two coils, so it is convenient to make a scale to indicate the degree of coupling. The simplest way to do this is to rule a line on the board to serve as a guide for the movable coil so that its axis always will coincide with that of the fixed coil, and then mark off half-inch intervals along the guide line. Zero spacing will simply be the closest possible spacing between the coil bases on the board, and need have no reference to the actual separation between the turns. This method of measuring coupling is purely arbitrary, but will serve the purpose satisfactorily. At the very close spacings, quarter-inch intervals on the guide line will be desirable.

At the start, set the coils at the maximum possible separation on the circuit board. This is about 5 inches in the arrangement shown in Fig. 8. No loading resistor is used in the first run. Use about 25 turns of the movable coil for the crystal oscillator plate tank, or whatever number of turns brings the setting for oscillation at or above half capacity on the oscillator tank condenser. Tune down a bit from the setting of the plate condenser which gives maximum output so that the oscillator operation will not be critical with loading. Move the coil a half inch at a time toward the fixed coil, taking readings at each interval. If the readings show rapid variation with spacing, reduce the interval to a quarter inch in the critical region. The secondary circuit should be adjusted for maximum voltage (resonance) with the loosest coupling between the two coils and then left alone while the coupling is increased.

The same procedure should be followed with parallel resistance loads of 100,000, 50,000, 25,000 and 10,000 ohms. After a run is complete, reduce the number of turns on the secondary coil and repeat. Do this for as many taps as is possible with the tuning capacity available. Make certain that the "ground" end of each circuit is connected to the facing ends of the coils to minimize capacity coupling, and in changing taps keep the active turns in the facing ends. Convert the data into voltage readings and then plot on cross-section paper. A typical set of curves so obtained is shown in Fig. 11. This series of curves was taken with 20 turns in the secondary coil with the exception of the dashed curve, which was taken with 35 turns.

This experiment illustrates the effect of the Q of the secondary circuit on coupling. In the case of the no-load curve, critical coupling — maximum output — is reached when the coils are separated about 2½ inches on the arbitrary scale. When the Q is reduced by the addition of the 100,000-ohm resistor in parallel across the secondary it is necessary to increase the coupling to about 1¾ inches for critical coupling, and as the loading is increased still more by shunting lower values of resistance across the secondary the coupling must also be increased to secure maximum energy transfer. It can be seen that critical coupling can be just about reached with the 10,000-ohm resistor in parallel, and with much lower values of resistance it would not be possible to get tight enough coupling for maximum output. Assuming that the losses in the circuit alone are negligible in comparison to the power in the resistor, the Q of the circuit is

$$Q = \frac{Z}{X}$$

and since the reactance of the 20-turn coil is calculated to be approximately 500 ohms, the circuit Q is 10,000/500, or 20. In this particular case, therefore, the secondary circuit must have a Q of the order of 20 at least if maximum energy is to be transferred. This is confirmed by the dashed curve, which was taken with 35 turns in the coil and the 25,000-ohm resistor in shunt. Using the new value of coil reactance represented by the larger number of turns the Q again works out to be approximately 20, and in this case the maximum energy transfer also is secured with the coupling distance at zero on the arbitrary scale. (At this "zero" there is still about ¾ inch separation between the actual ends of the

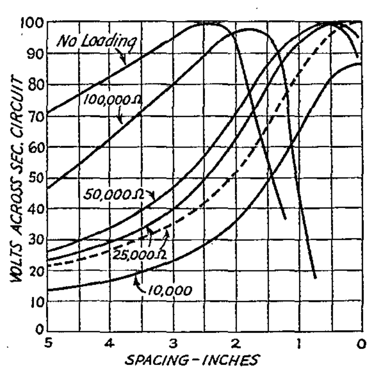


Fig. 11

coils, so that with other construction tighter coupling could be possible.)

From the data accumulated in the experiment, determine the cases where critical coupling is reached with minimum separation between the coils, and calculate the Q by the method above for these cases. The inductance can be calculated by means of the formula in the data chapter in the *Handbook* or by a *Lightning Calculator.* The effect of dead ends in the tapped coil can be ignored for the purpose of this approximate calculation.

After completing a run, go back and repeat any typical one, this time observing the effect on output voltage of varying the secondary tuning capacity at various degrees of coupling. It will be observed that with the coupling less than critical the output voltage will go through a resonance curve much like those in Fig. 9, becoming broader as critical coupling is approached, but that with coupling tighter than cirtical the secondary curve will have two humps, one on either side of the point where the circuit actually is resonant. The amplitude of the humps is approximately the same as the amplitude of the output voltage at critical coupling and is greater than the voltage at actual resonance (with greater than critical coupling) which drops off as shown by the curves. The tighter the coupling the greater the separation between the humps.

EXPERIMENT 17

Capacity Coupling

Apparatus: Same equipment as for Exps. 15 and 16.

Procedure: Use the grid coil in the oscillator for variable-frequency operation (operate the oscillator at half voltage) and set up the fixed coil and tuning condenser on the circuit board as in the previous two experiments. Because stray coupling between the oscillator and tuned circuit will mask the effects the experiment is intended to illustrate, it is necessary to provide sufficient shielding to reduce stray coupling to the point where it does not cause more than a volt or so to appear across the unloaded circuit. This can be accomplished by placing a large metal can such as a household sugar can over the oscillator plate coil, tube and tuning condenser (allowing the knob of the latter to project) and connecting the can to the negative "B" oscillator terminal. Reasonable separation between the oscillator and tuned circuit, and keeping the power leads bunched together where they run from the power supply unit to the oscillator and v.t.v.m., respectively, also will help. Connect the v.t. voltmeter to the circuit, set on the lowest range, and try different positions of the apparatus until not more than a volt or so appears across the unloaded circuit when it is tuned to resonance with the oscillator. An additional baffle shield judiciously placed near the oscillator (and also connected to oscillator negative "B") may help.

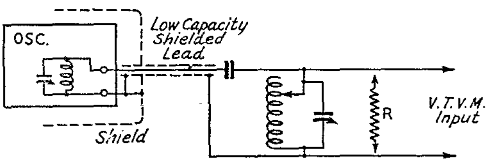


Fig. 12

In this experiment coupling between the oscillator and tuned circuit is by means of a small capacity. The circuit arrangement is shown in Fig. 12. The lead from the "hot" side of the oscillator tank circuit connects to one side of the small coupling condenser on the circuit board, and must be shielded for its entire length to prevent stray pickup. A loosely-fitting piece of shield braid over insulated wire will be satisfactory. A tight-fitting shield is not recommended since the capacity of such a wire will be high. Low-capacity shielded cable is good if available. In any event the lead should not be more than a foot long, to prevent the shunting capacity across the oscillator tank circuit from becoming too high. It will probably be necessary to use the smaller oscillator plate coil.

Stray capacity between the coupling condenser and the tuned circuit will provide enough coupling for the first attempt. Set the oscillator frequency to about 3700 kc., and, using all the turns on the tuned-circuit coil, adjust the circuit to resonance with the oscillator. Vary the oscillator frequency as described in Exp. 15 and take voltage readings. Connect a wire to the "hot" side of the circuit and bring it near the coupling condenser, again varying the frequency and taking a set of readings. Try various positions of the wire and finally connect it to the other set of plates on the coupling condenser. (This will probably result in overcoupling and a double-humped resonance curve with the unloaded tuned circuit.) Shunt the various values of resistance across the tuned circuit and repeat the measurements, noting approximately how much coupling capacity is required each time for maximum energy transfer. In all cases the capacity will be quite small.

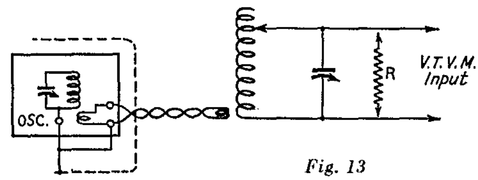


Fig. 13

When the data are taken and curves plotted, the similarity between capacity coupling and inductive coupling will become apparent, even though the two experiments were not performed on exactly the same basis.

EXPERIMENT 18

Link Coupling

Apparatus: Same as for Exp. 17.

Procedure: The circuit is shown in Fig. 13. The shielding described under Exp. 17 will be required, and stray coupling must be minimized. The link line connecting the two circuits should be twisted and both wires should be the same length. The links in both cases are temporary, consisting of a few turns wound around the ground end of the oscillator plate coil and the corresponding end of the tuned circuit coil. The link for the latter may be arranged to be pushed in and out of the coil to vary the coupling. Start with about 5 turns on each link and successively reduce the number of turns, observing the effect on the output voltage. The oscillator and tuned circuit should be returned to the original frequency each time a change is made. It will be found that, with fixed coupling (link wound around the coil) changing the number of turns on either link has relatively little effect so long as a turn or two is retained.

Make runs in the same ways as in Exp. 15, varying the loading over the range of available resistors and taking a run at each tap on the tuned circuit coil. Repeat for varying degrees of coupling at either end of the link circuit. Compare the results with the information obtained in the experiment on inductive coupling (Exp. 16) with respect to the effect of secondary circuit Q on the energy transfer. For the cases where maximum energy transfer is just attainable with maximum coupling between the link coil and the tuned circuit coil, calculate the minimum Q necessary to secure critical coupling.

EXPERIMENT 19

Coupled Resonant Circuits

Apparatus: Same equipment as for preceding experiments.

Procedure: The object of this experiment is to show the effect on selectivity of operating two resonant circuits in cascade. Set up the oscillator for tuned-circuit frequency control as in Exp. 17, checking stray pickup to make certain that not more than a volt or so is present on the tuned circuit on the circuit board. Connect each coil to a variable

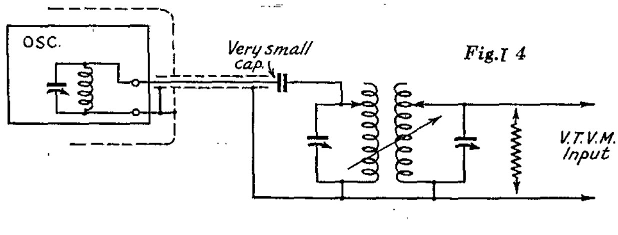


Fig. 14

condenser, using all the turns in both cases. The general circuit arrangement is shown in Fig. 14. Very loose coupling must be used between the oscillator and the first tuned circuit, the coil in which is movable with respect to the coil in the secondary circuit. No special coupling condenser is necessary; enough coupling can be secured by bringing a wire from the hot side of the primary circuit on the board to within a quarter inch or so of the end of the wire project-

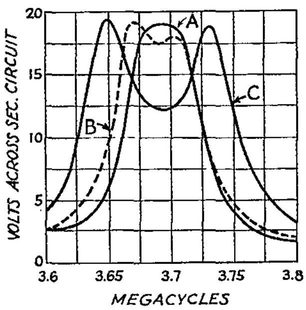


Fig. 15

ing from the shielded lead (described in Exp. 17) from the oscillator. Do not allow more than a half-inch of wire to project from the shield, and fasten the two wires securely so the capacity of this "condenser" cannot change during the experiment. Set the oscillator frequency to about 3700 kc. and adjust the coupling "condenser" to a value which permits the coupled circuit (the primary in this experiment) to be tuned through resonance without changing the oscillator frequency by more than a few hundred cycles. The secondary circuit should be disconnected when this check is made. If the frequency change is appreciable, the capacity must be reduced, since overcoupling (which is very easy to get) will greatly affect the measurements.

With the oscillator frequency at about 3700 kc., tune the primary circuit to resonance. The resonance point can easily be observed on the receiver (the beat oscillator should be on) or can be checked by bringing the hot lead from the v.t. voltmeter near (but not touching) the circuit and using the low range for measurement. The v.t.v.m. should not be connected directly to the circuit because its capacity will change the setting of the tuning condenser, hence the circuit will be out of resonance when the v.t.v.m. is shifted to the secondary circuit where the actual measurements are to be made. With the primary resonant, connect the v.t.v.m. to the secondary circuit and tune the latter to resonance. Move the primary coil away from the secondary until a reasonably high indication is obtained on the medium range — about 20 volts is satisfactory. Then reduce the coupling still more, check the tuning of the two circuits to make sure they are exactly resonant, and vary the oscillator frequency over a range of about 100 kc. either way from the resonant frequency, taking readings at 10-kc. intervals. Then, without touching the tuning of either circuit, increase the coupling and repeat. Follow the same procedure with progressively closer coupling until a quite pronounced double-humped resonance curve is obtained.

On plotting the data the curves can be expected to look something like those shown in Fig. 15. Curve A in this group was taken with quite loose coupling, the primary coil being at its maximum distance and its axis turned slightly to give a further reduction in coupling. Nevertheless the slightly flattened top on the curve, as well as the fact that the maximum amplitude is practically the same as that of the largest hump in each of the other two curves, indicates that the coupling is very near the critical value. Curve B is with "4-inch" coupling and shows a double hump, indicating that the coupling is greater than critical. Curve C, with "2-inch" coupling, shows considerable overcoupling and very pronounced double humps. In general, these curves will not be exactly symmetrical, either theoretically or practically. Slight inaccuracies in setting the circuits to resonance will have some effect on the symmetry, and an important cause of dissymmetry is overcoupling between the oscillator and the primary circuit. It is of first importance to make this coupling the loosest possible if reasonably good curves are to be obtained.

After completing a run with no loading on the secondary circuit the same procedure should be followed with the 100,000-ohm resistor connected in parallel with the secondary, and then again with the 50,000-ohm resistor in parallel. Plot the data and compare the curves to those obtained with no loading. It will be found that tighter coupling is necessary for maximum secondary voltage, and that the new maximum will be lower than in the no-load case. The resistance loading also tends to flatten the tops of the overcoupled curves, making the double humps less pronounced.

Compare the set of curves obtained in this experiment

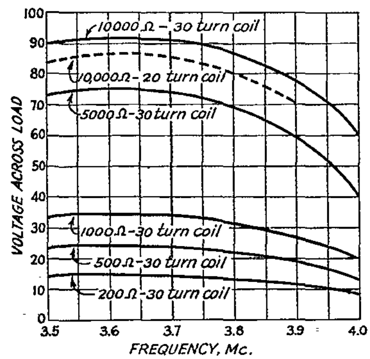


Fig. 17

with those secured in Exp. 15. How do the curves with corresponding loading compare near resonance? How do they compare at frequencies removed by 100 kc. or so from resonance? To make this comparison it will be necessary to convert the voltage readings to the same scale by plotting selected curves, representing typical sets of conditions, in terms of percentage of the maximum voltage obtained. Suggested curves to plot in this fashion are three corresponding to those shown in Fig. 9, and one set of three — less than critical coupling, critical coupling, and moderate overcoupling — for each condition of loading — no load, 100,000 ohms, and 50,000 ohms — as obtained in the present experiment. Note the "band-pass" effect of a pair of overcoupled circuits with appropriate resistance loading.

EXPERIMENT 20

Pi-Section Filter Operation

Apparatus: Same as for preceding experiment, with the following values of 1-watt resistors: 10,000, 5000, 1000, 500 and 200 ohms.

Procedure: The operating characteristics of the pi-section filter are investigated in this experiment. The circuit arrangement is shown in Fig. 16, the two condensers being connected with one of the coils on the circuit board to form a low-pass filter. The input side of the filter is connected directly across the oscillator tank circuit (a blocking condenser of about 0.001 μfd. should be connected in series with the hot lead if the oscillator plate circuit is series fed; this condenser is not necessary

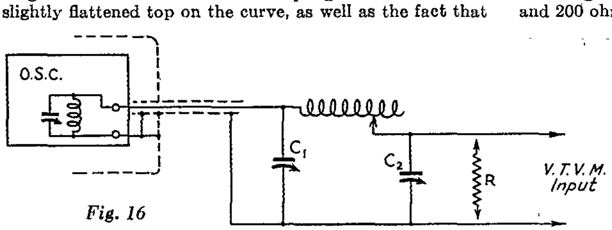


Fig. 16

with the circuit of Fig. 2), and the v.t. voltmeter is connected across the filter output to measure the voltage developed across the load. Make sure stray pick-up is minimized.

With the filter disconnected from the oscillator, set the frequency of the latter to about 3700 kc. Then, without touching the oscillator tuning, connect the filter, using an output load of 10,000 ohms. Rotate the input condenser, C_1, until the oscillator frequency returns to its original value. Then try different settings of C_2, the output condenser, until maximum output voltage is obtained. Each time the capacity of C_2 is changed, reset C_1 to bring the frequency back to the original value. When the maximum possible output voltage is obtained in this fashion, vary the oscillator frequency on both sides of the original frequency, taking v.t.v.m. readings simultaneously, until most of the 3.5-4-Mc. band has been covered. It will be satisfactory to take readings at 40- or 50-kc. intervals. Do not touch the tuning condensers in the filter while this frequency run is being made. When this series of data is complete, substitute the next lower value of resistance and repeat the whole procedure. Continue until all the resistance values specified have been used. Plot the data as illustrated in Fig. 17.

In taking the data it will be observed that as the value of load resistance is lowered the capacity required in the output condenser, C_2, for maximum output voltage progressively increases. It is by this means that the "impedance matching" function of the filter is realized, and this characteristic compares to the use of more capacity in a parallel-tuned circuit to maintain sufficient Q when the load resistance is lowered. By comparing the relative power (E^2/R) delivered to the various values of load resistance it can be seen that the output is approximately the same over the range of loads shown in Fig. 17, illustrating the ability of such a coupling circuit to provide proper impedance matching over a wide range of load resistances.

The low-pass characteristic of the filter can be observed from the curves, although there is no sharp cut-off. However, the output drops continually on the high-frequency side of resonance, while it is nearly constant for a 200-kc. frequency range on the low-frequency side. The heavy vertical line represents the initial frequency (3700 kc.) at which the filter was adjusted for maximum output.

Continue the experiment by taking a new value of inductance and repeating the original procedure with various loads. Plot curves and compare them with those obtained with the full 35 turns in the coil. Still larger values of inductance also may be used by connecting part of the second coil in series with the first. Changing the L/C ratio of the filter may result in a better impedance match with certain values of load resistance, less inductance and more capacity being required for low-resistance loads. This corresponds to the effect of a similar change in L/C ratio on coupling in an ordinary resonant circuit with the load connected in parallel.

The operation of the filter with loads having a reactance as well as resistance component, a condition frequently met when a pi-section filter is coupled to an antenna or transmission line, can be investigated by connecting various values of capacity or inductance in series with the load resistance. Useful information about the tuning capabilities of the filter can be obtained by observing the limits of reactance which can be compensated for by the filter, for various values of load resistance. The reactance values can be computed from the calculated or known values of inductance or capacity inserted in the load circuit.

ANSWERS TO PROBLEMS IN INSTALLMENT 2

If no answer is given to a question, it is to be found in the appropriate *Handbook* section or in the description of the experiment or experiments accompanying that section.

Assignment 4:

Q. 3 — 16,670 ohms.
Q. 4 — 25 henrys.
Q. 5 — 6 henrys.
Q. 11 — 3.155 ohms; 1.902 amp. 5-ohm resistor: 1.2 amp.; 7.2 watts. 14-ohm resistor; 0.429 amp.; 2.57 watts. 22-ohm resistor: 0.273 amp.; 1.64 watts.
Q.13 — 114,300 ohms.
Q.14 — 0.6 second.
Q.15 — 4 μfd.
Q.16 — 1000-ohm resistor: 35.7 volts; 0.0357 amp. (35.7 ma.). 500-ohm resistor: 35.7 volts; 0.0714 amp. (171.4 ma.). 250-ohm resistor: 26.8 volts; 0.1071 amp. (107.1 ma.). 300-ohm resistor: 18.36 volts; 0.0612 amp. (61.2 ma.). 150-ohm resistor: 9.18 volts; 0.0612 amp. (61.2 ma.). 600-ohm resistor: 27.55 volts; 0.0459 amp. (45.9 ma.).
Q. 17 — From end to 75-volt tap: 7500 ohms. Between 75-volt tap and 125-volt tap: 5000 ohms. From 125-volt tap to 250-volt end: 12,500 ohms.
Q. 18 — At "75-volt" tap: 18.75 volts. At "125-volt" tap: 56.25 volts.
Q. 19 — From end to 75-volt tap: 3000 ohms. Between 75-volt tap and 125-volt tap: 2000 ohms. From 125-volt tap to 250-volt end: 5000 ohms. With load, at "75-volts" tap 52.5 volts. With load, at "125-volt" tap: 97.5 volts. No.
Q. 20 — 25,000-ohm divider.

25,000-ohm divider	*Without Load*	*With Load*
7500-ohm section	0.75 watt	0.0468 watts
5000-ohm section	0.5 "	0.282 "
12,500-ohm section	1.25 "	3.00 "
Total	2.5 watts	3.328 watts
10,000-ohm divider:	*Without Load*	*With Load*
3000-ohm section	1.875 watts	0.919 watt
2000-ohm section	1.25 "	1.013 "
5000-ohm section	3.125 "	4.65 "
Total	6.25 watts	6.58 watts

Q. 21 — Connect 10,000 and 40,000 ohms in parallel, and the combination in series with 12,000 ohms.
Q. 22 — 316 volts; 0.00632 amp. (6.32 ma.)
Q. 23 — From negative end, 1st tap: 20 volts; second tap: 120 volts; 3rd tap: 220 volts; 4th tap (top): 300 volts.

Assignment 5:

Q. 14 — 15,000,000 cycles.
Q. 15 — 1.96 megacycles; 1,960,000 cycles.

Assignment 6:

Q. 1 — 45.5 ohms; 167.2 ohms.
Q. 3 — 1327.6 ohms.
Q. 4 — 2910 ohms.
Q. 5 — Circuit of Question 3: 0.0868 amp.; 115 volts across condenser; 3.47 volts across resistor; 3.02% power factor. Circuit of Question 4: 0.0395 amp.; 104.7 volts across condenser; 47.5 volts across resistor; 41.3% power factor.
Q. 6 — 11,300 ohms; 0.1173 μfd.
Q. 7 — 44.7 ohms if π is taken as 3.14; 41.5 ohms if π is taken as 3.1416.
Q. 8 — (Using 41.5 ohms for total reactance) 204.2 ohms;

	I	E_C	E_L	E_R	*P.F.*
Complete circuit	0.049	156	154	9.8	98%
Condenser shorted	0.00318	0	10	0.0636	0.636%
Inductance shorted	0.00314	10	0	0.0628	0.628%
Resistance shorted	0.241	767	757	0	0

(*I* in amperes, *E* in volts)
Q. 15 — 11,300 ohms; 26,500; 10,600; 2650.
Q. 16 — 530,000 ohms (0.53 meg.); 10.6 volts; 15 volts.
Q. 17 — 47%.

Assignment 7:

Q. 1 — 19 turns.
Q. 2 — No. 13 B&S on secondary; No. 25 B&S on primary (nearest size capable of carrying the current).
Q. 3 — 2130 turns.
Q. 5 — 7500 ohms.
Q. 8 — 0.815 to 1 (or 1 to 1.23).
Q. 9 — 117.7 watts; 1.022 amp.
Q. 10 — 19,450 ohms; 12,930; 38,900; 648; 32.4.
Q. 11 — 37.4 to 1 pri. to sec.; 3.16 volts; 0.632 amp.; 118.3 volts.
Q. 13 — 30%; volt-ampere rating.
Q. 14 — 15 turns; 5.33 amp.
Q. 15 — 174 turns.

★ HAMDOM ★

When Thomas J. McDermott, W2HOA, went to sea in April as "Sparks" aboard a U. S. Merchant Marine tanker, he didn't know that he was heading into an eight-hour running battle with three Nazi subs followed by 3½ days in the Caribbean in an open lifeboat. But even if he had known he'd probably have gone just the same. Tom never was one to run from a fight, which is why the Navy some years ago decorated him for bravery "above and beyond the call of duty."

It was 2:30 A.M., April 29th, and the Socony-Vacuum oil tanker was "somewhere off Bermuda" when Tom

was knocked out of bed by a torpedo striking starboard. Ten minutes later he had reported to the captain, got his orders and his "S S S" was on the air. The sub pack shelled the vessel from three directions in the glaring light of star shells, but the gun crew aboard the tanker fought back grimly and after thirty or forty rounds from the tanker's guns all was quiet. The ship was listing but maneuverable. She continued on her zigzag course. At 4:30 A.M. another torpedo blew the second mate's stateroom right off the ship. The tanker was badly hurt but limped along and managed to keep headway. As dawn grew in the sky there were no subs in sight. Then at 10:30 a third torpedo hit — port side, this time. Radio antenna gone, one lifeboat damaged, the captain gave orders to abandon ship. The fifty-three men aboard and the airedale mascot "Mickey" shoved off in the three remaining lifeboats. At 10:51 A.M. the ship went down.

Lifeboats lashed together, the officers decided to tack northeast to hit the trade wind which would bring them to Haiti — 400 miles away. Patrol planes were sighted each of the following three days, but no help came. At 2:30 A.M. on Sunday, May 3rd, Tom McDermott was doing his trick at the rudder when a "huge shape" loomed in the night. It was a U. S. sub chaser, which had heard his first distress call 96 hours before.

Monday at 8:00 A.M. they landed at San Juan. A few days later Tom was back home with his four children and his wife — herself a war worker at the Watervliet Arsenal. The Navy Department gave him major credit for the rescue. A ham since 1921, W2HOA is president of the Albany Amateur Radio Association.

Above is Marjorie E. Allen, W2NRC, believed by her proud radio alma mater — American Radio Institute, New York — to be the first, and possibly the only, licensed woman broadcast transmitter engineer actually operating in a b.c. station. Possessor of second-class radiotelephone and radiotelegraph licenses in addition to her ham ticket, she is at present employed at Muzak Corp.'s f.m. station W47NY in the triple role of transmitter engineer, control room engineer and announcer.

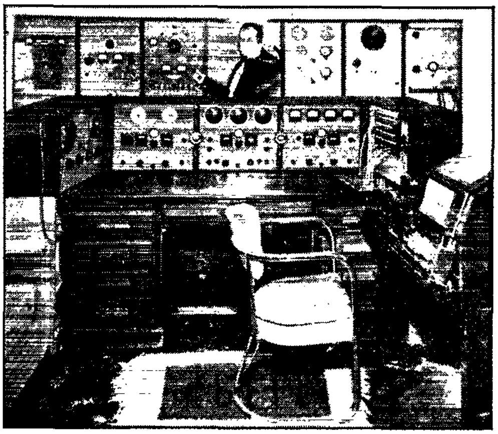
◆

Another well-known amateur station converted into an international monitoring and recording post is that of D. Reginald Tibbetts, W6ITH. Located at Moraga, Calif., the station is now under contract to United Press, serving as UP's San Francisco listening post.

Continuous observation, monitoring, recording and transcribing is maintained of all voice and code broadcasts from Tokyo, Hsingking, Hankow, Pekin, Shanghai, Manila, Hongkong, Nanking, Chungking, Perth, Saigon, Babkok, Singapore, Batavia, Sydney, Melbourne and Delhi as well as other Far Eastern and Pacific area points. About 10,000 words are handled daily. Biggest beat was getting the first announcement of the bombing of Tokyo half an hour ahead of other services.

The desk contains the frequency standard, mixer and gain controls, GMT and 140th west meridian clocks, monitoring speakers, level indicators, switchboard and three Hammarlund Super-Pros. Receivers are also maintained for watch on local and regional air-raid warning as well as ship distress frequencies.

For antennas there are five steerable tandem articulated rhombics for individual or tandem diversity reception. The equipment has been in continuous operation since December 8th.



Splatter

(*Continued from page 16*)

naturally come into possession of knowledge that we should keep strictly to ourselves. Even isolated fragments of information, if passed along, may provide just the missing pieces some long-eared stranger needs to finish the jigsaw puzzle that will make a valuable plan he can send back home to his friends — and our enemies. Hams being hams, the temptation to chew the rag about some of the fascinating new things we've learned about may be great at times — but when tempted remember the damage that a careless word might cause.

You'll find *QST* practicing its own preachments in this respect. Much as we'd like to tell you about some of the new developments we hear about, we know that now is not the time. National security comes first, and in consequence our columns are subjected to rigid voluntary as well as official censorship — in some instances by as many as three or four agencies. We're resolved to keep *QST*'s pages filled with interesting and worthwhile material, as always, but now the additional test of whether or not publication of technical data or general news is in the national welfare must be applied.

But once the lid's off — say, OM, wait'll you see all the hot dope we'll be bringing you then!

Special note to radio-class instructors: Sorry, but we can't supply advance copies of George Grammer's lessons on radio fundamentals — if only because the number of requests has been so great that we couldn't possibly supply them all. You'll just have to wait until the succeeding issues appear. (P.S. They'll be worth waiting for, too. Already it is evident that the methods used in this course are about the biggest thing that ever happened in radio instruction.)

• • • —

FEED BACK

In our review of Nelson Cooke's excellent "Mathematics for Electricians and Radiomen" in the April issue, we inadvertently tried to make an overcharge for the volume. The price is $4.00, not $4.50 as we had it. Anyway, the book is well worth the cost, whatever it is.

• • • —

Paul W. Ebert of the U. S. Naval Radio School at Noroton Heights, Conn., calls our attention to a couple of errors in W1JEQ's multi-range volt-milliammeter adapter story in the same issue.

". . . At the top of page 51 it states that 2.459 feet will be required for a resistance of 3.66 ohms. It should be 5.446 feet (3.66 ÷ 0.672). The paragraph on page 52, describing the wiring of the multipliers to the switch, gives the incorrect resistance numbering when referring to Fig. 1. They should be numbered R_5, R_6, R_7, etc., instead of R_1, R_2, etc. It may also be confusing to a beginner to have the 10-volt multiplier referred to as a shunt. The diagram in Fig. 1 has a wrong connection, inasmuch as no provision is made for including R_5 in the circuit. The voltage section of the switch has only 10 positions. The missing switch position is the sixth, counted from either end of the voltage section. The connecting wire, between R_5 and R_6 should lead to this missing position instead of directly to the + test lead, as shown. These errors are all too apparent for the amateur but to a beginner will cause confusion.

"I enjoy *QST* very much. As a potential ham, I get quite a bit of information from it. Keep up the good work."

Thanks, Navy. We'll do that!

• • • —

Moving along to the May issue, it has been called to our attention that, in the light-beam receiver diagram on page 14, the sensitivity of the 923 phototube can be increased by reversing the polarity of the anode supply voltage, connecting the positive to the anode (center) terminal instead of as shown.

• • • —

Coming now to the July issue: as any u.h.f. man knows, there should have been a blocking condenser between oscillator plate and mixer grid in W6ANN's superhet circuit on page 65. Our draftsman overlooked it because "Annie" didn't use a condenser, in the literal sense — just the twisted ends of a couple of lengths of hook-up wire, tailored for optimum coupling. And the unlabeled oscillator plate-dropping resistor can be 50,000 ohms or so.

Silent Keys

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

Lester E. Chadbourne, W1KAL, Jamaica Plains, Mass.
Henry L. Crabtree, W8SUQ, Syracuse, N. Y.
Col. R. P. G. Denman, G6HW, Stanwell Moor, Eng.
Sgt. R. Grimm, OK5GT
Colin B. Kennedy, early pioneer, St. Louis, Mo.
Sgt. Pilot W. C. Lees, GM4FT, Edinburgh, Scotland
John Millington, W8VJZ, Follansbee, W. Va.
Ammon C. Neff, jr., W3CMS, Towson, Md.
P. O. Basil E. P. Sadler, G2RC, London, Eng.

HINTS AND KINKS FOR THE EXPERIMENTER

SIMPLE MODULATOR FOR PORTABLE WORK

In Fig. 1 is shown a crude sketch of a simple audio amplifier that I have found very useful as a portable modulator and for general utility work. The idea is not new, since at least one manufacturer has used it in mobile police transmitters. Almost any power supply with an output of from 200 to 300 volts at 75 to 100 ma. may be used. The filtering is not critical and no mike supply is needed. I don't happen to have a picture of the complete unit but it measures only 3½ inches by 6½ inches by 4 inches high. It was built on a homemade chassis 3½ inches by 6½ inches by ¾ inch. One side of each heater is grounded, so only three connecting wires are needed.

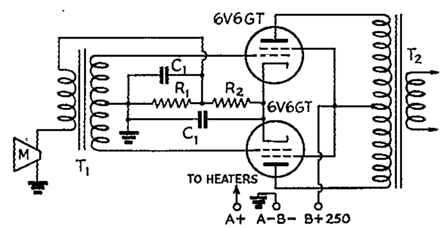


Fig. 1 — Simple modulator for portable and general utility used by W7FRA.
C_1 — 10 μfd., 25-volt.
R_1 — 100 ohms, 1-watt.
R_2 — 150 ohms, 1-watt.
T_1 — Thordarson T 83A78.
T_2 — Thordarson T 19M13.

Almost any single-button mike will do, depending on the quality desired. The bias tap may need to be adjusted to suit the mike and output required. R_1 and R_2 could well be a single resistor with a variable tap. If only a speaker is to be used, the output transformer could be changed. This amplifier with 275 volts on the plates will modulate a 25-watt final (input) 100 per cent.

— *Ray Harland, W7FRA.*

REDUCING RADIATION FROM THE MRT-3 TRANSCEIVER

The circuit diagram of Fig. 2 and the accompanying photographs show how W1EAO has succeeded not only in reducing considerably the radiation from the Abbott MRT-3 transceiver when operating as a superregenerative receiver, but also in increasing its sensitivity. In the original circuit, the detector plate is operated directly from the 300-volt terminal. By simply incorporating a regeneration control, as shown in Fig. 2, it has been possible to reduce radiation by about 12 db.

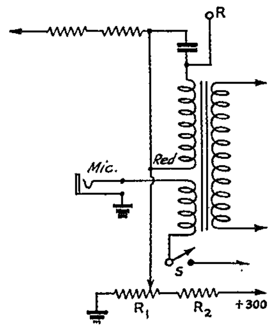
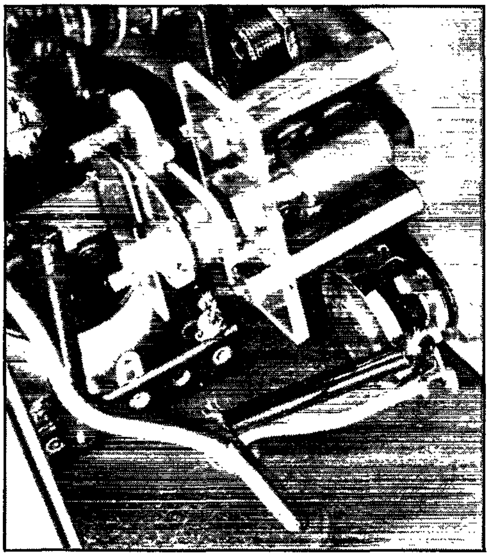


Fig. 2 — Diagram showing changes required in the original circuit of the MRT-3 to reduce radiation and improve sensitivity. R_1 is a 50,000-ohm midget volume control, while R_2 is a 50,000-ohm, 1-watt fixed resistance.

The regeneration control is a midget 50,000-ohm volume control (R_1), space for which may be found between the tuning condenser and the chassis. There is just enough room for a small control knob below the tuning dial on the front panel. Leads to the control are brought up through a grommet-lined hole in the chassis. The

The regeneration-control knob is just below the tuning dial.



Inside view of the MRT-3, showing the location of the regeneration control.

only other additional component required for the job is the 50,000-ohm, 1-watt fixed resistance, R_2. To the numerous owners of the MRT-3, the change will be found well worth the small amount of labor required to make it.

New Tubes

RCA HAS recently announced seven new special-purpose types, all of which should be of interest to amateurs. The 1A3, 1L4, 3A4, 3A5 and 6C4 are miniature types with envelopes and glass-button bases similar to those of the 1R5-1S4-1T4 series, while the 9004 and 9005 are acorns.

1A3

The Type 1A3 is a diode with a heater cathode. It is designed to be particularly useful as a discriminator tube in portable f.m. receivers and in high-frequency measuring equipment. With a heater rated at 1.4 volts, 0.15 amp., the rectifier rating is 117 volts r.m.s., 0.5-ma. d.c. output. The resonant frequency is approximately 1000 Mc.

1L4

The Type 1L4 is a sharp cut-off r.f. pentode, designed for use in f.m. receivers and in other circuits not requiring a.v.c. where compactness and light weight are important factors. Normally operating at a plate and screen voltage of 90 and zero bias, the transconductance is given as 1025 μmhos. with a plate resistance of 0.35 megohms. Plate and screen currents are 4.5 ma. and 2.0 ma., respectively. Internal shielding obviates the usual requirement of a bulb shield, but socket shielding is required for minimum *g-p* capacity. The filament ratings are 1.4 volts, 0.05 amp.

3A4

The 3A4 is a low-power transmitting pentode for use in light-weight portable equipment. As an r.f. amplifier, it has an output rating of 1.2 watts at a plate voltage of 150, screen voltage of 135 and plate current of 18.3 ma. As a Class-A_1 audio amplifier, the output rating is 0.7 watts at plate and screen voltages of 150 and 90, respectively, and an 8000-ohm load. The two sections of the filament may be connected in series for 2.8-volt operation at 0.1 amp., or in parallel for 1.4-volt operation at 0.2 amp.

3A5

The Type 3A5 is a twin triode designed for high-frequency applications. In push-pull Class-C service, it is designed to deliver a power output of 2 watts at 40 Mc. when operating at a plate input of 135 volts, 30 ma. total for both units. With the filament sections in series at 2.8 volts, the current is 0.11 amp. With the parallel connection for 1.4-volt operation, it increases to 0.22 amp.

6C4

The Type 6C4 is a heater-cathode type triode intended for use as a Class-C amplifier or oscillator in portable equipment where it will deliver a power output of about 5.5 watts at moderate frequencies and about 2.5 watts at 150 Mc. For maximum output, the 6C4 is designed to operate at a plate voltage of 300 and plate current of 25 ma. The heater is rated at 6.3 volts, 0.15 amp.

9004

The Type 9004 is a u.h.f. diode suitable for use as a detector, mixer or measuring device. Its resonant frequency is approximately 850 Mc. The heater operates at 6.3 volts, 0.15 amp. and rectifier ratings are 117 volts, r.m.s. and 5-ma. d.c.

9005

The Type 9005 is similar to the 9004 except that its output current rating is 1 ma., its resonant frequency approximately 1500 Mc., while the heater operates at 3.6 volts, 0.165 amp.

A table of characteristics of Sylvania lock-in-type receiving tubes can be obtained on request from the Commercial Engineering Department of Hygrade Sylvania Corp., Emporium, Pa.

A 24-page technical manual on G.E. radio receiving tubes, prepared to assist those who work or experiment with radio tubes and circuits, has been released by the Renewal Tube Sales Section of the General Electric Radio, Television and Electronics Dept., Bridgeport, Conn.

STRAYS

Several newspapers throughout the country recently carried the following AP story:

"The medical corps is a good outfit," said Private Kenneth H. Babcock to his commanding officer. "But I just don't feel right if I'm not tinkering with radio. I used to be a ham radio operator back in Blasdell, N. Y."

Five hours later he had been transferred to the Signal Corps and was on field maneuvers with a portable outfit.

That night his new top sergeant called Babcock's new commanding officer.

"Private Babcock won't go to sleep," he complained. "He wants to operate all night."

(He probably hadn't heard that Field Day was called off this year!)

—•••—

Shure Brothers, 225 W. Huron St., Chicago, Ill., has just published an interesting booklet on the care of microphones of all types. A copy may be obtained upon request.

The dynamic microphone is rated as the toughest under adverse weather conditions. Its performance is unaffected by extremes of temperature or humidity. Its greatest susceptibility is to accumulation of dust.

The crystal type is given a top temperature rating of 125° F. Care should be used in making soldered connections close to the crystal unit and microphones of this type should be operated in the shade and not left in closed cars on hot days.

Users of carbon microphones are warned against excessive current and allowing the microphone to remain idle for long periods with current flowing. Since microphones of this type are susceptible to moisture, they should not be operated in damp places and should be handled by the operator in such a manner as to minimize breath condensation. The importance of periodic servicing, if maximum performance is to be maintained, is emphasized.

—•••—

Georgia: "Do you know why radio announcers have small hands?"

W4ESL: "No, why?"

Georgia: "Wee paws — for station identification." — *The (N. C.) Arc*

—•••—

Molten metals contain considerable quantities of gas in solution. This causes cavities and pin holes when the metal solidifies, which decreases the strength of the material. A recently-developed experimental method of removing this gas produces vibration within the molten metal by electromagnetic fields. It has been found possible to remove all the gas included in molten aluminum or its alloys in less than one-half hour.

— *Ohmite News*

—•••—

The members of Great Britain's Women's Auxiliary Air Force had an important part in the devastating RAF raid on Cologne May 20th, particularly as telephone, teleprinter and radio operators, it was reported by the British Press Service. The women worked long shifts in handling communications for the raid, transmitting instructions for the bomber and ground crews.

— *Telecommunications Reports*

—•••—

Oscillation in pentode-type tubes may be reduced in some receivers by connecting the suppressor grid to ground instead of to cathode.

With this arrangement, a slight bias is placed on the suppressor grid equal to the control-grid bias, which increases the impedance of the plate circuit sufficiently to prevent oscillation.

— *Cornell-Dubilier Capacitor*

—•••—

When W7KV, now engaged in aircraft-pilot instruction, requested a training channel from the Air Force Command, he was assigned the frequency of 3940 kc. — his pet 75-meter 'phone frequency in the old days. Did *that* burn him up!

—•••—

W4DZX says a good use for that beam-rotating equipment and framework nowadays is to put a box or seat on each end and make a homemade merry-go-round for the kids — provided, of course, that it's built sturdily enough. DZX says that his is strong enough to carry his own weight. — *W4AXP*

(He doesn't *say* that he took it off the top of the 80-footer first before he tried it, but we'd recommend it.)

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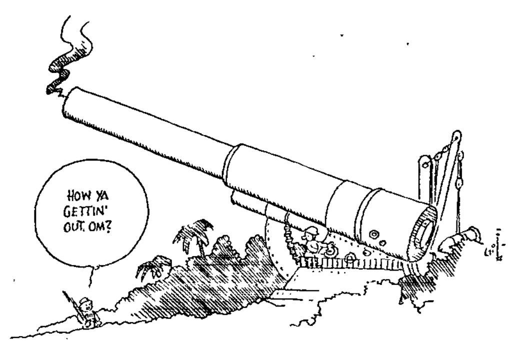

CORRESPONDENCE FROM MEMBERS

MEN OF THE NAVY

Pawhuska, Okla.

Editor, *QST:*

"Never again, when I read in the evening paper that a ship has been lost, will I think of it as being something distant and apart from us here in the prairie states." So said Henry Bennett, president of Oklahoma A&M College, after graduation of the first radar trainees recently. "You know, we read of a ship lost with 300 of its crew, and we think of them as 300 sailors. But now we have come to know sailors more intimately. They have lived among us. Losses at sea henceforth will never seem distant and apart."

Those who sat in Engineering Hall during the ceremonies were privileged to "come aboard" for a moment and get a glimpse into the spirit of the Navy — to see men, who a few short months ago were at home enjoying and pursuing their radio hobby, transformed into Men of the Navy. . . .

Many of these men have yet to be on water. But they are Navy men. They call it *esprit de corps,* when they want a 50¢ word for it. It is the thing that makes the Marine Corps. It is the thing that makes the Air Corps. It is the thing that makes America. Navy men on all the ships at sea and all the ports become stamped with the pride that makes their arm of the service great.

There in Engineering Hall you could feel it. You could reach out and break you off a chunk of it. In front sat a ready-appearing, freckle-necked fellow with a shock of sandy hair, a glint in his eyes and talk that sounded like Montana. And alongside was a Texas drawl, one of those tall go-to-hell longhorns, tough birds to meet in an alley fight or on a football field. And on down the line, 300 of them. Solid citizens, these guys. They were alert and intent on what was being said to them. The speaker was smart. He didn't dish out a lot of commencement fol-de-rol. He gave them one of those look-'em-in-the-eye talks. "Men of the Navy" — there it was again, sort of an imperceptible stiffening of shoulders all down the line.

Proud! These babies are proud of that uniform, proud of the fact that they are tackling radar, a field that is developing fast and fresh and takes an electrical technician of high order to handle. No tougher training program in the Navy.

Well, it was just a little graduation ceremony for a group of Navy radiomen, and there will be many of them over the nation. But no American can watch such exercises as these and not draw a great deep breath of faith and pride in being an American. Henceforth, no amateur will ever be thought of less than highly, for the amateurs have come through. Splendidly!

My amateur radio experience has fitted me for a part, and I was privileged to be a member of that graduating class. There is work to be done — a job the amateurs know how to do.

So to all my shipmates and amateurs in service, wherever you may be — "Here's wishing YOU a happy voyage home." — *George Bird, W5HGC*

WHERE IT CAN SERVE BEST

125 Bregman Ave., New Hyde Park, N. Y.

Editor, *QST:*

Your listing of receivers and transmitters that might be available to our armed services certainly got results. My receiver . . . is by now seeing active service with the Signal Corps somewhere in Alaska. Thanks for giving all your help to put my receiver where it can serve best — with our Army, not gathering dust in a seldom-visited radio shack. — *Bill Mauer, W2NLK*

FROM PEARL HARBOR

U. S. Submarine Base, Pearl Harbor, T. H.

Editor, *QST:*

. . . . Just received the May copy of *QST* and it certainly is like being back home to read about the gang. Have just finished reading Walworth's letter in the magazine and it sounds as though he had a pretty rough time. His information is about right but in some spots seems a little rough. Of course, I didn't get to see much of what went on in town so suppose am not qualified to do much talking. I had just about got my rig working on W3ADI/K6 with a Signal Shifter as the whole rig. Had several contacts with the boys on the West Coast when our little brothers paid us their surprise call. Needless to say, the rig was properly dismantled at once. I started for this place immediately and the wife did the dismantling of the rig. Accordingly I had no trouble with any one, but by what information comes through here the amateur rigs were properly seized, and *how!*

Have met up with several of the boys from back East and quite a number of them from the West Coast, and you fellows can truly be proud of them. How many have joined the "Silent Keys" we don't know, but we know a good number. I saw one of them trying his best to stop aerial torpedoes with a motorboat during the attack. His story will come out one of these days.

Please tell all the boys at home to work hard and give us all the help they can. The experimental work must be done there; we do not have time here to do it. We all feel sure that a lot of new gear and ideas will be coming along pretty soon, and most of the people in the services are looking to the boys back home to give us the dope. The experience of the good amateur comes into its own here. The old stunt of working out of a junk box is the biggest part of the job. Back home you could pop into a radio store and buy your parts, but we are quite some distance from that store here. Accordingly we either make them or make some sort of adaptation. Don't get the idea that we are not making out because we are keeping them sailing and in perfect condition, but at times it keeps you hopping. . . .

Give my regards to everybody, and you might tell them all that the mail is welcomed here and we like to hear from all of our good friends back there.

See you after the SUN sets.

— Lt. Allan R. Muncey, USNR, W3ADI

CONFIRMATION

Somewhere in U.S.A.

Editor, *QST:*

. . . I would like to confirm just what others are saying about hams being able to go directly into the Signal Corps and get radio work by presenting their license to the recruiting officer.

About two weeks ago I quit my job as a civil service operator at this very same station and enlisted in the Signal Corps as a radio operator. After about one week at the reception center I was sent back here on detached service by the Signal Corps to assume my old duties. The only change was in salary and uniform. Hi!

I also approve of what W9SPN said in his letter in June *QST* about standing watch for strange signals. During the time I have worked at this station as a civilian and in the Army (some four months) I have heard some strange things on the ether. . . .

I wish all fellow hams the best of luck and hope that they may get the branch of military service they desire. — ——— ———, W5— *

LISTENING POST

St. Louis, Mo.

Editor, *QST:*

On receipt of my June issue of *QST* I happened to notice the letter from W9SPN. . . .

I agree quite heartily with Mr. March; in fact, so heartily that I have been operating my own receiving equipment as a self-appointed listening post since as early as last November. I had frequently received signals whose sincerity and allegiance were sometimes doubtful. I did not know who to confront with such things at the time but finally, after realizing the seriousness of the possibilities therein, I went to the local FBI office . . . and also wrote to the FCC. . . . I have long been of the opinion that the jeopardy of the lives of our merchant seamen has been caused right here in our own country, and in all probability somewhere deep in the interior for the purpose of avoiding suspicion. It is obvious that there is a bad leak somewhere, since we are informed via the press that the U-boat boys aren't wasting any tin fish on banana boats or other non-strategic materials. . . .

I would like to see a concerted effort toward the establishing of listening post groups. This would require the use of all-band coverage receivers, and I am quite sure that a reasonable number of hams do have sets of this type. If, for instance, four or five hams in different locations in every large city would get together on their off hours for a little serious listening, sooner or later something would be picked up which might indicate the method in which the subs are getting such accurate information as to the position of our merchantmen. A signal of that nature, as soon as it is a certainty, should be reported with all possible haste to the nearest FCC listening post. On anything picked up that can be definitely determined as being immediately local, call the FBI as quickly as possible because time may be a very important factor. I do not mean to suggest that these two agencies (the FCC and FBI) should be constantly pestered by a lot of fluke reports, but we certainly can aid and abet the good work of these two offices by augmenting their listening power.

Let us all stand together, as many of us as can and are willing to put in a little time in this simple but highly effective way. Remember, we may save a few lives in doing so. *—Robert B. McClellan*

* Name deleted by request.

"LET'S REMEMBER OUR FRIENDS"

Lake Charles, La.

Editor, *QST:*

Reader interest of the July issue was high from many angles. But I think amateurs will find it significant to note the number of pages the issue contained — 112.

This means that, although the amateurs are off the air and have been off for more than six months, the nation's radio manufacturers and supply houses have not deserted *QST* or the amateurs. Their market has naturally been reduced tremendously, and it would be reasonable to suppose that they would reduce their advertising budgets correspondingly. On the contrary, most of them have stuck by us. Some are even taking more space.

This is a vote of confidence in amateur radio. It is reassurance that the manufacturers expect the amateurs to be returned to the air with essentially their former frequencies, and it is an indication that they desire this. If they didn't have a vital interest in our return, they certainly wouldn't be spending cash money reminding us that they are still producing components and complete apparatus for 80, 40, 20 and 10 meters.

Since these advertisers have stuck by us, the very least we can do is to note carefully all those who are advertising and, when conditions permit, remember them when we flood the market with orders for their new and improved equipment.

Let's stick together and remember our friends.

— *J. Howard Leveque, W5HHV*

EDITOR'S NOTE. — Take a look at the last page number in *this* issue! This is the largest August issue of *QST* ever published.

COLIN KENNEDY, PIONEER

6001 Dickens Ave., Chicago, Ill.

Editor, *QST:*

. . . The death yesterday, June 16th, in Chicago, of Colin B. Kennedy marks the passing of another of radio's original pioneering spirits.

When, back in 1921, I became associated with Chicago Radio Laboratory, which two years later became Zenith Radio Corporation, to me the two great names in radio were Grebe and Kennedy, both of whom now have passed on.

Colin Kennedy, back in those days, headed the radio company bearing his name, with St. Louis as its headquarters. He was an engineer radio pioneer, a quiet, modest man who sought no glory but contributed much to the early days of radio. He was one of the first holders of a license to manufacture home radio under Armstrong patents. I recommend that you check back into Kennedy's life and you will find much that is important and interesting.

Colin Kennedy, when he died, was doing his stint for his country as an OPM engineer assigned as civilian advisor to the U. S. Army Signal Corps.

—*E. F. McDonald, jr.*
President, Zenith Radio Corporation

"STEADILY BETTER"

1007 College Ave., Houghton, Mich.

Editor, *QST:*

I wish to congratulate you on the latest issue of *QST*. I believe it is the best I have seen. As a matter of fact, since the war started, the magazine has grown steadily better. . . .

— *George V. Swenson, jr., W9HTD*

RELIEVING THE PRESSURE

1616 Pandora Ave., Westwood Hills, Calif.

Editor, *QST:*

Numerous silent hours spent during the past six months staring blankly at my rig and idly fondling the cold but well-worn grips of my bug has well-nigh filled me to the bursting point, like an over-inflated barrage balloon — a condition that has forced me to admit that one of the attractions of ham radio is that it permits one to talk about oneself at great length and without interruption. This is very nice stuff, which is hard to get anywhere else.

As a matter of fact, I can't think right now of any similar opportunity in normal life, where you can sit and drool for endless minutes about your equipment, the weather, what your young son just did to your slide rule or how many guys you worked last week, without stopping for breath, all to a complete stranger who is panting to get a word in edgewise. Can you? No, because there ain't no such. People would just quietly get up and slip away, looking over their shoulder to see if you were following them, if you tried it on the street or in the park.

It must be that all hams are noblemen at heart. I can't think of another reason. Of course, it works both ways, and we've all heard those longwinded QSOs in which obviously neither man is paying the slightest attention to what the other is saying and both end up happily ignorant of the fact. I guess we must all have the faith that moves mountains, or else we're sure the other fella just has to pay some attention to what we say so he will know when we are ready to hand him the shovel for awhile.

Break-in has eliminated a lot of this heart-warming stump speaking, but it is also breeding a generation of rude opportunists who can hardly wait until the drooler pauses momentarily to get the cramp out of his little finger, so they can bust right in and start shoveling, pretending they didn't know the other guy still had four paragraphs left to get out of his system. This is very hard on confirmed stumpers, and mainly results in everybody sending twice as fast as they normally would and with only half the spacing necessary, so no one will interrupt. Naturally hash is produced which even the sender has trouble copying in his monitor.

A sad state of affairs which seemingly admits of no solution. But, after being a confirmed died-in-the-wool stumper these 21 years, I think *QST* should set up a sort of "Lovelorn" column — a place where we waggle-tongues can blatt away as we please and "Beatrice Ohmwatt" can laugh at our drippy gags and tell us our letter is the longest from the *N*th district and how many African cards did we say we had?

Ah! *That* would relieve this pressure. . . .

— *Bill Lippman, W6SN*

OPERATING NEWS

JOHN HUNTOON, W1LVQ, Acting Communications Mgr. GEORGE HART, W1NJM, Asst. Coms. Mgr

Operating Procedure in WERS. The FCC has not set any specific operating procedure to be used in the War Emergency Radio Service. Its only official reference to the subject appears in the rules and regulations, Sec. 15.42 of which provides simply that stations must identify themselves by the call letters and unit numbers assigned to the transmitter at the beginning and end of each QSO.

It thereby becomes the duty of the licensee, who doubtless will leave the matter to his radio aide, to specify tactical procedure in opening and closing net drills and tests, forms for practice messages and air-raid warning signals, methods of keeping log, Q Signals and abbreviations to be used. The operating system will need to be simple and brief, yet accurate, effective and, above all, *rapid.* The operating style of early WERS nets will be largely responsible for the good or bad opinions formed by interested governmental agencies.

The radio aide thus has a tremendous responsibility in setting up his procedure rules. If not already experienced in radiotelephone net communications and message handling, we strongly recommend that he work out the problem in conference with a League 'Phone Activities or Route Manager, or SCM. We'll be glad to suggest such a person in your vicinity, if he wishes us to. A copy of *Operating an Amateur Radio Station* (free to members only) will provide excellent basic material, too. Remember: keep procedure brief, simple and high-speed!

Operating Jobs. Six months ago, as the United States swung into full war production, there was a great demand for engineers, mechanic-technicians, testers and aligners. As the weeks pass and more and more equipment is turned out by manufacturing plants, the demand for personnel to operate that gear becomes greater and greater — both in the military services and in essential civilian work. The ranks of high-speed operators, particularly, seem to have been depleted. ARRL's Personnel Bureau has gone through its entire list for one government agency in trying to locate a number of operators capable of copying perfectly 40 or more words per minute to typewriter, and willing to accept work on either coast at approximately their present civilian salary. If you qualify generally for this opening and are interested, please communicate with ARRL at once.

Let's Pull Together. Your operating staff wish to express our sincere thanks for the many letters of good wishes received, wishing godspeed to Communications Manager Handy in his new assignment and good luck to us while carrying on in his absence. Although only recently acquainted with our practical tasks, we shall do our best to keep things humming. In the administration of WERS and radio training matters we are counting heavily on your help to do a bang-up job for amateur radio's record, and from past experience we know it will be forthcoming. 73.

— *J. H.*

Hamfest Schedule

Sunday, August 2nd, at Bliss Pond, near East Montpelier, Vt. In lieu of the state convention usually held in October, a Vermont Hamfest will be held Sunday, August 2nd, at Bliss Pond, near East Montpelier, Vt. There will be fishing, boating, swimming, ARRL club awards and discussions. Bring a picnic lunch and the whole family. Registration 25¢. Write to Burt Dean, W1NLO, Box 81, Burlington, Vt., for details.

Sunday, August 23rd, at Detroit, Mich. The Detroit Amateur Radio Association is sponsoring a trip to Bob-Lo Island on August 23rd. All amateurs, their neighbors and friends are invited. The boat also sails from Toledo. There will be baseball, roller skating, games of various kinds and lots of fun for everybody. Tickets, 75¢ for adults and 35¢ for children, are available from any DARA member. Details from Ken Conroy, W8DYH, 18030 Waltham Ave., Detroit, Mich.

Radio Spy Sentenced

W. A. Schuler of San Francisco pleaded guilty on May 14th to the charge of transmitting information for a foreign government over a West Coast commercial press station at which he was an operator. The message he sent contained supposedly vital information on Pacific Coast defenses, and was given to him by an FBI agent who posed as an enemy alien. Schuler sent the information by shifting slightly the frequency of the transmitter he was operating to a nearby designated spot, on which he had previously made other unauthorized transmissions. He was to have received $75 payment from the foreign government for which he thought he was working.

The FCC on May 26th issued an order revoking for life Schuler's commercial operator license, as well as both his amateur station and operator's licenses. Three days later a Los Angeles Federal Court sentenced him to six years' imprisonment, an extremely light penalty in view of the magnitude of the offense.

Schuler utilized neither his amateur station (W6NYI) nor his former amateur operator privileges in committing his act, so there is no resultant black mark on amateur radio's record. But let this stand as another warning to hams to take extreme care in our conduct with respect to our government and its wartime regulations.

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 program of defense radio training are eligible for the Honor Roll. Those groups listed with an asterisk teach both code and theory; those listed with two asterisks teach theory only. Others conduct only code classes.

*American Women's Voluntary Services, New York, N. Y. (sponsored by YLRL)
Associated Amateur Radio Operators of Denver, Colo.
Baltimore (Md.) Amateur Radio Assn.
Bamberger Radio Classes, Newark, N. J.
The Bell Radio Amateurs, Denver, Colo.
Binghamton (N. Y.) Amateur Radio Assn.
Burlington (Vt.) Amateur Radio Club
*Canton (Ohio) Amateur Radio Club
Central New York Radio Club, Syracuse, N. Y.
Central Oregon Radio Klub, Bend, Ore.
*Chair City Radio Assn., Gardner, Mass.
Chicago (Ill.) Radio Traffic Assn.
*Delta Radio Club, New Orleans, La.
*Detroit (Mich.) Amateur Radio Assn.
*Dutchess County Sheriff's Emergency Radio Corps, Poughkeepsie, N. Y.
*Electric City Radio Club, Great Falls, Mont.
The Electron Club, Denver, Colo.
*Eugene (Ore.) Vocational School
**Faribault (Minn.) Amateur Radio Club
*Finger Lakes Transmitting Society, Auburn, N. Y.
*Five Towns Defense Council, Cedarhurst, L. I., N. Y.
Galveston (Tex.) Amateur Radio Club
Grand Coulee Dam R. C., Coulee Dam, Wash.
The Greater Little Rock (Ark.) Amateur R. C.
*Greenville (Mich.) Radio Club
*Indianapolis (Ind.) Radio Club
*Iowa-Illinois Amateur R. C., Burlington, Ia.
Laramie (Wyo.) Ham Club
The Married Men's Club, Denver, Colo.
*Mass. Committee on Public Safety, Boston, Mass.
*Massillon (Ohio) Amateur Radio Club
*Merrimac Valley A. R. C., Lawrence, Mass.
*Nashua (N. H.) Mike and Key Club
New Haven (Conn.) Amateur Radio Assn.
Northern Minn. A. R. A., Unit One, Bemidji, Minn.
**North Newark A. R. C., Nutley, N. J.
*Olympia (Wash.) Radio Club
Oracle Radio Club, Delphi, Ind.
*Piqua (Ohio) Radio Club
Purdue University R. C., West Lafayette, Ind.
Richmond (Ind.) Amateur Radio Assn.
St. Paul (Minn.) Radio Club
*San Joaquin County Amateur Radio Operators Assn., Stockton, Calif.
Shy-Wy Radio Club, Cheyenne, Wyo.
Tawas City (Mich.) Defense Code Class
Toledo (Ohio) Radio Club
Walnut Hills High School R. C., Cincinnati, Ohio
Western Md. Amateur R. C., Cumberland, Md.
*West Phila. Radio Assn., Phila., Pa.

Field Day Notes

Our beloved institution of Field Day is not dead. On Sunday, June 14th, war or no war, the United Radio Amateurs Club of Wilmington, Calif., held their annual Field Day; but instead of transmitters, all the equipment they needed was a few flashlights, batteries, lamp bulbs, and semaphore flags. They report that the lamp bulbs with slow heating filaments which were operated by batteries did not work so well over comparatively long distances because of the time required for the light to reach full intensity after the key was pressed. Flashlights were much better and the beam remarkably small, especially when confined in a narrow tube. Semaphore was used as a secondary means of communication, but they found it a lot of fun and intend devoting more attention to it.

W6QFL and W6QFH (at key) during URAC Field Day

All in all the Field Day was much enjoyed, and the club intends holding other similar outings during the summer months on an expanded scale. Those participating were W6s MDX, GST, QFL and QFH.

BRIEFS

During the epidemic of forest fires in New England in early May, the Providence Police Mobile Radio Patrol went into action with two heavy-duty transmitters and six portable rigs distributed throughout the fire area in Rhode Island, while still keeping their organization in Providence ready for immediate action in the event of an emergency there. By scattering their mobile units, the Patrol was in constant touch with the entire fire area.

W9IAW writes us that, due to lack of amateur operating activity, the "Ham Forum" program over the University of Illinois' station WILL has been discontinued for the duration, winding up seven years of continuous presentations. He says they will be back on again when it's all over and hams are active once more.

ARRL Affiliated Club Honor Roll

The list below was compiled by analysis of a questionnaire returned in response to a year-end club survey.

All members of these are ARRL Members:

Amateur Radio Transmitting Society, Louisville, Ky.
Associated Amateur Radio Operators of Denver, Denver, Colo.
Bell Radio Amateurs, Denver, Colo.
Butte-Anaconda Radio Club, Butte, Mont.
Chester Radio Club, Chester, Pa.
Chippewa QRR Club, Chippewa Falls, Wis.
Connecticut Brasspounders Association, Noroton, Conn.
Delaware Valley Radio Association, Trenton, N. J.
Dells Region Radio Club, Wisconsin Dells, Wis.
Detroit Amateur Radio Association, Detroit, Mich.
Garden City Radio Club, Garden City, L. I., N. Y.
High Frequency Communications Association, Rock Island, Ill.
Hi-Q Radio Club, Lynn, Mass.
Intercity Amateur Radio Club, Irvington, N. J.
Iowa-Illinois Amateur Radio Club, Burlington, Iowa.
M.A.K. Radio Club, Boston, Mass.
Manchester Radio Club, Manchester, Conn.
Mon-Yough Amateur's Transmitting Association, McKeesport, Pa.
Nashville Amateur Radio Club, Nashville, Tenn.
Northeast Nebraska Radio Club, Pender, Nebr.
The OhPeKah Club, Bartlesville, Okla.
Order of Brass Pounders, Chap. No. 3, Kansas City, Mo.
Original Tri-County Amateur Radio Association, Cranford, N. J.
Pierre Amateur Radio Club, Pierre, So. Dak.
Spokane Amateur Radio Association, Spokane, Wash.
York Amateur Radio Club, York, Pa.
York Road Radio Club, Glenside, Pa.

ELECTION NOTICES

To all A.R.R.L. 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 A.R.R.L. 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 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 of the dates specified.

Due to resignations in the Missouri, North Dakota, Arkansas, Wisconsin and Northern Texas Sections, nominating petitions are hereby solicited for the office of Section Communications Manager in these Sections, and the closing date for receipt of nominations at A.R.R.L. Headquarters is herewith specified as noon, Monday, August 17, 1942.

Section	*Closing Date*	*Present SCM*	*Present Term of Office Ends*
Alaska	Aug. 3, 1942	James G. Sherry	June 14, 1942
Santa Clara Valley	Aug. 3, 1942	Earl F. Sanderson	Aug. 15, 1942
W. Mass.	Aug. 3, 1942	William J. Barrett	Aug. 17, 1942
Ohio	Aug. 3, 1942	E. H. Gibbs	Aug. 17, 1942
S. Minn.	Aug. 3, 1942	Millard L. Bender	Aug. 22, 1942
Kentucky	Aug. 17, 1942	Darrell A. Downard	Apr. 15, 1940
Hawaii	Aug. 17, 1942	Francis T. Blatt	Feb. 28, 1941
New Mexico	Aug. 17, 1942	Dr. Hilton W. Gillett	Apr. 15, 1941
Sacramento Valley	Aug. 17, 1942	Vincent N. Feldhausen	June 15, 1941
Nevada	Aug. 17, 1942	Edward W. Heim	Nov. 1, 1941
Oklahoma	Aug. 17, 1942	R. W. Battern	Nov. 1, 1941
E. New York	Aug. 17, 1942	Robert E. Haight	Nov. 1, 1941
W. New York	Aug. 17, 1942	Fred Chichester	Dec. 6, 1941
S. Texas	Aug. 17, 1942	Horace E. Biddy	Dec. 23, 1941
Virginia	Aug. 17, 1942	Frank S. Anderson	May 27, 1942
Missouri	Aug. 17, 1942	Robert C. Morwood (resigned)	....
N. Dakota	Aug. 17, 1942	Don Beaudine (resigned)	....
Arkansas	Aug. 17, 1942	John R. Sanders (resigned)	....
Wisconsin	Aug. 17, 1942	Walter Wallace (resigned)	....
N. Texas	Aug. 17, 1942	George W. Smith (resigned)	....
New Hampshire	Aug. 17, 1942	Mrs. Dorothy W. Evans	Sept. 1, 1942
Western Penna.	Sept. 1, 1942	Elmer Krall	Sept. 20, 1942
Utah-Wyoming	Sept. 15, 1942	Henry L. Schroeder	Oct. 1, 1942
No. New Jersey	Oct. 1, 1942	Edward Gursky, Jr.	Oct. 15, 1942
Kansas	Oct. 15, 1942	A. B. Unruh	Oct. 29, 1942
Tennessee	Nov. 2, 1942	M. G. Hooper	Nov. 15, 1942
Oregon	Nov. 16, 1942	Carl Austin	Nov. 22, 1942
Georgia	Nov. 16, 1942	William U. Hanks	Nov. 29, 1942

1. You are hereby notified that an election for an A.R.R.L. 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 A.R.R.L. members residing in the Sections concerned. Ballots will be mailed to 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 A.R.R.L. members residing in any Section have the privilege of nominating any member of the League as candidate for Section Manager. The following form for nomination is suggested:

(Place and date)

Communications Manager, A.R.R.L.
38 La Salle Road, West Hartford, Conn.

We, the undersigned members of the A.R.R.L. 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 A.R.R.L. members are required.)

The candidates and five or more signers *must* be League 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 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.

—*John Huntoon, 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.

South Dakota	P. H. Schultz, W9QVY	May 18, 1942
Alabama	Lawrence Smyth, W4GBV	May 22, 1942
Iowa	Arthur E. Rydberg, W9AED	May 26, 1942
Montana	R. Rex Roberts, W7CPY	June 1, 1942
Arizona	Douglas Aitken, W6RWW	June 15, 1942
Los Angeles	H. F. Wood, W6QVV	July 1, 1942

CORRECTION, JULY EC LIST

The list of coastal state ECs in July *QST*, as well as that in this issue, is by towns of residence. Some Coördinators have regional appointments for areas other than residence, but space did not allow complete data on each EC's territory.

There have been some new EC appointments in the New York City area, and Regional EC Vincent T. Kenney, W2BGO, 3330 Fenton Ave., Bronx, states the present roster is as follows: *Queens County:* Reeve Strock, W2GTZ, 178-15 Henley Rd., Jamaica; *Brooklyn:* M. A. McIntire, W2BO, 1127 Glenwood Rd.; *Manhattan:* Bert Kavanaugh, W2MCZ, 516 West 136th St.; *Bronx:* Carl Lomupo, W2DZH, 1017 Hoe Ave.

SCM Fraser of Connecticut points out that Henry Appleblad, P.O. Box 763, New London, is EC for Niantic and Waterford; Frederick Horner, 119 New London Road, Mystic, is EC for Noank; Gil Williams, P.O. Box 473-D, Bridgeport, is EC for Bridgeport, Stratford, Trumbull and Nichols as well.

Register With Your Coördinator

Last issue we listed the Emergency Coordinators in coastal states for the benefit of at-home amateurs who wished to join a local effort to establish a War Emergency Radio Service unit. There follows a list of Coördinators in the remaining sections of the country.

We repeat that in most communities there are hardly sufficient amateurs to carry out the operating work, and your services will be badly needed. Go on record with your EC *to-day* as being available to serve in defense of your town.

ALASKA

Fairbanks: L. F. Joy

ARIZONA

Ajo: Ed Powell
Buckeye: John L. Ashe, Box 1073
Chandler: Charles L. Wheeler, Box 159
Duncan: Albert E. Hamilton
Estrella: James T. Carter
Holbrook: D. W. Guttery
Jerome: Richard E. Lawrence
Kayenta: B. S. Hyde
Mesa: W. H. Hafford, 236 N. Robson
Nogales: Gladden Elliott, 218 Loma St.
Phoenix: Aaron Holcomb, Rt. 4, Box 606E
Prescott: Douglas Aitken, 341 S. Mt. Vernon St.
Safford: H. F. Hudson
Springerville: Arthur M. Gardner
Tucson: T. M. Elliott, 418 N. Fourth Ave.
Winslow: Gilbert L. Lawrence, 302 E. Third St.
Yuma: Leavenworth Wheeler, 675 Seventh Ave.

ARKANSAS

Fort Smith: Marshall B. Riggs, 805 South 14th
Jonesboro: Dan J. McGuire, 915 Huntington

COLORADO

Boulder: Kenneth F. Smith, 764 14th St.
Brighton: B. M. Weakland, 112 S. Sixth St.
Colorado Springs: LeRoy F. Austin, 308 Cheyenne Blvd.
Craig: J. W. McDonald, c/o District Court
Denver: Frank A. Swanlund, 1634 S. Ogden St.
Englewood: Walter M. Reed, 1355 E. Amherst Ave.
Estes Park: Franklin K. Matejka, Box 212
Fort Collins: Burt J. Bittner, 635 S. Lomis St.
Gunnison: Chas. W. Duree, 307 E. Virginia Ave.
Julesburg: L. A. Munson, 323 W. Third St.
La Junta: Lewis A. Shell, RR 1
Lamar: Elton Dimmitt, 503 E. Elm St.
Longmont: Robert H. Moore, 841 Brass
Paoli: Albert P. Smith
Pueblo: Henry L. Cook, 611½ E. Seventh St.
Charley A. Page, 1237 Van Buren
Sterling: Leo Rieder, 124 State St.
Towner: Orval Cunningham
Trinidad: Robert H. Oberman, 1303 San Pedro St.
Uravan: Robert Burton
Vernon: Carl F. Williams
Walsenburg: E. C. Richards, 511 Kansas Ave.
Wray: Arthur E. Weber, 136 E. Fifth St.

IDAHO

Blackfoot: Wm. C. Dunn, 292 S. Fisher Ave.
Boise: Donald Oberbillig, P. O. Box 486
Harold C. Williams, Rt. 3
Bonners Ferry: H. C. Buroker, Box 192
Buhl: Milton R. Parsons, 1230 Birch St.
Firth: Leo W. Gushwa, Box 42
Franklin: Stanley Atkinson
Gooding: George W. Weeks, P. O. Box 384
Grangeville: H. H. Hendron, 208 S. A St.
Idaho Falls: Holland R. Day, 309 N. Placer Ave.
Lewiston: Harley E. Steiner, 1011 15th St.
Rupert: Louis W. Dspain, Box 105
O. A. Moellmer, 818 Tenth St.
St. Maries: O. O. Russell, Box 166
Sandpoint: Pat Callahan, 525 N. Boyer
Shoshone: Donald T. Hansen
Soda Springs: Paul Tipton, Jr.
Stibnite: A. V. Dunkle
Weiser: Ralph M. Hinshaw, Box 294

ILLINOIS

Alton: Harold Jansen, 3519 California Ave.
Aurora: Julian M. Munyon, 702 N. View St.
Bartonville: John Roelfs, 6016 Garfield Ave.
Bloomington: Harry M. Matthews, 1007 E. Front St.
Browning: Francis Walton
Canton: R. L. Wiles, 402 N. Ave. A
Champaign: James G. Lehmer, 804 W. Daniel St.
Chicago: R. J. Higgins, 7446 Oglesby Ave.
Danville: Dr. Lloyd C. Elledge, V. A. Facility
Decatur: Ken Harding, 440 S. 22nd St.
Dixon: Dr. J. L. Tavenner, City Nat'l Bank Bldg.
East St. Louis: Raymond C. Schmidt, 648 N. 31st St.
Freeport: Allen H. Janssen, 720 S. McKinley Ave.
Galesburg: Charles R. Miller, 1218 N. Academy St.
Gibson City: T. C. McCall, 926 N. Lott
Granite City: James H. Adamson, c/o F. W. Woolworth Co.
Hillsboro: Paul J. Warrick, 103 Welch St.
Jerseyville: Edwin M. Porter
Kankakee: Edward P. Drolet, 167 S. Wildwood Ave.
Lawrenceville: Ivan B. Mayfield, 1408 Ninth St.
Lincoln: Kenneth E. Fuller, Fuller Seed Co.
Lockport: Ira F. Coon, 528 E. Fourth St.
Macomb: G. L. Barrett, 1025 E. Jackson St.
Marion: T. N. Cofer, 501 Future St.
Oregon: W. E. Marriner, 1104 S. Third St.
Riverside: George Ashton, 273 Shenstone Rd.
Rock Falls: George M. Billeaux, 205 Seventh Ave.
Rock Island: Franklin F. Wingard, Suite 215, Safety Bldg
Rockford: Eugene A. Hubbell, 2511 Burrmont Rd.
Shelbyville: Marion Spracklen, 2304 N. Charles
Springfield: Larry Barregarye, 2634 S. Seventh St.
Stockton: Hubert Williams, 122½ S. Main
Utica: George Keith, Jr., RFD 2, Box 22A
Villa Park: George Dammann, 15 S. Michigan Ave.
Woodstock: Bruce E. Steinke, 365 Hayward St.

INDIANA

Adams: Stanton E. Kirk, Box 122
Albion: Donald M. Barcus
Anderson: H. Gordon Gwinn, 935 W. 21st St.
Arcadia: Edward Nightenhelser
Attica: Robert W. Scribner, 500 E. Main St.
Auburn: Howard J. Clark, 208 E. Seventh St.
Bedford: Carl J. Finger, 1016 16th St.
Bicknell: Murlin D. Hoover, 708 N. Main St.
Bloomington: Thomas Wonnell, 311 S. Park St.
Columbia City: Phil E. Lemmon, 117 N. Oak St.
Columbus: Murray P. McKee, 1617 Meridian St.
Crawfordsville: Lee C. Doyel, 107 W. Market St.
Culver: Harold M. Baker, Culver Military Academy
Delphi: Harold A. Rees, 316 E. Madison St.
DeMotte: Ivan Cheever
Elkhart: Julian P. Gilliam, 422 Goshen Ave.
Fort Wayne: Raymond Eversole, 2602 Weisser Park Ave.
Francesville: Herbert C. Ames
Franklin: Wilmer Earl Broadus, 50 W. Julia St.
Gary: Herbert S. Brier, 385 Johnson St.
Gas City: Nestle Lines, 1012 S. Fourth St.
Goshen: Robert Hawk, 619 W. Lincoln Ave.
Greencastle: Maynard Tuttle, 315 E. Hanna St.
Greenfield: Kenneth F. Clark, 222 N. School St.
Griffin: Russell M. Price
Hammond: Robert Muffett, 1152 Indiana St.
Hartford City: Richard B. Haynes, 300 E. Conger St.
Hobart: Elmer Ballantyne, 829 Lake St.
Indianapolis: Nelson B. Trusler, 422 N. Randolph St.
LeRoy T. Waggoner, 1721 Winton St. Speedway

Jeffersonville: Chas. Jenney, 625 Main St.
Kendalville: George C. Sucher, 334 S. Summit St.
Knox: Jack C. Andrews, 418 S. Pearl St.
Kokomo: Everett K. Doud, 2221 N. Bell St.
LaFayette: O. L. Agnew, c/o Central Y.M.C.A.
LaPorte: Harold L. Brooks, 719½ Madison St.
Linton: Grover S. Dale, RR 1
Logansport: Glenn D. Obenchain, 2906 N. Pennsylvania Ave.
Marion: Lloyd V. Smith, 4524 S. Wigger St.
Michigan City: Charles J. Baldwin, 1106 E. Second St.
Mishawaka: Paul Metzner, 524 E. Third St.
Morristown: Wilbur L. Keaton, RFD 1
Mount Vernon: Kermit Seifert, 428 West 8th St.
Muncie: Herbert L. Green, 1227 West 17th St.
Vard A. Skinner, 317 Janney Ave.
Nappanee: Herbert Stamats, 752 E. Marion St.
New Albany: George L. Russell, Jr., 408 E. Spring St.
Newcastle: Albert Thompson, RR 1
North Vernon: Rev. Joseph A. Terstegge, RR 1
Pendleton: Otis O. Armstrong, 470 E. State St.
Rensselaer: Paul Goldsberry, RR 2
Richmond: Richard Maddox, 218 S. Third St.
St. Paul: Ernest Greeson
South Bend: LaRue H. Wirt, 1709 Leer St.
Sullivan: Kenneth P. Katterheinrich, 103½ W. Jackson
Terre Haute: Dr. A. W. Campbell, 1504 S. Center St.
Valparaiso: Andrew A. Collins, RR 1
Warsaw: William N. Long, 416 Pike St.
Washington: Marion F. Palmer

IOWA

Adel: J. A. Karr, 806 Rapids St.
Alton: Otto L. Luhring
Belle Plaine: C. E. Leonard
Boone: J. R. Crouch, 1023 W. Fourth St.
Burlington: George R. Goetz, 514 Franklin
Cedar Falls: Robert E. Blair, 623 W. Eighth St.
Cedar Rapids: Kenneth W. Reid, 1295 Elmhurst Drive, N. E.
Clinton: Jas. E. Reynolds, 2607 Pershing Blvd.
Council Bluffs: C. C. Cummings, 2623 Ave. B
Davenport: J. R. Schricker, 2417 Western Ave.
Des Moines: Leo D. Sparhawk, 407 Eighth St.
Dubuque: Donald Bussan, 1027 Central Ave.
Farmington: Donald F. Campbell
Fort Dodge: Vern L. Petersen, 1304 Ave. C
Garnavillo: Elmer J. Kregel, RFD 1
Keokuk: G. G. Bartholomew, 815 N. 12th
Lamoni: G. Stew Wight
La Porte City: George F. Abel
Lincoln: A. J. Ploog
Manilla: C. A. Conklin
Maquokata: Harold C. Wolmutt, 414 W. Platt
Mount Auburn: Vern L. Peterson
Mount Pleasant: R. J. Caldwell
Muscatine: Lee L. McKee, 926 Fuller St.
New Hampton: Frank D. Buchanan, 15 S. Water St.
Newton: Merritt A. Albee, Jr., 514 E. 11th St., S.
Ottumwa: Dave Carpenter, Box 202
Pilot Mound: Cecil L. Cline
Prairie City: T. J. Innis
Rolfe: Gerald L. Thompson
Sioux City: Carleton C. Boe, 2121 S. Helen St.
Spencer: Walter Geeting
Waterloo: Earl R. Word, 1022 Grant Ave.
Waukon: G. E. Schultz
West Liberty: E. J. Hoover

KANSAS

Atchison: Fr. Romuald Fox, OSB, 2nd and Division sts.
Beloit: Earl H. Beardmore, 621 E. Third St.
Coffeyville: John E. Morrow, 1104 W. Tenth
Dodge City: Wm. H. Balderston, 1303 Fifth Ave.
Emporia: Otto Kramer, 1312 Center St.
Fort Scott: Gene Swafford, 815 Crawford St.
Great Bend: Charles Larkin, 1216 Jefferson Ave.
Hays: Rufus Evans, 417 E. 17th
Jetmore: Lyndall Hubbell
Lawrence: Oscar H. Baker, 1824 Barker Ave.
Leavenworth: Ferris L. Taylor, 702 S. Fifth St.
Lyond: Millard H. Clary
Manhattan: W. G. Schrenk, 1528 Pierre St.
Marysville: Ernest R. Wolff, 508 Ralston
Neodesha: Louis Hay, 723 N. Eighth St.
Norton: Wm. M. Lathrop, 315 N. State
Olathe: Marshall H. Ensor
Parsons: M. G. Hoefle, 1706 Clark Ave.
Pratt: A. L. Leatherman
Topeka: Earl N. Johnston, 624 Roosevelt
Wichita: Glen Chambers, 1015 Lula
Winfield: L. P. Halloway, 1817 Millington

KENTUCKY

Ashland: E. G. Leachman, P. O. Box 406
Georgetown: Wm. S. Carley, RFD 1
Greenville: Frank Hunter
Lexington: Jim Boles, 622 Orchard Ave.
Louisville: J. B. Wathen, 3rd, Mocking Bird Valley
Ludlow: Al Barnes, 9 Euclid Ave.
Marion: Evers Mick, 303 W. Elm St.
Winchester: O. G. Wagner, 369 Crescent Ave.

MICHIGAN

Dearborn: Lewis H. Schmidt, 5051 Steadman
Detroit: Kenneth F. Conroy, 18030 Waltham Ave.
Donald L. Raleigh, 1587 LeJeune Ave., Lincoln Park
Ellwood Ryan, 18485 Steel Ave.
Charles A. Wise, 18325 VanDyke Ave.
Flint: Roy E. Godfrey, 117 Bruce St.
Grosse Pointe Park: Paul J. Palmer, 868 Whittier Blvd.
Higgins Lake: Orson B. Slocum
Jackson: Wallace H. Slocum, 1610 Maguire St.
Kalamazoo: C. V. Patterson, 1761 Chevy Chase Blvd.
Lansing: Paul Bauerle, 2008 N. East St.
Mt. Clemens: Louis B. Lang, 25 Pine St.
Muskegon Heights: Lyle F. Shaw, 1413 Jefferson St.
Owosso: Charles R. Grace, 816 E. Main St.
Pontiac: Frank D. Torrey, 9 Oriole
Turner: Paul N. Edmonds, Rt. 2

MINNESOTA

Bemidji: Armond Brattland
Coleraine: Ray Sterle
Crookston: Warren Wollery, 105 Fifth Ave., N.
Donnelly: Rubin Overson
Duluth: Carl W. Johnson, 1017 E. Fifth St.
Fergus Falls: Julian Krause, Rt. 4
Glenwood: W. C. Soderlund
Grand Marais: Dr. W. R. Smith
Kensington: Edwin Wicklund, Rt. 3
Lake City: Howard Kreger
Moorhead: Herb Parmeter, 418 N. Tenth St.
St. Paul: James Godward, 694 Hague Ave.
Robert Harshberger, 1050 Franzeier
Wheaton: Larry Hakanson
Willmar: Tom E. Davis, 915 W. Becker Ave.

MISSOURI

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Buffalo: J. E. Lovan
Clinton: M. W. Clark, 508 E. Bodine
Columbia: R. G. Semple, 108 McBaine
Crystal City: E. L. Roth, 115 Maple St.
Fair Grove: Eugene Leach
Kansas City: Herbert C. Heyde, 4324 Paseo Blvd.
Marionville: E. D. Muhleman, 401 S. Center St.
Miller: Gray W. Holmes
Monett: Chad Cowherd, 915 Fourth St.
Parma: Wm. B. Sharp
St. Louis: Henry J. Eschrich, 3524 Gravois
Sedalia: George Curnutt, 312 S. Smeed
Smithville: Arnold I. Johnson
Springfield: Russell L. Wilcox, 1008 E. National
Webb City: Leon E. Harbaugh, 719 S. Madison

MONTANA

Anaconda: George H. Whitfield, Box 397
Billings: R. T. Behrendt, 211 N. 26th St.
Butte: William I. Whipple, 2028 California Ave.
Deer Lodge: W. B. McElhiney, 811 Milwaukee Ave.
Great Falls: Ray A. Fretz, 1405 Second Ave., N.
Helena: Fred A. Jeswine, 519 Knight St.
Melville: Alan R. Eurich, Box 227

NEBRASKA

Craig (Mo.): Elmer A. Allan
Ceresco: Darold Miller
Gothenburg: Marvin Olson
Hastings: Garold C. Bennett, 214 E. Second St.
Potter: Dean W. Hagemeister

NEVADA

Reno: Emerson J. Wilson, 1102 Codel Way

NORTH DAKOTA

Williston: Anton C. Theodos, 923 Seventh Ave., W.

NORTHERN TEXAS

Abilene: H. S. Peake, 1529 N. 12th St.
Amarillo: James B. Redfearn, 3501 Jackson St.
Big Spring: H. A. Howell, Jr., 710 Goliad St.
Dallas: J. T. Moore, 5712 Berkshire Lane
Fort Worth: Wm. Wade Powell, 61 Westover Ter.
Plainview: Everett Lee Dye, Jr., M.D., 411 Beech St.

OHIO

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Athens: D. B. Green, 5 Arden Pl.
Bellefontaine: F. B. Webster, 641 N. Madriver St.
Canton: E. R. Roderick, 323 Dunn Ave., N. W.
Chillicothe: C. W. D. Hall, 728 E. Main St.
Columbus: Rod Meaney, 3002 N. High St.
Coshocton: C. Lynn White, 353 McClain Ave.
Dayton: D. C. McCoy, RR 7
Elyria: M. L. Brown, 120 Middle Ave.
Findlay: Merle Reamsnyder, 721 Crystal Ave.
Fostoria: Floyd J. Kinnaman, 435 W. Fremont St.
Ironton: J. P. Thomas, 216 S. Seventh St.
Lakewood: John A. Kiener, 1479 Rockway Ave.
Lima: Jas. C. Lisk, 902 S. Elizabeth St.
Marietta: C. J. Anderson, 418 Third St.
Medina: Karl G. Rau, 507 N. Broadway
Middletown: C. C. Whitehead, 715 15th Ave.
Newark: Chas. N. Moore, 67 S. Hazelwood Ave.
Piqua: E. W. Lape, The E. W. Lape Store
Portsmouth: Chas. K. Walker, 1713 Poplar St.
Salem: F. R. Mathews, 970 Homewood Ave.
Sharonville: Elmer Rahmes, WFD 1
Springfield: C. E. Prugh, 1992 Kenton St.
Toledo: H. C. Jarvis, 350 Richardson Drive
Urbana: M. A. Griswold, 702 W. Main St.
Wapakoneta: Gladys C. E. Nichols, 203 S. Wood St.
Wooster: John E. Wile, 725 Stibbs St.
Youngstown: Henry J. Hamm, 204 Clarencedale Ave.
Zanesville: Harold C. Ramsey, Bethesda Hospital

OKLAHOMA

Bartlesville: Ira Simmons, 130 N. Santa Fe
Enid: Russell W. Battern, Box 293
Oklahoma City: Harold Hartman, 1620 W. Tenth
Ponca City: N. B. Drake, 608 W. Otoe St.
Tulsa: Harold E. Davis, 439 S. Troost Ave.
Edward T. W. Hall, 518½ S. Elwood

SOUTH DAKOTA

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Alcester: Melvin Johnson, Rt. 2
Chamberlain: Earl Biskeborn
Eagle Butte: Jerome E. Payne
Hot Springs: Grover C. Caylor
Huron: Charles G. Atkinson, 1242 Dakota St.
Kaylor: Wilbur Simantel
Lead: Robert Wagner, 107 S. Galena St.
Milbank: Robert D. Jones, Jr., 312 Fourth St.
Arthur W. Lundeen, 513 Grant St., S.
Mobridge: M. C. Mack
Platte: Lawrence L. Simmons, Box 421
Philip: A. L. Russell
Pierre: Ted F. Anderson, 915 E. Sioux
Phil H. Schultz, 118 N. Yankton Ave.
Rapid City: Wallace Koppman, 1025 St. Cloud St.
Redfield: Carl G. Strauss, 130 Second St., E.
Sioux Falls: Harold K. Lindseth, 708 S. Dakota St.
Watertown: Orval P. Hanson, 220 Fifth Ave., S. W.
Wessington Springs: Damon Nuckols, c/o Dakota Central Tel. Co.

TENNESSEE

Chattanooga: Ward Buhrman, Overlook Drive
Clarksville: Joseph Moran, 119 N. First St.
Cleveland: W. D. Stuart, 215 31st St.
Jonesboro: Wright L. Hoss, Box 157
Kingsport: Lee G. Davy, 1604 Pinola Ave.
Knoxville: John C. Carter, Jr., 1001 Irwin St.
Maryville: Baxter E. Whitehead, Mynders St.
Memphis: Harvey B. Conover, 739 Looney Ave.
Nashville: Homer N. Smith, 1006 Petway Ave.
Norris: Robert R. Ralston, 85 Orchard Rd.
Paris: W. H. Carter
Pickwick Dam: Edmund W. Wilkins
Ripley: Taylor B. Rice
Sewanee: Douglas L. Vaughan, Jr.
Springfield: Don Payne, Walnut St.
Union City: W. B. Crenshaw, 1101 E. Main St.

UTAH

Ogden: Leland E. Weaver, 956 23rd St.
Salt Lake City: Raymond Fehr, 1912 Yalecrest Ave.

VERMONT

Bellows Falls: Charles S. Doe
Brattleboro: Val Morehouse, 27 Grove St.
Burlington: Burtis W. Dean
St. Johnsbury: Collins Farr, 12 Duke St.
Waitsfield: Donald Clark

WEST VIRGINIA

Clarksburg: Lyle E. Bates, 1328 Adams Ave.
Fairmont: Donald B. Morris, 208 Chicago St.
Huntington: Norman H. Shoup, 632 First St.
Kincaid: R. H. Kincaid
Logan: Bruce Glycadgis, High St.
Morgantown: C. B. Seibert, 519 Jefferson St.
Oak Hill: R. B. Ingram, Box 712
Princeton: Owens A. Hutcheson, Box 587
Wellsburg: William Mewha
Wheeling: C. S. Hoffman, Jr., 47 Lynwood Ave.

WISCONSIN

Ashland: W. J. Lott, 414 Third St., E.
Chippewa Falls: Roy W. Bushland, 1034 Warren
Green Bay: Paul Kehl, 1581 Kimball St.
Kenosha: Anthony T. Maruca, 2710-70th St.
Kohler: Chester C. Shepard, 402 Summit Rd.
LaCrosse: John Dilworth, 2001 Prospect St.
Madison: Ted Kennedy, Sunset Village
Milwaukee: Wendell S. Ciganek, 1723 W. Fond du Lac Ave.
Racine: George Porter, 933 W. Lawn Ave.
Superior: Thomas Wendt, 1210 16th St.
Wausau: Elwyn Dunst, 328 N. Fourth
Wisconsin Dells: L. A. Russel, 731 Church St.

WYOMING

Basin: H. C. Avery
Casper: J. B. Reasoner, 1117 S. Oak St.
Cheyenne: Charles Powles, 2820 Dillon Ave.
Douglas: Jerry Hay, 432 N. Third St.
Fort Laramie: L. H. Hendrickson, Box 247
Gillette: Eddie Pacot
Jackson: Everett E. Young, Rainbow Theatre
Newcastle: Harold M. Roberts
Rock Springs: J. S. Duffy, 938 D St.
Sheridan: Frank A. Speakerworth, 1012 N. Gould St.

Any engineer designing a fine piece of equipment has a strong temptation to use a special part whenever standard items do not fit his conception. This is far from being a fault, especially when the designer weighs his requirements carefully. A majority of the parts in the HRO were special at the time it was designed, with good reason. They were special because standard parts were not good enough.

We are always glad to make any improvements in our products that customers can suggest, of course. Whenever it is practical to do so, we are also very willing to make modifications of standard parts to meet special requirements. Often a dimensional change must be made, but it should be made only as a last resort.

We recently checked up on a single small item, the TX-10 Flexible Coupling. We found that we were making no less than 16 different models. Some users wanted 6 x 32 set screws, but others required 8 x 32. The set screws were located at all sorts of different positions. And so on. This resulted in endless delay and wasted effort. Often we had to choose between making the parts by hand with a prodigal use of skilled labor, or else delaying delivery for six months. More often, we had no choice about the delay.

This problem became so burdensome that we approached all of the "special" customers. Most of them found that the changes were not necessary, and promptly agreed to use the standard model. At present we are making only two special TX-10's in addition to the standard one.

Probably a majority of today's radio designers read *QST*, so we are using this page to ask them — you — to give manufacturers a break. We do not want you to compromise the performance of your design, but we do wish that you would make every effort to avoid placing the extra burden of special parts on a plant that is strained to the utmost in producing war-essential products. Thanks, and we'll do the same!

Gene Simms

Experimenter's Section

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on the frequencies above 300 Mc. in the past. Most fellows who have been active in this sort of work have been interested in it for the work itself, rather than for any intention of using the gear for any communication purpose. This sort of thing may well go on with interest in the field now extended to include more of us. And don't forget that there are *three* u.h.f. bands open to use under the WERS plan. Gear which gives promise of reliable performance may well be pressed into service for short-range work, leaving much-needed channels in the 112-Mc. band free for longer and more difficult hops. — *W1HDQ.*

QST Visits Noroton

(*Continued from page 44*)

quiet Connecticut community well inside Long Island Sound, he and his classmates are lined up on the platform and marched in formation up the road to the training station. After a short march up the tree-lined highway to Noroton Heights they sight the iron fence surrounding the station as it sprawls in mellow red-bricked ease on its broad hilltop.

The vine-covered buildings of the veterans' home, ranged around three sides of a grassy central park the size of a city block, remind one now of the campus of a venerable land-grant college. The earth where the old soldiers once had their spitting contests is now trod by earnest young sailors and studious blueclad ensigns, invariably seen with books and papers in hand.

Into the station the new class marches in a smooth column to the rhythmic "*hup — hup*" of the chief petty officer in charge. Before their arrival the number of vacancies left by the outgoing class had been listed, and the newcomers are assigned the empty places in wardroom and class by rotation. Then they are marched off to the staff doctor for a physical checkup.

By this time it is probably late afternoon and nearing the end of the school day, and so the newcomers are dismissed and left to the perennial Navy process of getting acquainted at the new station.

The morning of the second day the new recruits are assembled by the officer in charge of instruction. He greets them and gives them a questionnaire to be filled out showing their schooling in great detail, together with any other occupational data of possible interest — including amateur and professional radio experience, of course. This over with, back to the company organization they go.

The school is organized into companies of approximately fifty men for administrative purposes, and the new recruits are divided among the several companies. Each company is under a chief petty officer — a seasoned veteran of the service, usually recalled from a well-earned retirement reached after years of active sea duty.

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These company commanders — some of them with six or seven hashmarks decorating their sleeves — are carefully selected for their long experience in the Navy and their ability to handle men. Their job is to make the boys think and act the Navy way — to inculcate Navy ideas, viewpoint and philosophy. The company commander takes each young recruit and goes over his bag, making a record of the clothing and equipment, and assigns him his bunk. Then he starts right in with his job of teaching what the Navy is and does and how it acts.

The next items on the new recruit's program are lectures by the chaplain and the doctor on matters of health and personal behavior, with sex and hygiene being given honest, man-to-man consideration. He learns about the dispensary and the sick-bay — a complete small hospital of 20 beds. He gets acquainted with the dental officer who will keep his teeth in shape.

And then he starts right in to go to school. Instruction classes begin, and from then on the boot is a part of the system — following the rigid, disciplined routine of the school.

Each day falls into the same pattern. The students are awakened at 6:00 A.M. and given an hour and a half to bathe, dress and set their quarters to rights. This leaves a few minutes leisure before breakfast at 7:30.

At 8:00 A.M. the entire school falls in for colors, played over the p.a. system as befits a school teaching radio and electronics. The 600 or so officers and men on the station are drawn up in regimental formation, in three battalions. Following the raising of the colors and the playing of the national anthem they are given setting-up exercises for a 20-minute period, directed by three chief specialists who are graduates of Lt.-Commander Gene Tunney's famous school.

Classes begin at 8:30 and continue until 11:45. Each class is an hour long, with 5-minute intervals between. The students pile out of the building pell-mell — especially after the 11:45 session — but pull up short, form orderly columns and march off to the next class in regular formation.

Dinner is from 12:00 to 1:00, and then classes resume with four periods until 4:15. From 4:15 to 5:00 everyone on the station engages in compulsory athletics. Each battalion is assigned a field and there they go to it, with one of the three chief specialists in charge. The boys can choose their sport — softball, archery, horseshoe pitching are among the most popular — but one game or another they must play.

Five o'clock brings freedom — freedom of the station, that is. No leaves off the station are given during the week. The boys go down to the canteen for ice cream or soda or just to sit around taking it easy and chewing the rag until supper at 6:00 P.M. After supper they are again free to do as they please — play ball, read, write letters, or even study! The fact is that a good many of them do study. For some, extra study is compulsory; special classes are held from 7 to 9 P.M. for those having difficulty in keeping up. But with most it

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is voluntary. Special 7 to 9 classes are also held for those who want to take advanced instruction on a voluntary basis.

So it goes through the week from Monday through Saturday noon. Leaves are granted only over the week-end, from 11:30 Saturday morning until 9:30 Sunday night. All other times the men stay on the station. On Sundays religious services are held in the chapel. The recruit can attend either Protestant or Catholic services as he wishes, but attendance is not compulsory. On Tuesday and Thursday evenings movies are shown in the mess hall, usually together with some form of stage entertainment.

This is the routine that has been followed by thousands of young Americans for the prescribed four-month training period. They have gone forth from the school as trained radiomen, filled with Navy lore and spirit, and they have distinguished themselves and their school by their performance — at shore stations, in the air, on active duty at sea. There were Noroton men at Pearl Harbor — and probably in the Coral Sea and off Midway, too.

And when, at the end of four months, our young recruit has finished the course, he, too, will follow in their footsteps. If he works hard he stands a good chance of emerging a petty officer — radioman third class. At first all students completing the course automatically received that rating, but now it is given only to those with honor-roll marks — the fellows who have displayed better than average ability.

Of course, not every boot who comes to Noroton turns out to be a crack radioman. About 25% fail to make the grade. In some cases this is because of the lack of a genuine interest or aptitude for radio; in others it is the result of personal problems that handicap the student's performance.

Not every youngster has the aptitude to become a naval radio operator, of course. "The Good Lord made our brains along different lines," Captain Baggaley told us over the 4 P.M. coffee that stamped him as an old destroyer man. "Some of us just can't learn radio. We might make good cooks, or engineers, or even deck hands — but we can't learn radio operating."

The instructors have developed an uncanny knack of being able to pick out this kind of lad almost from the first moment they see him as a boot. It's something in the way he walks or talks — or even stands in repose. His reaction time, as demonstrated by his ability at athletics, enters into it, too. There are no single conclusive symptoms, but from intensified experience the instructors can tell which men will probably make better technicians or repairmen than operators.

Even some of the lads endowed with native aptitude have trouble, though. In these cases the difficulty is usually traceable to personal or domestic difficulties. The Noroton curriculum represents a highly-concentrated four-month course, and the student must be in there trying

Where Is Shangri-La?

Where is this place called Shangri-La
From which our heroes flew
To hurl down bombs on Tokyo
And other Jap towns too?
Where is this mythic airplane base
That's not on any maps,
Where Yankee fliers started off
To take war to the Japs?

This Shangri-La's a coral isle,
Hid in the far-out sea,
It is a factory in Detroit,
A camp in Tennessee;
It is a motor shop in Flint,
It is the workmen's chant
As Caterpillars grow from steel
In East Peoria's plant;
It is the Corpus Christi base,
A shell plant in Mobile,
A shop where old men help to make
War items out of steel;
It is the lonely night-watch there
In Sitka, and in Nome,
It is a soldier's mother's heart
Lonely, but brave, at home;
It is a Tazewell county farm,
A ranch in Idaho,
A victory garden in your yard,
A branch of the U. S. O.;
It is the Coast Guards and Marines,
Infantry, welders, cooks,
Cavalry units riding jeeps,
Students studying books;
It is the privates in the ranks,
Men who would learn to fly,
Corporal Karl Polarski, too,
Sergeants Schmidt and Bligh;
It is the management in plants
Where the war stuffs are made,
It is the man in overalls,
Skilled at an expert's trade;
It is the schools both here and there,
Churches, Y. M. C. A.'s,
Men at machines in tiny shops,
Girls who are running lathes;
It is a spot behind the lines,
A seaman 'board his craft,
The leaders up in Washington,
A lost man on his raft;
It is the man from Tuskegee,
And he who went to Yale,
The man brought up across the tracks,
The man who reads in Braille;
The man who lives in Bigtown, and
The one from Homeburg town,
The folks who're dark, or white, or red,
Or yellow, black or brown;
It is the giant warship as
It plows the waters deep,
The parents carrying on at home,
They, too, long vigils keep;
It is the lad who saves his dimes,
To buy more Victory Stamps,
The man who wheels big loads of shells
Up on the loading ramps.

Yes, Shangri-La, that mythic place,
Where airmen started out
To bomb Japan with all their might
Is not a place of doubt;
For it is here quite close to home,
And it is way off far —
It's every place in the wide, wide world
Where U. S. Patriots are!

By C. H. (Chi) Gamble. Reprinted courtesy Peoria Star Company

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all the time to make it. A fellow distracted with family problems just isn't able to give the course the concentration it demands.

Individual Attention to Student Problems

And so the educational department makes a special study of each case where the student lags behind. If they don't come up with the answer the chaplain, the doctor and — if necessary — Capt. Baggaley himself goes into it. If the student is having trouble at home, or there is something amiss with his personal affairs, they try to help straighten matters out. If additional teaching and practice will help, they give him that. Altogether, they give him the benefit of every bit of consideration and experience.

"No one goes out of here feeling that, 'By God, I didn't get a square deal'," declares Capt. Baggaley. "In fact, no one goes out except those who, for one reason or another, just simply can't learn radio operating."

He might have added that the converse is also true — that when they do complete the course they *do* know radio operating. The Bureau of Navigation says that the Noroton school turns out the best radiomen of any school in the country. That this is no idle praise is demonstrated by the fact that most of the Navy's current vastly-expanded program of radio instruction is based on the basic radio school curriculum developed at Noroton. This includes the universities and colleges which are training naval radiomen under contract — RCA Institutes, which alone is training 800 men; Harvard and Cornell, also with 800 men each, and many others.

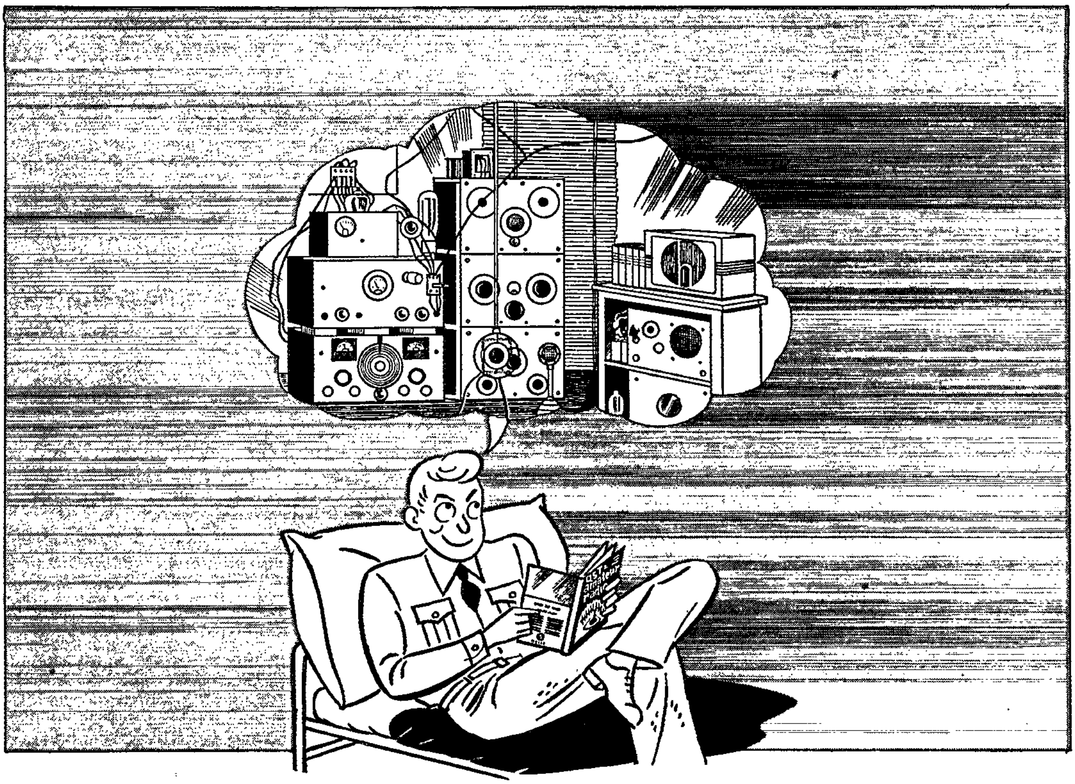
Beyond this, the "Noroton method" is also being used in setting up preliminary high-school courses in touch typing and radio. The state boards of education as well as individual schools frequently come to the staff for assistance.

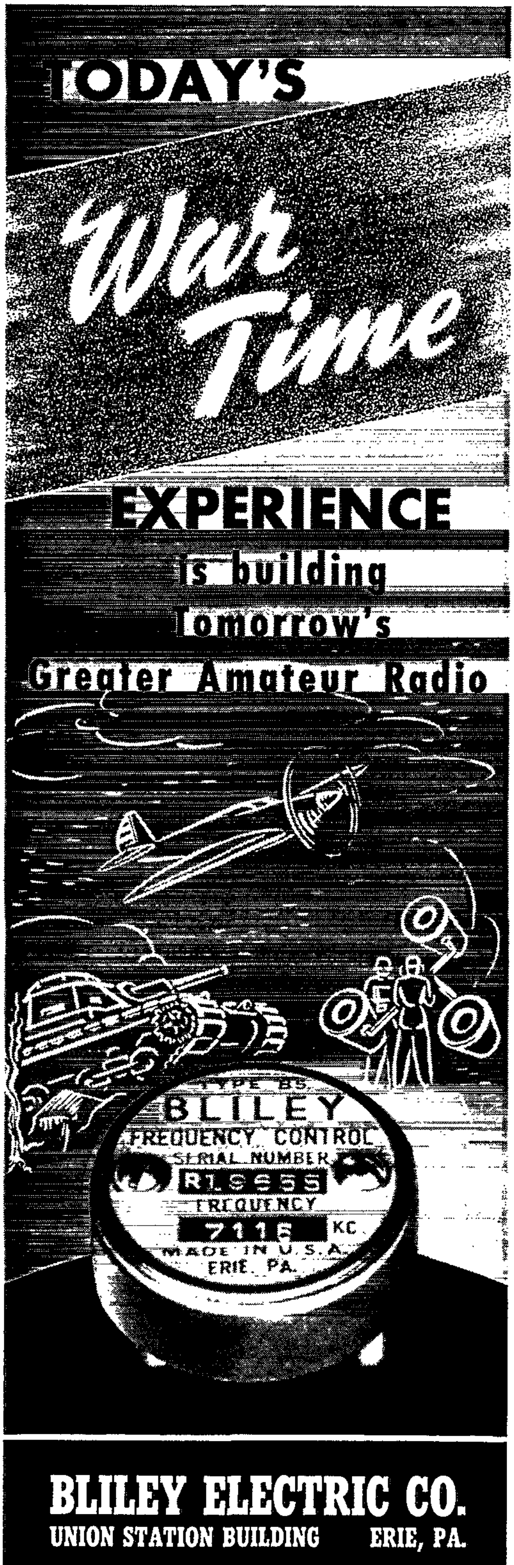
When Lt. Comstock was asked if he really would recommend the course to anyone who wanted to learn radio, he replied: "See that third lad from the end? That's my son!" W1MY jr. is doing above average work without any special treatment, but we suspect that if he had developed into an "Inapt" the OM would have revived the whipping post now outlawed but common in New England two centuries ago.

"90-Day-Wonders"

So far we have been speaking largely of the communications school for enlisted men, which is the original and by far the largest activity at Noroton. But there are other schools there too.

Second in stature is the officers' training school. There every month a couple of hams take 75 to 100 D-V (S) ensigns, whose only qualification is that they have no prior knowledge of radio, and in the space of 30 days make communications officers out of them. These "90-day-wonders" (they still call them that, even though the actual training period was cut first to sixty and now to thirty days) come in straight from college law courses (or accountancy or journalism — anything but





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communications), and radio and signaling are ground into them from seven o'clock in the morning until nine at night. They learn how to send and receive at 7 to 8 w.p.m. by code, semaphore and blinker. They learn how to use a flag hoist, something about touch typing, a little broad theory and a lot of procedure.

The extraordinary part about it all is that the system seems to work. These fellows come in and receive this highly concentrated training, then go out on active duty and proceed to put the details they've learned into practice before they can forget them. The result is that they receive their actual training by practical experience — and, all in all, they do very well.

There are two other classes at Noroton. One is a special class for the naval communications pool, brought in to receive advanced training. The other is a cook's school — an interesting project in itself, even though it has nothing to do with radio.

Ship Organization On the Station

The Noroton training station is run along the same lines as a ship. There is a duty commander and a duty officer. There are regular patrols and sentries. There are clean-up squads, grounds-keepers, messengers. One company is assigned as the duty company each period, and this company takes care of all the duty on the station.

Discipline and morale at the Noroton school are excellent. There is very little violation of the regulations or overstaying of leaves and so on. Of course, if ever an individual does step out of line retribution is swift and sure. There are prescribed penalties for various offences and these penalties are rigorously exacted. Excuses are not accepted; everyone knows the rules or is supposed to, and it is his responsibility to adhere to them.

Sometimes the captain wonders why they have so little trouble with the boys. Maybe they're too quiet; maybe they're putting something over. But no — the captain is sure that isn't the answer. "I think I did everything in my youth that they can think of, and maybe a little more," he said with a reminiscent chuckle, "and I know they're not getting by with anything."

The answer is, of course, that the students are for the most part serious American youths of better than average intelligence and possessed of a sense of responsibility. The captain believes in giving them a square deal and letting them know where they stand. Then, if they step out of line, the blame is squarely theirs. The fact that they don't step out very often proves the effectiveness of the system.

One reason for the excellent behavior record is the community in which the school is located. Noroton is a quiet surburban residential neighborhood, with no whit of the waterfront atmosphere often associated with the navy. At first frankly dubious about having some hundreds of roistering sailors in the neighborhood, the local citizenry and the school have grown to like and

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ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES — W3AKB is employed in Washington with the Bureau of Ships. 3BXE is getting along well at Sperry. 3NF left the FCC in favor of Philco in Philadelphia. 3AOC and 3APX are instructing inspectors at the Naval Aircraft Radio Inspection School. 3ATF reports losing three of their gang. The activities report from the West Phila. Radio Assn. is as follows: A class in radio operating and theory for men is nearing completion with about ten fellows preparing to take their ham exam in the near future. Recent advertising in local papers produced about 75 applicants for a class in radio theory and operating for women but, due to space limitations, we were able to enroll only 35. 3ITZ and 3IBB have received favorable results with wired wireless. 3JMZ is interested in earth current communication. The Navy League Service radio class graduated five members in code and theory and have started another class, this time numbering 28. The class meets three nights a week for 13 weeks. 3DOU and 3HFD are building elaborate u.h.f. emergency set-ups. 3HXA has a new QTH. 3AGV thinks he has a system for predicting long skip conditions on 6½ meter f.m. 3FWH purchased a new HQ120X. The wired wireless boys complain of detuning of their rigs when lights are switched on and off. 3IXN is the new secretary-treasurer of the Frankford Radio Club. The FRC and the York Road Club report activity as usual, but the YRRC is meeting at various members' houses due to curtailed attendance. The Chester Club has folded up for the summer. 73 till next month.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — SCM, Hermann E. Hobbs, W3CIZ — The Baltimore Amateur Radio Assn. reports continuance of its code classes with 27 attending. A new group will be started soon. The Western Maryland Amateur Radio Club has 40 attending its code classes and is thinking of starting a class in theory. W3AQV reports u.h.f. activity in Western Maryland. IIS has been commissioned in the Signal Corps and is now at Ft. Monmouth. CQS is at sea most of the time. CJT is with FCC at Norfolk. AKB is expecting to take a position with the government shortly. CVA and FAM have joined the Emergency Corps. The Washington Radio Club held a meeting June 27 at which three amateurs were nominated as suggestions for radio aide in the WERS set-up. A picnic was held June 28 at Arlington Forest, Va.

SOUTHERN NEW JERSEY — SCM, Lester H. Allen, W3CCO — Asst. SCM, W3ZI. This month I would like to remind the Emergency Coördinators of our section to check up on the records of AEC members and bring files up to date. If any Emergency Coördinators are no longer interested or are no longer at their QTH, your SCM will be glad to know of it. If you are interested in such an appointment send along your name. GNU has taken upon himself an XYL and congratulations are in order. AC, famous in u.h.f. work, is now employed at the Signal Corps laboratory. EFM is awaiting the call for active duty as a commissioned officer in the Signal Corps. CCC is pounding brass out Amagansette way. VE is at Fort Sill. Rumor has it Sam is to become a lt. colonel very soon. CFT has been made a sergeant and is at Fort Knox. AID is learning about aircraft radio at the Grumman plant. EUH is a maintenance electrician at Eastern Air. GRW, who is operating aboard an oil tanker, recently lost his ship to a torpedo and floated in a life boat for several hours before being picked up. The boys of the Delaware Valley Radio Association have started to maintain a listening post for all operable frequencies. The South Jersey Radio Association had a showing of the Hallicrafter film "Skyrider" at their last meeting. JRG has his telegraph first license. At Wenoah we have a new amateur operator, Herb Wright. ABS' radio school now is receiving 10 words per minute and the theory is coming along FB. Several renewals are in this month for AEC. They are: JL, FSR, DNH, DHJ, CKN, JWX, JRG, EBA and JSF. HLM is attending Bliss Electrical College. VW and GZS are carrying on QSOs via light beam over a distance of one mile. KW is doing a wonderful job in the Camden area on emergency work. UT and FMQ are teaching radio theory at the Atlantic City Vocational School. JKH is now in charge of radio at the Atlantic City airport. JKI is doing operating in North Carolina at one of the service camps. JTL is studying at MIT. ACX is working with civilian defense. Bill Newell, an ex-W3 from Atlantic City, is now operating aboard a trans-atlantic clipper. ECO is oping at WFPG and holds first class 'phone ticket. IIH is working on a wide range audio oscillator. Several requests have come from all over the section regarding the possibility of the annual hamfest held each year by the Delaware Valley Radio Association. A decision of "no" was rendered by the club due to the gasoline and rubber shortage; however, for those within reasonable distance of Trenton, the DVRA wishes to announce it will have a small affair, picnic style, on the 2nd Sunday of August. Anyone interested can get particulars from your SCM.

WESTERN NEW YORK — SCM, Fred Chichester, W8PLA. The Central New York Radio Club now has three code classes going with an average attendance of about 100. The Club is also making plans for entering the local ARP activities, supplying amplifier equipment and services of hams. According to SZB, QOT is in the army at Camp Upton. FYC is the papa of a fine baby girl. ECF is at Ft Monmouth as a civilian radio instructor. WAR is at Pine Camp. SZB has accepted a position with RCA as field engineer, working out of New York City. It is expected that Ralph Hayes, LLZ, will take over as EC for Jefferson county.

WESTERN PENNSYLVANIA — SCM, E. A. Krall, W8CKO — Asst. SCM in charge of EC, W8AVY. CMP advises he has three 2½-meter transmitters and receivers available for emergency work. TTD has classes in theory and code to make operator replacements available. MHE is one of our more active ECs. VYU informs us that IYI and UTT are both civilian operators at Langley Field, Va. AOE intends to take his 2nd class telegraph exam in September or October. OW is at the Naval Research Lab at Washington. WCV has moved to Sharon and WDK to Bloomfield. BTQ has completed teaching a defense class in radio. TWI is at State College and has been teaching a group of Signal Corps men. He has also completed a 10 week code class course to 200 students. PX, OC, QEL, AJV, BWP and MP assembled at the SCM's home June 20th to formulate a plan and make suggestions to the OCD radio aide, Mr. Myers of Allegheny County. The following amateurs were mentioned for activity leadership in their zones and recommended for license in the WERS: DNO, PDU, MKP, OC, CKO, UHB, BWP, QEL, MHE, ONW, BSO, AZG, OKU and PX. PX is to be complimented for his untiring efforts to get things rolling in Allegheny County. Our Asst. SCM for EC, R. M. Francis, is now before the draft board for induction. If he is inducted, we wish all ECs to note that VYU, Theresa McLaughlin, 131 Talbot Ave., Greensburg, will act as Assistant SCM in charge of Emergency Coördination until Wavy returns.

CENTRAL DIVISION

ILLINOIS — SCM, Mrs. Carrie Jones W9ILH — W9MTJ of Mt. Morris became the youngest and shortest staff sergeant of the U. S. Marine Corps on June 12th. NTV and NZU have received Class A tickets. WPP is now asst. engineering aide in Washington, D. C. IUE and ENY are radio technicians 2nd class in the Navy. HOA and NTV of Rockford are communicating via wired wireless on 110-volt line. RLM is in the Army. The Chicago Suburban Radio Assn. has discontinued meetings until fall. VND, chief radio operator aboard an oil tanker, has been home on vacation. IGC, former OPS, has been attending the Signal Corps Radio Trainee Repairman School in Chicago. UUM and WBS, of the Univ. of Chicago Radio Club, are working as part-time instructors for the U. S. Naval Radio Training School under TSN. HXG, EC of Ford County, is very active in organization of civilian defense in Gibson City. IHN is now in Hawaii.

INDIANA — SCM, LeRoy T. Waggoner, W9YMV — With amateur participation in civilian defense a reality, there should be a wealth of material for reports. W9WXI, KLS, GJP and HKQ are included in the list of this month's new ECs. PLG is at Fort Hayes, Columbus, Ohio. ZBK is in the Army Air Corps at Hendrick Field, Sebring, Fla. UYP is civilian radio technician at Patterson Field and navigator for Army Ferry Command. FEI is assistant radio engineer with the Signal Corps. UEM, instructor of the code and theory class just concluded by the Indianapolis Radio Club, announces a graduating class of forty. Another class will start the second week in Sept. and will offer both code and theory instruction. FFM is in Navy. MJW is operating at WBTY, municipal police radio. DNQ is now with the Signal Corps at Camp Crowder, Mo. Bob was misplaced in the Medical Corps at first, but through the efforts of the League got into radio promptly. IFM is teaching radio engineering. In his class is KDB of Jeffersonville. DAF is auxiliary fireman and is taking OCD Red Cross course. 8VQY is at Lake Wawasee and has applied for a W9 call. 9NKB advises that the Michigan City boys are having very good results with wired wireless. KBQ is in the Army. SAG, president of the Purdue University Radio Club, reports that they are having weekly code classes with attendance of about 35. YCF, IWN and QAN are in the Signal Corps as civilian employees. EOC has been appointed communications coördinator for Bicknell by the State Defense Council. GOE was promoted to captain in the Army. SVG is studying hard at copying code at Camp Crowder. HKP received papers at Fort Sill informing him he had completed his course as operator. HUV lost a mast in the breeze. WLV has just been appointed as EC of New Albany. The Indianapolis Radio Club had a pitch-in dinner at the clubrooms this month that was well attended in spite of the many members who are in the services. 73 — *Roy*.

MICHIGAN — SCM, Harold C. Bird, W8DPE — W8DYH reports DARA is co-sponsoring theory and code classes twice a week in conjunction with the Edison Legion club. NQ reports about five complete u.h.f. stations. AIZ is looking for operators to assist him in his CAP work. VQN still handling code classes and trying to keep his club intact. AMS is still conducting code classes for the "Tawas City Defense Code Class," sponsored by the Board of Education. UQD has emergency equipment all ready to go. UGR reports fourteen hams in his section all ready to assist. Now that the green light is on I expect that you fellows who have been waiting for this will study July *QST* and immediately take steps to get your local setup going. If you have not organized yet, do it now as per July *QST*. Luck and 73. — *Hal*.

OHIO — SCM, E. H. Gibbs, W8AQ — The good news of WERS operation was received with enthusiasm by the groups who have presevered in the AEC program over the past lean six months. Several of our AEC groups are well connected with local CD officials and look forward to participation in WERS plan at an early date. Cleveland has nearly 100 rigs ready to go on 112 Mc. DS has done a fine job as assistant EC and member of the CD technical subcommittee on communications. Most clubs have lost many members to the armed services, so it behooves those left behind to rally to the cause and show the value of amateur radio to the community. PUN's report for Chillicothe shows eight local hams, all registered in the AEC, but only four now at home, three with 112-Mc. gear built and ready. Cincinnati's QCEN has maintained activity in building u.h.f. rigs and expects to take over WERS duties. JFC has been commissioned in the Air Corps. Dayton's AEC organization is busy converting gear from 56 to 112 Mc. CBI has been appointed radio aide. Piqua club graduated five students in its 12-week code class and has started a class in theory. Zanesville code class has 15 students up to eight w.p.m. after 25 hours of instruction. MWL and his gang have been outstanding in their AEC work and have 31 rigs for 112 Mc. and 62 AEC members out of a total of 122 licensed hams in the county! Canton city officials have already written Washn. for WERS applications. Now that we have something concrete to work on, your SCM hopes to have a lot more reports of WERS activity. Please get them in by the 20th of each month to meet the deadline, fellows. Applications are invited from all communities not now having ECs.

WISCONSIN — Acting SCM, Emil R. Felber, Jr., W9RH — W9NPK has been appointed EC of Kenosha. 6 members of the Kenosha Kilocycle Club have gone to the aid of our country. DTE constructed an aircraft detector which was a great success. EC HHR reports he has emergency AC power for fixed station. He has 3 stations available. Retiring Secy. JWT of the Milwaukee Radio Amateurs Club reports the new officers for the coming season: pres., CDY; vice-pres., ONY; secretary, GIL; treasurer, DJC. The rest of the board of directors are VD, VWG, UIT and RH. The club has recessed until Sept. 3, 1942. At the last meeting we were honored with a visit from DTK. SYT has NY and CDY working on a new plan to assist local defense officials in case of an emergency. He wants more Milwaukee amateurs that have 2½-meter gear to register. DJC is building a new 2½-meter superhet receiver. ITJ is reconditioning his 2½-meter equipment. 9 boys of the NYA airport project passed their Class B operator's license exams. JWT has been commissioned 1st lt. in the Marine Corps and will leave for active duty soon. Ex-HWY has received his diploma from the Naval Research Laboratory and is leaving for Norfolk, Va., where he will be an instructor. PYM is attending the Army Signal School at University of Illinois. VIB writes he is teaching radio technology at the University of Alabama. His address is Box 1785, University, Alabama. EYH is now at Allegan, Mich. 73. — *Emil*.

DAKOTA DIVISION

NORTH DAKOTA — Acting SCM, John W. McBride, W9YVF — W9UNU reports that ZVE is now located in Springfield, Illinois. BMR writes that 7 graduates of his last class now hold amateur licenses. QGM is now attending radar at Baltimore, Md. ZZK and YVF attended the Min-Dak Club meeting at Milbank, S. Dak. We would like to have a few news items from Bismarck, Minot, Grand Forks, etc., not later than the 16th of the month. — *John, W9YVF*.

SOUTH DAKOTA — SCM, P. H. Schultz, W9QVY — W9YQR and ZWL are moving back to Rapid City. The Rapid City gang are working on fire drill in conjunction with CAP. The Huron gang have three 2½-meter rigs lined up and ready to operate with civilian defense. BDF is in Omaha with Signal Corps as civilian engineer. Would like to make reappointments for EC and Asst. EC. Please send in suggestions. Your SCM will act as clearing house for all military service men of Dakota Division. Where are you all? — *Phil*.

NORTHERN MINNESOTA — SCM, Armond D. Brattland, W9FUZ — This SCM is busy helping set up a Civil Air Patrol squadron in preparation for forest patrol duty. AQU received Class A ticket. CCF, now pounding salt-brass on a cargo ship, is home while ship undergoes repairs. KQA reports YKD received promotion at Ft. Meade. KET, now at Bliss Electrical School in Washington, expects to take commercial exam soon. TEF is with Coast Guard at St. Louis and letter from QDF there advises he is RM2c along with MPW and BBL. NHE is transferred to Naval Section Base for Marine radio maintenance from shipboard communications. NMARA unit at Thief River Falls now has only one member, YKV, remaining out of service. Crookston Unit had to abandon code classes with DPU leaving July first. PTB is with Signal Corps at McClelland Field. HMH is with same service in Penna. CNR is in No. Carolina with radio division of Air Corps and JBZ is sgt. in same service. UCA and George Gruber of St. Paul are with radar at Great Lakes. GVO is with radio inspection service of Air Corps at Wright Field and lives in same house with GNR. OME and WLE joined Signal Corps. DEJ is in Wisc. with WTAQ. IXR moved from Wisc. to St. Louis Park. In coöperation with radio station KSTP, the St. Paul Radio Club instruction committee is teaching classes running into the several hundreds per week day, with the possibility that the 9:30 Sunday morning broadcast instruction is reaching thousands. Bemidji Club (Unit one NMARA) still lays claim to being only radio club in Dakota Division (outside of the Twin Cities) holding *regular* weekly code practice sessions. Are there any challengers? 73 and luck.

SOUTHERN MINNESOTA — SCM, Millard L. Bender, W9YNQ — W9CWI is a first lieut. in the Air Force and stationed in Washington. HCC is a captain in the Air Force, location unknown at present. We lost a lot of men the past three months by enlistments. One of our men was on the Lexington as radio man when she went down. He is home in Minneapolis at present.

DELTA DIVISION

LOUISIANA — SCM, W. J. Wilkinson, Jr., W5DWW — W5BSR is communications officer for Lake Charles civilian defense. DMR is op. with FCC. HHV has volunteered with Marines. EGG is in radar work. HOA and ST are attending theory classes. IYL has accepted civilian radio job with Army. DGB will leave soon for West Coast. JYK reconstructed antenna in case of emergency. FXX is practicing cryptography. ECO is working on defense net. ISE, KJD and KPS are all active in club work. CXQ is teaching code and theory for Delta Radio Club. IXL has arranged for new clubroom, Roosevelt Hotel, New Orleans. HSH was recently granted furlough from naval school.

TENNESSEE — SCM, M. G. Hooper, W4DDJ — A very nice letter from DIJ/9 from Chicago, Ill., where he is working as Signal Corps inspector. A letter to the Chattanooga Civilian Defense Council from EC CBS places the services of the facilities and personnel of the Chattanooga Amateur Radio Club at the disposal of civilian defense. EC DFB is working relief between Memphis and Jackson, Tenn., in the service of N. C. & St. L. Ry. HWC is working for Nashville Electric Service. HUB is now in the Navy. DKV is with Navy at San Diego, Calif. DDF is doing communication work with the CAP in Nashville. GYE is now connected with WSIX. DLQ is with WSM.

HUDSON DIVISION

NEW YORK CITY AND LONG ISLAND — SCM, E. L. Baunach, W2AZV — DBQ and BGO are working day and night with the N. Y. C. defense council in collaboration with Mayor LaGuardia to get a practical working communications system. There has been an error on page 72 of July *QST* in regard to our Emergency Coördinators. Since May there has been one Emergency Coördinator for each county, as follows: DOG, Suffolk County; CET, Nassau County; GTZ, Queens County; BO, Kings County; MCZ, New York County; JEB, Bronx County; BGO, N. Y. C. Regional Coördinator; DBQ, Section Coördinator. DKH reports the 1942 officers for the Federation of Long Island Radio Clubs are: pres., FWX; vice-pres., KB; treas., BAA; general secy., DKH. The Federation, in conjunction with the Queens Guards, is offering a radio course to preselectees at the Jamaica High School gym on Friday nights. The instructors are BAA, CJY, DKH, FWX, KB, NAX and NZJ. The members of the Sunrise Radio Club and UHF Club have built wired wireless rigs, but have not had much luck in making contacts. NAZ is looking for volunteer instructors for the AWVS, both code and theory, especially from L. I. and Brooklyn. FYL, JRQ and MMW are teaching code to a group of Citizen Defense Corps messengers. FF is now located in Parkchester, Bronx. HAE and KZT are on active service with the Navy. HXT and JXQ are airplane observers. BRV, FUG, HAA, HAW, IYX, MBM and HAW all have joined the services. DBQ is busy making crystals for the government.

MIDWEST DIVISION

IOWA — SCM, Arthur E. Rydberg, W9AED — Thanks a lot, fellows, for your support. Iowa ECs leaving for the service, please advise your SCM or have someone do it for you, so that your community will not be left unorganized. WTD reports 100% registration in Emergency Corps, not to mention theory and code classes at local CAP and Iowa-Illinois Amateur Radio Club. VKZ also reports full registration. AJP renews EC. CCY now with Air Corps studying theory. KLC confined by sickness. LKL and REF in Civil Service, Chicago. JKA now at Jefferson Barracks. FVY in Signal Corps school. SQV in Navy radio school in San Francisco. UAD at Gallups Island. PJV is Civil Service radio opr. in Omaha. GBP is operating jeep radio in Army. OCG is in Ireland. TGL in Army officer's training school, BBB ditto Air Corps. TWX now shuffling mail at Iowa City. AUL trying to get carrier current converter to work. DIB says FDL now instructor at service school, Lexington, Ky. Wish to thank PJR for fine coöperation in helping new SCM get started. 73. — *Art.*

KANSAS — SCM, A. B. Unruh, W9AWP — TTU is now with the Army. Former EC PNX is with CAA at Douglas, Wyo. PFN is with CAA at Cheyenne, Wyo. QKV will be assistant physics instructor at K. U. this fall. CKV sent in EC certificate for endorsement (other ECs, please note). WAZ is now at M.I.T. GWI with W. E. at Kenwood, Ill. YAL and PYR at Navy radar school. WXY now holds commission as second lieutenant in Signal Corps. WAH is in the Army. NNU is now with 7th Corps Area Hq. at Omaha. MAE reports that GPR left with intentions of getting to China after being turned down by Army, Navy and Coast Guard. RXK is now chief pressman for Miami (Fla.) *Herald.* Ex-JJJ (W5HHJ) is now with Uncle Sam on West Coast. AMD is Signal Corps repairman and instructor. KVRC has discontinued regular meetings, but will continue to meet from time to time. OUU received Class A ticket,and plans to tackle commercial elements soon. DWC resigned as president of WARC due to accepting an out-of-town radio job of a confidential nature. Vice-Pres. NHB will carry on for the balance of 1942. ESL is thinking of starting a class in code and theory since ESMDT course has been sidetracked.

MISSOURI — Acting SCM, Letha E. Allendorf, W9OUD — Remember me? I'm back again until an election provides a permanent SCM. QMD took a flier to West Africa as op. for PAA and AEJ is pounding brass at Fort Omaha in a civilian capacity. BVW left the farm for Grand Island where he is working for the FCC. GCL left Springfield for St. Joe and a promotion. BHG and CWK have built emergency equipment as suggested by ARRL. KJC is keeping in touch with the Lawrence County emergency gang which is ready for action when authorized. NCD received a telegraph first and is in the Navy again. OXZ and OWQ are conducting code classes. PUV is now at the radio school in San Francisco striving for 35 WPM. TBU is with the FCC. WIS is teaching physics at the Mo. Institute of Aeronautics at Sikeston. WOC was at Grand Island for a couple of weeks, but his ears went back on him as a result of severe flu last winter. GZR is at Scott Field as civilian opr. HGB is working with the RI in Kansas City. BMS succeeds him as head of the radio dept. of the NYA and QJP is assistant instructor. DBD is a member of AWVC and is retiring secretary of the YLRL.

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Edmund R. Fraser, W1KQY — During the past month letters have been received from three Conn. hams in the service. LQK is now RM3c U.S.N. at an air station in the Canal Zone. DDP is now tech. sgt. in Army at Ft. Benning, Ga., where he instructs code classes. DDX is now RM2c at Anacostia, D. C., and expects advancement to RM1c shortly. From Hartford we learn that NI is actg. group c.o., DJC is actg. squad c.o. and AKF wing c.o. in the Hartford CAP. ATH, secy. of NHARA, reports two code classes now in their tenth week. Students are taking 9 ECs JQK, TD, BHM, NGQ, and BW expect to hold joint meeting shortly. Reports from ECs DGG, EYM, KGE, EFW, LWZ, KYW, DBM, AJO and BIH-KXB indicate their respective territories are all organized for WERS operation. They are securing necessary FCC forms through their local CD councils. TD, BYW and KQY are now doing part time monitoring work for a govt. agency. HBL reports a nice ham impromptu get-together at his shack. Those present were NNQ, HBL, CCF, KNM and 2ODO. Many thanks for the increase in reports this month. Keep them coming.

MAINE — SCM, Ames R. Millett, W1BAV — W1FKH, HLT, HWO, MW, LOA, LNI and NGV have been in Boston attending the Army Signal Repair School. LOA and LNI are now stationed back home in Portland. GOJ and KOH have recently sold some of their fine commercially manufactured equipment to the Army. 9LOG of Minneapolis was here in Portland for a short stay, and paid us a fine visit. FJK and EAX of Fitchburg and Melrose are stationed in Portland. EWN now has a commission in the Navy.

EASTERN MASSACHUSETTS — SCM, Frank L. Baker, Jr., W1ALP — Here are some more new Emergency Coördinators for this section: MON, Randolph; JXH, Holbrook; GWK, Roslindale and West Roxbury sections of Boston; AHP, Fall River; QD, Needham and Dover; NKE, Littleton. Again I would like to remind all ECs, if you move or go into the service of Uncle Sam or for any other reason cannot carry on as EC, please drop me a post card or a letter. John Doremus and his assistant, Norman Larrabee, deserve a lot of credit for the fine job they are doing for the Mass. Committee on Public Safety. ALP got the school in Quincy started, with IHA and John Donnelly doing the instructing. HX's XYL got her license and is now NUO. IIQ is now a lieutenant in the Army Air Corps in Alabama, doing radio work. 4GST is now living in Quincy. LBY is working in Springfield, Mass. MME is now in the Army Signal Corps. Ex-2MSS, now NVS, is living in Methuen. HUZ now working in N. J. LTG now working in Phila. NAD and NDI are moving to Boston. LEJ and LTI from Salem are now at Quonset, R. I. NLK has gone into the service. MJE, LWH and AKS are all running code classes. We are sorry to hear of the death of KAL on April 30th. Eastern Mass. Radio Assn. held an election: pres., FSK; vice-pres., HLX; secy., MPP; treas., ILR; board of directors, NGL, HUG and EHT. NKE completed his 3 years at Dartmouth and expects to go to M.I.T. in the fall. EVJ says that a code class is going to be started down on Nantucket. MTV will be in N. H. all summer, and is going to college in the fall. NAV is helping out in one of the radio schools. The Suburban Net has a nice news bulletin with Dick Colby as the editor. AKY is the proud father of a son. AHP is chairman of the communications committee at Fall River. The radio school is going fine with GDJ helping out. MD is new EC for Hingham.

NEW HAMPSHIRE — SCM, Mrs. Dorothy W. Evans, W1FTJ — GKE and MKD were married recently. JNC expects to be working in Concord soon. JSL is now at Fort Monmouth. The Nashua Mike and Key Club maintains a considerable amount of activity through their classes in code and theory. NAZ is in charge of code and GEY takes care of the theory. New officers were elected: LLD, pres.; FGC, vice-pres.; NAZ, rec. secy.; NQS, corr. secy.; JDV, treas.; GEY, act. mgr.

RHODE ISLAND — SCM, Clayton C. Gordon, W1HRC — MOK has been forced to give up his EC appointment at Westerly because of taking a job with the Signal Corps in Boston. INN has also taken a job with the Signal Corps. Cranston, Pawtucket and East Providence have expressed a desire to avail themselves of the new civilian defense radio set-up. The PRA has been taking up Nilson & Hornung's Questions and Answers as a club meeting project for several weeks past. KOG is somewhere in the Caribbean. His address is: Cpl. C. Iafrate, ASN 31056606, 12th Signal Ser. Det., A.P.O. No. 855, c/o Postmaster, New York, N. Y. JHD reports a class in code and theory running since February, with 6 to 8 students ready for their exams in a week or two.

VERMONT — SCM, Clifton G. Parker, W1KJG — W1AHN sent in a very interesting letter of his adventures in England. His address is changed to: Lt. R. E. Osgood, Hq. E.T.G., U. S. Army, A.P.O. 887, New York City, and he says letters are welcome. KUY would like to hear from the gang and may be addressed at Box R, Albrook Field, Canal Zone. JRU is electrician at the air base, Windsor Locks, Conn., may be addressed at Suffield, Conn., and plans a visit to Headquarters. JVS has resigned as EC for the Burlington area, and NLO has been appointed EC in his place. MIH has radio service work at Dennisport, Mass. LZQ, MJU/NUZ and 2JUB have returned to U.V.M. at Burlington for special summer session in engineering. FSV is working as operator at Derby Line and, with LGQ of Boston, recently visited GAN. IQG reports visit from JRU. IQG is petty officer in naval volunteers. HLH and ex-LVP are in Boston taking a special advance course in Signal Corps work, and report MLJ is also there. NDB is now in St. Johnsbury. Richard A. Evans, Essex Jct., is new amateur licensee. Burlington Amateur Radio Club has a code practice program including advanced group on mill and in longhand with beginner's group commencing about July 1st, and reports three trainees now ready for examination. The club has two u.h.f. units under construction and is undertaking a directional aircraft warning unit. Understand MMU has joined the Navy. LYD is reported to be enjoying Army life.

NORTHWESTERN DIVISION

MONTANA — SCM, R. Rex Roberts, W7CPY — The Electric City Radio Club at Great Falls continues active with both code and theory classes. ABT at Kalispell has taken himself an XYL. BCE is now with the CAA at Custer. BHB has commercial and class A licenses now. HFZ is QRL college in the East.

OREGON — SCM, Carl Austin, W7GNJ — W7BGM, now with G. E. and heading for the new job, drops a report from Iowa. HKO and IDJ are going into radar, and they tell me GLF is going into the Army as staff sergeant. GXO has signed on for radio service. Hats off to the Klamath Falls gang — 100% amateur turnout to the military radio services. Central Oregon Radio Klub is starting the third class in code and theory since January. Four additional certificates were issued last month, as follows: Paul Mickel and Helen Roats, 15 w.p.m.; Tom Currier and HVX, 20 w.p.m. Next month the club will run 15, 20 and 25 w.p.m. tapes. ARZ is operating KBND evenings. IIK is now attending U. of Houston, says it's tough. Mail reports the 16th. 73.

WASHINGTON — SCM, Carl F. Hofmann, W7EPB — New ECs are FWD and DAI. FWD has been asked to take radio aide post in new WERS set-up, and both he and FWR have been teaching radio classes for prospective ops. DAI has been teaching classes for NYA and also has been selected radio aide. OS has done a lot of hard work as communications officer in Tacoma civilian defense with AEA and DAI as very able assistants. We regret to hear of the passing of APR, well known in traffic work and AARS. GGO and FXI now have their commissions in Army flying service. GGO has taken unto himself an XYL. HBC is now teaching code to the boys in the Army. IZG received his ticket just before Dec. 7th. FPN reports AQB and FLD dismantled, EHO is ensign in Navy and CKZ teaching radio to prospective Navy recruits. HJC and HLU are in Navy school at Stillwater, Okla., and report meeting about thirty-five hams there. BES is at Anchorage, Alaska, in governmental Civil Service position. Al Towner, who used to operate W6NLL for AARS, is in Seattle in Army transport service. RT is in Alaska communications service. 73. — *Carl.*

PACIFIC DIVISION

SANTA CLARA VALLEY — SCM, Earl F. Sanderson, W6IUZ — W6SXA and TNG graduated from Sequoia High and are now working for Kaar Engineering Company. LCN has moved to Monterey. TAU is with the Army Signal Corp. RVZ is in the State Guard. Recent visitors at the shack of SYW were KZF, ZM, RJL, TAV, ESH, QUE and TAU. TBK reports that out of a former total of 47 active amateurs in his locality, there are now only 5, the others in the armed forces, working in civilian capacity or in defense manufacturing centers. 73. — *Sandy.*

EAST BAY — SCM, Horace R. Greer, W6TI — The ARRL East Bay section meeting was held at the Hotel Leamington, Oakland, California, on Wednesday, June 17th. Mr. Ross B. Lohry, ex-LF,-AN,-BNN,-AZP and -FRQ, radio electrician, City of Oakland, gave an interesting talk on "Communication Problems Connected with Development of a 2-Way Police Radio System." The following were present: AHG, MPL, UFD, TJP, QDE, PU, THO, ZM, EY, AKB, KGF, SFT, HGM, FKQ, UHM, QKA, SEW, QAZ, EDA, PKP, HH, TI, JEE, C. Wright, Simon Peter, J. Locke, L. Kelsey and A. Hartzell. Much interest was shown by the gang on the OCD plan just released, and plans are going ahead. 73. — *"TI."*

ROANOKE DIVISION

WEST VIRGINIA — SCM, Kenneth M. Zinn, W8JRL — W8MKE is doing defense work at Western Electric plant in Baltimore. UNH is a second lieutenant in the Signal Corps. RCN is now in radar in the Navy. PAJ is an ensign in the Navy and is located at a naval engineering experiment station. VKF is teaching a code class of scouts and Civil Air Patrol students. TZT has a code class under way at Logan. The defense radio engineering course in Logan is progressing very nicely. BWK is going to radio school at night. UVU, UBW, SDU, MZT and QFN have enrolled in the radio technician training course at Marshall College. TDJ/SPY has about 12 students in ESMDT radio technician course. The code class in Morgantown is doing fine. NTV is civilian radio instructor for a school of the Army Signal Corps. DFC is in Civil Air Patrol as a radio operator. ASI and JKN say their code class at Buckhannon is coming along very nicely. 73. — *Ken.*

ROCKY MOUNTAIN DIVISION

COLORADO — SCM, Stephen L. Fitzpatrick, W9CNL — Rocky Mountain Division Convention, Aug. 8th–9th, Albany Hotel, Denver, Colo. Coming? TFP, BQO and QYU are the convention committee, and they are promising a good time for one and all. To the hams in Colorado Springs: Your report did not reach me in time for last month's edition, so here it is with some changes. UPT and EVT are working with U. S. Engineers. HDU is doing a fine job at the NYA center. EHC is radio shop foreman at Ogden, Utah. DSB and ex-LJF are both crew chiefs in the shop. YYO is going to Colorado College, is opr. at KVOR at night. GKJ now lives in Englewood but visits us occasionally. JWC is doing a splendid job on the KPCS police radio. James Simpson has received his opr. ticket. A late report shows UPT at Climax, Colo., working for the Molybdenum Company. He has five students in a code class. KHQ has been too busy for work on 2½-meter equipment. JB is reaching radio secondary class at School of Mines in Golden. First night registration totaled 25. PTI is first lieutenant in Army. GHY, of the School of Mines in Golden, goes to radar on the East Coast. Members of the Radio Widows Club are planning picnics for their husband hams. WYX is working for the city and county of Denver Police Department. KNZ works for the Hathaway Instrument Company. Denver Area Radio Club Council's four code classes are still under way, using ARRL code course. NFX is in India. WFJ is in Kearney, N. J., doing defense work. QXJ and CAW are at KLZ in Denver. Bell Radio Association is closed for the summer season. HLJ, JKC and NBK are still at Treasure Island, California. WKP is doing defense work in Boston. OLL is in Ogden, Utah. ATK is in defense work at Lowry Field. MKN is stationed at Great Lakes Training Station. PDA and QCX teach radio at Boulder University. BJN is in defense work in Denver. VGC is overhauling his 2½-meter rig to meet the new civilian defense requirements, CAA, BQO and WYX are setting up an amateur organization for civilian defense. AYV is kept busy doing commercial radio work. TFP works late shifts at Mountain States Tel. & Tel. Electron Club members are taking instructions for their commercial tickets. OUI is recovering from a serious illness. 73. — *Steve, W9CNL.*

UTAH-WYOMING — SCM, Henry L. Schroeder, W7GZG — Utah: We have just been advised of the enlistment of 6QVY in the Marine Corps Radar. Vincent E. Connor, pilot for U.A.L. is taking over as secretary-treasurer of the Salt Lake City Club. 6QWI has been working for KUTA recently. Jack Wilson has been transferred to Ogden by the CAA. Salt Lake City reports three completed and tested 2½-meter rigs ready for use. 6RIV is expecting to go into the Army Air Force shortly. 6QWO has signed up with Navy's V-1 class and is going back to school until he graduates. Wyoming: The Shy-Wy Club at Cheyenne reports a DX visitor during May in the person of a young chap in the RAF who had worked in a London broadcast station and who gave the club an interesting discourse on television. The new meeting schedule of the Shy-Wy Club is set at twice a month on the first and third Thursdays. New members are 7HZI, 6SJ and 9FRE of Chadron, Nebr. Club membership now adds up to 28 members. The club is giving code instruction to a class of 145. Of further interest in this line is the report that 7HDS has been giving code instruction over KFBC on Monday, Wednesday, and Friday nights at 11:15 P.M. and on Sunday mornings at 9:45 A.M. She also reports graduating from the Defense Radio Technician Training Class. At Laramie, six members of the code class were awarded certificates of proficiency at speeds varying from 10 to 20 w.p.m., both sending and receiving. All ECs should revise their lists to bring them up to date preparatory to the new set-up of the OCD. BCNU — 73. — *W7GZG.*

SOUTHEASTERN DIVISION

ALABAMA — SCM, Larry Smyth, W4GBV — W4GAL and GPW are students at Auburn. They, with CYC are also acting as instructors in the Naval Training School at A. P. I. GKZ is in the Army Signal Corps. GOX is doing his bit in Washington, D. C. AUP is experimenting with 60 cycles. EVI is radio engineer for the Marine Corps at Washington. JY is now civilian radio engineer at Washington Navy Yard. DHG is back in New York attending a special instruction course. 73. — *Larry.*

WESTERN FLORIDA — SCM, Oscar Cederstrom, W4AXP — W4PE is now full lieut. in Naval Reserve attached to Navigation Dept. at Naval Air Station, Pensacola. Tompkins can be found at home with the missus at their old residence. EZT is now RM2c with Uncle Sam's Navy down in Puerto Rico. HJA is making good down at the A & R shop. DZX bought Lt. Greenleaf's rotary beam. DNA, who now lives in East Point, Ga., is a sgt. in Uncle Sam's Army. FJR is teaching a code class. Ex-5AIN is now lt. (jg) and an aviator at Pensacola Naval Air Station. MS is trying to promote a power circuit communication set-up. DZX is also interested in this work. For your part in 2½-meter OCD work see your local Emergency Coördinator and find out what you must do to take part. 73. — *AXP.*

SOUTHWESTERN DIVISION

LOS ANGELES — SCM, Ralph S. Click, W6MQM — This is the last report this SCM will write. In leaving the SCM post I want you all to know that I appreciate the coöperation that has been shown and all the help you have given me. I hope the new SCM will continue to receive the help of all the gang. SN has replaced his 150THs with 250THs just in case. BUK reports that OMQ and his XYL have gone to Reno, not for the usual reason but for the FCC. OKL is somewhere on a tanker as radio op. MAQ reports some new members of the AEC gang: UTJ, ONW and UQC. — *Ralph.*

ARIZONA — Acting SCM, Gladden Elliott, W6MLL — Congratulations to RWW, our new SCM. KOL has finished at Harvard and is at M.I.T. OVK is doing lab research at M.I.T. KMM has joined class V-6 for the eight month training course in one of the coast schools. RWW has taken down his poles. TOZ is an opr. at KSUN. RXQ is doing relief at KCRJ. MSP is in air raid warning section in N. J. QWG is back in Phoenix after a couple rough trips across the Atlantic, and is trying for a job at KOY. RJN has left Camp Barkley for a job with the FCC. MUP visited the gang in Tucson and Nogales. EJN is a government flying instructor. GS and TJH are running new code classes in Tucson and have fifty YLs enrolled in one. TPP is planning a theory course for telephone employees at Tucson. USC and SOB are rebuilding. UTC is now located in Tucson. TOY-PCB write from Pittsburgh. UOC is a morse opr. for SP. RNB gave code tests to six of MLL's students and gave them an OK. MLL has a night theory and code class. City of Nogales has instructed MLL to get to work on WERS. RNB is working at KVOA. Both the Tucson and Phoenix clubs have adjourned for the summer. Thanks a million fellows for the fine coöperation during the past four months. 73. — *Elliott.*

SAN DIEGO — SCM, Richard Shanks, W6BZE — Some of you men that have u.h.f. gear, get in touch with BZE and let him know what you have available. We have some new hams in the San Diego area, but have only heard from one. He is Frank Grey, W9LLM/6, and is a u.h.f. man. He is living at present time in El Cajon. CFN has recently moved from L. A. to Santa Ana and is interested in signing up some stations for the American Legion emergency net. His address is 914 West First St., Santa Ana. BZR is teaching theory and code in his home every Monday, Wednesday and Friday and says you are welcome. Ex-EOH, now in the USN, is just about ready to leave the hospital where he had a touch of scarlet fever. Ray Hickman is now a tech. sgt. in our Army, located in Camp Calland. — *W6BZE.*

WEST GULF DIVISION

NORTHERN TEXAS — Acting SCM, Gordon Ash, W5CY — AAN has a class of future Navy operators at Texas A. & M. College. Have heard that HIP has been transferred to Philadelphia. III has a new radio job at Amarillo. IT is in the service. GOB is at present brushing up on radio at A. & M. College. EER is helping Uncle Sam at Fort Sam. EVI is working day and night on a defense housing project. DXR is flying now. JEW is attending R.O.T.C. camp at Fort Worth. — 73.

The Month in Canada

MARITIME — VE1

From L. J. Fader, 1FQ:

1OI is in the Canadian Navy and is doing radio operating on a corvette. 1CN is going to take unto himself an XYL shortly and is busy building a new home. 1OL is with the Dept. of Transport and doing operating at one of the coast radio stations. He made a trip across the Atlantic as wireless operator in a convoy, and had some rather exciting moments. He is now taking a radio engineering course while operating at the coast station.

1MB is stationed somewhere in England; I do not know what branch of the service he is in. 1MV is at the same coast station as 1OL and is studying for his first class commercial ticket. He expects to take unto himself an XYL shortly. 1KL is with the Dept. of Transport and is located at one of the beacon stations. He has been stationed at the same place for nearly two years. 1BR is still confined to his home through sickness. Here's hoping for an early recovery, Frank, OM. 1AV and 1ON are waiting patiently for the present goings on to cease so they can get back on the air. 1GG, the OM and the OW are both sitting twiddling their thumbs waiting for hostilities to cease.

I have to extend my thanks to Bill and Mary for the above dope on some of the gang on Cape Breton Island. How about some of you lads from the other sections of the island sending me along some dope on doings in your particular districts? I would appreciate hearing from you.

I am sorry to report that, since sending in my last report, word has reached us to the effect that Doug. Smith, 1FO, who was a prisoner of war, has passed away. He died from wounds received when his plane was shot down in Africa, and he will be sadly missed by the VE1 gang, especially the Halifax hams, who knew him so well. I am also sorry to report that Cliff Short, 1AW, has not been in good health the past while back. We all wish Cliff a speedy recovery.

There are about a dozen hams in one particular section of the Canadian Navy doing installation work of radio equipment on ships here at Halifax. Most of this particular gang are boys from the VE4 district and I hope within the next couple of weeks or so to be able to pass along a list of them.

Bob Stevens, ex-1AA, expects to take unto himself an XYL shortly. Bob is with the Dept. of Transport and is at present located at one of the Airways stations used in conjunction with the Trans-Atlantic Airways Service. 1HV has joined the RCAF and received a commission. He was formerly in the radio servicing business in Halifax. Len Foster, ex-1EF, who held a VE3 call at one time, is conducting code classes in the Reserve Army in Halifax. Len was in the American Army in the last war, and spent some time at Fort Monmouth, N. J., and also at one of the U. S. Army radio stations in Texas. 1GY is now with the Dept. of Transport. He started studying for his commercial ticket shortly after the outbreak of war, and was successful in passing his exam. Ex-1AQ is with the RCCS and is in charge of the station at Camp Debert.

1NS recently paid a visit to Halifax. He is now stationed at Chatham, N. B. Mac is in the Dept. of Fisheries and suffered severe injuries in an auto accident last year, but we are happy to report that he is recovering speedily and will soon be all OK again. 1EK is in the Reserve Army at Halifax.

1FQ has changed his job slightly and is now in the Railway Mail Service running between Halifax and Campbellton, N. B. Any of the boys located in the towns through which the Maritime Express passes might call down and see me sometime, and pass along any dope they might have. I would appreciate hearing from more of the gang, so that we can have the VE1 district represented each month, instead of having a blank every other month or so. How about it gang?

Well, I guess this will be all for now, so 73 to all the gang.

1FQ also forwards the following from Iris Chittick, 1AYL:

1ML is a wireless operator in the Navy. 1GI is in the Department of Transport, Aviation Branch, Moncton, N. B. 1IC, 1FL, 1EE, and 1JN are in Dominion Provincial Youth Training, RCAF, courses. 1MJ is lighthouse keeper at Gannet Rock Light, N. B. 1DY is chief instructor at No. 1 Wireless School in Montreal. 1FU is with Maritime Central Airways, Ltd., St. John. 1GQ is with the New Brunswick Telephone Company. 1LI is doing government electric inspection service. 1HL is Supervisor of Radio Courses for the New Brunswick Department of Education. 1FC is on active service in Signals. 1GP is with the New Brunswick Telephone Company. 1DE is with Barbour Company, Ltd. 1AN and 1EW work for McAvity & Sons, Ltd. 1BF is in the Dept. of Transport, St. Paul Island. 1GX is taking a commercial wireless course at St. John. 1IF is electrician at St. Joseph's Hospital. 1IZ, for the summer months instructor for the RCAF Radio Training School at the University of New Brunswick, is now with the New Brunswick Electric Power Commission, Newcastle Creek, N. B. 1JO is apprentice to a machinist. 1IE is a corporal in the RCAF, overseas. 1KQ is LAC in the RCAF, overseas. 1HB is LAC in the RCAF at Moncton, N. B. 1LB is a lieutenant and 1EJ a captain, both on active service in Signals. 1CG is radio inspector for New Brunswick and Prince Edward Island. 1LS is in the Navy.

QUEBEC — VE2

From Lin Morris, 2CO:

Eight years ago Colin Dumbrille, 2BK, was the youngest VE2 to obtain his amateur ticket. Now only 22, 2BK has been promoted to the rank of captain in the RCCS and is attached to brigade headquarters "somewhere in England."

2HG conducted a radio course in theory and operating at Plateau Academy. 2CU came down from the mining country on vacation and had a QSO with 3JI, 2CO and ex-2CX; Johnny says he does the odd bit of brasspounding, and has trained several operators, all of whom have joined up. 2IE has a new QRA and has built himself a workshop.

2GE reports that two former ops from the McGill A.R.A. station, 2CP, are in his class at Brockville. 2DU was out to see W2BNX at Belmont Park. Seen but not heard: 2JY, 2II, 2GA, 2HI, 2CJ, 2PW, 3AKO. 2DO is with the RAF Ferry Command.

2DD, who is a WEM, spent the last half of 1941 in charge of a radio expedition doing research work in Labrador. He is now a sergeant-instructor in electricity and radio at an aeronautical engineering school.

ONTARIO — VE3

From Len Mitchell, 3AZ:

We learn with pleasure that Pilot Officer Chas. W. Boughner, 3IM, was awarded the British Empire Medal in the recent King's Birthday honor list. The RCAF recommendation for this distinguished honor stated: "For the past eight months this officer has left his work only long enough for food and rest." Anyone who knew Charlie and the keen interest he took in his hobby will understand the devotion to duty that would prompt such a recommendation. Charlie joined the non-permanent squadron of the RCAF about 4 years before the war, became a peace-time sergeant and resigned from service before war was declared. Immediately after the outbreak of hostilities he reenlisted and went overseas in February, 1940, where about a year later he obtained a commission as pilot officer. His many friends both in and outside the radio fraternity will take great pleasure in seeing his work so signally honored. Congratulations, OM.

From 3AND we learn that 3AWE is in England with the RCAF, Special Signals Division. He says his boss is G3FM. Ken gets *QST* regularly from a London Radio Store but would like to hear from more of the boys in Ontario. It is rumored he has had several close shaves in landing accidents. 3AND is still working for Riis Radio in Hamilton. A newcomer to the Hamilton area is 3EH, until recently located at Kapuskasing with the CNT but now transferred to Hamilton. His address is 233 Grosvenor Street South.

The Kirkland Amateur Radio League is still active. We learn that two of its members, 3OC and 3AUW, have recently left town to join the civil service. 3PH has a lightbeam transmitter working, and he and 3ALW recently gave a demonstration to the Club.

3LR writes to say that he has been transferred from the Toronto Studios of the CBC to their engineering hq. in Montreal. 3MI has taken over his old operating position. He also sent along some dope on other VE3s in the Montreal area. 3VA is chief operator at the local Ferry Command headquarters. 3KT also hangs out there the odd bit. 3APG is somewhere in England pushing a key for the Army. 3AD was in England with the RCAF but returned some time ago and is now with REL, along with 3AIB and 3AXZ. 3SE is doing traffic control work at Malton Airport. 3LR is still a member of the West Side Radio Club in Toronto and would like to hear from any of its far flung members. His address is 5120 Westbury Ave., Apt. 1, Montreal, P. Q.

ALBERTA — VE4

From W. W. Butchart, 4LQ:

4LQ met VO6D/VE2JK the other night, and finds that 2JK is working up at the Edmonton Airport for TCA. 2JK's name is Tom Cunningham, and he is anxious to meet up with members of the Edmonton ham fraternity. 4HM visited 5EP's folks on one of his trips. 4XE is finally joining the ranks of the benedicts. He gets married June 15th. Best of luck to you, Dick. By the way, Dick's YL is an Army op with the CWAC in Calgary. 4EA is drifting gradually into home processing of his movie films. 4AEN, now working in Calgary, was an Edmonton visitor over a week-end. 4AEV is now at No. 4 I.T.S., Edmonton, and says that it's a hard old grind. For fear of being relegated from "potential pilot" to "wireless air-gunner," 4AEV had to "play dumb" when it came to reading code over there! Tsk! Tsk!

4VJ advised us the other day that 4PX, Wilf Cameron, a former Edmonton ham, had been killed in air operations overseas. 4AKK is on annual holidays. He hit out south in his "wreck" and got as far as Calgary, where someone told him that his B-1 ration card would prevent him from going into Banff Park, so he turned Old Betsy's nose back to Edmonton again. Bob says there's always some lug trying to take the joy out of life! 4VJ has taken over 4AKK's shift at CFRN until Bob gets over his holidays. He'll probably have to take an extra two weeks in which to recover, so Ken appears to have a steady job for a while! 4BW and 4HT were the leading highlights on the evening festivities when "E" Troop Cavalry Signals put on their annual smoker. 4QL, the former "Voice of Unity," Bill Wilkinson, is now working in Edmonton with the Motor Car Supply Co. Bill belongs to "E" Troop Cavalry Signals.

Getting news items out of the boys is just like pulling teeth, and 4EA is no exception. During the course of a telephone conversation the other evening we asked if he knew of any items of interest. After a bit of prodding, Roy finally came away with the news that 4KD, Willard Jensen of Calgary, is now on the staff at CFRN. Willard joined the RCAF as a WAG, but was sent back from England as medically unfit. We sent word down to 4VO (Dot) of Calgary that we would like her to send some dope up for this column, but at time of writing nothing has shown up. How about it, down there?


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respect each other. Indeed, the community is mighty proud of the station, now; they ask the boys to their homes for dinner, invite them to take part in community affairs. The kids appreciate it, too, and show it by conducting themselves with propriety.

In short, they like it at Noroton. We talked with quite a number of the students, and they all thought the training and the surroundings were about the best thing that had ever happened to them. From the boy on guard duty at the gate, who reluctantly admitted that he hadn't been able to make the grade and was going back to the Newport training station the following week, to the cocky little youngster who announced that after being there two weeks he was at the six-week mark in code speed but was going to slow up lest he show himself too good and draw a shore assignment — one and all they agreed that there was no place like Noroton.

How Recordings Are Made

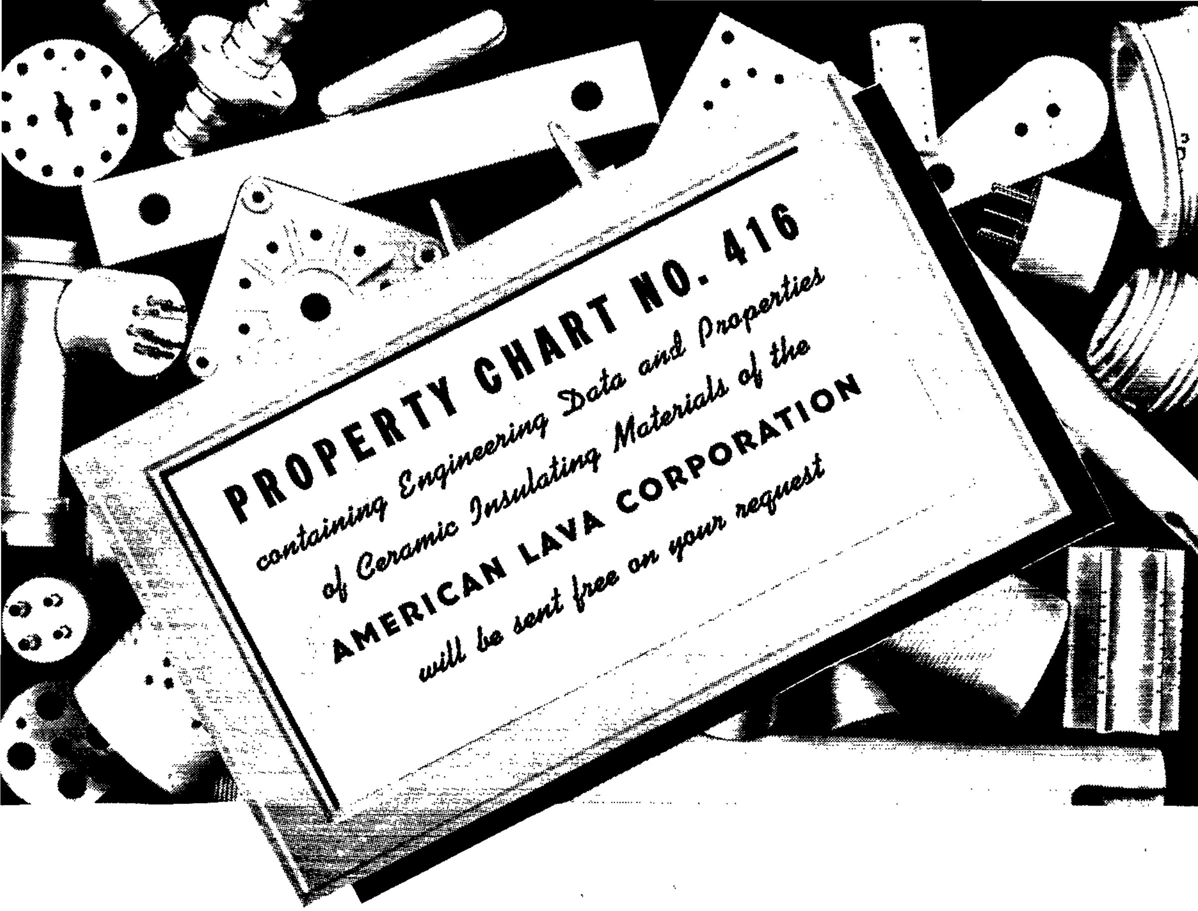
(Continued from page 59)

than ample power and a V-belt drive system similar to that used on light machine tools. The belt drive avoids most of the disadvantages of other systems: slippage is negligible, motor vibration is not transmitted to the turntable and no special tension adjustments are required. The motor and drive should be arranged so that the turntable rotates in a clockwise direction.

In operation, turntable speed must be carefully adjusted to the prescribed standard. This is customarily done with a stroboscopic card, obtainable from almost any radio dealer or music store, marked with rows of lines or dots so arranged that, when placed on the revolving turntable and viewed under a neon or fluorescent lamp with 60-cycle a.c. supply, or even ordinary house lights, the dots appear to stand still if the turntable is rotating at the correct speed, or seem to advance or retreat slowly if the rotation is too fast or too slow. The speed adjustment should, of course, be set so that the dots appear to stand still. Failure of the pattern to remain stationary over a long period of time indicates that the motor speed is not constant and the apparatus will not record properly.

Lacking a stroboscopic card, an approximate check of speed can be obtained by placing a mark or indicator on the rim of the turntable and counting the revolutions over a period of several minutes. This is done more readily at 33⅓ r.p.m. than at 78, of course. At best, however, it is a laborious and unsatisfactory method.

In playback the friction of the disc against the turntable pad suffices to turn the record. In cutting, however, additional "hold-down" pressure is required to avoid slippage. The pressure need not be great; a pound or two is usually enough. With overhead feed this pressure is provided by the leadscrew spindle plate which rests on the record. In home recorders a spring pin is mounted in the turntable. This pin engages a hole in the


PROPERTY CHART NO. 416
containing Engineering Data and Properties
of Ceramic Insulating Materials of the
AMERICAN LAVA CORPORATION
will be sent free on your request

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blank, providing a positive drive. If the same turntable is used in playback with an ordinary pressing, the spring pin merely depresses below the turntable level.

One difficulty with the spring-pin drive is that the pin does not always engage the hole tightly, particularly with thin cardboard blanks. This results either in a slight but troublesome vibration or in "climbing" of the disc on the pin. In that case, either a screw-down clamp (a large thumbnut on a threaded center pin) or simply a weight made of a round chunk of iron or lead faced off and drilled with a hole for the center pin may be used.

Feed

To make the cutting head trace the prescribed number of grooves per inch — 80 or 96 or 120 or whatever the number may be — it is necessary to provide a mechanism for moving the cutter slowly across the face of the blank. This mechanism is called the feed.

To avoid crossovers and erratic cutting, and yet allow maximum playing time, the feed must move the cutter in exact ratio to the speed at which the turntable revolves. For example, to cut 96 lines per inch at a speed of 78 r.p.m. the cutter must traverse 0.812 inches per minute, with a groove pitch of 0.0104 inches per revolution.

The construction of a satisfactory feed mechanism is obviously no simple job. It requires a highly-accurate gear train, usually of the worm and gear type. In the more advanced professional equipment a leadscrew and carriage similar to those on machine lathes is used.

Most ordinary home-recording outfits use a cutter head mounted on a swinging arm in the same manner as the pickup on a conventional phonograph, with a fan-type feed mechanism as shown in Fig. 4-A. This system is comparatively inexpensive and simple to operate. It has two disadvantages. First, there is the inherent lack of precision and accuracy of the gear system, particularly if ordinary spur gears are used as is common in the less expensive recorders. Second, there is the change in cutting angle of the stylus face as it progresses across the record, so that at only one point does it cut a theoretically perfect groove. At other points the tangent error results in unsymmetrical groove shape.

In the simple fan-drive mechanism shown in Fig. 4-A, a follower arm terminating in a half-nut rides on a horizontal screw geared to the turntable. Lowering the cutter head on the record automatically engages the drive.

Intermediate-grade recorders use a variation on this method wherein the follower arm is replaced with a fan-shaped rack or quadrant gear which is worm- or spur-gear driven. With carefully-machined gears of fine pitch this system can be made to have high accuracy.

The other major feed classification is the straight-across carriage type of feed, in which the cutter is attached to a carriage which travels across the record in a straight line, as shown in Fig. 4-B. Occasionally the feed screw and drive

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are mounted under the turntable to protect them from dust and damage, the cutter being suspended from an extension arm carried on guide rails with its vertical support outside the turntable radius. This underdrive system shares the neat appearance of the concealed-mechanism fan drives, but for maximum precision and performance the direct overhead drive is preferred.

In the overhead assembly the cutter is suspended from a carriage riding on a single guide rail and a threaded half-nut which engages the leadscrew. The leadscrew is driven either through a spindle resting on the turntable driving a worm and gear (the arrangement shown in Fig. 4-B), or through an external gear-train or belt-and-pulley drive direct from the motor or turntable shaft, with the worm and gear in the outer support of the leadscrew.

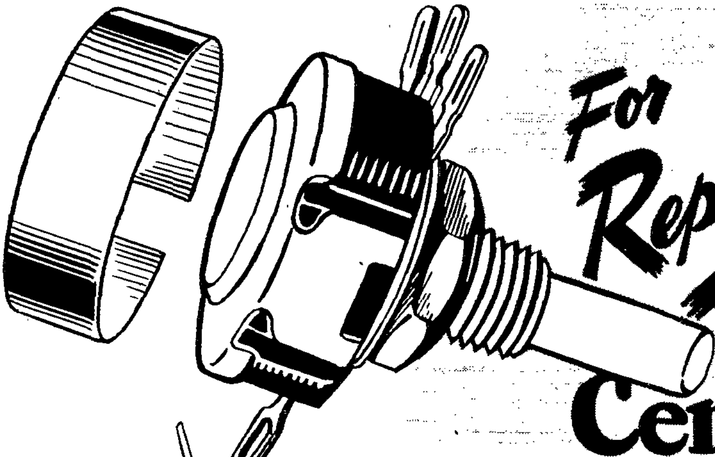
Regardless of the method used, the parts must be finely made and accurately fitted if satisfactory recording is to be accomplished. Gears, worms and feedscrews must be carefully cut and mated to mesh perfectly. Screw threads must be deeply formed so that the arm or follower does not tend to climb or lift itself out under load, yet the tooth shape must be such that the clearance with normal alignment is sufficient to allow tight meshing without backlash. In standard practice the tracking error should not exceed 5% of the mean groove pitch; e.g., the actual pitch must not deviate more than 0.002-inch from true pitch at 96 lines per inch.

On professional recorders accurate scales are provided, showing the exact line at which recording begins or ends and giving total playing time. This facilitates accurate playback of transcriptions, dubbing, etc. In commercial transcription work, a handwheel is provided for manual feed, supplementing the automatic feed, which is used to make the standard starting and stopping spirals — two to four grooves (8 grooves per inch) in the starting spiral before modulation occurs, and a locked concentric stopping circle at the end.

The standard feeds for transcription work have been established as 96, 104, 112, 120, etc., in increments of 8 grooves per inch. The actual feed to be used in a given case will be a compromise, with the desired maximum playing time weighed against the accuracy of the feed system in the recorder, the maximum amplitude to be recorded, etc. In commercial transcription work, 120 lines per inch is common and up to 160 may be used. The home recorder is usually limited to around 96 lines, with 112 or 120 as maximum.

The final important consideration in feeding is whether the stylus is to move from "inside-out" or "outside-in." Many recorders are provided with reversible gears in the feed-screw drive to permit feeding in either direction at will. The record should always be labeled with the method used, to avoid confusion in playback.

As far as quality is concerned, there is no particular choice. Outside-in recording is often preferred because it corresponds with the commercial



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(Continued from page 108)

pressings and most transcriptions, and is essential for use with automatic record-changers. Inside-out recording has the advantage that the thread or chip which comes from the stylus in an endless string tends to wind up around the center of the record, automatically freeing itself from the outward-traveling stylus. With outside-in recording the operator must keep the thread brushed away from the stylus to prevent it from tangling and pulling or making the cutter jump. In commercial equipment this problem is eliminated by a thread control device. This may be either (1) a mechanical "chip chaser" with a rubber wiper blade which trails the cutter, sweeping the thread toward the center where it winds around the pin or spindle, (2) a pneumatic device employing a stream of forced air, or (3) a miniature vacuum-cleaner which disposes of the thread by suction.

(This article is No. 2 of a series. The next part will discuss the recording amplifier. — Editor)

100 Centimeters and Down

(Continued from page 37)

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Technical Aspects of WERS

(Continued from page 28)

hence the frequency is affected by the presence of the wires. However, with fairly loose coupling a rather good job of frequency measurement can be done, and a receiver so calibrated will be capable of checking transmitter deviation over an operating period. The primary check on the calibration of the wires is of course the measurement of length; this measurement should be made with a good steel tape. The recommended system is to calibrate a receiver and then use the latter for checking the frequencies of the transmitters in the network. A regular check of the receiver calibration will provide a frequency check for the whole system. Since these checks can be made only on the air, it is sufficient to recheck the receiver calibration before each test. With a little forethought in setting up apparatus, this calibration check should take only a few minutes

For more accurate checking of band edges an ordinary crystal oscillator will be ideal, provided some one of the gang can grind a 160-meter low-drift crystal to exactly 2000 kc. Nearly every community of any size has at least one ham who has specialized in frequency measurement. The frequency of such an oscillator can be checked against WWV by various means, some of which are described in the *Handbook*. Such an oscillator will give calibration signals at 112, 114 and 116 megacycles, accurately determining the band limits. The rougher calibration, to identify harmonics, can be made by the Lecher Wires. It would be worth while to have such a standard, since comparatively few parts are needed to make a simple pentode crystal oscillator. The average oscillator at this frequency will give strong enough harmonics to be heard in the 112-Mc. band without any special means for amplifying them. This is, unfortunately, not true of 100-kc. crystal standards.

In putting transmitters in operation, note that (b) in Section 15.25 requires that *all* the emissions of a transmitter must be confined inside the band limits. This calls for a check of the incidental frequency modulation of amplitude-modulated transmitters to make sure that there is no "splash" outside the band. Crystal-controlled transmitters and those using high-*C* modulated oscillators can be set closer to the band limits than low-*C* oscillators can, because of the smaller amount of frequency modulation. A listening test on the calibrated receiver will show quickly whether any sidebands are slipping over the edges.

On the whole, although the tolerances and requirements differ considerably from the regulations under which we have been accustomed to working, it seems readily possible to meet the transmitter stability requirements, and a reasonable interpretation of the regulations on frequency measurement imposes no particular hardship in this respect. There is no technical reason, then, to prevent us from getting right down to business in WERS. Use what you have — and what you don't have, make up from the odds and ends in the junk box. It'll work!

Another Eimac Achievement

Illustration shows typical application of electromagnet actuating coil to Vacuum Relay. In certain installations outside flash-overs are eliminated by use of ball type connectors.

Solves a Tough Electrical Problem

Handling 20,000 volts RF potential with this Eimac vacuum relay is as easy as turning on your living room lights.

Over two years ago Eimac engineers developed this strange looking vacuum tube which has been seeing service ever since. It is a single pole double throw relay used for many high voltage switching applications. Although the contact spacing is only .015", no arc-over is experienced inside the tube. Changes in air pressure and humidity, such as encountered in aviation, have no effect on the breakdown within the relay, because the contacts are in vacuum. Actually a flash-over will occur across the outside terminals before breaking down within. A tribute to the high degree of vacuum attained on Eimac pumps.

This development is a direct outcome of the far-reaching advancements made possible through the Eimac technique of vacuum tube construction. A typical example of why Eimac transmitting tubes are first choice of leading engineers throughout the world.

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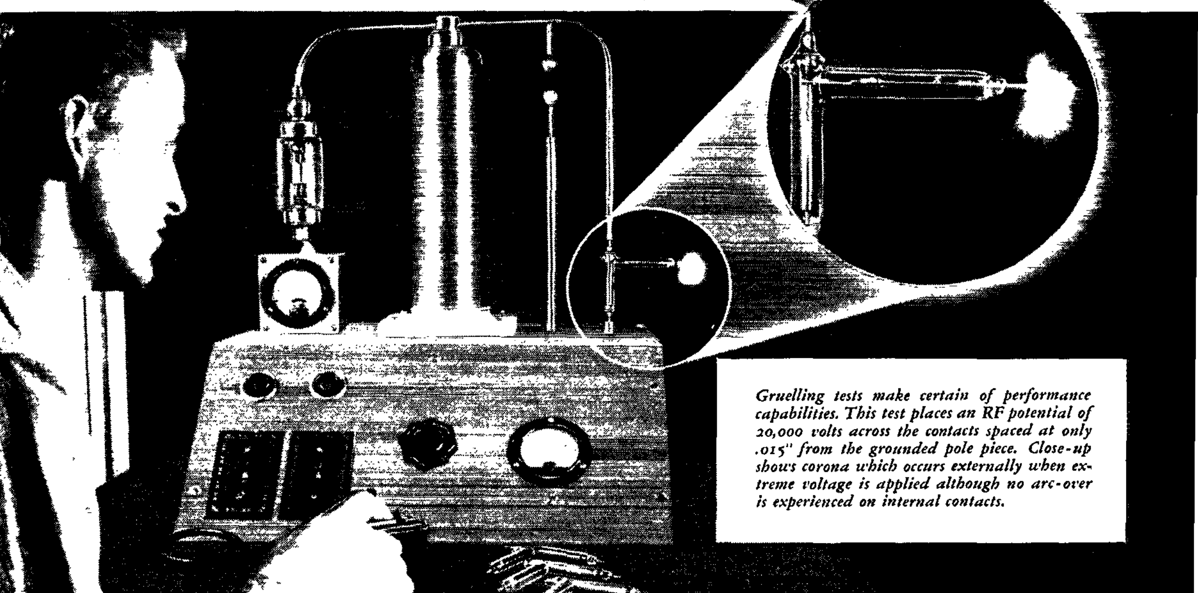

Gruelling tests make certain of performance capabilities. This test places an RF potential of 20,000 volts across the contacts spaced at only .015" from the grounded pole piece. Close-up shows corona which occurs externally when extreme voltage is applied although no arc-over is experienced on internal contacts.

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Planning WERS

(*Continued from page 24*)

simple enough procedure, but again, while no ruling has been made, we believe if you adequately show in your application that the antenna is not a hazard to air navigation because of low height, height of surrounding buildings and structures, etc., the extra forms will not be necessary.

Supplemental Data

FCC will not issue a station license unless the application shows in detail, as required, the complete setup of civilian-defense communications. (One of the first applications received was from a small community wishing an eight-unit station but apparently having only two operators available!) Extremely important in FCC's decision is the map of operations and supplemental data required in the regulations. OCD requests — and we earnestly second the hope — that applications will be made out with extreme care and thought, with all documents in order and all plans of operation thoroughly explained.

Necessary supplemental data include the following:

a) The proposed plan of operation including:
1) general operating procedure;
2) the scope of service to be rendered;
3) type of messages to be transmitted;
4) methods to be used in monitoring, supervising, and controlling the operation of all stations for which license is requested;
5) methods used to measure the operating frequencies of the transmitters;
6) provisions for periodic inspection of the equipment;
7) source and distribution of the equipment.
b) The area in which the stations are to be operated.
c) Methods used to ascertain the loyalty and integrity of radio station operating personnel.
d) Plans for enlisting radio operating personnel, and whether they will serve on a paid or voluntary basis.

Also in the supplemental data should be included a positive statement of the licensee's ability to silence its units upon order of the regional defense commander. This entails establishing proof of close and continuous contact with the district warning center and of arrangements for immediate relaying of any such signals. It might be accomplished by setting up a station unit over in the d.w.c. city, with an established channel for relaying any such order. If service is to be rendered adjacent municipalities (as in the cases of licensing by entire warning districts), sworn copies of agreements made between the municipalities and the applicant must be included. However, if the district warning center city, licensed for WERS, wishes to establish a channel with a subcontrol center city, separately licensed for WERS, it may do so at any time without such legal procedure.

Operator Licensing

In many communities there will not be sufficient amateurs nor other FCC licensees to man the necessary equipment. Radio aides and club groups will need to conduct intensive training courses for desirable personnel aimed either at an amateur license or a restricted radiotelephone

(Continued from page 114)

operator permit, with emphasis probably on the latter due to the comparative ease of qualifying for it.

FCC commercial operator regulations provide to "employees of a division of local or state government" the convenience of "resident" examinations for the restricted 'phone permit, this provision being originally aimed at police station operators. WERS radio aides will be pleased to learn that FCC has extended this privilege to personnel selected to operate State Guard and Civilian Defense stations, thereby relieving many persons of the necessity of a trip to the nearest inspector's office. In practice, the municipality should communicate with the district radio inspector, furnishing the names of the applicants and the person designated to supervise the examination (who might well be the radio aide). FCC states that in the case of WERS stations, examinations will not be authorized prior to the submission of application for station licenses. Please note this convenience applies to the restricted 'phone permit only — not to amateur licensing.

Now Go To It!

We have waited many months for the "go" signal; now we have it. Now we can do our specialist part in civilian defense, helping to protect our homes and loved ones from any enemy air attack — a possibility not so remote as some of us may think. Those of us remaining at home to do essential civilian jobs, or kept from active military service by reason of dependents or physical defects, need to put our efforts behind local administration of this new emergency radio plan, lend u.h.f. equipment to our community, help train new operators, sign up for operating watches. It is a real assignment. Amateur radiomen are the only ones who can do the job. And we will!

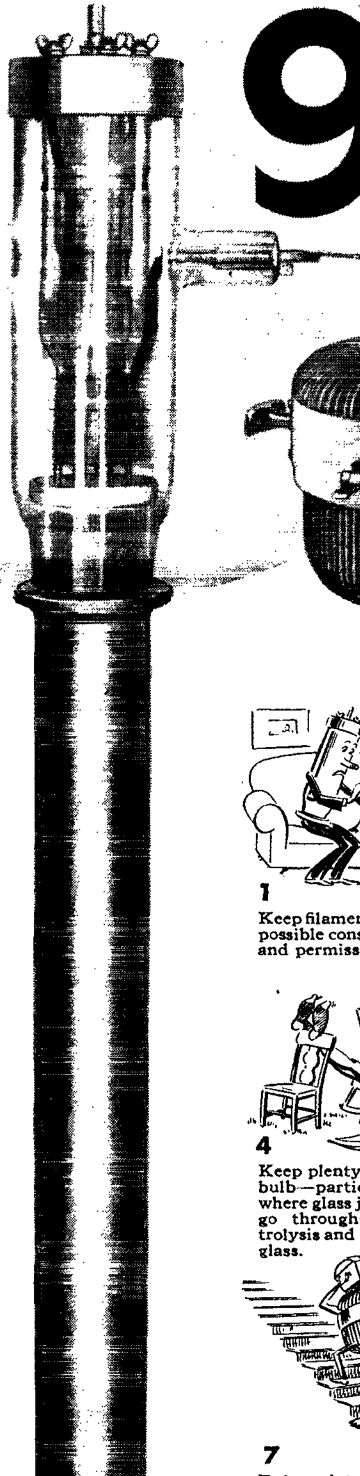
Aircraft Equipment

(Continued from page 21)

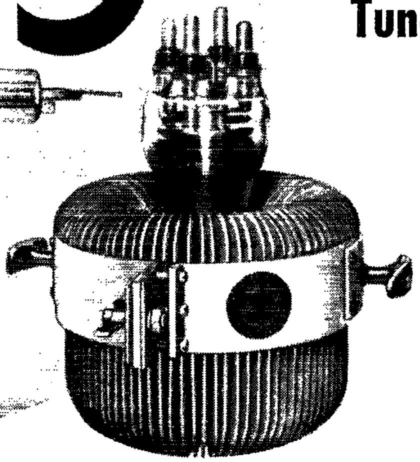
shown in the photograph. The antenna coil, L_3, is mounted on a long machine screw, with locking nuts either side of the chassis, so that its position in relation to L_2 may be changed to adjust antenna coupling. Other small components are supported by soldering their leads directly to the terminals to which they connect. In cases where there is danger of bare leads shorting, they should be covered with short lengths of "spaghetti." Lock-washers under all nuts or screws are recommended to prevent loosening under vibration.

Power Supply

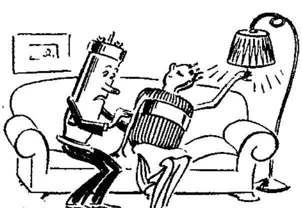
The diagram of a suitable vibrator-type power supply for the station is shown in Fig. 3-A. It consists of a 300-volt, 100-ma. power unit, a smoothing filter and control relays. Ry_1 operates from the toggle switch on the receiver to light the filaments of both transmitter and receiver and to turn on the plate-voltage supply. Ry_2 normally



9 WAYS to Make Your Tungsten-filament Tubes LAST LONGER



Here are a few suggestions for prolonging the life of pure-tungsten-filament tubes. Specific installation and operating instructions are available for *every* General Electric tube, as well as general instructions for water-cooled and air-cooled types. Send us a list of the G-E tubes you use. We shall be glad to furnish you with complete service information. A brief review of these instruction sheets will enable you in many cases to get thousands of extra hours from hard-to-get tubes. *General Electric, Schenectady, N. Y.*

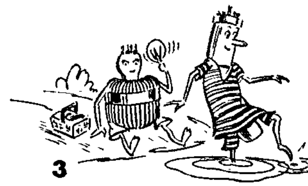


1

Keep filament voltage as low as possible consistent with output and permissible distortion.

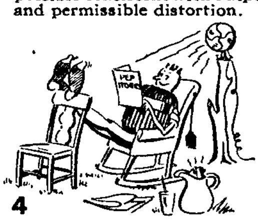
2

Minimize anode dissipation by careful tuning of transmitter.



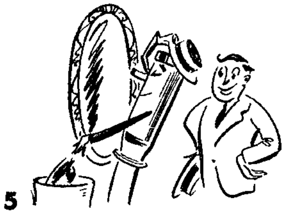
3

Be sure there is plenty of water flowing on water-cooled anodes and plenty of air on air-cooled anodes to prevent hot-spotting and gassing.



4

Keep plenty of air on the glass bulb—particularly on the seals where glass joins metal or leads go through—to reduce electrolysis and gas evolution from glass.

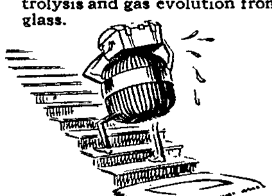


5

Switch leads every 500 hours, preferably once a week, when filaments operate on d-c.

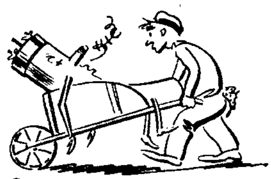
6

During starting cycle be sure the instantaneous current does not exceed 150 per cent of normal current.



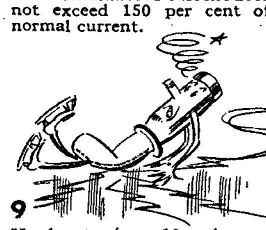
7

Raise plate voltage in easy steps when starting.



8

Prevent damage caused by overloading the plate circuit. Use protective devices such as a fuse or relay.



9

Hard water (over 10 grains per gallon) should not be used for water-cooling. Distilled water will reduce scale formation on anode.

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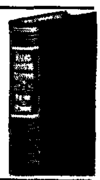

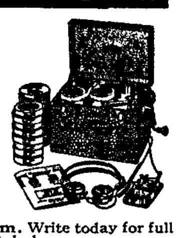

(*Continued from page 116*)

connects the output of the power pack to the receiver through its back contact. The push-button switch on the microphone shifts the output to the transmitter during periods of transmission. Separate cable sockets are provided for transmitter and receiver.

Fig. 3-B shows how the transmitter cable may be arranged to include a plate meter for tuning purposes.

Tuning the Transmitter

If a good crystal in the 3500-kc. band is available, it is suggested that it be used for preliminary tuning of the transmitter to avoid confusion by the uncertain properties of a special crystal. The positive plate-voltage lead to the 6V6 should be opened temporarily until the amplifier stage has been neutralized. With S_2 open and the key closed, plate voltage should be applied to the oscillator and C_1 tuned for minimum plate current which should run between 5 and 10 ma. Off-resonance plate current should run approximately 35 ma. The amplifier may now be neutralized in the usual manner, adjusting C_3 for minimum glow of a neon bulb touched to one of the mounting screws of C_2, with C_2 tuned to resonance near maximum capacity. Plate voltage may now be applied to the 6V6 and C_2 tuned for minimum plate current. At resonance, the total plate current should fall from an off-resonance value of about 75 ma. to approximately 30 ma. Care should be taken to make certain that the amplifier is tuned to the crystal fundamental frequency and not to the second harmonic which occurs with C_2 near minimum capacity.

The amplifier may be loaded until the plate current reaches about 65 ma. at resonance. With S_2 closed, placing plate voltage on the modulator, the plate current should increase to about 100 ma. With modulation, the total plate current will swing up to 110 or 115 ma. on peaks.

The Crystal

The assigned frequency of 3105 kc. for CAP work requires, of course, a special crystal. With the market such as it is, the easiest way to obtain one in most cases will be to grind down a 160-meter ham-band crystal. Satisfactory grinding can be done only with the assistance of a micrometer, borrowed or otherwise obtained. The thickness of the selected crystal should be checked against its known frequency before grinding is started, to determine the approximate thickness of the finished crystal from the formula:

$$t_2 = \frac{3105\, t_1}{f_1}$$

where t_2 is the approximate thickness of the finished crystal, t_1 the thickness of the crystal to be ground down and f_1 the original frequency of the latter. A crystal of good response should be selected if trouble is to be avoided. One that is a "dud" at 1800-kc. will usually perform no better when ground to the higher frequency.

Grinding is done by rubbing the crystal in ir-

(*Continued from page 118*)

regular spirals with light pressure over a piece of plate glass covered with a solution of water and carborundum powder. One side of the crystal should be marked as the reference side and all grinding should be done on the opposite side. Frequent checks with the micrometer should be made as the grinding progresses, not only to check the thickness but also to make certain that it is the same thickness at all points. Should any humps or hollows develop, they should be taken out by applying pressure at the high points. No. 180 carborundum will cut fast for the first portion of the grinding, but No. 200 should be used for finishing the last one-thousandth inch or two. The frequency of the crystal should be checked often in an oscillator, both to make sure that it will oscillate and to check the speed of frequency change with grinding. The speed of grinding can be controlled to a certain extent by the weight of the solution, a heavier solution with more carborundum cutting faster than a lighter mixture. Extreme care should be used in the final grinding to make sure that the frequency of 3105 kc. is not exceeded, thereby making the crystal useless for this purpose. Checks over the last 5 kc. or so should be made with the crystal in the transmitter, since the channel tolerance is only 0.02 per cent. This means that the final frequency must remain within the limits of 3105.6 kc. and 3104.4 kc.

Antennas

The transmitter is designed to work with one output terminal connected to the frame of the ship and the other to a trailing-wire antenna approximately one-quarter wavelength long. The antenna system is usually tuned by simply reeling out wire until the antenna hits resonance as indicated by an increase in plate current. Coupling to the output amplifier may be adjusted by moving L_3 in relation to L_2 or by adjusting the taps on L_3.

A separate fixed antenna may be used for the receiver. Better results will be obtained, however, if the transmitting antenna is used for receiving, although a fixed antenna as short as 6 or 8 feet has been used successfully. To use the transmitting antenna, an antenna relay may be connected with its winding in parallel with Ry_2 and its contacts arranged to connect the antenna to the transmitter when the microphone push-button switch is closed.

Noise

The amount of electrical noise encountered in reception depends upon many factors, some of which may be peculiar to a particular installation. Complete noise elimination may require the installation of a shielded harness by a licensed mechanic, although satisfactory reception may sometimes be obtained simply by proper selection of the spot for the receiving antenna and the point of grounding. Usually the farther the receiver and its antenna are placed from the motor and instrument panel the better.


YOU'LL OPEN YOUR EYES WHEN YOU SEE MY ECHOPHONE EC-1

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WANTED: radio operators for Merchant Marine, must have commercial license, wages $290 to $350 monthly. Radio Officers' Union, 265 West 14th St., New York, N. Y.

OLD QSTs. Buy — sell 1915/41. Files or single copies. W6SN.

WANTED: Par-Metal cabinet No. ER205 — grey. State condition and price. Racine Police Department, Racine, Wisc.

WANTED — Skyrider Marine S22R. R. Barnum, Mt. Pleasant, Iowa.

SWL'S? — QSL's? Samples? W8DED, Holland, Mich.

WE pay cash immediately for used communications receivers and transmitters. Write, telephone, telegraph description. Henry Radio Shop, Butler, Mo.

WE still have a large stock of communications receivers, transmitters, meters, code machines, radio supplies of all sorts. You get lowest prices, personal cooperation, ten day trial. Your inquiries and orders invited. Henry Radio Shop, Butler, Mo., and 2335 Westwood Blvd., W. Los Angeles, Calif.

RECONDITIONED guaranteed communications receivers and transmitters. All makes and models cheap. Free trial. List free. Henry Radio Shop, Butler, Mo.

SELL new Abbott DK3 112-Mc. transceiver with tubes, batteries, Universal 820 handset, $25; new RCA 866A/866 $1.50, f.o.b. destination. W5ALA, 5712 Berkshire, Dallas, Texas.

PAY $50 cash for good SX16 with speaker. H. S. Lair, Vineyard Haven, Mass.

WANTED Webster Deluxe or similar record player for installation with Super Pro. V. K. White, Lee Plaza Hotel, Detroit, Mich.

SELL: 110 volt A.T.R. inverter, like new, make offer. Bill Dolan, Box 24, Lovelack, Nev.

CRYSTALS: new type E62 and E64 Steatite units now available, smaller and better. High quality commercial crystals meeting FCC requirements. Suitable for frequencies in the 1600 to 10,000 kilocycle range. These new and smaller type crystal units are interchangeable in most all installations. Send for information or order from us, high priority advisable. Eidson's, Temple, Texas. (Phone 3901.)

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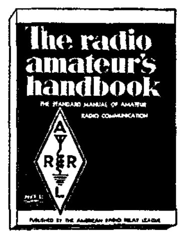

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SPECIAL DEFENSE EDITION — This new edition of the Handbook is designed especially for use in radio training courses. It eliminates those portions of the regular edition which are not useful for instruction purposes and has added chapters on mathematics, measuring equipment and code instruction. Brand new is the first chapter covering the elementary mathematics necessary for the solution of all formulas and interpretation of graphs appearing throughout the text. This includes a review of decimals, method of extracting square root, algebraic notation and manipulation of formulas, laws of exponents, logarithms, a discussion of linear, power and exponential functions and their application to graphs, and the use of coordinates. Supplementing this chapter, a four-place log table is included in the Appendix. *Price $1.00*

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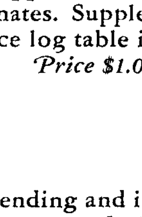

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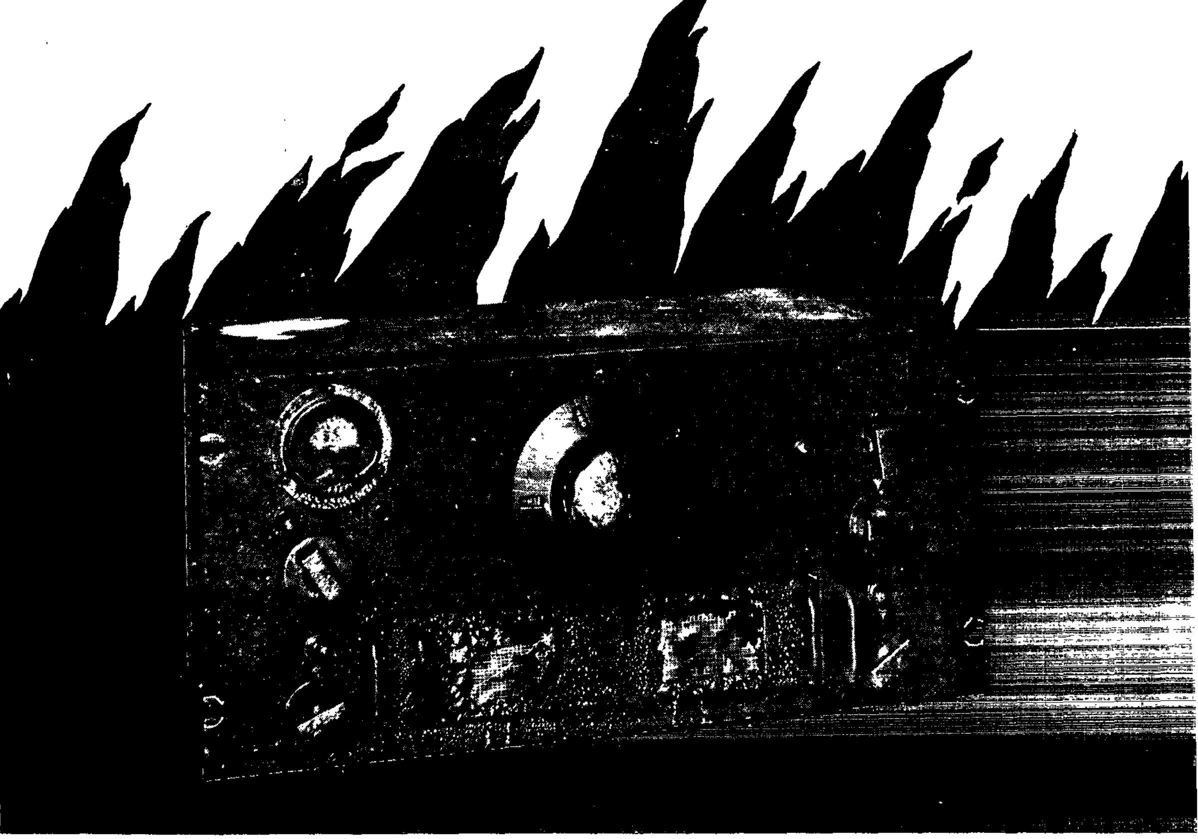

HELL—AND HIGH WATER

The HRO Receiver shown above was one of four in a building severely damaged by fire. The heat was so intense that it blistered paint and distorted Bakelite parts on all four receivers. Without any repairs, two of the four receivers tested normal in all respects except for some noise when tuning. This defect was eliminated by wiping soot from the rotor contacts. The remaining two HRO's required only minor resistor replacements, after which they likewise showed superb performance.

Two HRO's being loaded on a ship were dropped into the salt water of the harbor when a loading sling broke. They were recovered, and returned to us. One, without any repair or adjustment, showed performance that approached normal, except on one coil range which had an open circuit. The second receiver gave satisfactory performance on one coil range, after that coil had been baked in an oven. In spite of the delays in shipment to us, salt water still dripped from the coils when the equipment was received at our plant. ¶ Incidentally, we do not recommend this type of treatment.

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