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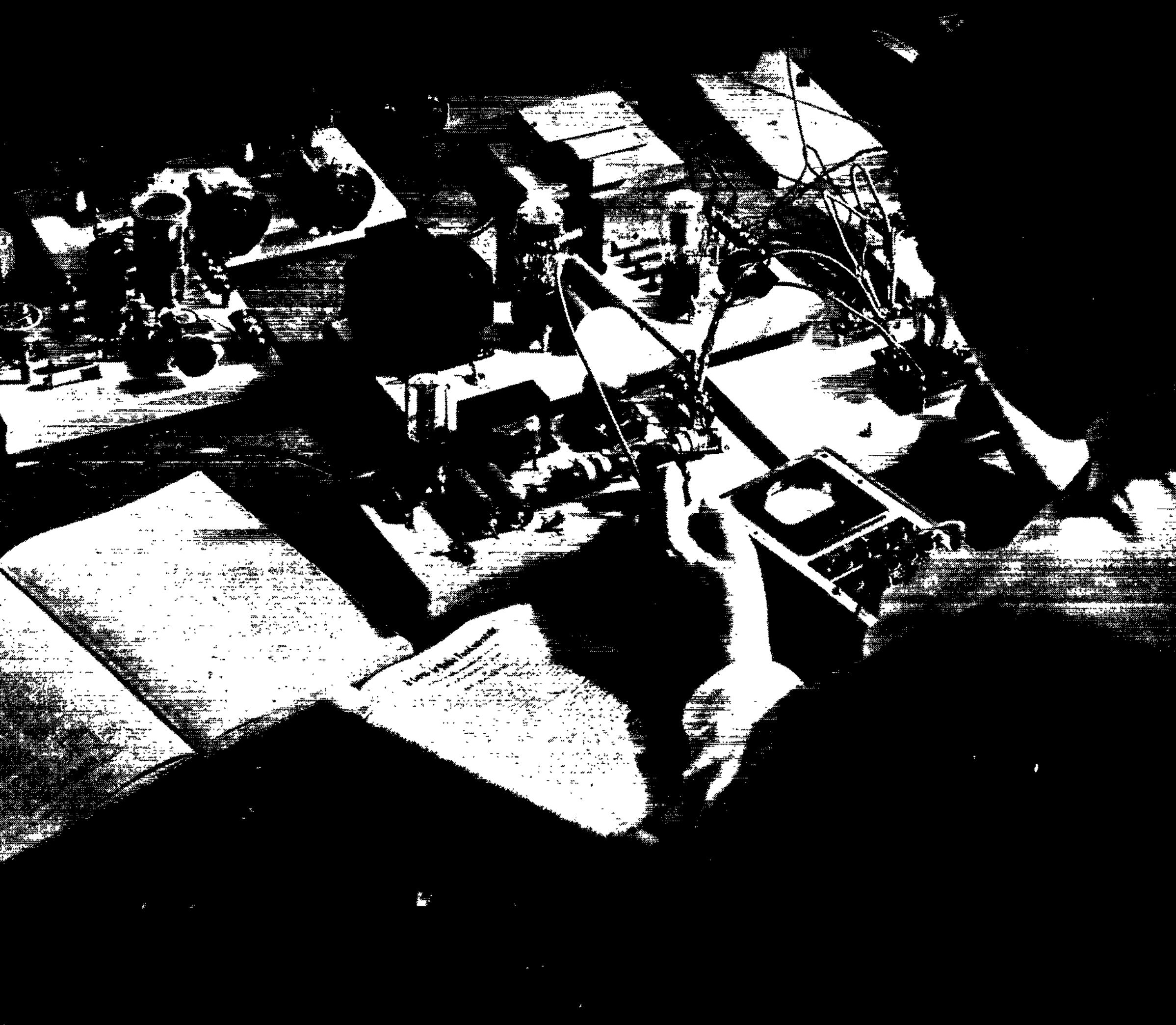

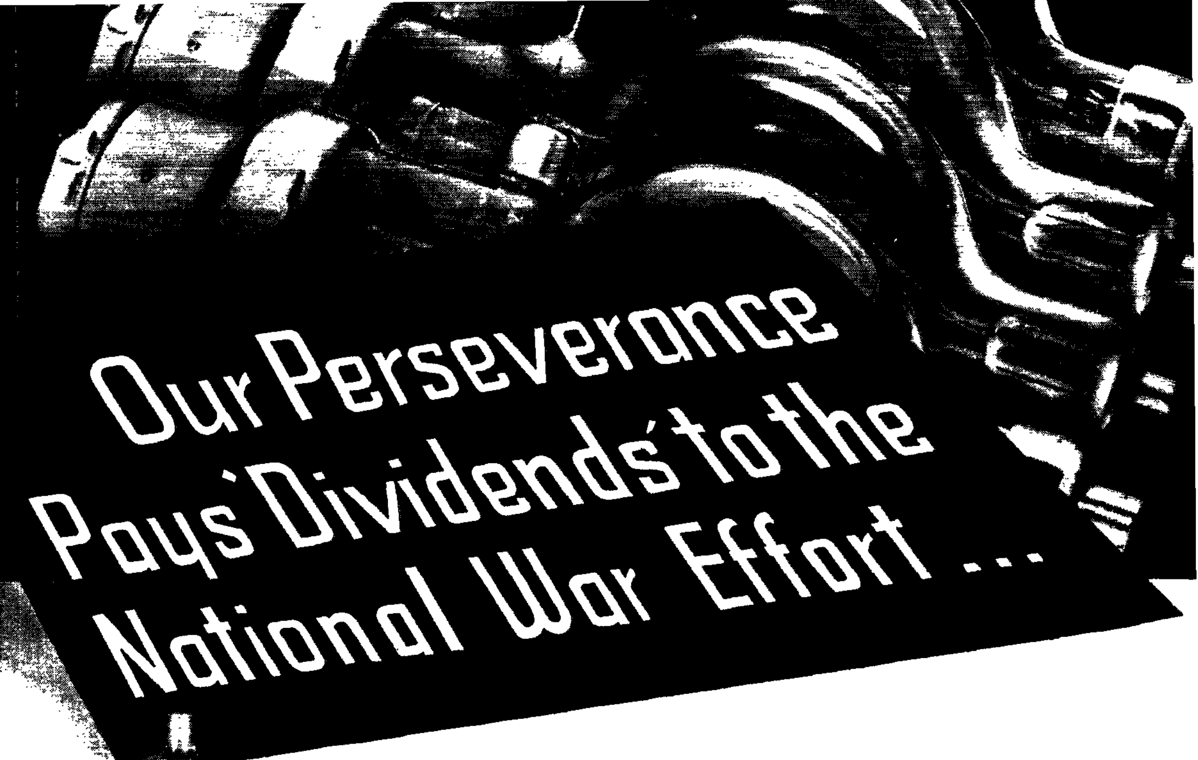

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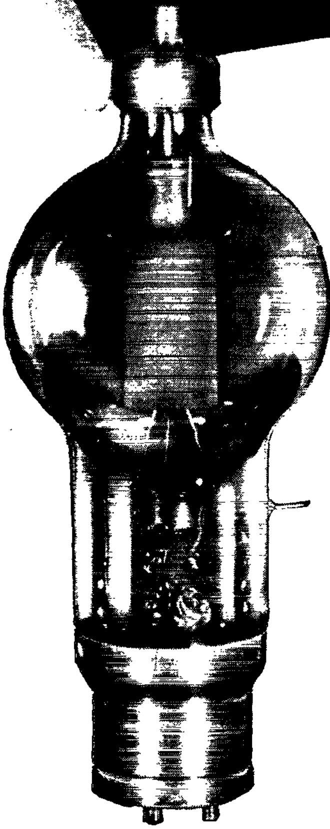

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SEPTEMBER 1942

VOLUME XXVI

NUMBER 9

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Subscription rate in United States and Possessions, $2.50 per year, postpaid; all other countries, $3.00 per year, postpaid. Single copies, 25 cents. Foreign remittances should be by international postal or express money order or bank draft negotiable in the U. S. and for an equivalent amount in U. S. funds.

Entered as second-class matter May 29, 1919, at the post office at Hartford, Connecticut, under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized September 9, 1922. Additional entry at Concord, N. H., authorized February 21, 1929, under the Act of February 28, 1925. Additional second-class entries to cover sectional editions authorized March 20, 1935.

QST devoted entirely to AMATEUR RADIO

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

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

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 non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its board.

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

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

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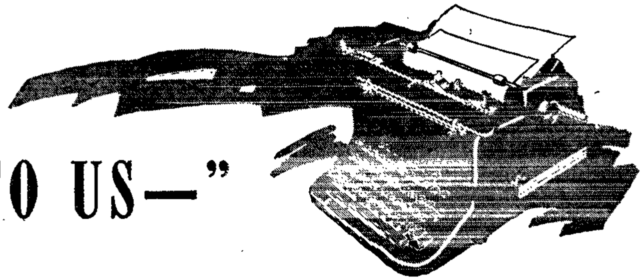
"IT SEEMS TO US—"



WE MUST NOT FAIL

Added importance is being given to the War Emergency Radio Service, particularly in regions away from the coasts, by plans now under way to permit the use of these communications facilities on behalf of the Red Cross in the event natural disaster visits a community. This is the only thing in sight for the relief of the civilian distress that can be caused by old Mother Nature's miscarriages — the floods, earthquakes and storms that produce the emergencies with which we amateurs have had so much experience. If your community is basking in the golden thought that it has no need to fend against air raids in its inland location, perhaps this new promise will put the spur to WERS organization.

If you fellows had had the opportunity to see the confidential reports from abroad that we have seen, you'd know how terrrifyingly important it is to have auxiliary radio communication for civilian-defense activities. Believe us, it is. OCD has tossed the ball to ARRL on the whole job of lining up amateurs and their gear for WERS, doing the explaining, helping in the appointment of good radio aides. For the sake of our communities and our families, WERS simply must succeed. It's not going to be easy, because so many of our gang are away from home and apparatus is so hard to get. But we must not let it be said that there were too few amateurs, or that we were too busy or tired from wartime work, or that we couldn't succeed in throwing together the necessary additional apparatus. We can set up evening classes and qualify local folks for third-class certificates and eventual WERS permits, to supplement our own diminished numbers, and do the whole job in a week. Our "technical committees" can set up miniature production lines and build a dozen 2½-meter stations at a crack out of the parts in our junk boxes or the pile of "trade-ins" that is in every radio dealer's basement. We can do it. We must. Up and atom, gang!

SPEAKING OF JUNK

War production during the critical months ahead will be seriously hampered unless scrap and junk metal can be kept freely flowing, in increasing quantities, to war plants producing material for our fighting forces. The attics and cellars and farms of America are a rich mine of millions of tons of such raw materials lying idle and useless. America must now work this mine. A concerted drive is on in every state and you must have heard about it in your own city. Citizens are being urged to dig out every article of metal that can be spared and either give it to a local charity to dispose of or, if there's enough to make a sale worth while, sell it to a junk dealer.

Comes now the War Production Board's salvage section with a particular appeal to the radio amateurs of the country to contribute copper, particularly scrap copper wire, of which there is a critical scarcity. We publish their letter in this month's correspondence section and it is worth your reading. Like every citizen, we can dig out the old beds and tire chains. Being hams, we can go further and throw in those old chassis and the miscellany of brass and aluminum we all accumulate for hard times; these *are* hard times. But our particular pigeon is copper. Without denuding ourselves of anything needed in WERS work, we still think WPB too conservative in hoping for an average of only a pound from each of us. We've never yet been in an amateur shack that didn't have a large box of scrap wire, and in most of our cellars there still hangs that unsuccessful antenna of year before last, just the way we took it down and coiled it up hoping that some new use would come for it. It has come; this is it!

So jump in, OMs and YLs, and bundle up that copper. Hang it on your handlebars and drop it off tomorrow morning at the headquarters of your favorite charity. There'll be millions of spools of new wire when we need it after this war. In the meanwhile this is something that we hams with flat heads and square feet or too many babies can do to assist Uncle. It will help make up for the fact that we're not out there in a tank or a bomber or a destroyer. Let it be our particular way of sending our 88 to Schickelgruber and Hirohito and their little playmates!

K. B. W.

★ SPLATTER ★

OUR COVER

When this lad has finished he's really going to know radio principles — having learned by doing, as well as by reading. The reason, obviously, is that he's taking *QST's* "Course in Radio Fundamentals." There's many a ham doing it, and benefiting accordingly.

WAR BONDS AND THE HAM

The editorials on page 9 emphasize again the special responsibilities of the stay-at-home ham in this war. When it's all added up, ours *is* an extraordinary responsibility. As members of a group which has benefited so much from the American way of life — the radio amateurs — it is up to us to do even more than our neighbor in discharging our obligation to the principles of democracy.

That obligation extends beyond the specialized radio duties we can perform, or even the unique source of critical scrap materials our shacks represent. It applies to this business of buying U. S. War Bonds and Stamps, too.

There's an awful lot of radio equipment being used in this war, you know. We read the other day that $2000 worth of radio gear goes into every tank that rolls off the assembly lines, that every big bomber contains something like $50,000 worth. The Signal Corps is currently giving final acceptance tests to more than $2,000,000 in radio equipment *daily*.

It's going to take a lot of everyone's dough to pay for all that. And an even higher than normal percentage of that dough should come from hams — because we are going to benefit even more than most when the war's over, not alone in the major sense of being able to maintain our way of life, but because of the resulting technological advances in research and manufacturing.

That brings up another point. Vast though the stream of radio manufactures flowing from our plants is now, there still exists a critical lack of equipment — particularly in some of the specialized items, like receivers, needed for individual jobs at key points. If you have equipment of the type that's needed and failed to fill out the questionnaire in August *QST* (p. 31), for your country's sake do so now.

And then convert the proceeds from whatever you sell into war bonds. It'll be the best investment you ever made — better even than the original equipment, because not only do you thus provide yourself the cash to buy modern replacements when the war's over, but you help to guarantee that some day we'll all be able to use amateur radio gear again.

FOOTNOTES

The contributed material in this issue comes from an exceptionally well-qualified collection of authorities, you'll be interested to know. **John A. Doremus, W3EDA/1,** who writes on WERS, got his post as Massachusetts State Radio Aide through plain outstanding merit, for example — no political or other pull entered into it. He's a brilliant fellow with exceptional organizing ability who made such an outstanding record at Lafayette College that MIT called him up to Cambridge to teach aeronautical engineering. He's also State Radio Engineer for Massachusetts. **Donald D. Millikin** is one of the nation's foremost code and cipher experts, compiler of the "Standard Code of the American Hotel Association," contributor of the article on cipher writing in current editions of *The Encyclopedia Americana*, and owner of one of the finest collections of works on cryptology in the country. **Dr. R. W. Woodward, W1EAO,** is an expert on both WERS and frequency measurement — among many other things. A well-known metallurgist, as well as one of the most active amateurs who ever took the air — all bands, 'phone and c.w. — he is currently serving as Connecticut's State Radio Aide. **Eileen V. Corridan,** who contributes the second in what we now hope will be a series of rhymed lessons on radio, takes her intriguing analogies from the depths of her own recent intensive training. A graduate of the New York City AWVS classes, she made such an outstanding record that the Signal Corps now has her working as a radio technician at Fort Monmouth.

We won't go so far as to say that **H. Frank Jordan, W5EDK,** author of the fiction yarn on page 55, is an expert on the Japanese character. In fact, he more or less disqualifies himself in that direction by the unique twist he gives the end of the yarn. We don't want to say more for fear of giving the point away — but we can't refrain from adding that, if any Jap ever did behave that way, it would have to be one who had read *QST!* Anyway, W5EDK tells an interesting tale, and you'll enjoy it.

ON THE ULTRAHIGHS

CONDUCTED BY E. P. TILTON,* W1HDQ

For the devoted readers of Ed Tilton's "On the Ultrahighs" column who will search in vain for it in this issue, a word of explanation. Unfortunately, material prepared for the column was found by censorship authorities to contain information considered to be of vital military importance. There being insufficient time for preparation and approval of alternative material, the department for this month is omitted, with apologies to W1HDQ and his myriad followers.

Massachusetts Civilian Defense Radio

Practical Application of WERS to Meet State and Municipal Needs

BY JOHN A. DOREMUS,* W3EDA/1

PEARL HARBOR caught many Americans off guard! However, the amateur radio organizations of many towns and cities of our country have emergency communications units which had already been conducting practice drills for many months. Adams, Massachusetts, for example, has a working organization which has been conducting regular drills since 1936. Many other towns have similar organizations with complete disaster plans organized under the direction of the Emergency Coördinators.

The Citizens' Defense Corps of Massachusetts was organized under the Governor's Committee on Public Safety, which has since become known as the Massachusetts Committee on Public Safety. This organization was quick to realize that radio could play a vital role in the control system of the ARP services. So that close coördination might be maintained between amateur efforts and the needs of civilian defense, a radio communications department was established under the Protection Division of this Committee on Public Safety.

During the reactivation period, stations in many towns throughout the state were reactivated and emergency nets formed to work in close collaboration with the civilian-defense groups. Unfortunately, amateur stations were permanently silenced early in January and emergency nets were permitted to exist only on paper. During the long winter evenings, radio participation in civilian defense was the subject of many fireside discussions. Seemingly, the greatest accomplishment of these meetings was the consumption of dozens of doughnuts and gallons of coffee supplied by the YLs. Yet these informal ragchews did bring about an exchange of ideas that crystallized into a "six-point" plan which was communicated to Dean Landis of OCD near the end of March. We received a pleasant reply from the Office of Civilian Defense stating that a strikingly similar plan was being considered by the Defense Communications Board and that favorable action might be expected in due course of time. This was the assurance that we needed to start the ball rolling again!

* Massachusetts Institute of Technology, Cambridge, Mass.

First, we held organization meetings in the cities and towns throughout the state. The details of the probable role of radio in civilian defense were discussed. As the significant points were discussed, everyone realized that this was an undertaking that required a radio communications network with exacting control, and that it must be operated by personnel with unquestionable loyalty to our country. All were eager to participate.

It was the collective opinion of men throughout the state that radio communication details must be thought out well ahead of time. Control stations of each network should be located at principal control points in the civilian-defense organization, and the networks should cover a sufficiently great area to allow the interchange of equipment within a network if one section should be more heavily involved in enemy action than another. Opinions were expressed that definite channels should be voluntarily established and assigned in such a way that each town would have a relatively clear channel for its operation.

Administrative Control

For administration of the civilian-defense organization, the State of Massachusetts is divided into nine large regions. Each region contains several officially-designated warning districts. The radio department was designed along the same general lines as the parent civilian-defense organization. A Regional Radio Representative was

The State of Massachusetts has long recognized the potential value of amateur emergency communication in possible enemy air raids, as evidenced by its formation many months ago of a radio communications department headed first by Col. Davis Boyden, W1SL, and now by John Doremus. The preparedness of Massachusetts is indicated by the fact that the first applications for WERS licenses were mostly from towns in that State. An excellent communications organization has been set up based on air-raid warning districts, and is described here as an aid and guide to Emergency Coördinators and others formulating municipal plans. This article has been prepared with the help of Norman H. Larrabee, W1KKV, and Miss Helen M. Wright, who together with the author form the staff of the state headquarters radio department, Committee on Public Safety.

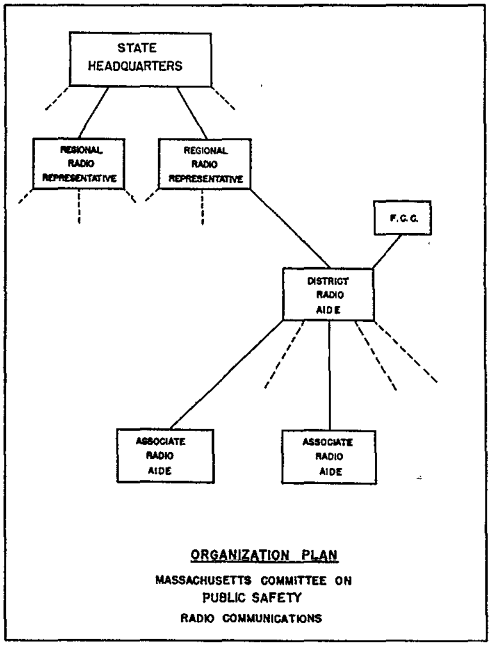


Fig. 1

chosen in each region to coördinate the activities of that area and relay accomplishments back to State Headquarters. These men in all cases were prominent amateurs and Emergency Coördinators in their areas. They chose assistants in each warning district who worked with the ECs in each town and kept them in touch with the civilian-defense organization. A plan of the present organization is shown in Fig. 1.

As the individual groups were formed, names of all people interested in civilian-defense radio were forwarded through channels to the State Headquarters and entered on a large mailing list. Occasional bulletins of pertinent information were sent out to these individuals. This helped the state-wide activity to grow as a whole rather than in widely-separated groups. Then, too, the personnel from State Headquarters made occasional trips to all districts to meet the gang and discuss the many problems that could not be effectively discussed by mail.

As no organization can thrive on "talk" alone, the equipment problem was studied. An appropriation was obtained from the funds of the Committee on Public Safety to purchase equipment for the stations at the control centers in each warning district. A transmitter-receiver similar to the popular TR-4 was designed, along with a power unit capable of operation from either 110 volts a.c. or 6 volts d.c. This equipment was manufactured for us by a Boston radio company. As soon as the organization in each district was well formed, equipment was issued for the control center including, in addition to the transmitter-receiver and power unit mentioned above, two storage batteries, a microphone, a spare set of tubes and a 50- or 75-foot length of coaxial cable for the antenna lead. Unfortunately, no satisfactory antenna could be purchased and the individual groups were required to construct these or "appropriate" a signal squirter from one of their own silenced stations.

Most of the equipment for the many stations needed to form a successful civilian-defense network was contributed wholeheartedly by amateurs who formed the backbone of the organization. Rigs range from a four-stage crystal-controlled outfit to small, light, hand-carried portables. In a few instances where the amateur gear was not available, additional equipment was purchased without the aid of priorities from the stocks of local dealers.

Operating Plan

To be of greatest value in civilian defense, radio should be used to establish auxiliary communication links that parallel the normal communication circuits of ARP services. The first stations to be erected, therefore, should be those located at district control centers, town and city control centers, and fire, police, ambulance, and water, gas and electric department headquarters in each town. In many larger cities, sector warden headquarters are located in schoolhouses and other public buildings, and these, too, might well be equipped with fixed-station units. Portable hand-carried units might be located at any of the above-mentioned radio points. Then, if needed, such a portable unit could be dispatched with an operator to the scene of an incident and be at the disposal of the incident warden. In metropolitan areas, mobile equipment would be of little use since, when it would be needed at an affected area, the chances are that it would not be able to get to the point because of damage to the streets. In rural areas, however, mobile units form an essential part of a practical network. All units, when not in use, should be covered with lock-type boxes or stored in adequately protected rooms to prevent use by unauthorized persons.

Operators should have definite posts of assignment, with an adequate number of men assigned to each post to insure that at least one will be there when the need arises. Arrangements should be made to extend to the radio group the first warnings that are received, in order that they may get the units operating and "check in" on the net before things start to happen.

During the spring months, portions of every warning district in Massachusetts were active in getting together both operators and equipment to form operating networks that would fit into the plan described above. Then, on that eventful day in June, the War Emergency Radio Service was announced. The lid was off! Our stations would

Suggested Channels for War Emergency Radio Stations in the 112–116-Mc. Band

Channel	*Center Frequency*
A	112.1 Mc.
B	112.3 Mc.
C	112.5 Mc.
D	112.7 Mc.
E	112.9 Mc.
F	113.1 Mc.
G	113.3 Mc.
H	113.5 Mc.
I	113.7 Mc.
J	113.9 Mc.
AA	114.2 Mc.
BB	114.6 Mc.
CC	115.0 Mc.
DD	115.4 Mc.
EE	115.8 Mc.

be able to emerge from the planning board and become a working reality.

Licenses by Warning Districts

Almost at the same time the new service was announced, we learned that the Washington office of the OCD had worked out plans for including all stations in a warning area under one license. This plan offered many unique advantages, as follows:

1) An entire district operating under one net-control station located at the warning center can be quickly silenced upon receipt of a single order at the district warning center.

2) In a system administered by a single Radio Aide for an entire district (who would be responsible to FCC for the system), with the guidance and counsel of Associate Radio Aides in each town, off-frequency operation and other similar problems can be quickly and easily solved before they become serious and jeopardize the standing of the entire WERS.

3) Portable equipment can be temporarily moved throughout an entire district quickly to cope with any incident which may require more facilities than a town has available.

4) Operators, likewise, can work throughout the district wherein they are licensed.

5) Last but not least, frequency meters and other expensive test units are more easily made available to all towns in a district when operating under one Radio Aide who is responsible for the operation of all of the stations.

In short, this plan seems to give radio a better chance of being useful to civilian defense and it was quickly adopted throughout most of Massachusetts.

When the frequency bands were definitely established by FCC in its announcement of WERS, the State Headquarters staff made a suggested division of the band into channels as shown. Since this service is available to both State Guard and civilian-defense stations, a meeting was arranged with the state communications officer of the Massachusetts State Guard. Discussion showed that, at least for the immediate future, the State Guard was mainly interested in portable operation with field units, and it was agreed that in the 2½-meter band the frequencies from 115.2 Mc. to 116 Mc. would be used by the State Guard, while the frequencies from 112 Mc. to 115.2 Mc. would be used by civilian-defense stations. This agreement is designed to promote the most effective use of the frequencies available and may be called for review at any time by either of the parties.

First Application

The first application for operation of an entire district was forwarded to FCC shortly after the new service was announced. The Lawrence district was chosen, as all towns there had equipment ready to go and their operator organizations were well formed. Then, too, it is a rather small district and information needed for the application was easily collected. Thus we have a guinea pig. (Apologies to Lawrence!)

The Lawrence warning area includes five towns as shown in Fig. 2. These towns cover an

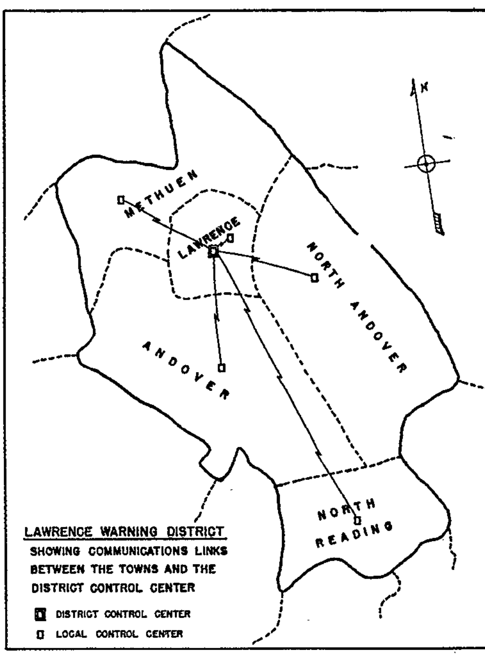


Fig. 2

area of approximately 170 square miles and have a population of 125,000. The city of Lawrence has agreed to sponsor the license for the district and made an inter-municipal agreement with each of the other towns in the area. A sample inter-municipal agreement is shown at the end of this article. We like to think of each district as a coöperative group, one member of which has agreed to sponsor the license. Each town has an Associate Radio Aide who supervises the operation of the equipment, located within his town, which has been obtained from amateurs or purchased by the town. The Associate Radio Aides, together with the Radio Aide (who often comes from a town other than the one in which the district control center is located), form the administrative group for the network.

Fixed stations are located at the district control center city, the control centers of each of the towns and cities and at some of the police and fire headquarters. Portable units are also located at these points to be dispatched to incidents when needed. In some of the smaller towns in this area, the police headquarters, fire headquarters and the town control center are all located in the same building. All stations are to operate on the same frequency when working with the district control center. A second, predetermined frequency is to be used for operation between units within any one town.

The first application was made for only 13 units. This is intended as a skeleton network and will be increased as the equipment and operators become available. At this writing the license has not yet been granted and, therefore, operation has not yet been possible under the new rules.

Schools

From the very beginning it became quite clear that the limiting factor in our War Emergency Radio networks would be operators. Many of our loyal amateurs have joined the armed forces. To cope with this situation we established a state-wide radio school system to train operators. Three courses are offered: (1) to train operators for restricted radiotelephone permit, (2) to train operators for amateur license, and (3) to train operators for second-class commercial radiotelephone license. These courses are promoted by the state headquarters but are given by local groups of amateurs in each town and city. They are given without cost to the students by instructors serving without compensation, and rooms are obtained on a no-cost basis. Formal class outlines and other lesson material are prepared by the state headquarters. The text used for the amateur course is the Defense Edition of *The Radio Amateur's Handbook*, while Nilson & Hornung's *Radio Operating Questions and Answers* is used for the other two courses.

We now have 32 schools operating throughout the State, with an enrollment of over 2000 students. It is interesting to note that over 85 per cent of these students are enrolled in the amateur course.

It seems to us that our big job now is to provide radio communications for civilian defense. Our last reactivation failed because we did not get together 100 per cent behind this job. The way is neither smooth nor straight, but it will provide many interesting problems for us to solve. In civilian defense we are interested in protecting civilians regardless of political or geographic boundaries. This is our chance to show that now, as in past emergencies, radio can do the job.

For the benefit of those whose district WERS organization must be arranged to include a number of communities each with its own local government, there follows a sample form of inter-municipal agreement which may be used to satisfy the legal requirements in defining the relationships between the municipality which actually applies for the license and the remaining cities and towns in the area. The form may, of course, be altered as required.

WAR EMERGENCY RADIO SERVICE
INTER-MUNICIPAL AGREEMENT

IT IS AGREED THAT the City/Town of ...., ... hereinafter known as the licensee, will apply to the Federal Communications Commission for permission to construct and operate radio stations in the War Emergency Radio Service in the area known as ....;

AND THAT the City/Town of ...., hereinafter known as the sub-licensee, lies within said area and wishes to participate in a single War Emergency Radio Service network serving that area;

WHEREAS the Licensee is required by the Massachusetts Committee on Public Safety to furnish such emergency communications service to all municipalities within said area;

IT IS HEREBY AGREED by both parties:
THAT all radio equipment installed by the sub-licensee for the above purpose shall be under the direction and control of the licensee,

AND THAT the Radio Aide agreed upon by the licensee shall administer the operation of and be responsible to the licensee for all equipment in said network;

AND THAT during the existence of this agreement, the sub-licensee will not request individual authority for a War Emergency Radio Service station license;

AND THAT this agreement may be terminated at will by either of the parties concerned but that notification shall be given to the Federal Communications Commission sixty days prior to the termination of this agreement by either of the parties.

IN WITNESS WHEREOF, we hereunto set our hands this .... day of .... 19 .

The City/Town of .... The City/Town of ....
By .... By ....
Title .... Title ....
Commonwealth of Massachusetts
County of ....

SUBSCRIBED and sworn to before me this .... day of .... 19 .

Notary Public ....
My commission expires ....

Building WERS Gear from Salvaged B.C. Sets

How a Workable 2½-Meter Transmitter-Receiver Can Be Made From a Defunct Broadcast Receiver

BY DON H. MIX,* W1TS

Shortages and salvage — the current keynotes of the wartime world — are the twin ideas that underlie this article. With the current widespread need for 2½-meter stations for WERS and the lack of manufactured equipment to supply it, hams are turning anew to their junk boxes. Where even these fall short, resort may be had to the discarded b.c.l. sets that infest the basements of the nation's radio stores. Herein it is shown that even a mongrel chassis from such a collection can be made to supply all the necessities for a complete u.h.f. emergency station — requiring in addition only a little ham ingenuity and improvisation.

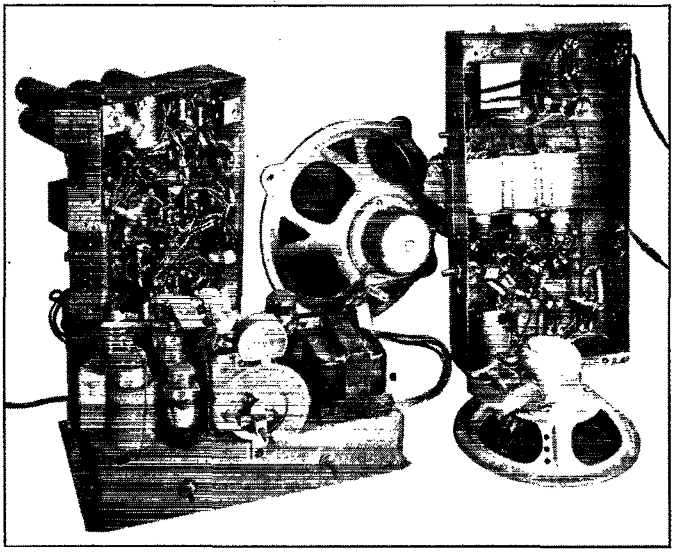
Every day new priority rulings make it tougher to obtain the parts required for WERS equipment. And, make no mistake, it's going to take a real heap of stuff to provide the coverage which may be necessary in case of a serious emergency at home. In many localities amateur groups looking into the future made an impressive start months ago in equipping themselves with 2½-meter gear and starting organizations which are now proving invaluable in the rapid forming of WERS units. However, other sections, slow to get started, may now find the going much harder. In some places collections among amateurs may yield enough high-frequency components to furnish at least the key stations. Sooner or later, however, it now looks as though many of us would be scraping the bottoms of our junk boxes in an effort to make ends meet.

With these drab prospects in view, we thought it might not be a bad idea to see what could be done, if it becomes necessary, with discarded broadcast-receiver chassis, some of which may still be picked up for little or nothing at radio retailers. The results aren't exactly pretty to look at, but they show that a ham with persistence can still play Robinson Crusoe, if he has to, as he did back in the early days of amateur radio.

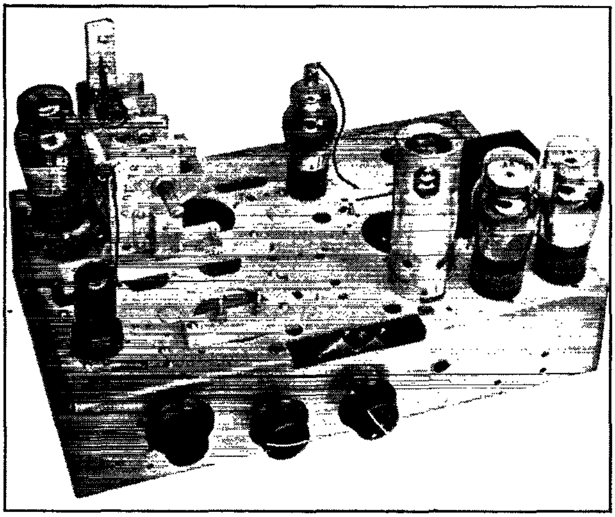
* Asst. Technical Editor, *QST*.

The finished product will depend to a great extent, of course, upon what the builder finds left on the chassis when he gets it. Some will be luckier than others, but in any case there will be plenty of room for real ingenuity in using parts to best advantage. In our case, all of the chassis from which a choice could be made were rather sorry specimens and most amateurs should be able to pick up more encouraging-looking prospects. Obviously, it is impossible to describe something which may be duplicated exactly, but we can at least show how some of the obstacles may be overcome.

The older-type b.c. receivers with husky audio and power-supply sections are most suitable, and fortunately are most often found in discarded stocks. However, even the lowly a.c.-d.c. chassis can be made into a workable unit (see the Hints and Kinks section in this issue). In the larger



A group of relics of the early 1930s, typical of the sort of junk which can be used to build WERS equipment.



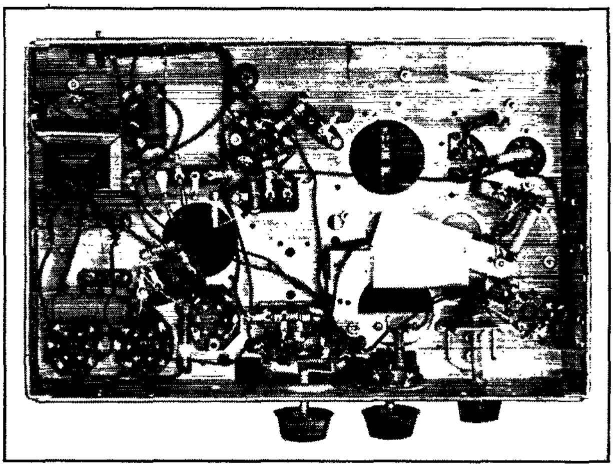
Not much to look at, but she works! The audio equipment occupies the right side of the chassis, while the transmitter-receiver is at the left. The transmitter is mounted on top of the chassis, while most of the receiver is below.

receivers, the power-supply section will provide most of the parts with which to construct a combination a.c. and vibrator-type unit for emergency work. The power transformer may be altered as described in *QST* for January, 1942.

In most cases, the audio section of the b.c. receiver may be left virtually intact to serve both as modulator for the transmitter and audio output for the receiver. In a typical case, the output stage was designed for push-pull Class-A 42s; in fact, one of the tubes still remained in the socket. The primary of the speaker output transformer was used as a modulation autotransformer with a 2-to-1 step-down ratio. Since the 42s require a load of about 10,000 ohms, this ratio is just about right for reasonable input to the oscillator, which may vary from 300 volts at 60 ma. to 200 volts at 40 ma. or thereabouts. An exact match is not too important.

The stage preceding the output stage formerly used a diode-low-μ triode and was transformer-coupled to the 42s. Since no use could be made of the diode and a couple of 78s were found still intact in other sockets, the screen and plate of one of the 78s were tied together to form a low-μ. triode with which transformer coupling could be used. A careful search of the chassis revealing no mike transformer, the second 78 (a variable-μ tube) was biased down to a reasonable plate current and used as an additional speech amplifier to provide enough gain to permit coupling the mike by resistance, dispensing with a microphone transformer.

Of course, it is preferable to use components with low-loss insulation and small dimensions, whenever they are available, for the simple r.f. sections required for transmitter and receiver. But, if such parts are not available it should not be forgotten that providing a *workable* unit is of much more importance than maximum efficiency. Even bakelite or dry wood can be made to serve in a pinch without too much loss. In the case described, every effort was made to press into service any part which might conceivably be made to work. For instance, to make use of another of the available 6-prong sockets, a 42 was used in the transmitter. It was connected as a low-μ triode with its screen and plate tied together. Plates were removed from two sections of



Underneath view of the converted b.c. receiver. Receiver components are at the right with the improvised variable padding condenser behind the inductively-tuned coil.

the gang tuning condenser to form a split-stator condenser of about 25 μμfd. per section. The frame of the condenser was insulated from the chassis by mounting it on strips of dry hardwood and the condenser mounting screws were countersunk to prevent contact with the chassis. The end of the shaft was slotted with a hacksaw for screwdriver adjustment.

The various components were arranged, so far as possible, to take advantage of the original holes in the chassis. In only one or two instances was it necessary to drill even small holes. This saved a considerable amount of time and labor in construction.

The transmitting tuning condenser was mounted with its terminals close to one of the socket holes. The socket itself was removed from underneath and mounted on spacers above the chassis, to permit short direct leads between the condenser stator terminals and the grid and plate terminals of the socket. The coil L_2 was soldered directly to the upper stator terminals at the top of the condenser, after removing the mica trimmers. A strip of wood fastened to the rear of the condenser frame served as a mounting for the antenna coupling coil. R.f. chokes were wound on short sections of pencil or wood dowel.

Since no tube or socket was available for the detector of the superregen receiver, a bakelite octal socket and a 6J5 had to be dug up to fill in. If they had been available, other older-type tubes might have been made to serve, however. One of the aluminum cans shielding the r.f. coils was slit down the side and flattened out to form a small sheet from which pieces were cut to form a crude variable air padding condenser for C_1. The stator, consisting of a piece about 2½ inches square folded at the center to form two connected plates spaced about ⅛ inch, was tacked with small brass brads. The rotor was cut to form a plate about 1 inch wide and 3½ inches long. The extra inch of length was used to mount the piece

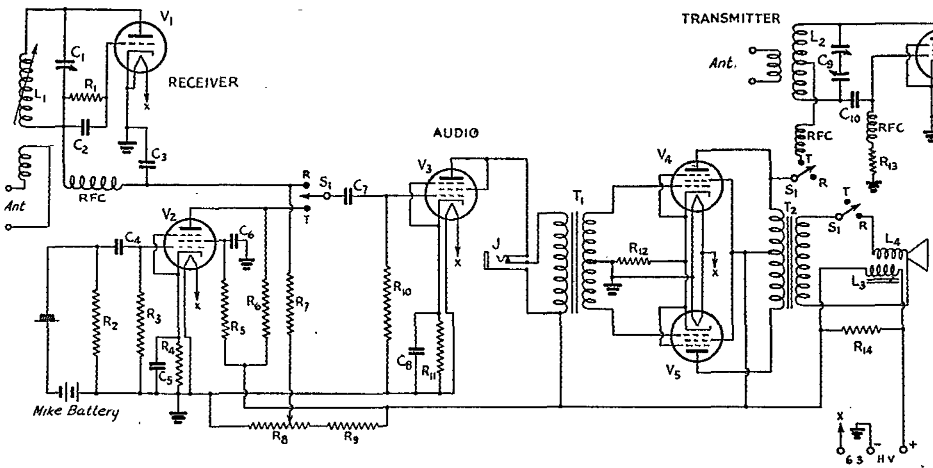


Fig. 1 — Circuit diagram of the 2½-meter transmitter-receiver made from b.c. receiver parts. Values given in first column indicate most appropriate values, while those in parentheses indicate values actually used where departures were made.

C_1 — 25-μμfd. variable (approximately 20 μμfd.)
C_2 — 50-μμfd. mica (100 μμfd.)
C_3 — 0.005 μfd. (0.0025 μfd.).
C_4 — 0.01 μfd.
C_5 — 4 μfd. (0.25 μfd.)
C_6 — 0.05 μfd.
C_7 — 0.005 μfd. (0.01 μfd.).
C_8 — 0.5 μfd. (0.25 μfd.).
C_9 — 25 to 100 μμfd. per section (approx. 25 μμfd. per section).
C_{10} — 50-μμfd. mica (100-μμfd. mica).
C_{11} — 250-μμfd. mica (0.01 paper).
J — Closed-circuit jack for headphones.
L_1 — 3 turns No. 12 wire wound on ½-inch-diameter form, turns spaced about ½ diameter of wire. See text for tuning adjustment.
L_2 — 2 turns No. 12 wire wound on ½-inch-diameter form, length about ¾ inch.
L_3 — Speaker field.
R_1 — 5 megohms.
R_2 — 200 ohms.
R_3 — ½ megohm (¼ megohm).
R_4 — 2000 ohms (1500 ohms).
R_5 — 1 megohm.
R_6 — ½ megohm (¼ megohm).
R_7 — 25,000 ohms (50,000 ohms).
R_8 — 50,000 ohms (0.1 megohm).
R_9 — 50,000 ohms (5000 ohms).
R_{10} — ½ megohm.
R_{11} — 7000 ohms.
R_{12} — 500 ohms.
R_{13} — 15,000 ohms.
R_{14} — 1000 ohms.
RFC — ¼-inch-diameter form wound to length of 1¼ inches with No. 28 d.s.c. wire.
S_1 — Changeover switch.
T_1 — Push-pull interstage transformer.
T_2 — Speaker-to-voice-coil transformer.
V_1 — 6J5.
V_2 — 78.
V_3 — 78 with plate and grid tied together.
V_4, V_5 — 42s.
V_6 — 42 with screen and plate tied together.

on a machine screw so that it could be pivoted and swung in between the plates of the stator. This condenser, with L_1 soldered across the terminals, was mounted close to the octal socket.

Since another variable condenser was not available, the receiver was tuned inductively by means of a copper washer cemented to the end of a ¼-inch tuning shaft. The arrangement is similar to that described by W1JPE for the 2½-meter superregenerative receiver in January, 1942, *QST*. If preferred, the cord-and-spring arrangement described by W6OVK in the May issue might be used instead.

The shaft is a section of round pencil. A hole in the front edge of the chassis and another in a bracket made from a piece of the hardware found on the chassis and mounted near the end of L_1 serve as bearings for the shaft. Fibre washers were cemented on the shaft against the bearings to prevent end play. The end of the shaft was cut off at an angle of 45 degrees and the copper washer cemented on at this angle so that rotation would change the plane of the washer with respect to the axis of the coil. The length of the shaft and its position should permit placing the washer within the end of L_1. Some adjustment of the size of the coil and position and size of the washer may be necessary to get the tuning range to cover the band. A wood strip across one of the r.f.-coil openings nearby in the chassis was used to support the antenna-coupling coil.

A multiple-pole, single-throw rotary switch was found on the chassis. It was so constructed that it was possible to revamp it to take care of the necessary functions of S_1.

The small parts — by-pass condensers and resistors — were sorted out and the nearest appropriate values used in the new circuits. In only a few instances was it necessary to use units not found on the chassis. In some cases, considerable departure from recommended values was possible without ruining the performance of either transmitter or receiver. For instance, by-pass condensers below normal value were used in the audio circuits without affecting materially the response at voice frequencies.

Since the speaker field required separate excitation, it was connected in series with the B + lead. To reduce the voltage drop across the field, it was shunted by a 1000-ohm resistance. This reduced the field excitation, but enough was left to provide satisfactory operation.

Of course, we hope that it won't be necessary to go to such extremes to produce the gear which is so urgently needed for WERS. It violates our inborn aesthetic sense of what well-built ham equipment ought to look like. But on the other hand there's a war to be won, and it's nice to know that we don't *have* to have acorn tubes and polystyrene insulation to be able to build workable gear.

"Modern Design"

BY WHITNEY S. GARDNER,* W3IBX

You have removed the chassis from your receiver to replace a resistor. That job done, it simply becomes necessary to slip the chassis inside the cabinet and attach a few knobs. A lead pipe cinch!

You place the chassis squarely on the table and, holding the cabinet firmly between the left and right hands, slowly lower it. The front bottom edge strikes the condenser shaft, so you ease the cabinet forward. Again you lower it. This time the rear edge of the cabinet strikes the power transformer.

Remove the cabinet. Study the situation. Remove the tubes to get more clearance. Lower cabinet. Ah, it clears the transformer but strikes the condenser shaft. Remove cabinet and place it upside down on table. Invert chassis and lower it into cabinet. There, just tip it slightly and it clears both transformer and condenser shaft. Oh, oh — it clears both transformer and condenser shaft. Oh, oh — it slipped. Now it's gone down too far. Invert the whole works. Now lift up on cabinet. You can't. That's because condenser shaft and transformer have a tight grip on cabinet. Front of cabinet bulges. Bang it sharply on

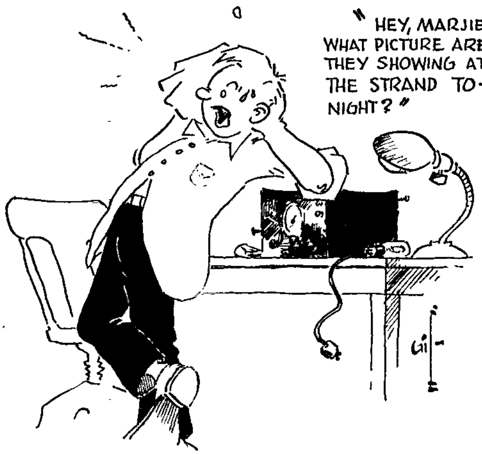


table. Cabinet gives suddenly and comes off chassis. So does dial pointer.

Straighten dial pointer. That's good enough. Lower chassis into cabinet, but not too far. Something is holding it back. Why, of course; the power cord should have been threaded through that grommet first. Now once more. At last it's

(*Continued on page 92*)

* 4627 Briarclift Road, Baltimore, Md.

U.S.A. CALLING!

NAVY RESEARCH

One of the activities of the United States Navy is in need of civilian experts of high professional skill to participate in their laboratory research and development work in connection with the war. They want what are called in the Civil Service junior, assistant and associate radio engineers; and physicists and assistant and associate physicists. The salaries range from $2000 to $3800 per year. Further information and application forms may be had by writing to The Director, U. S. Navy Radio & Sound Laboratory, San Diego, California.

AMATEURS WANTED AS TEACHERS

The Signal Corps, with the assistance of the Office of Education, is engaged in a mammoth program to train some tens of thousands of civilians as radio mechanics and technicians, under contract arrangements with over a hundred colleges and technical schools scattered all over the country. The course lasts about three months and consists of both shop work and theory. Something like a thousand additional instructors are urgently needed to carry on this work. You are probably needed somewhere right in your own state.

High-school or college physics teachers, with a minimum of two years' experience as a teacher, are needed to do the teaching of theory. For instructors in the practical shop program, the basic requirements are for a radio serviceman with at least five years' experience as such, or a radio amateur with at least two years' experience under license, and with the ability to teach others. If without experience in teaching, a free course in that subject itself can be arranged through the State Boards of Education. The salary offered will vary from state to state with the cost of living and other scales but for an acceptable man will lie between $65 and $90 a week, according to information given *QST* by OE.

These are not Civil Service jobs. The work is under an ordinary civilian contract between the teacher and the school. If you are qualified for this work and able to take it on, address the State Director of Vocational Training for War Production Workers, State Office of Education, in your state capital — except in the states of Connecticut, Maine, Michigan, New Hampshire, New Jersey, Rhode Island, South Carolina and Vermont which have no such Signal Corps programs, in which case you should address the State Director of a neighboring state. Or you may apply to the nearest office of the United States Employment Service. The League has been asked to see if we amateurs can't help in this training program. Can we?

These schools are sadly short of meters, test equipment and other gear needed for the instruction of their students. They are interested in buying, borrowing or renting the needed apparatus. Both clubs and individual hams have a chance here to help their country's effort. Refer to the item on page 27 of May *QST* and see if you can't help in your home state.

MORE INSTRUCTORS WANTED!

The Lexington Signal Depot of the Army Signal Corps is engaged in a training program in which several thousand civilian employees and radio mechanics and engineers will be trained in the maintenance of the radio equipment used by the Signal Corps. They are in urgent need of a large number of competent instructors and are looking to us amateurs for help. These positions are under the Civil Service but a competitive examination is not given, the eligibility of the applicant being determined by his training and experience. The appointments are of what is known as the War Department Indefinite type. Age limits, 20 to 56. Male applicants must be in a deferred draft classification. Women equally eligible.

The basic position is known as Junior Instructor and carries a salary of $2000 per year. Duties include instruction, under supervision of an instructor of higher rank, of from 15 to 25 men on one particular type of radio equipment of comparatively simple nature; grading quizzes on this unit; spotting trouble in this equipment and supervising its correction. Applicants must be high-school graduates or have at least 14 units of high-school credit and, in addition, have *one* of the following qualifications:

1) Degree in engineering or physics from a four-year recognized college or university course which has included radio engineering or vacuum tubes and circuit theory.

2) Degree in engineering or physics plus at least one year's experience as a radio operator or as a teacher of physics or engineering; or a year's graduate study of EE or physics; or the successful completion of an ESMDT radio course.

3) Four or more years' experience in radio work. May include work as repairman, engineer,

operator, etc., plus either three months' experience teaching radio or one year's experience as a supervisor.

4) Successful completion of the course at a radar school recognized by Army or Navy.

The next grade is that of Assistant Instructor, with a salary of $2600. The duties are similar but deal with various advanced types of equipment and the applicant must demonstrate that he is qualified to supervise the work of instructors of lower grade. In addition to the requirements for Junior, he must have had either a year or more of graduate study in radio plus a year or more of teaching experience; or six months' experience in teaching radio.

There are also a number of positions in the rank of Associate Instructor, $3200, and Instructor, $3800, with proportionately higher requirements. Because of the rapid growth of this training program, the opportunities for promotion are excellent.

Write, with particulars on yourself, to Capt. W. Gayle Starnes, OIC Civilian Training, Lexington Signal Depot, Lexington, Kentucky.

STILL MORE INSTRUCTORS WANTED!

The Army Air Forces have taken over the Stevens and Congress Hotels in Chicago (and probably will acquire the Chicago Coliseum) for a gigantic radio school to instruct the radio personnel of our expanding Air Forces. An appeal has been made by Brigadier General Krogstad, head of the school, for 1200 amateurs to serve as instructors of the 15,000 cadets. There will be a special school to *train these instructors*. Candidates for the instructorships must have had six hours of college physics, 20 hours of college mathematics, and either possess an operator's license or have received technical training. There are four salary classifications, with pay ranging from $1620 to $3200 a year. Interested amateurs should write immediately to Air Forces Radio School, Room 430-A, Stevens Hotel, Chicago.

RADAR OFFICERS

The Army Signal Corps with its ETG, the Navy with its AV(S), and the Marine Corps' AWS are all looking for candidates for commissioning as second lieutenant or ensign in their radiolocating services. The requirements, the instruction and the nature of the work are fundamentally the same in all three services, so that in general you can take your pick. See many previous articles in *QST* on this subject. This is radar, the stuff of microwaves and c.r.o., used for tracking aircraft. In all the arms there are special courses of instruction, after which the officer becomes responsible for the installation and operation of such units. In general, the requirements are the possession of a college degree in electrical engineering or in science with an electronics-physics major, and a thoroughly healthy body. For further information write, with full particulars on yourself, to G. W. Bailey, Office of Scientific Research & Development, 2101 Constitution Ave., N.W., Washington.

TROOP CARRIER COMMAND

The Army Air Forces offer appointments as second lieutenants in the Troop Carrier Command to radio amateurs over thirty years of age who are willing to serve outside of the continental United States and who are willing to go into the air. Commissions are available to amateurs who do not have a college degree provided that they have had plenty of radio experience and are physically fit. The work will be in the expanding communications system of this new and important command of the AAF. Write, with particulars on yourself, to G. W. Bailey, 2101 Constitution Ave., N.W., Washington.

NAVY RADIO OPERATORS

Radio operating in a shack similar to the finest of ham shacks, clean, and free from dust and grime, is the good fortune of amateur radio operators who join the Navy. Hams feel right at home. Holders of commercial tickets likewise enjoy the atmosphere of a ship or shore Navy radio station. Those who serve their country as radio operators in the Navy can testify that theirs is a pleasant but very important job aboard ship. Many men who have had no experience want to be Navy radio operators. The Navy has a number of radio operator schools in different parts of the country, which give complete training to beginners. The nearest Navy Recruiting Station can supply all details and enlist operators in ratings according to their radio experience, age, and general qualifications.

NAVY RADIO TECHNICIANS

Many hams prefer the technical and maintenance side of radio to operating. A new rating, Radio Technician, is now available for these men. There are many phases of this radio material work, including operation and maintenance of radar equipment. This branch is one of the fastest-growing and most fascinating in the Navy. Its opportunities are practically unlimited. The rating at which a man enlists will depend on his radio experience, age, general qualifications, and his classification on a simple test covering arithmetic, algebra, plane geometry, shop practice, physics, electricity and radio. Navy Recruiting Stations can supply full information on Radio Technician ratings, and are prepared to give the above test to those who want to fit themselves into the work they are best suited for.

MARITIME OPERATORS

Seagoing operators are needed for the Merchant Marine in just the worst possible way. Required types of operator licenses have been greatly relaxed, as mentioned in briefs in *QST* recently. Base pay varies from $105 to $165 a month, depending upon the position filled and as to whether additional clerical work is done for the line, but there are also handsome war-risk bonuses for certain voyages and, with found, the pay of maritime radio operators now runs to several hundred dollars a month. In most lines there is also two weeks' vacation with pay. Hams who would like to go to sea to pound brass, and who are able to help in this very important respect, are asked to communicate with G. W. Bailey, 2101 Constitution Ave., N.W., Washington.

Do you remember the article in *QST* for June of a year ago about the beautiful Merchant Marine radio school operated by the Coast Guard at Gallups Island in Boston Harbor? It is a remarkable institution, offering magnificent free training to any man between 18 and 23 years of age with two years' high-school education, including a year in algebra. Operators are trained there for our Merchant Marine and we've seen enough of the school to know that it does a splendid job. Moreover, there is good pay during the instruction period, with free clothing, food, quarters, books and medical and dental care, and free transportation to Boston from the point of signing up. Here's adventure and a chance to do a real job for Uncle. A special plea for amateur operators has been made to enlist in this part of the war effort, to man the merchant ships now sliding down the ways. Ask for further information at any State Employment Office or write direct to the United States Maritime Commission, Washington, D. C.

WOMEN WITH LICENSES WANTED

WOMEN amateurs are still wanted for civilian appointment in various agencies in Washington, including the Navy's Bureau of Ships. They must have radio licenses. This does not mean that they are to do radio operating. They're not, and code knowledge is not particularly important, so that one cannot bone up for one of these jobs just by joining a code class. The jobs are administrative, office work, largely in engineering and procurement sections, and what is needed is a knowledge of the theory and terminology of radio sufficient to take over an officer's job so that the officer may be released for fighting service. The amateur ticket is accepted as attestation of sufficient knowledge. The pay starts at $1620 a year. Please write to Mr. George Bailey at 2101 Constitution Ave., N.W., Washington.

SIGNAL CORPS ENLISTMENTS

THE Army Signal Corps still needs amateur or commercial radio operators or radio repairmen who have recognized radio licenses, membership in the Radio Manufacturers Service or Radio Servicemen of America, or who at the time of application for enlistment are engaged in radio service work. You can request enlistment under this plan at the Army recruiting station nearest your address and be enlisted directly in the Signal Corps as a private. However, if you make good, you won't remain a private for long — there is plenty of opportunity for advancement. If you need further training before you are qualified to enlist in the Signal Corps, you can make application for courses of instruction for the Enlisted Reserve Corps. Apply to your Corps Area Signal Officer, or refer to G. W. Bailey, Office of Scientific Research & Development, 2101 Constitution Ave., N.W., Washington, D. C., for further details.

MARINE CORPS SERGEANCIES

HIGH-SCHOOL graduates who cannot qualify for a commission for AWS duty for want of a college degree are wanted in the Marine Corps as noncommissioned officers, starting with the rank of staff sergeant. They receive valuable instruction preparing them for maintenance duty in the Aircraft Warning Service. The recent action of Congress raises the pay of such sergeants to a range of from $96 a month, in addition to food, clothing, shelter and medical care, upward to $145.50 including allowances. To arrange for such an appointment, 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.

COMMUNICATIONS CADETS

YOU'VE heard about these Aviation Cadet Examining Boards? There is one near you. One kind of cadet applicant being sought is for nonflying communications officer — to be in charge of radiotelegraph and teletype and directional equipment. The applicant must have at least two years of college credits, which must include a year of college physics, unless he is the holder of an amateur or commercial radio license. (That license does help!) A transcript of college record is required. When accepted, the cadet is given 16 weeks of specialized study at the Air Force School at Scott Field, Illinois. The curriculum sounds pretty good. Upon graduation, the aviation cadet is commissioned a 2nd lieutenant in the Air Force Reserve and assigned to duty. Physical requirements the same as for reserve commissions. Cadets receive $75 per month while training, plus subsistence, uniforms, etc., and $10,000 government insurance.

Go to your nearest Board for further information.

OFFICER CANDIDATE SCHOOL

IN THE appointment of officers from civilian life the requirements are frequently fussy, often including college education. But after a man is in the service and has demonstrated that he has something on the ball there are frequently opportunities for him to be appointed to an enlisted men's officer training school and receive instruction and become an officer. All the services maintain such schools. Many amateurs who enlisted in the Signal Corps have made the grade as second lieutenants. Any Army recruiting office will enlist an amateur in the Signal Corps if he shows his amateur license to the recruiting officer — provided of course he is physically qualified. (If the recruiting officer doesn't know that he should accept an amateur license as giving the right to voluntary enlistment, send a telegram to Mr. Bailey.) After enlistment in the Signal Corps the amateur is sent to the nearest signal school and, after some weeks of preliminary training, he has at least a fair chance to be given an opportunity to attend officers' training school. Thus there is no reason for feeling that one's chances for a commission are utterly hopeless because of the lack of higher education. It's worth a try, at least, isn't it?

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. These positions carry a salary of $2600 for duty in continental United States.

COLLEGE STUDENTS

Don't let your enthusiasm to jump into this war run away with you. The War Department is continuing the enlistment of electrical engineering and electronics physics students in the Signal Section of the Enlisted Reserve Corps and the immediate appointment of these students as officers upon graduation, for duty with the Electronics Training Group. You can be deferred from Selective Service until you successfully complete your college course. This means that you students will be assured of using your technical ability in the best interests of the war effort — without sacrificing your education. Service in the Signal Corps now will mean a great deal after the war is won. The experience in up-to-the-minute ultrahigh-frequency equipment and radio gadgets will be invaluable in the post-war world of electronics.

Interested students should write now to the Office of the Chief Signal Officer, War Department, Washington.

25 YEARS AGO THIS MONTH

"Good old September has come around once more with its promise to cut down on the static," as *QST* for that month in 1917 appears. "But this time old September is different than he has ever been before. None of these little things dear to the heart of the amateur wireless bug are happening. Not since Amateur Number One first strung a wire in the air has there been a September like this fateful one of 1917. Not a single amateur aerial is in the air, from the Atlantic to the Pacific. The little buzzing spark is gone and dust covers the once shining apparatus." But, says the editor, when the boys come home after the war "there will truly be something doing in radio in these good old United States of America. . . . With their military experience and training and their familiarity with the finest kind of wireless apparatus, it looks to us as though amateur wireless might come pretty near being a new kind of game when we get loose again. . . . The ARRL and the traffic it will handle, when the happy days arrive, will be something that even the craziest of us has no idea of to-day."

The leading technical article, by Roy Griffith, reports his experiments in the Philadelphia region on "Ground Telegraphy" or TPS, in the same general manner as the group working on Project G in to-day's Experimenter's Section. He reports a half-mile range using a buzzer as a transmitter and simple headphones as the receiver, each station having a pair of pipes driven into the ground about thirty feet apart. Special circuits are suggested for balancing out "ground hum" and for permitting break-in.

S. Kruse describes "A Regenerative Audio Connection" that, so far as we can recall to-day, is the first description in *QST* of the plain plate-tickler-feedback circuit. The tickler is fixed and regeneration is controlled by a throttle condenser across the phones. Great amplification results, distant signals being readable with the phones on the table. Many features of post-war receivers are glimpsed here: there is no doping of coils, there are no deadend tap losses, and some of the condenser plates are removed to spread the scale. Amateurs are closed now and it will be two years before they get going again, so this circuit will have to be discovered all over again in the 20s.

In fact, amateur radio is pretty well throttled and the lid is on tighter than we supposed. Not only are phantom antennas barred but there may be no experimenting with radio gear. It makes the editor pretty sore that "all radio inventing

(Continued on page 94)

The Japanese Morse Telegraph Code

With Some Notes on the Japanese Language

BY DONALD D. MILLIKIN*

THE Japanese Morse Code is used on the landline telegraph system of Japan and by Japanese ship and fixed radio stations. However, when messages are sent to foreign countries or ships they are transmitted by International Morse.

Although the dot and dash signals are identical in both codes for the numerals and for the letter U, there are great differences between Japanese and International Morse. Signals for the single letters A, E, I, N (or M), and O in the Japanese system are totally unlike the equivalents in the International. The other combinations of dots and dashes represent the two-letter and three-letter groups of *Rōmaji* (pronounced *rō-mä-jē*), an English language phonetic system approximating the Japanese spoken sounds.

Messages in Japanese Morse may be transmitted according to the Rōmaji spelling or the Nippongo modification. No dependence can be placed upon frequency tables for Japanese single letter occurrences because of the differences in spelling and peculiarities inherent in the language itself; tables of digraphs and trigraphs are needed. Although the word lengths of plain language text vary greatly, messages are frequently sent in regular groups of fifteen letters each. Such communications are not in code, the code messages being usually transmitted in five-letter groups.

Japanese Morse signals are recorded on paper tape by means of the ink-recorder just as the characters of the International code are received on tape. For the ideographs, or "picture-writing," that are equivalent to Rōmaji, both tape and page types of teleprinters are used.

Accurate translations of messages transmitted in Japanese Morse would be difficult unless one were familiar to some extent with the Japanese language and the Rōmaji and Nippongo spellings. The following notes will be intelligible to anyone equipped to go ahead with such translations.

Notes on the Japanese Language

It is a strange fact that of these three neighboring countries between which frequent communication has existed for a great many years, China has not deviated from ideographic script, Korea invented an alphabet, and Japan devised a syllabary. Most of the ideographs in the Japanese language are taken from the Chinese. The Japanese found by analysis that all of the required sounds could be conveyed by less than one hundred different syllables. They selected the ideographs corresponding to these sounds and reduced them first to forms called "Hiragana" (sometimes spelled with a K — "Hirakana"). These forms were simplified later into "Katakana." A number of years ago an Englishman, J. C. Hepburn, invented the system of using Roman letters to represent the Katakana ideographs. His method is known as Romanized Kana, or Rōmaji. It has been used in printing Japanese and an understanding of it is essential to the proper use of the Japanese Morse code. The Japanese used the Hepburn system until a few years ago, when they

*39 Orchard St., Manhasset, N. Y.

Sample Message In Japanese

シ	SHI	リョ	RYO
チ	CHI	ダ	DA
ヂ	JI	ン	N
ニ	NI	ワ	WA
ス	SU	ア	A
ス	SU	ス	SU
メ	ME		
デ	DE	ゴ	GO
ショ	SHO	ゼ	ZE
ウ	U	ン	N

Message in Roman Characters:

RYODAN WA ASU GOZEN SHICHI-JI NI SUSUME DESHŌ.

By Syllables for Radio Transmission:

RI YO DA N WA A SU GO ZE N SHI CHI - JI NI SU SU ME DE SHI YO

English Translation:

"(The) BRIGADE WILL MARCH AT SEVEN O'CLOCK TOMORROW MORNING."

developed a modified spelling known as "Nippongo," because they did not like employing a method invented by a non-Japanese.

Twenty-two letters of our English alphabet are used in Rōmaji, but L, Q, V, and X do not appear as there are no similar speech sounds in Japanese. The only letters occurring by themselves are the five vowels, A, E, I, O, U, and the consonant N (or M). All other letters appear in combinations of two or three. Only a single one-letter word exists — E. All words end in a vowel or N. Digraphs and trigraphs always end in a vowel. The vowels may be short or long. Long I is always doubled and written as II, to avoid confusion between I and T. The other four vowels are sometimes doubled to indicate the long sound, as AA and EE, or a line is placed above them, e.g. Ō and Ū. In the trigraph SHO at the end of a word the ideograph for U is added when the O is long. C, F, and J occur only in the syllables CHI, FU,

This chart, designed by Charles E. Holden, shows the characters of the Japanese language in order of frequency of appearance. In each group are Roman letters showing the English spoken equivalents or "Romaji"; the dots and dashes of the Japanese Morse code; the heavy characters of the Katakana ideograph equivalents; and the lighter Hirakana equivalents, used principally for letter writing and newspaper type. There is only one set of ideographs for the numerals, and the telegraph code equivalents are the same as in International Morse. The code symbol for a hyphen is also used before a vowel to indicate that it is long. Note that some characters have two groups of dots and dashes for their code equivalents.

One of the complicating factors in fighting a war is that your enemy often speaks a different language than you do. In this war not only are the languages different, but one of our major foes — Japan — uses an entirely different alphabet and method of writing, and even a different radio code. This calls not only for skilled linguists to transcribe and interpret the spoken and written word but — on the vitally important front of radio communication — operators who can copy the Japanese code.

To assist in the education of operators, both military and civil, for this genuinely important need, *QST* has been fortunate in securing the aid of a recognized authority. Following military service as a cryptanalyst on General Pershing's AEF staff in 1918, Donald Millikin has had a life-time career in communications by code, cipher and foreign languages. He was for eighteen years manager of RCA's code office, has lectured extensively on the subject, and has taught many Army classes in cryptanalysis.

and JI, in Rōmaji. They are absent in Nippongo. Consonants doubled are NN, PP, SS and TT. When the combination HA is a part of a word in Kana characters it is pronounced and written in Rōmaji as HA; but when it occurs alone as a two-letter word it is pronounced and written WA. Whenever KA appears by itself at the end of a sentence it is not a word but indicates interrogation. If the letter N occurs before B or P it is pronounced and written as M. The word NO has many meanings and may also be used as the apostrophe ('). It is a contraction for the word MONO and may be further contracted to N', in this particular case. KOTO is used occasionally in the place of NO.

The names of the numerals are as in Chinese:

1 — Ichi	6 — Roku
2 — Ni	7 — Shichi
3 — San	8 — Hachi
4 — Shi	9 — Ku
5 — Go	10 — Jū

The number twelve is written Jū Ni. Thirty-five is San Jū Go (3 times 10 plus 5).

Nippongo Modification

Some examples of changes from Rōmaji to Nippongo are:

Single syllables

SHI	becomes	SI	FU	becomes	HU
CHI	"	TI	JI	"	ZI or DI
TSU	"	TU	DZU	"	DU

Compound syllables

SHI	and	YA,	or	SHA,	becomes	SYA
CHI	"	YA,	"	CHA,	"	TYA
JI	"	YA,	"	JA,	"	ZYA
SHI	"	YU,	"	SHU,	"	SYU
CHI	"	YU,	"	CHU,	"	TYU
JI	"	YU,	"	JU,	"	ZYU
SHI	"	YO,	"	SHO,	"	SYO
CHI	"	YO,	"	CHO,	"	TYO
JI	"	YO,	"	JO,	"	ZYO

The spellings of words are changed, e.g.:

FUJI	to HUJI
SHINTO	to SINTO
SHIMA	to SYAMA
CHOSEN	to TYOSEN

The effect of the Nippongo modification may be seen in these tables of single-letter frequency of occurrence. A count of telegraph text is also shown; the tendency to omit unimportant words and to abbreviate results in somewhat different figures. Note that in Nippongo the occurrences of C, F and J have dropped to zero. The literary Rōmaji statistics have been reduced from a count of 5118 letters.

	Rōmaji		*Nippongo*
	Telegraph (Millikin)	*Literary (Holden)*	*Literary (Millikin)*
A	98	183	141
B	6	7	10
C	2	6	0
D	16	20	25
E	56	61	51
F	5	3	0
G	16	13	26
H	35	45	10
I	112	125	101
J	2	2	0
K	66	52	79
L	0	0	0
M	31	54	35
N	72	68	88
O	154	123	142
P	6	2	10
Q	0	0	0
R	41	39	48
S	49	65	29
T	45	76	68
U	75	39	58
V	0	0	0
W	23	25	30
X	0	0	0
Y	51	9	14
Z	9	3	7
Total	970	1000	972

Analytical Data

Here is a table of digraphs and their supporting single vowels, listed in order of frequency of appearance in the Japanese language, based on a literary text count of 2524 (Holden). There are

(Continued on page 120)

A Simple Method of Frequency Measurement for WERS

BY RAYMOND W. WOODWARD,* W1EAO

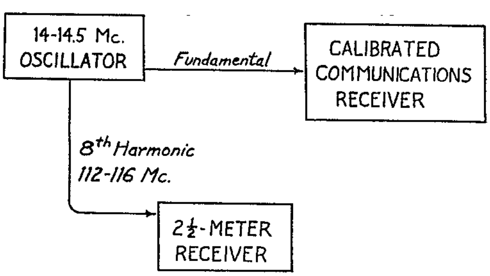
One of the requirements of the WERS (Sec. 15.26) is that a means independent of the frequency control of the transmitter shall be provided to measure the transmitter frequency, and that the means used shall be of sufficient accuracy to assure operation within the permitted maximum deviation.

In the past most operation on 2½ meters has confined itself within the boundaries of a few local crystal-controlled stations used as markers, and little attempt has been made actually to measure the frequency of radiated signals. Some operators have used Lecher wires to assure operation within a band, and when first going on a u.h.f. band such as 1¼ or ¾ meters this is good practice. However, it is rather difficult to secure the required accuracy with the usual manipulation of Lecher wires, and it is hardly convenient to carry a 12-foot pole to each transmitter location to measure frequency periodically. Furthermore, Lecher wires alone do not afford a means of continuously monitoring a group of transmitters.

The smallest frequency tolerance specified for WERS stations (Sec. 15. 25) is 0.1 of one per cent, or 112 kilocycles at 112 Mc. Obviously the frequency measurements must be to a closer tolerance, but there is hardly need to have the accuracy attainable on 80 meters (better than 0.001 of one per cent).

To meet these requirements the author has made use of a simple system which easily allows measurements within 25 kilocycles, or about 0.02% at 2½ meters. Briefly, the system consists of beating the eighth harmonic of a 20-meter oscillator against the incoming 2½-meter signal in the regular u.h.f. receiver, which may be superregenerative. The 20-meter oscillator frequency is then measured on a regular communications receiver whose calibration is known. Multiplying by 8 we have the 2½-meter frequency.

* State Radio Aide, State Defense Council, Connecticut. 1820 Boulevard, West Hartford, Conn.



Using a calibrated communications receiver and auxiliary 14-Mc. oscillator for 112 Mc. frequency checking.

The use of a 20-meter signal is advisable to overcome possible errors or mistaken identities of harmonics. Thus the seventh and ninth harmonics, at 98 and 126 Mc. respectively, would hardly be confused with the eighth at 112 Mc., since the calibration of the 2½-meter receiver surely is known that well. But if a 40-meter signal were used, the fifteenth and seventeenth harmonics at 105 and 119 Mc. might be confused with the sixteenth, or the oscillator might accidentally be set at a frequency which would cause other than a known harmonic to produce the beat note. On the other hand, if a 10-meter signal were used, there would be danger of confusing the signal with the image in the measuring receiver. This condition should not be bothersome at 20 meters with a modern communications receiver.

A convenient 20-meter oscillator is the h.f. oscillator of an additional superheterodyne receiver, but lacking this a simple stable oscillator similar to those described for monitoring purposes in the *Handbook* can be provided. If a receiver is used for the purpose, it should be placed in proximity to the 2½-meter receiver but needs no antenna. Certain receivers are so well shielded that special coupling between the h.f. oscillator and the 2½-meter receiver may have to be provided so that the eighth harmonic can be picked up. Others give a strong signal and completely knock out the rush on a superregen. The measuring receiver can be anywhere in the same room, since no trouble should be experienced in picking up the signal from the oscillator or "buffer" receiver on the same band. In fact, a very small piece of wire probably will have to be used for an antenna in order to prevent too great signal pick-up for good measurement.

Procedure

Let's follow through the measurement of a signal on approximately 113 Mc. The transmitter should be unmodulated during the measurement period, which need not be more than one minute. The signal is picked up in a normal manner on the

2½-meter receiver, which, if superregenerative, should have the regeneration set as low as permissible. The 20-meter oscillator or "buffer" receiver is tuned to give a signal at approximately 14,125 kc. If a superhet "buffer" receiver is used the dial will be set at either 13,670 or 14,580 kc. (14,125 ± the i.f. of 455 kc.) depending on whether the high frequency oscillator of the receiver operates above or below the detector frequency.

The oscillator should be tuned slowly through the range, and if the 2½-meter receiver is a superregen a series of beat notes or heterodynes will be heard when the 8th harmonic encounters the transmitter's carrier. In the middle of this series of "birdies" will be found one beat distinctly stronger than the others. Carefully zero beat the 20-meter oscillator to this strong heterodyne and then do not further touch the tuning controls. If the transmitter stability is good enough this setting can be made within ± 1.5 kc.

The 20-meter signal is next picked up in the measuring receiver and the frequency noted from the calibration of the receiver. The author uses an HQ120-X for this purpose; other receivers of comparable grade will be satisfactory. By having first set the bandspread dial by means of a "bandsetter" multivibrator from a 100-kc. standard, or other satisfactory method, it is readily possible to measure the "buffer" signal to within ± 1.5 kc. Assume the measurement is 14,106 kc. Eight times this is 112.848 Mc., but since the overall accuracy is ± 3 kc. at the fundamental the final result has an accuracy of 8 × 3 or ± 24 kc., so that this result should be rounded off accordingly to 112.85 Mc.

If the 2½-meter transmitter is crystal controlled, it would be possible to use regular frequency-measuring technique on the 20-meter "buffer" signal and secure much greater accuracy. However, this is not necessary, and probably is not desirable for WERS where time is seldom available. A further refinement would be to use a 2½-meter superhet for receiving; by incorporating all these the author has measured 2½-meter signals to ± 1 kc.

The receiver requirements for this measurement system should not be too severe for WERS work, since in any community network suitable equipment surely can be found for installation at the monitoring point. An opportunity has not existed for trying the system on 224 Mc. or higher frequencies, but there is no reason why, with suitable modification, it should not work.

P. O. W.

It is reported that G6SN and G8KU are being held as prisoners of war.

Power Supply

BY EILEEN V. CORRIDAN*

The how and why of a power supply
Is something very quaint.
It takes the a.c. current
And makes it what it ain't.
You start with good ole a.c.
But you need some pure d.c.
How the PS finally makes it
Is now quite clear to me.

First, gimme a primary winding;
A secondary, too.
Now I've got a transformer —
Let's see what it will do.

The primary takes the line juice;
Inductance does the rest.
But you gotta split the secondary
To do its job the best.

"Less turns in the coil for the heater,
More turns for the plate supply."
We've still got only a.c.
Which the tube will rectify.

Now we come to the moment
When tube and a.c. meet.
Just keep in mind a rectifier
Acts like a one-way street.

A.c. travels in wave form
From plus to minus, and then
It simply changes direction
And does it over again.

But the tube says, "Nothing doing —
This is no swinging door.
I'll take one-half of your wavelengths,
One-half — and nothing more!"

At least a half-wave rectifier
Would act about that way.
We'll use another plate in there
And thus save wave and day.

So now one plate says, "Come ahead."
It takes its half-waves through
The other plate is minus, then;
It has no job to do.

Then comes along the other half.
The second plate starts working.
So half and half are now a whole
While number one plate's shirking.

From filament to filtering
The current that is flowing
Is now d.c. — pulsating kind —
That toward the filter's going.

(Continued on page 104)

*979 Summit Ave., New York City.

HAPPENINGS OF THE MONTH

ELECTION NOTICE

To all Full Members of the American Radio Relay League residing in the Central, Hudson, New England, Northwestern, Roanoke, Rocky Mountain and Southwestern Divisions:

You are hereby notified that, in accordance with the constitution, an election is about to be held in each of the above-mentioned divisions to elect both a member of the ARRL Board of Directors and an alternate thereto for the 1943–1944 term. Your attention is invited to Sec. 1 of Article IV of the constitution, providing for the government of ARRL by a board of directors; Sec. 2 of Article IV, and By-Law 12, defining their eligibility; and By-Laws 13 to 24, providing for the nomination and election of division directors and their alternates. Copy of the Constitution & By-Laws will be mailed any member upon request.

Voting will take place between November 1st and December 20, 1942, on ballots that will be mailed from the headquarters office in the first week of November. The ballots for each election will list, in one column, the names of all eligible candidates nominated for the office of director by Full Members of ARRL residing in that division; and, in another column, all those similarly named for the office of alternate. Each Full Member will indicate his choice for each office.

Nomination is by petition. Nominating petitions are hereby solicited. Ten or more Full Members of the League residing in any one of the above-named divisions may join in nominating any eligible Full Member of the League residing in that division as a candidate for director therefrom, or as a candidate for alternate director therefrom. No person may simultaneously be a candidate for the offices of both director and alternate. Inasmuch as the by-laws were recently amended to transfer all the powers of the director to the alternate in the event of the director's death or inability to perform his duties, *it is of as great importance to name a candidate for alternate as it is for director.* The following form for nomination is suggested:

Executive Committee

The American Radio Relay League
West Hartford, Conn.

We, the undersigned Full Members of the ARRL residing in the .... Division, hereby nominate ...., of ...., as a candidate for DIRECTOR; and we also nominate ...., of ...., as a candidate for ALTERNATE DIRECTOR; from this division for the 1943–1944 term.

(*Signatures and addresses*)

The signers must be Full Members in good standing. The nominee must be a Full Member and must have been both a member of the League and a licensed radio amateur operator for a continuous term of at least four years immediately preceding receipt by the Secretary of his petition of nomination, except that a lapse of not to exceed ninety days in the renewal of the operator's license and a lapse of not to exceed thirty days in the renewal of membership in the League, at any expiration of either during the four-year period, will not disqualify the candidate. He must be without commercial radio connections: he may not be commercially engaged in the manufacture, selling or renting of radio apparatus normally capable of being used in radio communication or experimentation, nor commercially engaged in the publication of radio literature intended, in whole or part, for consumption by licensed radio amateurs. Further details concerning eligibility are given in By-Law 12. His complete name and address should be stated. The same requirements obtain for alternate as for director. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon EWT of the 20th day of October, 1942. There is no limit to the number of petitions that may be filed on behalf of a given candidate but no member shall append his signature to more than one petition for the office of director and one petition for the office of alternate. To be valid, a petition must have the signatures of at least ten Full Members in good standing; that is to say, ten or more Full Members must join in executing a single document; a candidate is not nominated by one petition bearing six signatures and another bearing four. Petitioners are urged to have an ample number of signatures, since nominators are frequently found not to be members in good standing. It is not necessary that a petition name candidates both for director and for alternate but members are urged to interest themselves equally in the two offices.

League members are classified as Full Members and Associate Members. Only those possessing certificates of Full Membership may nominate candidates, or stand as candidates; members holding certificates of Associate Membership are not eligible to either function.

Present directors and alternates for these divisions are as follows: Central Division: director, Goodwin L. Dosland, W9TSN; alternate, Stuart H. Gates, W9CNE. Hudson Division: director, Robert A. Kirkman, W2DSY; alternate, Robert M. Morris, W2LV. New England Division: director, Percy C. Noble, W1BVR; alternate, Clayton C. Gordon, W1HRC. Northwestern Division: director, Karl W. Weingarten, W7BG; alternate, R. Rex Roberts, W7CPY. Roanoke Division: director, Hugh L. Caveness, W4DW; alternate, J. Frank Key, W3ZA. Rocky Mountain Division: director, C. Raymond Stedman, W9CAA; alternate, Charles W. Duree, W9EII. Southwestern Division: director, John E. Bickel, W6BKY; alternate, Eldridge E. Wyatt, jr., W6MYO.

These elections constitute an important part of the machinery of self-government in ARRL. They provide the constitutional opportunity for members to put the direction of their association in the hands of representatives of their own choosing. Full Members are urged to take the initiative and to file nominating petitions immediately.

For the Board of Directors:

K. B. Warner,
Secretary

August 1, 1942

APPARATUS NEEDS

As most amateurs now know, the Signal Corps has had representatives over the country buying up amateur-owned factory-built transmitters and receivers and other gear, starting originally with lists obtained from the registrations with the ARRL Ap Bureau and branching out from there wherever they could develop local contacts. Hundreds of amateur rigs have been bought, assembled at a central depot and reconditioned, made available for instant issue to hot spots. Of course it's confidential where these equipments are going but you may be very sure that they're being put to good use and that most of them are participating in stirring action. If you leave your call on your rig when you sell it, you're likely to get a letter after the war from some ham operator who used it to help make history on the other side of the globe. The Signal Corps fellows buying this gear tell us that the average amateur is pretty high on coöperation, although some of the boys have attempted to gouge them on prices and occasionally they encounter a ham who won't sell because he expects to be back on 40 in a few months!

The armed forces are in need of gas-engine generators, of any power from 500 watts up to 25 kw. No d.c. machines wanted; must deliver 60-cycle a.c., single-phase or three-phase, 110 volts or multiples thereof. You shouldn't sell any emergency power supplies you are likely to need in WERS work but if you have one that you can spare and care to sell, please register the dope at once with the ARRL Apparatus Bureau. State the make of both generator and engine, give complete technical dope from the data plate, and state age, condition, cost, price wanted, etc., together with your name, address, call and telephone number.

The Eastern Sea Frontier of the Navy, with headquarters at 90 Church Street, New York City, has issued an urgent appeal to all owners of ship-to-shore radiotelephones to make their sets available for equipping small vessels in the anti-submarine service. They need about a thousand complete radiotelephone installations, standard factory-built makes only, covering the 2000-3000 kc. range with an output of 12 watts or more. Communicate by mail to the address given, giving full nameplate data and descriptive details. The Navy will send an officer to inspect suitable sets and make a purchase offer.

Whenever you sell anything registered with ARRL, please drop us a card so we may cancel its listing.

F.C.C. REGISTRATION

Don't confuse the ARRL request to tell us of factory-built apparatus you'll sell with the FCC requirement to file a registration of your transmitter and receive and affix a certificate of registration. There is no connection. The FCC action comes from a BWC order based on considerations of national security.

Every licensed amateur station owner has until August 25th to register under Order 101, the usual amateur case. But where a station license does not exist, Order 99 applies, and the compliance date given under this order was June 28th. It has not been extended, but the people at FCC realize that they are depending upon the public press to spread work of the requirement and they ask us to say in *QST* that there is no likelihood whatever of penalty for late compliance by an amateur whose station license has expired and who has just heard of the order. If you fall under this order and have not yet complied, we urge you to do so at once, stating in your response that you have just heard of the matter. See helpful suggestions on page 29 of August *QST*.

In Puerto Rico and the Virgin Islands, all amateur transmitters are being removed and impounded, as is the equipment of every other station there not currently authorized to operate. BWC "has determined that the national security and defense and the successful prosecution of the war demand" this action in a region that lies astride vital routes, and has directed FCC to take the action. It is probable that every K4 amateur will receive a letter directing him how to proceed. Our understanding is that the apparatus will be stored in Army warehouses and an Army receipt given for its safe return after the war. K6 apparatus was removed (hurriedly and in many cases nastily) in early December; the K4 procedure should be thoroughly orderly and reasonable. There is no talk of impounding in the continental United States.

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.

F.C.C. NOTES

To facilitate the licensing of radio operators needed in the country's war effort, FCC has named a number of new examining points at which the exams for operator, including amateur, will be given.

Examinations are now available quarterly at the following additional cities: Birmingham, Ala.; Fresno, Calif.; Huron, S. Dak.; Indianapolis; Milwaukee; Davenport, Ia.; Charleston, W. Va.; Grand Rapids, Mich.; Syracuse, N. Y.; Fort Wayne, Ind.; and Little Rock, the last name being advanced from a semi-annual point to a quarterly point. The exact date and place of the examination should be obtained by writing to the Inspector in Charge of the district in which the city is located.

Holders of amateur Class C licenses residing within 125 miles airline of any of these cities would normally now have to put in an appearance for Class B license within four months; but as of this writing, it is not the intention of the Commission to require this of amateurs in the areas around these 11 new quarterly examination points, owing to wartime conditions, and the new field offices are being so notified. Of course, if any Class C amateurs within convenient distance wish to appear voluntarily, they may do so, and if it is convenient we urge that they do — but it isn't a requirement.

Amateurs should make every effort to keep their licenses in existence, for many reasons: participation in WERS, automatic attestation of satisfactory qualifications for Army and Navy ratings, easier registration of apparatus, etc.

Without the requirement for Class C licensees to appear, but as an additional convenience in taking any of the operator exams, FCC has also designated the following additional cities for the holding of *semi-annual* examinations: Bangor, Me.; Hartford, Conn.; Roanoke, Va.; Memphis, Tenn., Mobile, Ala.; Corpus Christi, Tex.; Reno, Nev.; Wichita, Kan.; Omaha, Nebr.; Williamsport, Pa.; Cumberland, Md.; Portland, Me.

FCC's Baltimore office, long located at Fort McHenry, has now been moved to 508 Old Town Bank Building at Gay Street & Fellsway, in the city.

George E. Sterling, W3DF, who has done a "sterling" job of organizing the National Defense Operations section of FCC, has been rewarded by being appointed assistant chief engineer in charge of the Radio Intelligence Division of the Commission's engineering department, to which stature his old section was also raised. . . . William N. Krebs, W3AEA, another long-time amateur on the Commission's staff, is now chief of the Safety & Special Services Division of the engineering department. In this work he succeeds Assistant Chief Engineer E. M. Webster, no amateur but long a valued friend of the ham, who has been called back into the U. S. Coast Guard to take charge of their communications with the rank of Captain.

As a further wartime relaxation of its operator rules, FCC has amended (a) (2) of Sec. 2.53 of its rules to read as follows:

(2) In the case of two or more stations, except amateur and broadcast, licensed in the name of the same person to use frequencies above 30,000 kilocycles only, a licensed radio operator of any class except amateur or holder of restricted radiotelephone or radiotelegraph operator permit who has the station within his effective control, may be on duty at any point within the communication range of such stations in lieu of the transmitter location or control point during the actual operation of the transmitting apparatus and shall supervise the emissions of all such stations so as to insure the proper operation in accordance with the station license.

Silent Keys

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

William E. Berner, W6MVG, Holbrook, Ariz.
Lloyd W. Cunningham, W8HWY, St. Johnsville, N. Y.
Charles W. Eggenweiler, W6PMB, Los Angeles, Calif.
Steve J. Janak, W5FFR, Hallettsville, Tex.
Prof. Everett L. Roberts, W1CNP, No. Clarendon, Vt.
Aaron Harry Schapiro, W2NSP, Far Rockaway, N. Y.
Clifford C. Tatge, W9FZY, Norfolk, Neb.
James Tweedie, W9HKU, West Terre Haute, Ind.
Lt. Charles Wesley Woodin, U.S.N.R., K4ICW, Manila, P. I.
Ira B. Woundy, ex-1CSL, New Canaan, Conn.

Simplified Band Switching

Link Neutralization for Easy Band Changing

BY HAROLD E. JONES,* W9JZI

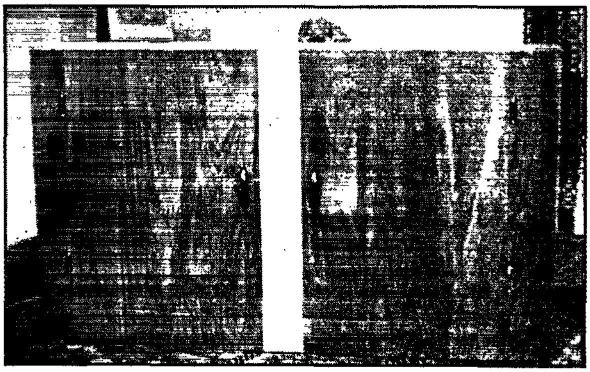
As long as six or seven years ago I desired to build a band-switching transmitter, but nowhere could I find the practical information that I wanted on the subject. Following some kind of economic law, desire finally overcame the lack of initiative, and I raided the junk box and pulled the family purse strings and started to experiment — which is what one usually has to do anyway. This story describes the result — a medium power transmitter featuring band switching with relative simplicity, and it is fairly inexpensive. I hope that it will clarify a few details of band switching which have mystified others as well as myself.

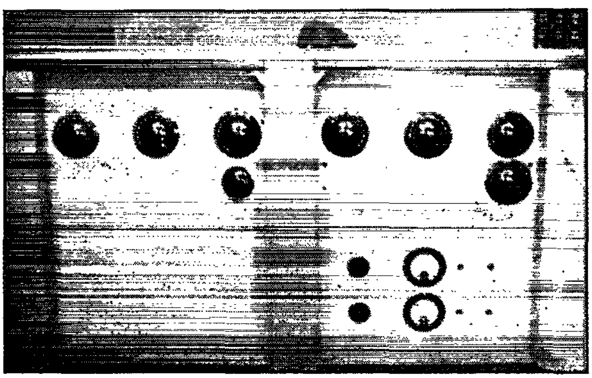
Among the many problems to be solved were what kind of switch would be satisfactory, if one coil could be used with shorting sections or if a coil for each band would be better, what kind of neutralizing could be used that would not have to be adjusted every time the frequency was changed, how the antenna was to be matched to the final, and what kind of antenna would be the most flexible. All of these had to be solved, of course, with an eye to simplicity and economy.

The Pierce oscillator circuit was chosen because it eliminates a tuned circuit, thus simplifying the transmitter and reducing the cost. In connection with stability, let me say that in the nearly one year that this transmitter has been in use not once has this oscillator failed to start the instant it was turned on, a situation not always enjoyed by previous transmitters. Another advantage of the Pierce oscillator is that it is not necessary to neutralize the buffer stage, which also contributes to the simplicity of the rig. I have always been in favor of reducing things to their simplest form if for no other reason than that I can understand more readily what is happening. I have often noted that equipment that avoids tricky or complicated circuits is more likely to be satisfactory in the long run. Getting back to the rig, the type 42 oscillator is easily capable of supplying more than enough excitation to the 6L6 buffer. Doubling, when required, is accomplished in the plate circuit of the 6L6.

* 824 N. Gilbert Street, Iowa City, Iowa.

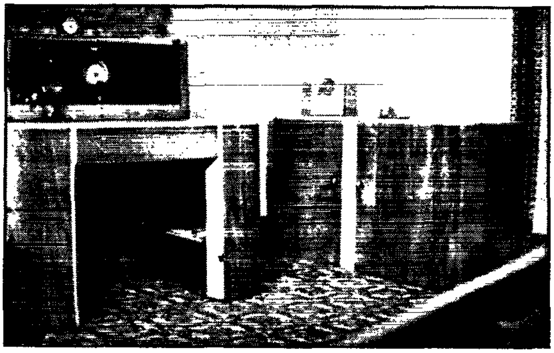
In the quest of neutralization, the article in July, 1936, *QST* by Craft and Collins on "Inductive Neutralizing" led me to experiment with it. However, the arrangement suggested there proved too cumbersome for my requirements. The simplicity of the scheme interested me, however, and finally resulted in the use of the link to obtain the feed-back voltage. While I don't suppose the use of a link to obtain feed-back voltage for neutralizing is new,[1] I have never seen it used before. The use of the link permits placing the coils in a more advantageous position, and the neutralization adjustment is at the same time relatively simple. While it might have





The transmitter cabinet closed (above), and open (below) to show the controls and meters.

[1] It isn't. Various amateurs have used it during the past five or six years, but it has never enjoyed widespread popularity. — Ed.



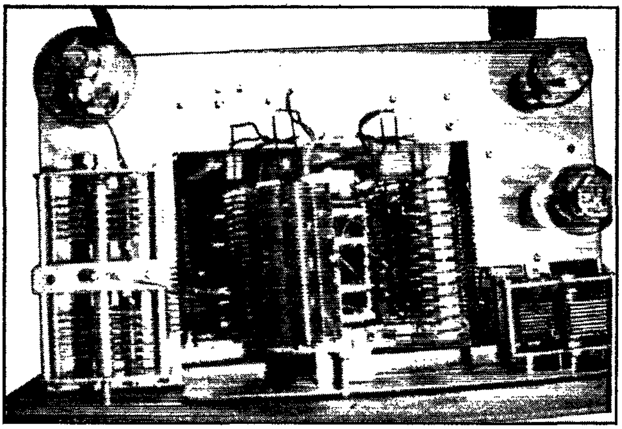
W9JZI uses a modernistic cabinet to house his transmitter right) and matches it with a modernistic operating table.

been possible to use a single coil with shorting taps and thus simplify the rig, it would have complicated the neutralization adjustment no end. When the inductance of the tank coil is changed by shorting out part of it, it is necessary to change the coupling of the link coil. This can be done also by shorting out part of the link coil, but the adjustment would be a tedious process, since the exact point of the shorting tap would have to be found by a cut-and-try process.

Having decided on individual coils for each band, the turret arrangement seemed the most logical arrangement. There are two possible arrangements, a true rotating turret or an arrangement with a rotary switch within a group of coils. Probably the best arrangement, as far as short leads are concerned, is one where the coils are built up around the tank condenser with the coils rotating around the condenser. The rotating coil arrangement was abandoned in favor of the rotating switch mainly because of mechanical difficulties and the desire to keep the rig as simple as possible. The longer leads required where the tank condenser is located outside of the turret seem of little importance except on 20 meters, where a slight reduction in efficiency seems the only disadvantage.

After choosing the arrangement, the selection of a suitable switch came next. A wafer type switch with Isolantite insulation seemed desirable. The first switches tried had two individual selector sections or poles on each wafer and, while these were satisfactory for the crystal switching and for shorting the antenna coil (L_7), they were not good enough for the tank circuits. The r.f. voltage in the tank circuit was high enough to cause corona discharge between sections of the insulation and arcing between contacts of different circuits. The insulation would appear to be red hot due to the corona discharge. In fact, after about one hour of operation in the final, one of these switches had burned so badly that it was impossible to turn the rotor. This problem was solved by the use of a switch with only one set of selectors — one pole on each wafer. The Centralab No. 2545 is such a switch, and it has been in use nearly a year with no trouble from arcing. The picture shows the construction used in mounting the coils. In this arrangement the switch (S_2) is mounted on one of the metal end plates of the turret, and the coils are mounted on small insulators around the switch, with the coils for any one band on opposite sides of the turret. The link coils are mounted inside of the coils and can be moved within the coils to get correct feed-back voltage. The method of checking the final for neutralization is the same as for any other neutralizing circuit; that is, with excitation applied and plate voltage removed, check for r.f. in the tank coil or for reflection in the grid circuit when the plate circuit is tuned through resonance. Neutralization is obtained by adjusting the coupling of the link coils to the tank coils. If the circuit refuses to balance it may be due to improper phasing of the link, and this may be corrected by reversing the connections on one of the link coils. The coils were designed to work on 20, 80 and 160 meters, since these are the bands most interesting to me. The 40-meter band may be added, though, because there are four positions on S_2. They represent, probably, as wide a frequency range as is practical to attempt to cover with one condenser. Considerable difficulty might be experienced in attempting to work higher-frequency bands because of the relatively long leads required by the mechanical arrangement. As a matter of fact, some difficulty was experienced in getting the rig to work on 14 Mc. First, the coil calculations proved to be in error because the inductance in the rather long leads was not taken into consideration, and the coils had to be pruned considerably. Then the 20-meter coils would not neutralize completely. After several hours' work the trouble was proved to be caused by the mutual coupling to adjacent coils being greater than on the lower frequencies, for some reason, and the feed-back voltage in the link had to be increased to overcome this. This was done by using four-turn coils instead of three-turn coils. The 20-meter coils then neutralized and behaved as nicely as did the lower-frequency ones.

Here is one of the simplest three-band band-switching rigs ever to come down the pike. W9JZI licked the band-switching problem when using a neutralized triode by using link neutralization. Even if you aren't building a new transmitter these days, you may be interested in the ideas contained herein—for use when, as and if.



A top view of the transmitter shows the placement of tubes and tuning condensers.

Pierce oscillator, the oscillations take place on the fundamental frequency, the output is rich in harmonic content, and the desired frequency can be selected in the plate buffer.

The antenna problem was solved by the use of a matching network and an end-fed piece of wire, at present about 150 feet long over all. Antennas as long as 300 feet have been used satisfactorily, and the long antenna seems best for long skip and DX on 160 and 80 meters. By proper selection of the tap point on the final coil, any reasonable length of wire can be matched to the final amplifier. Good harmonic suppression is obtainable with this arrangement. It is only necessary to consider the probable impedance of the load and select the tap on the final coil accordingly. Little success will be had in attempting to match a low impedance load to a high impedance tap on the tank coil. Bad side bands and probable strong harmonic radiations can occur, the common result of over coupling in any type of matching system. Likewise, difficulty will be had in attempting

In operation, the plate of the buffer is tuned to the same frequency as the final on all bands. A so-called 20-meter crystal of the 60-meter fundamental variety gave the most satisfactory operation on 20 meters. This type of crystal oscillates on 60 meters or on its second or third harmonic, depending on which frequency the plate circuit of the oscillator is tuned to. However, in the

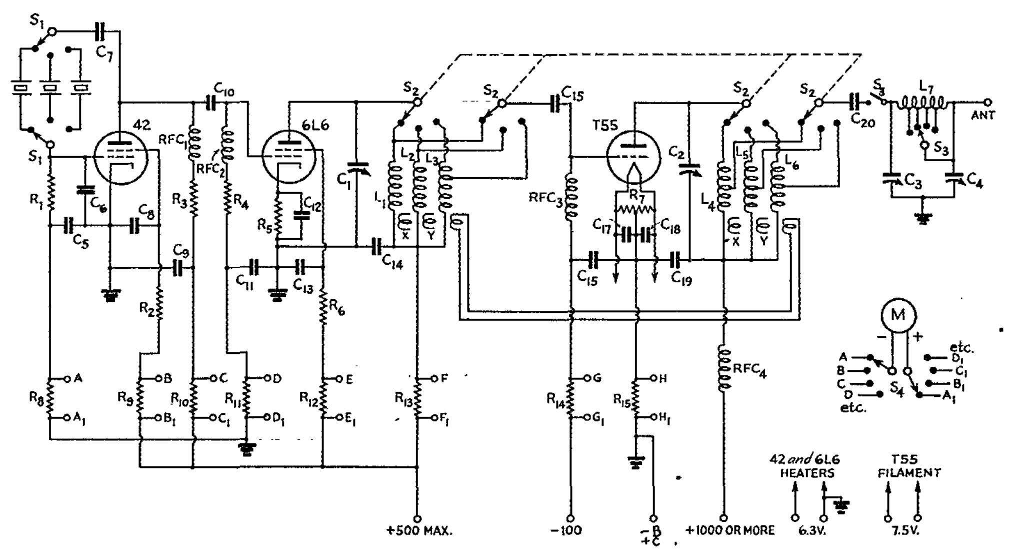
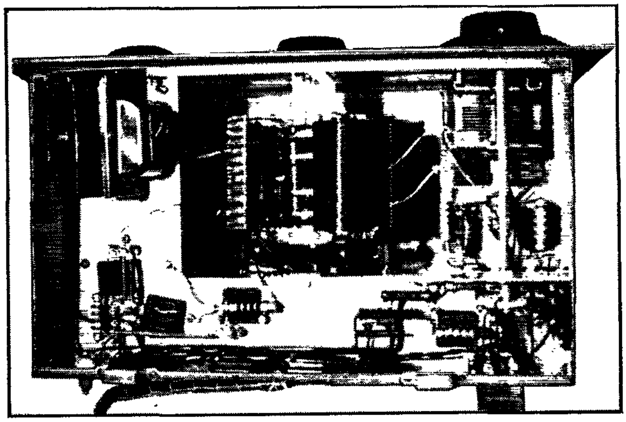


Fig. 1 — Wiring diagram of the simplified band-switching transmitter.

C_1 — 250-μμfd. variable.
C_2 — 200-μμfd. variable.
C_3, C_4 — 440-μμfd. variable.
C_5, C_8, C_9, C_{11}, C_{12}, C_{13}, C_{14}, C_{16}, C_{17}, C_{18}, C_{19} — 0.005-μfd. mica, 500 volts.
C_6 — 50-μμfd. mica.
C_7 — 0.002-μfd. mica, 500 volts.
C_{10} — 250-μμfd. mica, 500 volts.
C_{15} — 0.01-μfd., 500 volts.
C_{20} — 0.002-μfd., 5000 volts.
R_1 — 50,000 ohms, 1 watt.
R_2, R_6 — 30,000 ohms, 5 watts.
R_3 — 5000 ohms, 10 watts.
R_4 — 15,000 ohms, 2 watts.
R_5 — 200 ohms, 2 watts.
R_7 — 75 ohms, center-tapped.
R_8–R_{16} — 50 ohms, 1 watt.
S_1 — Crystal selector switch (Centralab 2505).
S_2 — Band selector switch (Centralab 2545).
S_3 — S.p.s.t. knife switch.
S_4 — Meter selector switch.
L_1–L_7 — See coil table.

to match a high impedance load to a low impedance tap on the tank coil. The amplifier will not draw enough plate current and the harmonic radiation may be high. By a high or low impedance, I refer to the extreme of perhaps 10 or 20 ohms on one hand and several thousand on the other. A moderate mismatch is certainly permissible, of course, for it is the purpose of the network to compensate for this. In attempting to compensate for too great a mismatch, it may not be possible to reflect a resistive load to the final. Admitted, a network is sometimes a tricky thing to work, but it seems to me the most satisfactory arrangement where a wide range of frequencies is to be used.



A view underneath the chassis shows a filament transformer and the various by-pass condensers.

Bias for the final is obtained partly from a bias pack and partly from rectified grid current. The resistors in the bias-pack bleeder were selected so that about 100 volts protective bias is supplied at all times, and the flow of grid current will bring the bias up to about 150 volts. The resistors R_8 to R_{15} are meter shunts, individually calibrated for a range of 10-100-300 ma. depending on the circuit requirements, and are so arranged that either of the two meters can be switched into any circuit of the transmitter. If one doesn't wish to go to the trouble of individual shunts he can use any meter and switch it across the 50-ohm resistors as shown, although in that case the meters will read a little low.

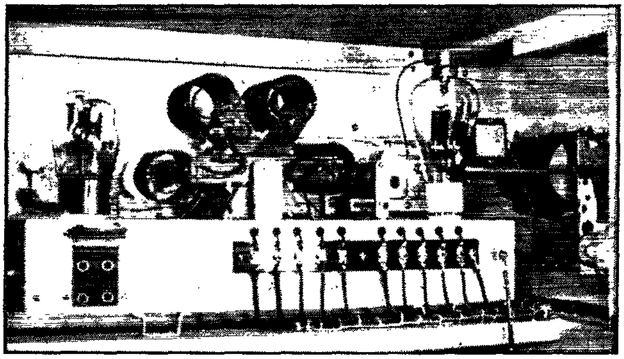
Nothing much need be said about the tuning of the transmitter because that has been covered in so many other stories. The oscillator plate current runs around 20 ma. and the buffer draws about 30 ma. The final grid current is up around 30 ma., except on 14 Mc. where it drops down to about half this, and the final plate current is usually adjusted to about 150 ma., at a voltage of 1000.

The cabinet and the control desk shown in the pictures are of the simple modern trend, and the idea developed from pictures of consoles used in broadcast stations, although that is about as far as the similarity goes. After I had more or less decided on the design of this "ham" furniture I found the construction a bit of a problem. I had seen many pieces of furniture with round corners, but I realized I didn't know how it is constructed. I went to the lumber yard to ask questions. Original plans called for walnut plywood but walnut, I found, costs about forty-five cents per square foot, and that was very discouraging to me. However, birch plywood was available and costs twenty-five cents per square foot. Birch has a grain and texture very similar to walnut and, with a little walnut stain, makes an excellent substitute. The lumber man was kind enough to write the manufacturer to inquire if the material could be bent around a 4-inch radius, and the company replied that they had a ⅛-inch three-ply birch which could be formed around a 4-inch radius by removing the back ply. Some of this material was ordered and proved quite satisfactory. I later found that they have both a special bending ply and a standard type three ply. The standard ply is much stronger, but the bending ply is better to work with on round corners. Because the bending ply was available in larger sheets only, I did not use it on the first cabinet, although I wish now that I had. The light colored trim is clear white pine. The use of the white pine as a contrast trim is perhaps questionable because its coefficient of expansion from moisture is not the same as that of birch and may result in a separation of the joint, although this may happen with any joint. The horizontal trim around the top of all the units is ¾-inch quarter-round white pine, the vertical trim is 1 by 4 clear white pine. The trim and the plywood are glued to the framework so that no nails, screws or fasteners of any kind show. In gluing the plywood, it was found necessary to use a water-proof glue. The first piece of plywood was glued with ordinary glue and came off within half an hour after the clamps were removed.

COIL TABLE

Coil	*Turns*	*Diameter*	*Length*
L_1	50	2 inches	3¾ inches
L_2	27	2 "	3¾ "
L_3	5	2 "	2 "
L_4	45	2 "	4 "
L_5	22	2 "	4 "
L_6	6	2 "	2½ "
L_7	50	2 "	5 "

All coils are of No. 14 wire. Link coils are 3 to 4 turns, as needed, and are connected permanently (not switched).



The band-switching transmitter shown from the rear. The final amplifier tube is at the right of the coil assembly and the oscillator and buffer at the left. The coils do not rotate about the switch — the assembly shown is merely a simple way of mounting the inductances about the switches.

All material in the framework is straight-grained clear white pine. While white pine is not the best material for the purpose, it is relatively cheap, fairly strong for its weight, and in a clear straight-grained piece has practically no tendency to warp or twist. All joints are either splice joints or the shoulder-corner type, and they are put together with glue and screws. This is important, especially in the transmitter cabinet where the weight loaded is nearly 200 pounds. The frame, with the exception of the base, is of 1 by 2 stock. The base frame of the transmitter cabinet is 2 by 4 pieces placed lengthwise. A space of about 8 inches is left open between the 2 by 4 and covered with screen. This provides for ventilation of the power supplies. A space of 2 inches is left open at the top and bottom of the rear access doors for additional ventilation. The cabinet rests on four large ball-bearing castors. It is advisable to use good ball-bearing castors, as the cabinet is hard enough to move at best.

The desk was a novel experiment in modernizing what was called a library table ten or twenty years ago. It was a medium-sized one with heavy square legs, well-braced and substantial. However, it was long out of date and the finish was badly marred. A framework, largely of 1 by 2 white pine, was built up on each end and around the corners in the same manner as the cabinet, and ⅛-inch birch plywood was glued on. The back was covered with Presdwood. The desk is supported by the legs on the original table, and the plywood sides are actually nothing but a skirting around the old table; the result, a modern knee-hole desk even to the mythical 29-inch height. The corners are cut on a 4-inch radius as in the cabinet. A piece of plywood was glued on the top to match.

The only tools used were a small saw, a half-inch chisel, a smoothing plane, hammer, screwdriver, brace and bit, and about a dozen clamps of assorted sizes. Probably twenty or thirty clamps could have been used at times had they been available.

The following procedure was used in finishing the pieces: First all surfaces to be finished were sanded with No. 2, and then with No. ½ sandpaper. Then a light walnut oil stain was applied. A little experimenting with a piece of scrap wood will determine the amount of stain and length of time before rubbing off to the desired tone. Then a coat of varnish thinned with turpentine was applied. After this has dried another coat (not thinned — only the first coat was thinned) was applied. When this had dried it was rubbed down with 6/0 waterproof sandpaper and water. This procedure will remove most of the varnish, but will leave a fairly smooth surface. Care must be taken to avoid rubbing down into the wood as this will remove some of the stain and leave light spots in the finish. This was followed by more varnish and rubbing with 6/0 sandpaper and water. At least six coats of varnish will be required to get a good finish. After the last coat had been rubbed down, it was cleaned with Simonize cleaner and then waxed with Simonize wax. The inside of the cabinet was painted white, as this has been found to greatly facilitate wiring and other work by providing better lighting. The panels were painted dove gray. The panel mounting facilities are such as to take standard 19-inch panels. The cabinet is 20 inches high, 18 inches deep and 49 inches wide. The desk is 29 inches high, 29 inches deep and 43 inches wide.

I think I derived as much pleasure in designing and building the cabinets as I did in building the transmitter! The location of the ham rig is a serious problem for apartment dwellers and even some of those who own their homes, because many a rig has been relegated to the basement where the excessive moisture has ruined the set in short order. By installing the ham gear in furniture, it is possible to locate the station in the living room without making the place an "eyesore."

Strays

There is nothing like bicycling to teach you that power is the *rate* of doing work. — *W1EH.*

★ BOOK REVIEWS ★

Acoustic Design Charts, by Frank Massa. Published by The Blakiston Company, Philadelphia, Pa. 228 pages, 6 × 9; 107 charts. Price, $4.00.

The contents of this book can best be described by a quotation from the author's preface: ". . . a compilation of acoustical engineering data . . . intended to serve as a quick, handy reference for the convenient use of anyone interested in the design or construction of electro-acoustic apparatus." As such it should save a great deal of laborious calculation in specific problems.

The material presented is divided into ten sections: Fundamental relations in sound waves; attenuation; mechanical vibrating systems; acoustical elements and vibrating systems; radiation from pistons; directional radiation characteristics; reverberation and reproduction; exponential horns, electromagnetic design data; and miscellaneous data. An illustrative example is included with each chart. Scales have been chosen so that the precision of reading is independent of the magnitudes of the quantities involved.

American Standard Definitions of Electrical Terms, published by the American Institute of Electrical Engineers, 33 West 39th St., New York City. 311 pages, 8 × 11; fabricoid binding. Price, $1.00 in U. S. A., $1.25 elsewhere ($1.00 in Canada if ordered from CESA).

The publication of this volume marks the first time that definitions of important electrical terms common to all branches of the art have been assembled under one cover. Work on the project of standardization of electrical terms was begun in 1928 by a committee sponsored by the AIEE with the approval of the American Standards Association, and altogether some 300 engineers have aided in the preparation of these standards. Now approved by the ASA and the Canadian Engineering Standards Association, the definitions authoritatively represent agreed American usage. Definitions of terms used in electrocommunication and in electronics form an important part of the work.

A compilation such as this is a most useful addition to the library of anyone practicing or interested in electrical work. The price has purposely been kept low so that the distribution can be as wide as possible.

Rhombic Antenna Design, by A. E. Harper. Published by D. Van Nostrand Co., Inc., New York City. 111 pages, 8 × 11; 44 diagrams and charts. Price, $4.00.

The information contained in this book has largely been selected from hitherto unpublished material accumulated by engineers of the Bell Telephone Laboratories, although previously-published data have been included wherever necessary. Following an introductory discussion of directional radio transmission, the design of rhombic antennas is taken up in detail, with emphasis on current practice rather than on basic theory. Practical information is given on methods of matching the antenna to the transmission line, construction of terminating impedances, and constructional design of the antenna itself, with working drawings. Measurement and test methods also are described. Tables of various mathematical functions used in rhombic antenna calculations are included, as well as tables of other pertinent information such as typical ground constants and experimental data on existing antenna installations.

Obviously useful for engineers engaged in the design of communications circuits, this book also should be valuable to the amateur with engineering background in that happy day when rhombics again can get to work pushing ham signals to the far corners of the earth.

Basic Radio, by J. Barton Hoag. Published by D. Van Nostrand Co., Inc., New York City. 379 pages, 5½ × 8½; illustrated. Price, $3.25.

Written for beginning radio classes, this book covers a considerably wider range of tube circuits and applications than is to be found in the ordinary elementary radio text. There is the usual sequence of treatment of fundamentals — electricity, magnetism, direct and alternating currents, resonant circuits, diode and triode operation, applications to amplification, reception and transmission. But in addition considerable space is devoted to subjects such as gas-filled tubes, photoelectric cells, cathode-ray tubes (including types used in television), circuits for producing special waveforms (pulses, etc.), magnetrons and klystrons. Material on direction finding, microwaves and waveguides is included, making the book a rather extensive, albeit elementary, survey of the more important present-day vacuum-tube applications.

The treatment is almost wholly descriptive, brief, and confined to essential basic principles. There are none of the mathematical developments common to more advanced texts, the mathematical parts being confined to the presentation of frequently-used simple equations. A problem section contains some 400 questions designed to test the student's understanding of what he has read.

Fundamentals of Radio, by E. C. Jordan, P. H. Nelson, W. C. Osterbrock, F. H. Pumphrey, L. C. Smeby, edited by W. L. Everitt. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York City. 400 pages, 6 × 9; illustrated. Price, $5.00.

The war has inspired the preparation of a number of texts directed toward the elementary radio training classes now in existence and being inaugurated all over the country. *Fundamentals of Radio* is such a book, representing the collaboration of five authors under the editorship of Prof. Everitt. The subject matter covers the fundamentals of d.c. and a.c. circuits, vacuum-tube operation, principles of receivers and transmitters (including frequency modulation), wave propagation and antennas. There is also an introductory chapter on mathematics which provides a review of elementary algebra, trigonometry and logarithms. Questions and problems are included in each chapter.

The general educational level at which the book is aimed is that of the high-school graduate with mathematics and physics courses successfully behind him. The treatment is therefore not "popular" nor is it of strictly engineering grade, but strikes a medium between the two. Considerable attention is paid to d.c. and low-frequency a.c. circuits, to the fundamentals of vacuum-tube operation and the applications of the tube as an audio amplifier. Electromagnetic waves and wave propagation also are given more detailed consideration than has been customary in older volumes which fall in the same classification.

As a presentation of basic fundamentals the book as a whole is very successful. The chief criticism to be levelled at it from this standpoint is that, in comparison to low-frequency a.c. circuits and tube operation, radio-frequency tuned circuits are treated rather too briefly. A few additional pages describing quantitatively the effects of coupling, loading, etc., would add considerably to the value of this section. On practical grounds it is perhaps unfortunate, in view of the purpose for which the book has been prepared, that in the discussion of transmitters and receivers high- and ultrahigh-frequency communications equipment is given little, if any, attention, the examples being drawn wholly from the standard a.m. and f.m. broadcast fields.

Ultrahigh-Frequency Techniques, by J. G. Brainerd, Glenn Koehler, H. J. Reich, and L. F. Woodruff, under the editorship of Prof. Brainerd. Published by D. Van Nostrand Co.,

(*Continued on page 104*)

Calculation of Variable Condenser Capacities

A Simplified Time-Saving Method

BY LOUIS F. LEUCK,* W9ANZ

It is often necessary to determine the capacity of a tuning condenser of unknown characteristics, and the information given below will enable its calculation with a minimum expenditure of time and effort. It is only necessary to multiply three numbers together. These can be determined by inspecting the condenser and referring to Tables I and II.

TABLE I

S	K	S	K
.500	.45	.118	1.91
.450	.498	.106	2.12
.415	.542	.096	2.33
.374	.584	.087	2.57
.336	.670	.078	2.88
.303	.732	.070	3.21
.272	.826	.063	3.57
.245	.918	.057	3.93
.222	1.06	.051	4.40
.200	1.11	.046	4.88
.180	1.25	.041	5.48
.162	1.39	.037	6.06
.145	1.55	.033	6.80
.131	1.72	.030	7.47

TABLE II

Diam. Inches	A (Area) Sq. Inches	Diam. Inches	A (Area) Sq. Inches
4	6.25	2⅜	2.21
3⅞	5.85	2¼	1.98
3¾	5.50	2⅛	1.76
3⅝	5.10	2	1.57
3½	4.81	1⅞	1.37
3⅜	4.46	1¾	1.20
3¼	4.13	1⅝	1.01
3⅛	3.83	1½	.88
3	3.53	1⅜	.74
2⅞	3.23	1¼	.60
2¾	2.96	1⅛	.49
2⅝	2.7	1	.39
2½	2.45		

$C = KAN$

C = the capacity of the condenser in $\mu\mu$fd.

K = a quantity which depends on the spacing S of the plates. The spacing may be determined by direct measurement, or by inserting new coins or pieces of shim stock (obtained from an auto supply store) of known thickness between them. Once in circulation, newly-struck coins lose a part of their thickness in a surprisingly short time. The measurements given below are for coins which have been in circulation long enough to lose their brightness but do not show any appreciable signs of wear:

Dime—0.05″
Cent—0.06″
Nickel—0.07″
Half-dollar—0.08″
Dollar—0.10″
Government post card—0.01″

Strips of firm government post cards are useful in connection with single-spaced condensers. Remember that S refers to the spacing between a stator and a rotor plate. K will be found directly to the right of S in (I). For accurate results some interpolation will be necessary.

A = the area of one side of one of the rotor plates. Table II saves your making this calculation providing the plates are semicircular. Measure the plate diameter and simply read off the corresponding area.

N = the number of *spaces* between plates. Count them.

*3720 A St., Lincoln, Neb.

Example: We have a 12-plate condenser (6 stator and 6 rotor), with plate spacing of 0.162″ (a dollar and a cent just slip loosely between the stator and rotor plates when in mesh) and the plate area corresponds to a diameter of 2¾ inches.

$$C = KAN = 1.39 \times 2.96 \times 11 = 45.2\ \mu\mu\text{fd.}$$

By applying this formula to a number of condensers whose capacities were specified we found the results were usually within 10 per cent and sometimes within less than 5 per cent of the manufacturer's rating. The manufacturer's rating compared to actual capacity probably is very little closer than this. The formula is based on a theoretical condenser having complete semicircular plates with no capacity to shafts, and plates, or supports. Actually, rotor plates are less than semi-circles because of rounded corners and cutting away of some of the straight edge so as to secure a low minimum. The extent of this can be determined by turning the rotor fully out of mesh and noting the separation between the stator and rotor groups. Then again the stator plates usually have a part missing because of rotor shaft clearance. On the other hand this is usually offset by added area in the region of the supports.

The result given by the formula is usually a

(Continued on page 92)

A Course in Radio Fundamentals

Lessons in Radio Theory for the Amateur

BY GEORGE GRAMMER,* W1DF

No. 4 — Vacuum-Tube Fundamentals

Experiments designed to show comprehensively the operation of the vacuum tube as an amplifier require a fairly elaborate array of test apparatus. Finding the gain-frequency characteristic of an audio amplifier, for example, requires the use of a calibrated source of variable frequency over the audio-frequency range, plus a calibrated attenuator and means for measuring voltage with readings independent of frequency, while distortion cannot readily be observed without an oscilloscope. Such equipment is expensive and satisfactory substitutes cannot readily be constructed at home.

However, simple experiments designed to show the properties of vacuum tubes readily can be performed with the gear described in the preceding installments. As a convenience in setting up apparatus, a tube board such as is shown in Fig. 1 can be added. It consists simply of a baseboard on which is placed a square piece of bakelite in which is mounted an ordinary octal socket, connections being brought out from the socket prongs to machine-screw terminals. This permits changing tube connections without soldering. The heater terminals are permanently connected to a terminal strip mounted at the back of the board; this strip also has terminals for "B" supply, one negative and two positive. The latter take care of separate plate and screen voltages when a tetrode or pentode is used. A push-button mounted on the board provides a means of closing the plate (or screen) circuit when the milliammeter in the test instrument is being used for other measurements.

* Technical Editor, *QST*.

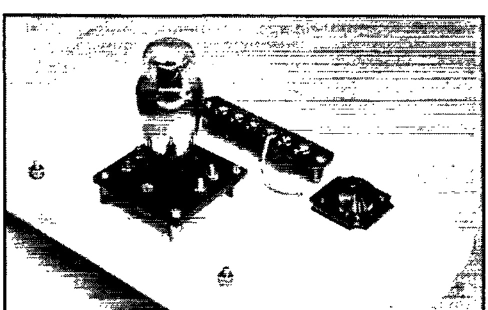


Fig. 1

In using the plate power supply with its variable voltage divider it should be remembered that only a limited current can be taken through the divider taps for more than very short periods of time. The variable resistor, in particular, is rated at only a few watts, and if the output current is more than 15 milliamperes or so the time during which current flows must be kept to a minimum. Since a reading can be taken in a matter of seconds this is no handicap, but if the supply is used for continuous output the resistor arm should be set at the end connected to the transformer center tap (see Fig. 4, p. 65, August *QST*), or else a switch should be provided for shorting between the negative output terminal and the wire connected to the center-tap of the power transformer.

Tube Characteristics

Some amplification of the *Handbook* material dealing with tube constants may be helpful in connection with the experimental work. In the paragraph on "Characteristics" (§ 3-2), for instance, plate resistance is defined as "the ratio, for a fixed grid voltage, of a small plate voltage change to the plate current change it effects." This can be written in the form of an equation:

$$r_p = \frac{\Delta E_p}{\Delta I_p} \; (E_g \text{ constant})$$

where r_p stands for plate resistance, ΔE_p for the change in plate voltage, and ΔI_p for the corresponding change in plate current. The sign Δ indicates that we are concerned not with one value but with the *difference between two values.* (In other respects the equation is simply the familiar statement of Ohm's Law.) The other two constants, amplification factor and mutual conductance, also can be defined in formulas instead of words:

$$\mu = \frac{\Delta E_p}{\Delta E_g} \; (I_p \text{ constant})$$

$$g_m = \frac{\Delta I_p}{\Delta E_g} \; (E_p \text{ constant})$$

By simple substitution in these formulas it is found that the three constants are related in this way:

$$g_m = \frac{\mu}{r_p}$$

The values of the constants can be found by plotting characteristic curves and measuring the change which occurs in one quantity when the other is changed any arbitrary amount. However, this method must be used with some caution when the characteristic curve does not turn out to be a straight line. If the line bends, the "constant" is not actually always the same, but varies with the point on the curve at which it is measured. For example, suppose that Fig. 2 represents a curve showing the variation of plate current as the plate voltage is varied, and from it we want to determine the plate resistance. We arbitrarily select A as the point from which to start and, also arbitrarily, decide to make the plate current change, I_p, 2 milliamperes. A 2-milliampere increase brings us to point B on the curve. Then the corresponding change in plate voltage, E_p, is the difference between the plate voltages which cause 1 and 3 milliamperes to flow. Thus $E_p = 70 - 30 = 40$ volts. Then

$$r_p = \frac{\Delta E_p}{\Delta I_p} = \frac{40}{0.002} = 20{,}000 \text{ ohms}$$

Suppose that instead of 2 milliamperes for I_p we had selected 1 milliampere. This would bring us to point C on the curve, and now $E_p = 53 - 30 = 23$ volts. Substituting these new values in the equation gives us

$$r_p = \frac{23}{0.001} = 23{,}000 \text{ ohms.}$$

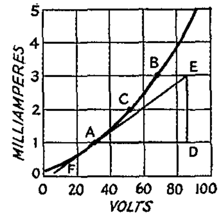
Because of the curvature of the characteristic the value of the "constant" r_p as measured by this method will depend considerably upon the value of Δ selected. As the value of Δ is made smaller and smaller the value of the ratio $\Delta E_p/\Delta I_p$ approaches the ratio AD/DE, where the line FE is drawn tangent to the curve at point A (that is, the line FE touches but does not intersect the curve at point A). In Fig. 2 this ratio is

$$\frac{AD}{DE} = \frac{85 - 30}{0.003 - 0.001} = \frac{55}{0.002} = 27{,}500 \text{ ohms}$$

which is the value of the plate resistance at point A on the curve. If points B or C had been selected instead of A as the starting place (point at which plate resistance is to be determined) different values of plate-resistance would be obtained, since it is obvious that tangents drawn through these points would not coincide with the tangent EF.

In determining the values of the tube constants from the curves, therefore, the preferred procedure is to draw a tangent to the curve at the point at which the value of the constant is to be measured, and then use the tangent line as a basis for measurement of ΔE_p and ΔI_p (or whatever pair of quantities is represented by the curve).

Fig. 2



While there is bound to be some inaccuracy in drawing the tangent, in general the results will be nearer the truth than if two points on the curve itself are selected. Of course if the curve is straight the curve and its tangent coincide, so that in the special case of a straight-line curve points can be taken directly from the curve.

Caution!

In the diagrams of the various set-ups for the experiments to follow, milliammeters and voltmeters are indicated where measurements are to be made. If enough separate instruments are at hand, they may be used as shown. However, if only the single combination test instrument is available for measuring currents and voltages, extreme care should be used to see that the proper range is selected before making voltage measurements. In alternate switching from current to voltage it is only too easy to leave the range switch on 0–1 ma. when connecting the instrument across three or four hundred volts — with consequences easy to imagine. Such an error — bad enough normally — would be practically fatal now, with instrument replacements or repairs virtually impossible. Watch that range switch!

ASSIGNMENT II

Study *Handbook* Sections 3-1 and 3-2, starting page 42. Perform Exps. 21, 22 and 23.

Questions

1) How does conduction take place in a thermionic vacuum tube?
2) What is the space charge?
3) What is the purpose of the grid in a triode?
4) Name the three fundamental tube characteristics and define them.
5) Why is a "load" necessary if a vacuum tube is to perform useful work?
6) What are tube characteristic curves?
7) Why is amplification possible with a triode tube?
8) What is meant by the term "interelectrode capacity"?
9) What is the difference between static and dynamic characteristic curves?
10) In what form is the power supplied to the plate-cathode circuit of a tube dissipated?
11) What is the purpose of tube ratings?
12) What is meant by the term "plate-current cut-off point"?

13) What is grid bias, and why is it used?
14) Define saturation pont.
15) What is rectification?

ASSIGNMENT 12

Study *Handbook* Sections 3-3 and 3-4, starting page 44. Perform Exp. 24.

Questions

1) Name three forms which the plate load for a triode amplifier may take.
2) Define voltage amplification; power amplification. What is the essential difference between amplifiers designed for the two purposes?
3) What determines the choice of operating point for an amplifier?
4) Define plate efficiency. How does it vary with different types of operation (Class A, B and C)?
5) What is harmonic distortion and how is it caused?
6) Describe Class-A amplifier operation.
7) What is feed-back? What is the result of application of positive feed-back? Of negative feed-back?
8) How is the input capacity of a triode amplifier affected by its operating conditions?
9) What is driving power?
10) What is the phase relationship between the alternating voltage applied to the grid of an amplifier having a resistance load and the amplified voltage which appears in the plate circuit?
11) What is the effect of the value of load resistance on the amplification obtainable with a given tube?
12) If a certain power amplifier circuit delivers 3.5 watts when a signal voltage of 20 peak volts is applied to the grid, what is the power sensitivity of the amplifier?
13) Describe Class-B amplifier operation.
14) What is the definition of a decibel?
15) If the power level at one point in an amplifier is 0.25 watt and at a later point is 4 watts, what is the gain in db.?
16) What are the distinguishing characteristics of a Class-C amplifier?
17) What is the difference between parallel and push-pull operation?
18) A certain circuit provides an attenuation of 15 db. What is the ratio of power levels in the circuit?
19) If a signal of 0.6 volt is applied to an amplifier having a voltage amplification of 125, what is the output voltage?
20) In a certain amplifier an input voltage of 0.01 volt produces an output voltage of 50 across 500 ohms. The input resistance of the amplifier is 0.1 megohm. What is the gain of the amplifier in db.?

ASSIGNMENT 13

Study *Handbook* Sections 3-5 and 3-6, beginning page 48. Perform Exp. 25.

Questions

1) What is the purpose of the screen grid in a tetrode or pentode tube intended for use as a radio-frequency amplifier?
2) Does the shielding afforded by the screen grid have to be as complete in a tetrode or pentode designed for audio-frequency amplification as in one designed for radio-frequency amplification?
3) Describe secondary emission.
4) How may the effects of secondary emission be reduced in a screen-grid tube?
5) What is the difference between a "variable-μ" and "sharp cut-off" tube?
6) Why is a mercury-vapor rectifier preferred to a high-vacuum rectifier when the rectifier tube must handle a considerable amount of power?
7) How does a mercury-vapor grid-control rectifier differ from a high-vacuum triode? Could such a "gas triode" be used for amplification in the ordinary sense of the word?
8) Identify five general types of multipurpose tubes.
9) What is a beam tube?
10) Name the two general types of cathodes used in thermionic vacuum tubes.
11) What is the advantage of the unipotential cathode?
12) What is the purpose of center-tapping the filament supply of a tube whose cathode is heated by alternating current?
13) A certain r.f. power amplifier requires a negative grid bias of 200 volts for Class-C operation. The d.c. grid current is to be 16 milliamperes under operating conditions. If the bias is to be obtained entirely from grid leak action, what value of grid-leak resistance is required?
14) A triode amplifier requires a negative grid bias of 30 volts, at which bias the plate current is 45 milliamperes. What value of cathode resistance will give the required bias? If the amplifier is to be used at audio frequencies as low as 100 cycles, what value of by-pass capacity should be shunted across the resistor to minimize negative feed-back?
15) What value of cathode bias resistance should be provided for a 6F6 used as a Class-A pentode audio amplifier with 250 volts on the plate? (Use published operating conditions.) What value of by-pass condenser should be used to prevent negative feed-back at frequencies down to 80 cycles?
16) A push-pull r.f. power amplifier requires 400 volts bias and a d.c. grid current of 15 milliamperes per tube under rated operating conditions. If 130 volts of fixed bias is to be provided by batteries, what grid leak resistance should be used?

ASSIGNMENT 14

Study *Handbook* Section 3-7, beginning page 50. Perform Exp. 26.

Questions

1) How may a vacuum-tube circuit be made to generate self-sustained oscillations?
2) Can oscillations be set up in a circuit in which the feed-back is negative?
3) What is negative resistance?
4) Define series feed; parallel feed.
5) Draw two circuits utilizing magnetic feed-back.
6) How can the amount of feed-back be controlled in the Colpitts circuit?
7) Draw a simple triode crystal oscillator circuit. Which of the ordinary oscillator circuits does it resemble most closely?
8) Define the plate efficiency of an oscillator.
9) Name four factors which can affect the frequency of oscillation.
10) What is a multivibrator? Name one of the uses for this type of oscillator.
11) How can the effect of plate voltage variations on frequency of oscillation be minimized?
12) Draw three oscillator circuits with capacity feed-back, and describe how the feed-back may be controlled in each.
13) What is the usual method of obtaining grid bias in an oscillator circuit? Why is it used in preference to other methods?
14) How can frequency drift in an oscillator be reduced?
15) A 25-microhenry coil is available for use in an oscillator circuit which is to operate at approximately 2000 kc. What capacity will be required to tune the coil?

ASSIGNMENT 15

Study *Handbook* Sections 3-8 and 3-9, beginning page 55.

Questions

1) What is a fluorescent screen?
2) Describe the construction and operation of a simple cathode-ray oscilloscope tube.
3) By what methods may an electron beam be deflected?
4) Define deflection sensitivity.
5) How is the intensity of the fluorescent spot controlled?
6) What is the purpose of the sweep circuit in an oscilloscope?

7) Name two common forms of sweep. What are the advantages and disadvantages of each?

8) What is an electron gun?

9) Why is it desirable to use amplifiers for the deflection voltages for a cathode ray tube?

10) Why should the time of the return trace in a linear sweep circuit be as short as possible?

11) Explain the method by which patterns are formed on the fluorescent screen. Construct a pattern, using a linear sweep with return trace time equal to 1/20 of the total time of the sweep cycle, for two cycles of a sine wave applied to the vertical plates. Construct a pattern, using the same two sine-wave cycles applied to the vertical plates, but with a single sine wave for the horizontal sweep. Compare with the linear sweep.

12) Describe the operation of a gas-triode linear sweep generator.

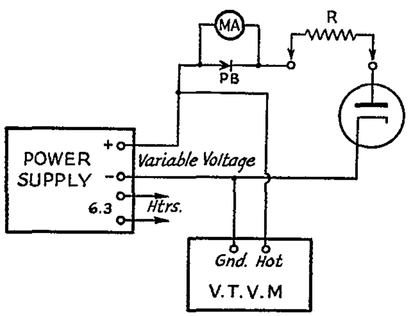


Fig. 3

EXPERIMENT 21

Diode Characteristics

Apparatus: This experiment uses the plate power supply, tube board, test set, vacuum-tube voltmeter, and three 1-watt resistors, 25,000, 50,000 and 100,000 ohms. The circuit arrangement is shown in Fig. 3. Measurements must be made of the voltage applied to the tube and the current flowing in its plate-cathode circuit; the single test instrument can be used for both purposes by being shifted back and forth for each pair of readings. However, the small current consumed by the instrument when used as a voltmeter will cause the actual output voltage to be lower when the voltage is being measured than when the instrument is shifted to read plate current. Unless a separate voltmeter which can be left permanently in the circuit is available, it is advisable to use the v.t. voltmeter, thus avoiding the loading effect. The test instrument is therefore shifted between the plate circuit of the tube being tested and the plate circuit of the voltmeter tube.

The tube to be tested may be a 6H6, the diode section of a combination diode-amplifier tube, or simply a small triode such as the 6J5 with the grid and plate connected together to act as a single plate.

Procedure: The object of the experiment is to plot characteristic curves, plate voltage vs. plate current, for the tube alone (static characteristic) and with various values of load resistance in series with the plate circuit (dynamic characteristics). Starting at zero plate voltage, increase the plate voltage in small steps, taking plate current readings at each voltage step. With no load resistor in the circuit, take readings at intervals of voltage which will give current intervals of about 1 milliampere so that enough points will be secured to give a smooth curve when the points are plotted. In the case of the 6H6 tube, using one plate and cathode only, one-volt intervals are suitable. Proceed similarly when the load resistance is inserted in the circuit; in this case larger voltage intervals (5-volt steps, for instance) can be used.

In using the single test set for all measurements. the push-button should be closed while the voltage measurement is being made so that the voltage can be adjusted to the proper value with plate current flowing. If the plate circuit is not closed at the time the voltage is adjusted, the voltage will drop when the milliammeter is connected in the plate circuit of the tube to measure plate current. It is not necessary to make provision for closing the plate circuit of the v.t.v.m. when the meter is being used elsewhere.

The observed data should be plotted in the fashion shown in Fig. 4, which gives characteristic curves taken on a 6H6. With no load the current is quite high, reaching 10 milliamperes with about 7.5 volts applied. Other types of tubes may give considerably different plate-current values without load, but should approximate the load curves given since the current which flows at a given voltage is principally determined by the load resistance rather than the tube. As is to be expected, the current decreases, at a given applied voltage, as the load resistance is increased.

If the no-load curve is inspected carefully, it will be observed that it is not a straight line, particularly near the low-voltage end. The lamp in Exp. 10 was another example of a non-linear circuit, although for a different reason. In the present case, the non-linearity arises from the fact that the number of electrons drawn to the plate is not strictly proportional to the voltage applied between plate and cathode. The *d.c. resistance* of the diode at any voltage is equal to that voltage divided by the current which it forces through the tube. In practice the behavior of the tube when an alternating voltage is applied is of more interest, in which case the a.c. plate resistance, or resistance effective to small *changes* in applied voltage, is important. The value of this plate resistance is found as described in the introduction to this installment.

When a load resistance is inserted in the plate circuit the linearity of the circuit consisting of the resistance and the tube is better than that of the tube alone. This improvement, which increases as the load resistance is increased, is because the load resistor tends to reduce the effect of variations in the resistance of the tube. For example, if the resistance of the tube varies between 1000 and 3000 ohms with a

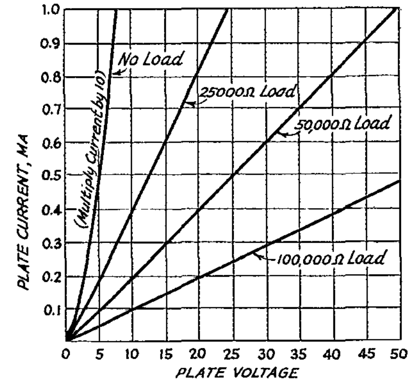


Fig. 4

certain range of applied voltage the resistance change is 2000 ohms, or an increase of 200%, using the smaller number as a base. If a 10,000-ohm resistor is connected in series, the minimum resistance becomes 11,000 ohms and the maximum resistance 13,000 ohms, so that the increase in resistance is now only 2000/11,000, or 18%. With 100,000 ohms in series, the increase is from 101,000 to 103,000 ohms, so that the percentage increase is now 2%. In the curves of Fig. 3 the addition of the load resistance makes all the points fall on a line which is practically straight except at the low voltage end where the tube resistance has its highest value. The higher the load resistance the less marked does this slight curvature become.

In taking data it will be observed that a small current flows in the plate circuit even at zero plate voltage. This current is the result of the fact that some electrons are emitted from the cathode with sufficient velocity to reach the plate even though there is no positive charge on the plate to attract them. For complete cut-off of plate current

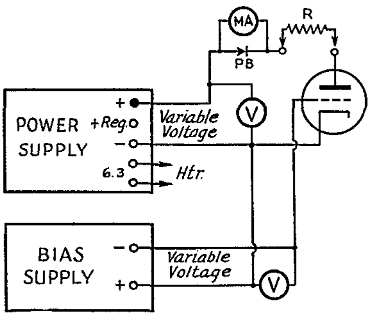


Fig. 5

it would be necessary to make the plate a volt or two negative with respect to the cathode, thus repelling these high-energy electrons from the plate. Since the current in any case is very small — a very small fraction of a milliampere — it can be neglected in most applications of the tube. However, in flowing through an external load resistance of high value a volt or two may be developed across the load, which may need to be taken into account in some cases.

EXPERIMENT 22

Triode Static Characteristics

Apparatus: The set-up for this experiment is shown in Fig. 5. Insofar as the plate circuit of the triode is concerned, the arrangement is practically the same as that used for diode measurements, Fig. 3, except that it is possible to measure plate voltage with the test instrument rather than the v.t. voltmeter. This is because larger plate-voltage steps may be used so that a high range (500 volts or the nearest provided on the test instrument), which will have a resistance of a half megohm or so, will give sufficient accuracy for all measurements. The bias supply is incorporated in the

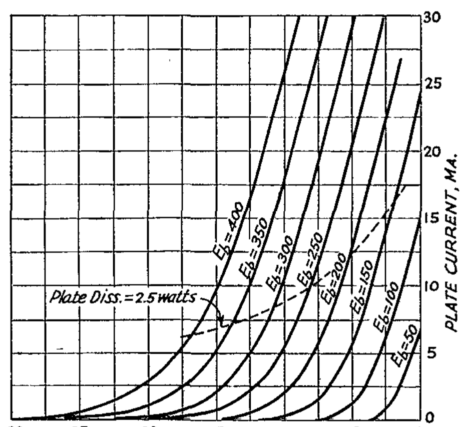


Fig. 6

set-up to provide variable grid bias, and its voltage output also may be measured by the test instrument on the condition that the voltmeter resistance is 25,000 ohms or so (25-volt scale). Be sure that the positive output terminal of the bias supply is connected to the grounded side of the 115-volt line, using the lamp provided for checking as described in July *QST*. In using a single instrument in place of the three indicated, the push-button should be closed each time the plate voltage is measured so that the voltage will be that existing when plate current flows.

The resistor *R* shown in Fig. 5 is not needed in this experiment, so the push-button may be connected directly to the plate.

Procedure: The object of the experiment is to determine the relationship between plate voltage, plate current and grid voltage of a small triode. One quantity is held constant throughout a run, the second is varied, and corresponding measurements of the third are made. A receiving triode such as the 6J5 is suitable. Three sets of characteristics can be taken; the first, with the plate voltage held fixed while the behavior of plate current with varying grid voltage is observed, is called the "grid voltage-plate current" characteristic. When a series of such data is taken with several fixed values of plate voltage, a "family" of curves results. A typical grid-voltage plate-current family taken in this way on a 6J5 is shown in Fig. 6. The plate voltage was set at 50-volt intervals from 50 to 400 volts (the maximum output voltage of the power supply described in August *QST*),

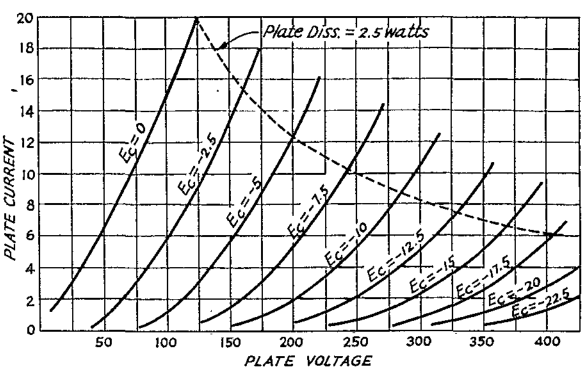


Fig. 7

enough points being taken at each plate voltage to permit smooth curves to be drawn. Notice that for each value of plate voltage the curve bends at the higher values of negative grid voltage (as the plate current decreases toward the cut-off point) but that the curvature decreases as the grid bias becomes less negative. The curves eventually straighten out and become practically parallel, and the distances between the 50-volt intervals also approach equality. The dashed line shows the value of plate current at which the plate dissipation (plate voltage multiplied by plate current) is equal to the maximum rated value for the tube; above this line the plate dissipation is exceeded.

The "plate family," shown plotted from experimental data in Fig. 7, is obtained by holding the grid bias constant at selected values and measuring the plate current as the plate voltage is varied. These curves show the same general tendency to bend when the plate current is near cut-off, and to straighten out at higher values of plate current. The plate family is frequently more useful than the set of grid voltage-plate current curves represented by Fig. 6.

When the remaining quantity, plate current, is held constant while the grid voltage is varied (the plate voltage being adjusted for each value of grid bias to give the selected value of plate current) the set of curves shown in Fig. 8 results, again plotted from experimental data on a 6J5. These "constant current" curves show the relative effect of grid voltage and plate voltage on plate current. The curves are nearly straight lines for all except very small values of plate current, showing that the amplification factor is practically constant for a given plate-current value regardless of the plate and grid voltages. The fact that, with the exception of the curve for a plate current of 0.1 milliampere, the curves are very nearly parallel indicates that the amplification factor also is nearly independent of the plate current so long as the latter is not near the cut-off point.

The values of amplification factor, μ, plate resistance, r_p, and mutual conductance, g_m, can be measured from these three sets of curves. The mutual conductance, $\Delta I_p \Delta E_g$, can be found from the curves of Fig. 6 since these curves show the relationship between grid voltage and plate current. The plate resistance, $\Delta E_p/\Delta I_p$, can be measured from the curves of Fig. 7, which relate plate current to plate voltage for various values of grid bias, while the amplification factor $\Delta E_p/\Delta E_g$, can be taken from the curves of Fig. 8. The method of making these measurements is described in the introduction to this installment. Since these "constants" are a function of three variables a large number of graphs would be required to give their behavior even partially completely, but one special case is shown in Fig. 9. This graph shows the variation in μ, r_p and g_m as a function of grid bias when the plate voltage is held constant at 250 volts, the normal rated operating voltage for the tube, and is a plot of values measured at 250-volt points on each of the three sets of curves in Figs. 6, 7 and 8. It is plain that the amplification factor changes relatively little compared to the changes in the other two quantities. Increasing negative grid bias causes

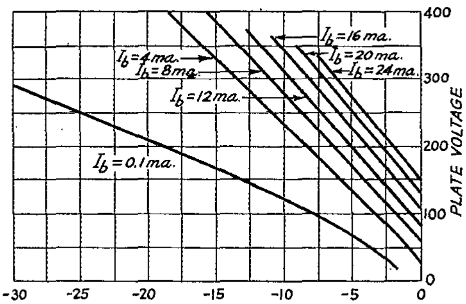


Fig. 8

the mutual conductance to decrease, which means that the amplification obtainable from the tube also decreases since amplification is proportional to mutual conductance, other things being equal. On the other hand, the plate resistance increases with increasing negative grid bias. As a check on the accuracy of measurement, the three curves should satisfy the relationship

$$g_m = \frac{\mu}{r_p}$$

within reasonable limits of accuracy, for any given value of grid bias.

If published average curves for the type of tube measured are available, it will be of interest to compare them to the curves determined experimentally. Exact duplication of the published curves is not to be expected, of course, because of slight variations in manufacture.

EXPERIMENT 23

Triode Dynamic Operation

Apparatus: Same equipment as for Exp. 22, with the addition of the following resistors: 5000, 10,000, 25,000, 50,000 and 100,000 ohms. Resistors of 1-watt rating will be satisfactory.

Procedure: The object of this experiment is to plot dynamic grid voltage-plate current characteristics for representative values of plate load resistance. Using a fixed value of plate-supply voltage, insert a resistor at R, Fig. 5, and measure the plate current as the grid bias is varied in steps of 2.5 volts or so. Each time the grid bias is changed, readjust the plate-supply voltage (measured across the

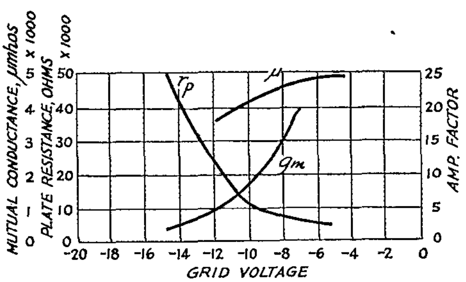


Fig. 9

supply terminals, not from plate to cathode of the tube being investigated) with the push-button closed so that the voltage under load will be the actual value selected. The voltage will need to be re-set as the plate current increases, because of voltage drop in the power supply. When a complete set of data has been obtained with one value of plate load resistance, change to another value and take another run. When finished with all values of resistance, plot the data in the form of curves showing plate current against grid bias.

A typical set of such curves, taken on a 6J5 with the plate voltage constant at 300, is shown in Fig. 10. As the plate load resistance is made larger the maximum plate current (at zero grid bias) becomes smaller, as is to be expected. The plate current cut-off point, however, occurs at approximately the same value of negative grid bias in each case, since the plate voltage is fixed and at zero current there is no voltage drop in the load resistor. As in the case of the diode which was the subject of Exp. 21, increasing the value of load resistance has the effect of straightening out the curve, so that the curves taken with high values of load show less bending than curves with no load or small values of load resistance.

The effect of the load resistance on the amplification obtainable from the tube, and also the distortion it introduces, can be found graphically from curves such as these. In Fig. 11, as an illustration, the curve for $R = 10{,}000$ ohms has been plotted singly for the purpose of showing the relationship between varying grid signal voltage and the corresponding variations in plate current. An operating point should be chosen somewhere near the middle of the relatively-straight part of the curve, such that the product of the plate current by the voltage between plate and cathode

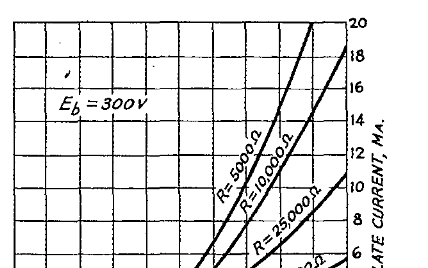


Fig. 10

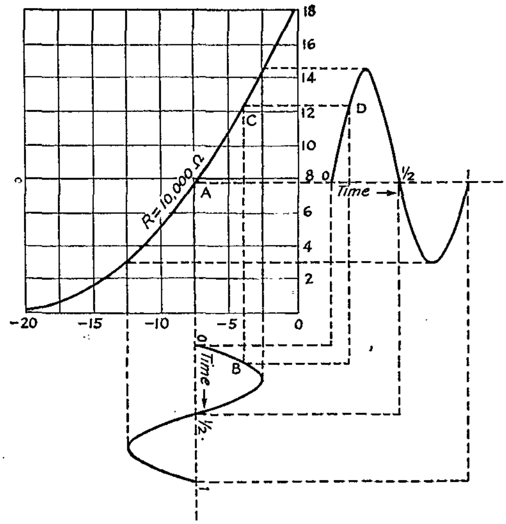


Fig. 11

will not exceed the rated plate dissipation of the tube. In Fig. 11 the operating point selected is the point *A*, at −7.5 volts grid bias, making the no-signal plate current slightly less than 8 milliamperes. The dashed line extending downward from *A* is the axis of grid voltage, and the line extending to the right is the axis of plate current. On the grid voltage axis a sine wave is plotted as the assumed signal voltage (the actual shape of the signal wave is not highly important, but the sine wave is representative of a single frequency) as a function of time, one complete cycle being represented. In Fig. 11 the signal has a maximum amplitude of 5 volts, so that the instantaneous grid voltage swings between the limits of −2.5 volts and −12.5 volts about the fixed grid bias of −7.5 volts. A corresponding time scale is applied to the plate current axis so that the plate current corresponding to the grid voltage at a given instant can be plotted.

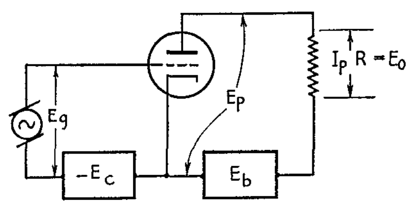


Fig. 12

At zero time (beginning of the cycle) the grid voltage is −7.5 and the plate current 7.8 ma., approximately. One-eighth cycle later (point *B*) the grid signal voltage has risen to 71% of its maximum value so that the instantaneous grid voltage is −4 volts. The plate current, *C*, at that same instant is 12.3 milliamperes, and this value is plotted at *D*, one-eighth cycle from zero time on the plate-current axis. Points for other instants are similarly obtained until enough are plotted to permit drawing a smooth curve. When the cycle is complete it can be compared for shape to the original grid signal. As Fig. 11 shows, the two halves of the plate current cycle are not exactly the same shape, as they were in the grid signal. This difference in shape represents distortion, and the greater the difference the more distortion there is present. As is obvious from the drawing, the distortion is caused by the curvature of the tube characteristic, since if the characteristic were perfectly straight the plate current would be proportional to the grid voltage. Plotting similar graphs from dynamic curves taken with different values of load resistance readily will show the effect of the load resistance on distortion.

The gain of the tube as an amplifier can also be found from the graph of Fig. 11 or from the curves of Fig. 10. Referring to Fig. 12, it can be seen that with fixed plate supply voltage, E_b, the current flowing in the plate circuit will cause a voltage drop across the load resistance, this drop being equal to I_pR, where I_p is the value of the plate current and R the resistance. The voltage actually between plate and cathode of the tube is the plate-supply voltage minus the voltage drop in the resistance. When an a.c. signal is applied to the grid, the plate current varies at the same frequency, hence a corresponding a.c. voltage is developed across the load resistor. This a.c. voltage is the useful output of the tube. The maximum drop in the resistor occurs when the plate current is maximum, corresponding to the most positive value of instantaneous grid voltage, and the minimum drop occurs when the plate current is minimum, corresponding to the most negative value of instantaneous grid voltage. In Fig. 11 these plate-current values are 14.5 milliamperes for an instantaneous grid voltage of −2.5, and 3.0 ma. for a grid voltage of −12.5. Since the plate load resistance is 10,000 ohms, the maximum voltage drop is 0.0145 × 10,000, or 145 volts, and the minimum drop is 0.003 × 10,000, or 30 volts. The difference, 145 − 30, or 115 volts, is the total change in voltage across the load corresponding to a total change in grid voltage of 10 volts. Hence the voltage gain is 115/10, or 11.5. The same information could be obtained from the curves of Fig. 10 by finding the currents corresponding to any chosen change in grid voltage, and then proceeding as above to find the voltage output. From such information a curve can be plotted showing the variation of amplification with load resistance.

EXPERIMENT 24

Class-A Amplification

Apparatus: The power supply, bias supply, v.t. voltmeter and tube board are used in this experiment, together with a potentiometer or volume control and the resistors specified in Exp. 23. Almost any potentiometer resistance may be used, although values higher than about 100,000 ohms should be avoided if possible. The circuit arrangement is shown in Fig. 13. The heater voltage for the tubes is used as a source of a.c. voltage for the grid of the tube being tested, the value of voltage applied to the grid being adjusted by means of the potentiometer. The a.c. voltage in either the grid or plate circuit is measured by the vacuum-tube voltmeter, the input circuit of which is connected to the circuit being measured through the 0.01-μfd. condenser. This condenser blocks the d.c. voltages present and permits only the a.c. to be measured.

Before performing the experiment the v.t. voltmeter should be calibrated on a.c. A source of variable a.c. voltage can most conveniently be obtained by making a slight change in the bias supply so that its voltage divider can be connected directly across the a.c. line. Referring to Fig. 2

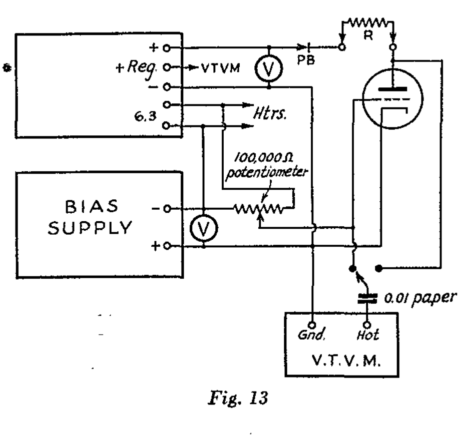


Fig. 13

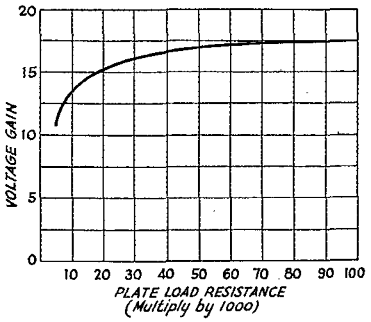


Fig. 14

page 56, July *QST*, disconnect the top end of R_2 from the filter and connect it to the a.c. output terminal. Then proceed to calibrate the voltmeter by the same method used in making the d.c. calibration, using the 0.01-μfd. blocking condenser in the "hot" voltmeter lead. Connect the 1-μfd. condenser, C_3, to the cathode of the voltmeter tube (Fig. 6, page 66, August *QST*). The calibration will be in terms of r.m.s. voltages, since the test set calibration is r.m.s. The a.c. calibration will resemble that taken on d.c., except that the curve above about 40 volts on the high range may show considerable departure from linearity. If so, use only the linear part of this scale. This effect is attributable to the fact that with a capacity of only 1 μfd. at C_3 the time constant of the circuit is too small at 60 cycles to permit the cathode bias to build up to a value sufficient to prevent grid current from flowing at the higher applied voltages. In performing the experiment care should be taken to keep the maximum voltage to be measured within the linear part of the high-range curve.

Procedure: The purpose of this experiment is to confirm by measurement the results of the gain calculations carried out as described in Exp. 23. Adjust the grid bias (restore the voltage divider connection to the filter after completing the a.c. calibration) and plate voltage to the values used in the calculations, using the same tube. These were −7.5 and 300 volts respectively in our example, using a 6J5. Set the potentiometer so that the voltage applied to the grid is about 2 volts r.m.s. as measured between grid and cathode (Fig. 13). Insert a resistor in the plate circuit of the tube at *R*, and adjust the plate-supply voltage to the selected value (300 in this illustration) with plate current flowing (push-button closed). Shift the v.t.v.m. to the plate circuit and measure the a.c. output voltage, keeping the push-button closed. Repeat for various values of plate load resistance, using two resistors in series to make up values intermediate to those available in the single units. The results of a typical set of measurements are given below, for 2 volts r.m.s. applied to the grid:

Plate load resistance, ohms	*Output voltage*
5000	21.5
10,000	27
15,000	29
25,000	31
50,000	34
75,000	34.5
100,000	35

The gain of the amplifier will be equal to the output voltage divided by the input voltage, or just half (input voltage = 2) the figures above. Plot the data in the form of a curve, as shown in Fig. 14.

Note that the gain rises as the plate load resistance is increased, but eventually a point is reached where a considerable increase in load resistance causes only a negligibly small increase in gain. The gain obtainable is proportional to the amplification factor and also to the ratio of the plate load resistance to the sum of the plate load resistance and the a.c. plate resistance of the tube, and when the plate load resistance is large compared to the tube resistance this ratio changes very slowly. Hence the amplification tends to level off as the plate load resistance is increased. From the curves of Fig. 9 the tube plate resistance is seen to be about 7500 ohms. When the plate load resistance is about 5 times the plate resistance, or approximately 40,000 ohms, the amplification increases very slowly with further increases in load resistance. Hence a load in the vicinity of 50,000 ohms is a suitable value for this tube as a resistance-coupled voltage amplifier.

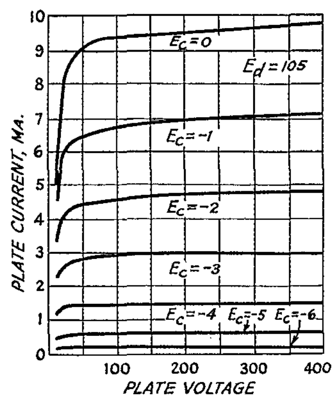


Fig. 16

At 10,000 ohms, the value used in the illustration of Exp. 23, the measured gain is about 13.5 as compared to the calculated value of 11.5. The percentage difference, while fairly large, is to be expected in view of unavoidable errors in measurement and in plotting and reading the curves. Also, the resistance was assumed to be exactly 10,000 ohms in the calculations, while the manufacturing tolerances on these resistors is ± 10%. Ohmmeter measurement of the resistor actually used in the experiment showed the resistance to be on the high side of 10,000 ohms.

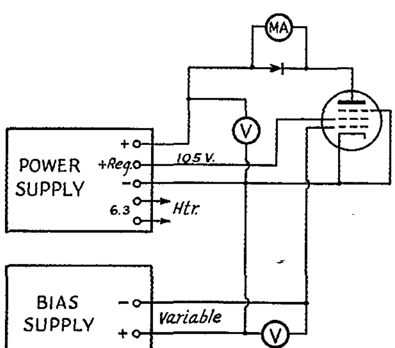


Fig. 15

EXPERIMENT 25

Pentode Characteristics

Apparatus: The apparatus set-up used in this experiment is shown in Fig. 15. The power supply, bias supply, tube board and test instrument are required. In taking one set of data it is necessary to maintain the screen grid at constant voltage, preferably the rated value, and for this purpose a VR–105–30 is substituted in the power supply for the

VR-150-30 previously specified. The tube tested can be a small receiving pentode such as the 6J7.

In making voltage measurements, the highest voltage range on the test instrument which will permit reasonably accurate reading should be used so that the effects of voltage regulation will be minimized. The 500-volt scale for plate voltage and 25-volt scale for grid voltage will be satisfactory (or nearest equivalent ranges provided on the actual instrument).

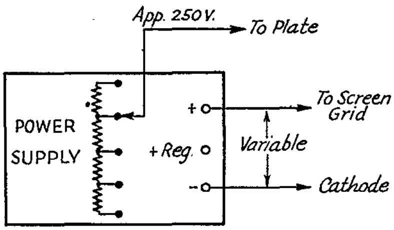


Fig. 17

Procedure: In this experiment curves equivalent to those plotted for the triode (Exp. 22) are to be obtained, for the purpose of determining the relationships between plate current and grid and plate voltages in a pentode. It is advisable to take data for the plate-voltage-plate current family first. Using a 6J7, first set the grid bias at zero and then vary the plate voltage, taking plate current readings at each value of plate voltage selected. From a plate voltage of 100 up to the maximum available from the supply (about 400) 50-volt steps will be satisfactory. Below 100 volts it is suggested that readings be taken at 10, 25, 50 and 75 volts. Each time the plate voltage is adjusted be sure the push-button in the plate circuit is closed so that the voltage will be set to the proper value with plate current flowing.

When a set of measurements has been made with zero grid bias, increase the bias to 1 volt negative and repeat. Continue at 1-volt intervals in bias until a set of measurements has been taken for —6 volts. At higher bias the plate current will be cut off, or else so small in value as to be negligible. Plot the data in curves such as are shown in Fig. 16.

Comparing these curves to the equivalent triode family in Fig. 7 shows a tremendous difference in the behavior of plate current with varying plate voltage. In the triode case (Fig. 7) the plate current is very markedly dependent upon the plate voltage. On the other hand, except for the region of plate voltage lower than the screen voltage, the plate current of the pentode is practically unaffected by the plate voltage. The curves begin to droop as the plate voltage is reduced below 100, but the drop-off is not really marked until the plate voltage is quite low. The fact that the plate voltage has relatively little effect on plate current while the grid voltage has a very great effect indicates that the amplification factor, $\Delta E_p/\Delta E_g$, is very high.

The cause of this behavior is the screen grid. Since the

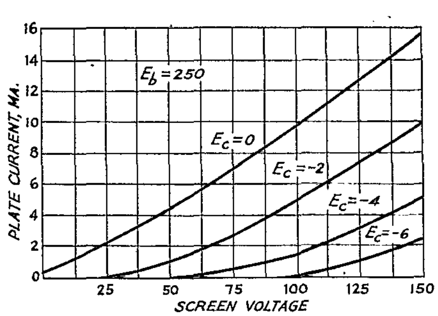


Fig. 18

screen grid is an electrostatic shield, it prevents the electric field set up by the plate from penetrating to the region occupied by the cathode and control grid, hence electrons in this region are unaffected by the plate potential. The control grid, however, has just as much effect on the electron stream as it does in a triode. Electrons passing through the control grid are attracted to the screen because the latter is operated at a positive potential, but many of them have sufficient velocity to pass between the screen-grid wires without being caught by the screen grid itself. These electrons then come under the influence of the electric field set up by the plate and are attracted to it, forming the plate current. Since the plate can attract only the electrons which get through the screen, it is obvious that the plate current will be determined almost wholly by the screen potential and the structure of the screen grid.

The effect of the screen grid on plate current can be found by holding the plate voltage at a fixed value and varying the screen voltage (for a fixed value of grid bias) while observing the plate current. A slight modification of the experimental set-up of Fig. 15 is necessary. Connect the screen grid to the variable tap on the power supply as shown in Fig. 17, and tap the plate connection on the power-supply voltage divider so that the plate voltage will be about 250 volts. The first tap below maximum will be satisfactory. If the plate voltage varies slightly during a run no harm will be done since the plate current is only slightly affected by the plate voltage so long as it is appreciably higher than the screen voltage. Vary the screen voltage in small enough steps so that smooth curves can be plotted from the data. Do this for several values of grid-bias voltage. Typical experimental

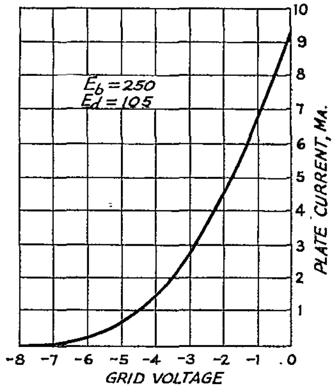


Fig. 19

curves obtained by this method are shown in Fig. 18, taken on a 6J7. These curves have essentially the same nature as the curves of Fig. 7, which is to be expected from the explanation of the operation of the screen-grid tube given above.

Since the plate voltage has relatively little effect on the plate current, a single-grid voltage-plate current curve will suffice for practically all plate voltages above the screen voltage, so long as the latter is not changed. Such a characteristic can be taken by holding the plate and screen voltages fixed, reading plate current while varying the grid bias. An experimental curve on a 6J7 is shown in Fig. 19. Although in the triode case the corresponding curves (Fig. 6) had to be drawn for several values of plate voltage, in this case such a series would lie so close together as to merge into one curve, for all practical purposes. It can be seen, however, that the curve has the same general characteristics as those typical of triodes, and if the mutual conductance is measured it will be found to be approximately the same as for a triode of the same size. The plate resistance is obviously high, since a large change in plate voltage is required to make a comparatively small change in plate current. Both plate resistance and amplification factor are very difficult

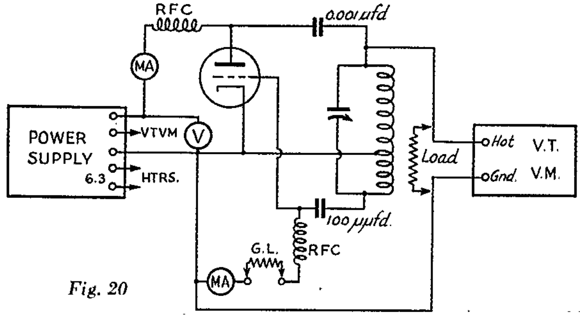


Fig. 20

to measure with any reasonable accuracy because in each case the ratio of the two quantities involved is so high that the probable error in measuring the smaller of the two reflects a large error in the ratio.

Further experimental work may be done with the tube by plotting a series of grid voltage-plate current curves for different values of screen voltage. Also, the effect of secondary emission may be investigated by running a series of plate voltage-plate current curves, corresponding to those of Fig. 16, but with the suppressor grid connected to plate instead of cathode. The characteristics of a variable-μ tube of the same general type, such as the 6K7, also may be taken and compared to the sharp cut-off 6J7.

EXPERIMENT 26

Oscillator Operation

Apparatus: The power supply, v.t. voltmeter and tube board are needed for this experiment, together with the additional parts indicated in the diagram of Fig. 20. The Hartley oscillator circuit is indicated in this diagram, with parallel feed in both plate and grid circuits. The radio-frequency chokes are 2.5-millihenry pie-wound units, and the blocking capacities are midget mica condensers. Provision should be made for changing the grid-leak resistance and for using different values of load resistance. The 1-watt resistors used in previous experiments will be satisfactory in both cases.

Procedure: The object of this experiment is to show the effect of grid-leak resistance on oscillator plate current, grid current, and r.f. output voltage, the plate voltage being fixed at some convenient value and other circuit conditions left unchanged. In the circuit of Fig. 20 the tuned circuit is formed by one of the condensers and coils on the circuit board, the whole 35-turn coil being used with the cathode of the oscillator tube (a 6J5) tapped on the coil 10 turns from the grid end. The v.t. voltmeter is connected between the cathode and plate of the tube (through the plate blocking condenser) to measure the r.f. plate voltage. The 1-μfd. by-pass condenser in the v.t.v.m. cathode circuit (C_3) should not be used.

With the plate voltage at some value which prevents excessive plate current, such as 100 volts, insert a 5000-ohm resistor as a grid leak and measure the plate current, grid current, and r.f. plate voltage. Adjust the plate voltage to the chosen value with the plate circuit closed so that the tube draws plate current. There should be no load on the oscillator on the first run. Change the grid leak to 10,000 ohms and repeat, then continue with successively higher values of grid-leak resistance up to 100,000 ohms. Connect a 25,000-ohm resistor across the v.t.v.m. input circuit as a load and repeat the measurements. Continue with lower values of load resistance until the circuit refuses to oscillate. The data may then be plotted in graphical form.

Typical results of such measurements are shown in the curves of Fig. 21. Curves for no load and for a load of 10,000 ohms are shown for comparison, although if several values of load resistance are used it would be better to use separate sheets for each, to avoid confusion. With no load the variation in r.f. output voltage over the whole range of grid-leak resistance is relatively small. The plate current is low and decreases somewhat as the grid-leak resistance is increased. The grid current at the lowest grid-leak resistance is relatively high, but decreases with increasing grid-leak resistance. The grid bias — product of grid current by grid-leak resistance — shows comparatively little variation, indicating the self-regulating properties of the oscillator in this respect; that is, the grid current regulates itself so as to develop about the same bias over a wide range of grid resistance.

When the circuit is loaded the plate current shows a pronounced increase. This is partly because the load reduces the Q of the tuned circuit, thus lowering its parallel impedance and hence allowing more plate current to flow, much in the same way that the plate current increased in the curves of Fig. 10 with lower load resistance for a fixed value of grid bias. At the same time the r.f. output voltage decreases while the internal voltage drop in the tube increases. This effect is comparable to the decrease in amplification with lower load resistance which was observed in Exp. 24. The plate-current increase is exaggerated in the case of the oscillator because the decrease in r.f. plate voltage is accompanied by a proportional decrease in r.f. grid voltage, since the r.f. grid voltage is obtained from the plate circuit. Hence the grid bias also decreases, if the grid-leak resistance and feed-back coupling are fixed. With lower grid bias more plate current will flow, and to some extent the amplification increases so that the r.f. output voltage tends to become greater. Thus two tendencies working in opposite directions are present, but with the net result that there is a decrease in both r.f. output voltage and grid bias and an increase in plate current. Increasing the value of grid-leak resistance again results in self-regulating action with respect to grid bias, while r.f. output voltage and plate current decrease together.

The experiment can be extended by making a similar set of observations with a new value of feed-back, obtained by changing the position of the cathode tap on the coil. It is also of interest to compare the operation of the various oscillator circuits which can be made up from the coils and condensers on the circuit board.

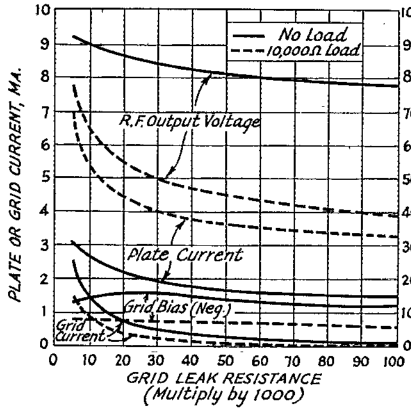


Fig. 21

ANSWERS TO PROBLEMS IN INSTALMENT 3

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.

(*Continued on page 114*)

IN THE SERVICES

ARMY — GENERAL

STAFF SGT. ZETTLER, 8UYF, Camp Bowie, Texas, sends in the names of amateurs in the Army, all privates, minus QTH, for which many thanks; Boyer, 8IZJ; Sackl, 8PMS, Hudson, 8SRD; and Bennett, 8OZE.

Lt. Jacks, 9UFU, is stationed at Ft. Benning, with the 4th Medical Detachment, 4th Division, and Gumley, 4DH, is now a 4th grade technician at Benning. Pvt. Schroder, 2MVU, at Camp Gordon, Ga. volunteers to send us some names for this column. Pvt. Meurer, 8VFN, is in a Signal Company at the Presidio, San Francisco; Sgt. Davidson, 9DZD, is with the 4th Cavalry Service Troop; and Sgt. Navarre, 5JSF, is in a hospital at El Paso, Tex. Doesn't say whether duty or illness. Pvt. Thorn, 9JOY, sends in a card from Ft. Lewis, and Hummel, 8EOO, from Camp Grant, Ill., where he is in the 26th Medical Training Battalion.

Staff Sgt. McMurray, 7GXN, sends us some Mojave Desert Sand and writes he and Staff Sgt. Wilson, 7FVO, are both at the Desert Training Center, Indio, Cal. Pvt. Lanham, 8LGB, is with the Armored Signal Co., Camp Polk, La., and Pvt. Ricks, 5KEI, is stationed at Shaw Field, S. C., with the 458th School Squadron. Simmons, 9TXK, reported sometime ago from Camp Wolters, Tex., that he was anxious to get transferred into radio work; we hope this has come through. Fort Worden, Wash. has Master Sgt. McFeely, 7BZP, as chief op in charge of the harbor defense radio and Technical Sgt. Paul, 7IJR, as his able assistant. Pfc. Geenen, 8SWA, operator with the 125th Infantry has plenty of ham company with Workman, 8DOV; Halton, 8MSB, and Farrell, 6BNY, as co-ops.

At Fort Knox, Lt. Doxsie, 8EVV, is theatre officer, Post Hq.; Pvt. Jones, 5HJS, and Skiados, 9QJY, are both attending the Armored Force school electrician's course.

Pvt. Goggio, 9GHD, writes from Chanute Field that he would like to hear from all amateurs in the service, but requests of this kind cannot be included in this column on account of space limitations and frequent transfer of men in the service. Pvt. Dolsberry, ex-9JVC/9OAQ, says Ciezak, 8UPJ, is with him in varied and interesting radio, telephone and cipher work at Fort Sill. Johnson, 9KDC, with the 560th School Squadron, Scott Field, asks our help in getting Campbell, 9JAL, at Camp Forrest, Tenn., assigned radio duty. We are glad to act on cases of this kind where an amateur is in non-radio work, but in every case the request *must* come from the man himself. He should state his experience, present non-radio duty and specifically request a transfer.

Pvt. Kukura, 9TTW, posted a request for hams studying in the 12th Technical School Squadron, Scott Field, to register for this column and this is the result: Zartler, ex-9TTX; Patsios, 9MTG; Martensen, 9ZDA; Nielsen, 9AOC; Billing, 9RET; Domke, 9HWK; Johnson, 9KDC; Hausmann, 8MOH; Harris, 8MOI; Williams, 8VOH; Miller, 8SPV; Gregory, 4CSE; Senuk, 2OGI; Pascuit, ex-2ENP. Tnx vy, OM, we appreciate your interest.

Some of the men in Dixie don't like the heat much, but our Hartford office thermometer read well up in the 90s a few days ago, so we sympathize. Only a month now to cool weather. Amateurs attending advanced radio class at Kessler Field, Miss., were listed with us by Sgt. Thomas; Donohue, 8UYT; Cline, 9CWC, and Salm, 9HKH. After studying procedure and code they will be assigned as full-fledged operators at Army Airways Stations.

Caffrey, 3JOO, is operating at Camp Polk, La. Dr. Coleman, 9YAL, reports for medical duty at Camp Claiborne, La., as 1st Lt., and Davis, 8EKC, at the same camp hopes to be transferred into radio work. Capt. Boles, 9ERV, at Camp Shelby, Miss., suggests changing the form of this column for easier location of friends in the service and we have this under study. Pvt. Fritsch, 3HHC, is also at Shelby and hopes to land at the officer's training school at Ft. Monmouth.

Berman, 1BGW, is a radio operator at Ft. Jackson; Sgt. Durham, 4HHU, is in a cavalry troop at Camp Blanding; and Tech. Sgt. Besancon, 5ARQ, is in charge of a communication squadron detachment at Midland Army Flying School, Texas, known as the world's largest bombardier school. Pvt. Brown, 9GWY, is a student at Midland. On distant duty, Capt. Tarrance, 6PAO, is in the Canal Zone; Lt. Lewis, 9ZZS, is off on a military mission; and Johnson, 2NED, and Turner, 9EXL, are in parts unknown. Gilham, 6SHE, and Votaw, K7WY, are both in Alaska in radio work.

We have a nice list from the Armored Force, Ft. Knox, Ky. Capt. Soules, 9DCM, is signal officer; Lt Werkman, 9JJO, is attending the communications officer school; Pvt. Martin 7HEC, has a radio operator's trick and the following are instructors in code and procedure; Tech.

Sgt. Surmount, 3FWV (chief instructor); Staff Sgt. Brust, 8QCU; Sgt. Luce, 8TPK; Cpl. Jones, 9QPV; and Pvt. Thompson, 9DOM. Pvt. Westrum, 7IUZ, is the Iron Bugler — operates the p.a. system for the Center.

Quite a number of amateurs on miscellaneous assignments have registered with us recently: Pfc. Hiskey, 6UDC, at Camp Elliott; Hums, 9HKP, and Neal, 1KIK, at Ft. Sill; Lee, 7HZR, Seattle, Wash.; Pfc. Landis, 6MDO, Pescadero, Cal.; and Staff Sgt. Turnow, 8RFR, at Ft. Riley. Among the officers are Major Mullender, 6RMR, at Camp Callan, Cal.; Major Thornton, 9JQM, at Ft. Leavenworth on the General School Staff; Capt. Vogt, 3JGR, at the Army Medical Center, Washington, D. C.; and Lts. Chamberlain, 5AUE, at Edgewood Arsenal, Md.; Dockler, 1DKX, communications officer at Camp Edwards, Mass.; Miller, 5HFU, at Camp Roberts, Cal.; and Farmer, 9KYA, at Ft. Riley, Kan.

Pvt. Hermann, 6URB, writes us the following have finished a three months' training course in Pittsburgh and have been assigned radio duties at the cavalry school, Ft. Myer, Va.: Jester, 5HXU; Whitver, 9DXR; Burke, 9TWL; and Baker, ex-9OWA.

Partial information has been received that the men listed below are in the Army, and we would like to have more data for our roster if they will send it in: Capt. Garman, 9GOE; Lt. Laycock, 9CRZ; Sgts. Hefton, 3IGC, and Ray, 2JYR; Chase, 9NJO; Earle, 9KBQ; Gregorowicz, 9SVJ; Hoffmeier, 9BXT; Schull, 9MFD; and Hegerty, 9RQW, and Fisher, 9OYB, ops at WUV. Lt. Spillner, 2NCY, sends us the name of three amateurs now in the outfit: Burke, 2MLW; Perry, 2LFR; and Dangerfield, 2BZS. Peterson, 9OJD, leaves a broadcast station and goes to Jefferson Barracks for further assignment. Staff Sgt. Artimovich, 2NWP, has done considerable traveling, was recently in Persia, misses *QST* and the gang, but wants to report he is quite alive and has met a number of foreign amateurs.

As a matter of information, if any of you fellows in or out of the services want to get in touch with a friend, write us for his latest post office address. In most cases we have it, if he has thought to register with us. If he is on foreign duty it will not show his location but the letter will be forwarded through proper Army or Navy Post Offices. A line or two of home or ham news is more than welcome to men in camps and foreign service.

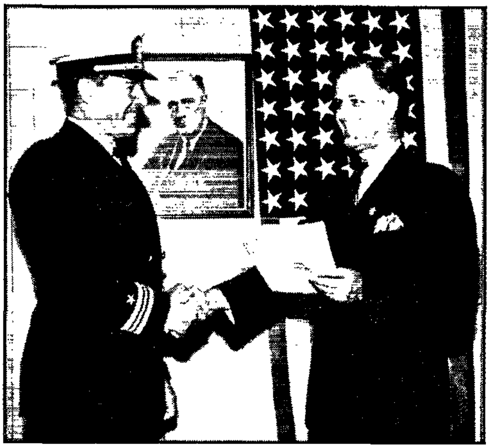
Pvts. Ackerman, 2HVL, and Gauzens, 4DTJ, are both in non-radio work and have requested our help in getting them transferred where their past amateur experience can be put to better use. We hope, by the time this gets in print, they can report success. Remember, fellows, if you are a licensed amateur in the same situation and want a transfer, give us full information and specifically request a change to radio work. There are certain Army branches which refuse to take such action, but in most cases we have been successful.

Pvt. Thompson, 3DRQ, teaching radio at Camp Chaffee, Ark., has sent us a list of amateurs who were in his classes: Pvts. Kaminski, 3KRV; Meara, 3EMR; Roth, 3DLT; Stahl, 9HVZ, and Taylor, 9VZL. By now they should be holding down an operating trick of their own.

NAVY—RADAR

After the war we wonder where the most crowding in the amateur bands will take place. With the great number of amateurs working with u.h.f. gear and radar equipment, will they ever be satisfied to go back to the overcrowded 40 and 80 bands? This month we present some large lists of hams in primary and advanced radar schools, future engineers of tomorrow in this fascinating phase of radio development.

Kauphusman, 9ZSA, and Schwardt, 8TRX, send a list of men graduated from the Navy radar school, Utah State Agricultural College, Logan, Utah, with rating of Radio Technician 2nd class. With the exception of Czarnecki, 9SX, and Rector, 9YVH, who have been retained as instructors, they go to Treasure Island for advanced training. Alford, 9JLG; Bauer, 8SIN; Berglund, 8TUM; Billingsley, 9SWP; Blakesly, 9NLY; Brown, 8MHH; Bunch, 9PSH; Czarnecki, 9SX; Danials, 9WSO; Deem, 9ENY; DeVoss, 9BNF; Dinger, 9RDK; Farmer, ex-9TOL; Finchum, 9FVO; Gfeller, 9QCS; Gibson, 8SJJ; Hardy, 9IQX; Herbert, ex-9CJB; Herzil, 8LXI; Hoffman, 9HXJ; Hopper, 9JQX; Ireland, 9VIS;



Myron Jay Hook, W6KDD, formerly active on 20 and 40 meters, a sound and broadcast engineer for ERPI and Warner Bros., reënlisted in the Naval Reserve as Chief Radio Technician for duty as instructor at Treasure Island, Cal., Radar School. Lt. Cmdr. Howe, officer-in-charge of Los Angeles area Navy enlistments, congratulates W6KDD on joining the Reserve. Official U. S. Navy photograph.

Johnson, 9TWZ; Kasten, 9IUE; Kent, 9AYX; Kopras, 8MJP; Littlejohn, 9DPH; Martin, 9WGN; Mickelson, 8QOA; Miller, 9IXB; Ordway, 9YCU; Palmer, 9MMI; Phillips, ex-9IUW; Rector, 9YVH; Ricks, 8DXW; Rotunda, 9TSW; Shelton, 9BYM; Steward, 9CJL; Stoia, 8MEO; Thornburg, 8KJX; Valikai, ex-9PMI; Van Horn, 9IWU; Wackernagel, 9HIE; Walters, 9VVV; Warner, 8THO; Wells, 9WXG; Werbinski, 8DJT; Weston, 9ZHS; and Whalen, 8OYO. RT3c Schwab, 6CAW, is also being detailed to Treasure Island where CRT Hook, 6KDD, is an instructor.

RT2c Magruder, 9OIC, is attending radar classes at the Univ. of Houston; Shamonsky, 8OST, and Snyder, 9NJB, are both in radar work; and Lang, 3FGA, writes that Beam, 8PGM, Lutz, 8VZK, and Mrzlack, 8OTO, are with him as students at Grove City College, Pa. In the several radar schools in the Chicago area the following Radiomen, 2nd Class, are getting instruction: Abbott (call not yet assigned); Adams, 9AQE-9CNY; Alexander, ex-8VQ; Buus, 9BZI, Cummings, 8OYE, Fouts, 9NYZ; Greene, ex-9CSR; Hagerbaumer, 9DPC; Hatter, 9SMM; Higgins, 8UJT; Kuester, ex-9BQB; Manos, 8VGD; McKissick, 9LCA; Mroch, 8BSA; Rickman, 9DGJ; Sawin (call not yet assigned); Schafer, 8UXI; Sorensen, 9USQ; Stimson, 9IQJ; Teats, ex-9CSE; Taeschner, 9IHJ; Woods, 9YAI; and Wooldridge, ex-9VTM.

Last, but by no means least, RM2c Heritage, 7AFZ, goes to considerable trouble to compile a list of hams and ex-hams in the Third Company, Naval Radar School, at Oklahoma A. and M. College. Most of them are RM 2c. Sivik, ex-1AWV; Randall, 1KVP; Walso, ex-1MA; Fantasia, 1LFA; Ziemnisky, 1NNY; Fairbanks, 1IRA; Ferris, 1HZ; Bradshaw, 1NLK; Leyden (no call yet); Krinsky, 2HQW; Greenburg, 2NYU; Hand, 2CQL; Klahn, 7EAF; Johnson, 7ACP; Nichols, 7OZ; Henderson, 7HNK; Olsen, 7GWC; Miller, 7IHS; Dugger, 7GLJ; Moulton, 7HCH; Ronner, 7CHO; Louis, 7EO; Morris, 7GT; Fields, 7GNB; Heritage, 7AFZ; Wilson, 7HSL; Claunch, 7IYE; Croger, 7HJC; Grey, ex-7ACC; Kocher, 7BRI; Leonard, 7DPU; Mifflin, 7AMB; Parsons, 7HLU; Shults, 7GEI; Stacy, 7DUP; Tucker, ex-7CVW; Young, 7CIA; Kruse, 7IZV; Dow, 7INO; Clark, ex-7AAO; Reid, 7HPR; Braidwood, 7AZR; Wastradowski, 7JAS; White, 7JBD; Peel, 7LT; Walker, 7GIU; Ruppe, 7FTN; Rogoway, ex-7FPX; Friedli, 7COQ; Ryan, 7FTZ; Duffy, 7HLO; Trunkey and Donnelly (no calls yet); Von Volkenburg, 8GWM; and Clegg, ex-8DTE.

ARMY—AC, FA AND CA

Col. Henry, 3HCC, Major Handy, 1BDI (ARRL Communications Manager), and Capt. Castor, ex-3MY, are on duty in the Directorate of Communications, Washington, D. C.; Capt. Quinn, 8PMP, is at Cadet Squadron Headquarters at Santa Ana, Cal.; Capt. Gibbons, 7KV, former Northwestern Division Director and United Airlines pilot is training Army pilots at Camp Williams, Wis.; Lt. Biggs, 4HBN, is assistant post communications officer at Moody Field, Georgia; Lt. Groendyke, 3ATP, is an instructor at Stout Field, Indiana; Lt. Wright, 9WGL, has left Scott Field for Cambridge, Mass.; Lt. DeRose, 1CND, is with the Air Force in Miami and Lt. Rose at Charleston, S. C., hopes to get a more active radio assignment. Lt. Johns, 8JRS, has AB duty at Pendleton Field, Oregon.

Staff Sgts. Lee, 4GUK, and Wallace, 4FIV, are both in the same communications squadron at Maxwell Field pounding brass. Pvt. Spielman, 9LAE, is a student operator at the Salt Lake City Air Base and Hums, 9WDV, is at Bowman Field, Ky., in non-radio work. He asks our help in getting him transferred but this is one branch of the Army where transfers are refused. Sorry, OM. Sgt. Wilson, 9EPR, and Long, 9UZQ, are in the same outfit at New Orleans; and Courtad, 8FFK, writes he is a private at Drew Field, Tampa, but "give him time." The MPs will take care of that with very little urging.

Pvts. McCandless, 9THG, and Mason 8SRI, are at Scott Field, the latter as communications instructor. Pribyl, 9OMC, is somewhere in Alaska; Hurley, 9MKM, is at Hammer Field, Fresno; and Ellinwood, 1MPY, is in Manchester, N. H., at the Army Air Field. Ducros, K4HZM, and Fucetola, 2OHN, are now on duty outside the United States. Lts. Parks, 8PHS, and Gross, 8WME, are in especially interesting work for the Air Force; and Sedik, 9NRN, is pounding brass for Uncle Sam at Davis Monthan Field, Tucson, Arizona. Tech. Sgt. Oherg, 9UGU, at Langley Field, expects foreign duty but isn't sure whether he likes the idea right now. Reason: the arrival of a jr. op whom he has never seen. Heckert, 9SXS, has finally found another ham at Jefferson Barracks in the form of Casem, 3DEV, and we can add to this Pingel, 8FUR, and Presson, 9BDB. Our last Air Corps name is Eaton, 6KCX, who is flight instructor, no QTH given.

Four good hams are attached to the Field Artillery communications school at Ft. Sill: Bulot, 5JWI; Levy, 5GIA; Oldt, 3HPL; Reis, 3FOE. Frank, 9WRF, is with the Headquarters Battery, Camp Shelby. Gustafson, 1FWC, is attending radio operating classes in a Coast Artillery battalion at Benicia, Cal., and Taylor, 1ICU, with the C.A. at Ft. Adams, R. I., hopes to be transferred to radio work soon.

NAVY—GENERAL

The 15th Naval District, Canal Zone, reports two amateurs on duty in that section. Lts. Geise, 3BPN, and Packard, 6RL; Ens. Dewars, 9TQW, is based in Newfoundland; and RM2c

Page, 5JLK, advises he is at Guantanamo Bay, Cuba. Byram, 8AVS, is doing radio work in India. We would like to hear from more men on overseas duty.

8BGV writes us Lt. Cmdr. Heiser, 8DME, is at New Orleans, and Wildner, 8NQC, is Chief Radio Man and operator on a plane. Lt. Greene, 1NIX, is in the Bureau of Aeronautics, and Lt. (jg) Tonjes, 6CGU, is in the Bureau of Ships, both Washington, D. C. Lt. Somers, 7FCY, is Communication Watch Officer, 13th Naval District, Seattle; Lt. (jg) Mealer, 6AK, reported for active duty April 22nd as Communication Watch Officer, Mare Island; Lt. (jg) Emig, 6CYS, has been assigned temporary duty at Cal. Tech.; and Lt. (jg) Battey, 1UE, formerly ARRL assistant communications manager, is on an inspection trip to West Coast radio schools. Ens. Kelley, 1IEB, is at Lisbon Falls, Maine, and Ens. Ewell, 2JKH, and Leddy, 6PLJ, are in Cambridge, Mass., for special training. The Rudnicki family is well represented in the Navy with Ens. 2HNT taking an indoctrination course at Notre Dame, and Ens. 2JUN assigned duty at Pearl Harbor.

Lt. (jg) Fulmer, 4HAV, and CSP Klaiss, chief engineer of the 4QN sideswiper, are at the Naval Air Station, Jacksonville; Ens. Lochmiller, 8OKF, was reported as being stationed in Seattle, and Ens. Sigler, 3GKT, is taking the indoctrination course at the Naval Training School, Cornell University. RT2c Greene, 1KO, and RT2c Key, 1DWD, reported for duty July 1st and were assigned temporary duty at the Portsmouth Navy Yard, N. H. awaiting further orders to a radio school. RM1c Moran, 3IKW, and RM2c Freeze, 9LOW, are both Navy men, QTH unknown; RM2c Kelly, 8PFV, is at Cape May, N. J., and RT3c Green, 9NHE, is in radio repair and maintenance work at Cape Henry, Va. RM2c McClelland, 9APK, at Treasure Island School, bemoans the fact his *QSTs* are not reaching him; probably sticking to the fingers of other hams there, OM, before they reach you. RM2c Kemper, 5IXB, is there, too, and *is* getting his *QSTs*, which is probably pure coincidence — we hope.

ARM1c Smith, 5HWR, is stationed at Key West; RM1c Dobler, 6CNB, is at A and M College, Texas; and Sea2c Yesensky, 7IAX, is about to complete a course at the Naval Training School, Univ. of Wisconsin, for further assignment. CRM Weinstock, 6ACJ, is serving at the West Coast Sound School, San Diego, and Cunningham, 5JET, is Pharmacist's Mate, 2c, at the Naval Hospital, Pensacola. Likes it, too! RM3c Helton, 9MVE; Buus, 9BZI; and Weilert, 9FFM, are all in the Chicago Naval Training school area. RT2c Woods, 7EDZ, is at Bremerton Navy Yard temporarily and has his XYL forward his *QSTs*. Another reason for a wife, fellows.

A radio duo who have gone all-out for the defense effort are Lt. (jg) Loyt Lathrop, USNR, 2IOF, in training at Brooklyn Polytechnic as aviation volunteer specialist, and Mrs. Lathrop, 2KUG, a Signal Corps radio inspector at G. E., Schenectady. Mrs. Lathrop is also secretary of the Schenectady Amateur Radio Association.

The Coast Guard has a small representation this month, only three fellows reporting in. CRM Munro, 8GLS, is stationed in the New York area; RM1c White (call not yet issued), is on radio operating duty; and RM3c Raiselis, 1BTZ, is a radio technician and maintenance man at Manhattan Beach, N. Y.

MARINE CORPS

In the Marine Corps, Staff Sgt. Yoder, 9MTJ, who stands 5 feet 6, was kidded by one of the usual 6-foot sergeants, who remarked: "You're sure a little guy to be a staff sergeant". MTJ retorted: "I thought the Marines wanted ability—not size!" Which seems to cover the situation pretty thoroughly. Carlisle, 9ZKQ, Hotchkiss, 9LSO, Schilbach, ex-9LET, and Wheaton, 9EUJ, all Staff Sgts., are receiving an 8-week course with an aviation squadron at Corpus Christi, Texas, supplementing a short course at Annapolis.

PHOTOS

Readers please take note. We would like to have more photos from the gang in the armed services. Individuals, groups, school classes, families in the service, with calls and condensed biographical data. Any good, clear photo about 4 × 5 will do.

Training Civilians for Wartime Operating

Organizing Community Classes for Radio Training

BY JOHN HUNTOON,* W1LVQ

In the prosecution of the war our armed forces find themselves confronted with a great shortage of trained specialists. This is particularly true in the communications field. Training schools by the hundreds with a prodigious total enrollment have been set up to relieve this shortage, but they are not enough. Then, too, the flow of trained civilians into military service has stripped essential home communications activity of personnel, creating a serious problem in finding operators to man the War Emergency Radio Service.

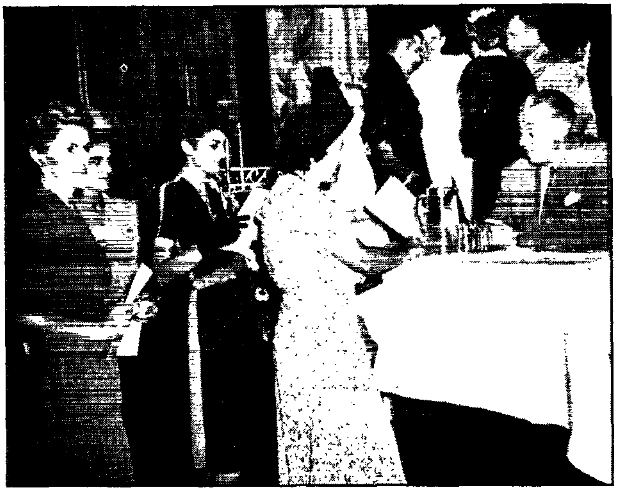
Many affiliated clubs and other amateur groups have responded to this need by setting up classes in radiotelegraph code and theory in their respective communities. Now that Autumn is upon us and the school season returns, this is an "all-out" call to every club and every amateur remaining home to assist in this widespread training work. Let it not fall on deaf ears at "one of those meetings of hams at which everyone sits and suggests that something ought to be done," (as Jack Hill describes them on page 80). This is an important job, one which we amateurs can do well since we have a supply of the necessary raw material — instructors and equipment.

* Acting Communications Manager, ARRL.

Our broad objectives should be three-fold: First, to give pre-induction training to prospective selectees so that they may advance rapidly during their military communications schooling; second, to prepare local civilians to fill essential communications jobs whose former holders have gone to war; and third, to train operators for the War Emergency Radio Service. Every training class should have as its goal the acquisition of an FCC license, amateur or commercial, by each student; such a license is about the only documentary evidence, aside from a radio engineering degree, which military personnel officers will honor in support of a candidate's claim to radio ability.

Planning

The first step is to decide what scope of training you will offer — code or theory, and to what degree. Important considerations will be what instructor material is available and what equipment can be secured. Probably code is the better course to offer, at least at the beginning, for it is a more interesting one to evening students and one which a greater percentage of amateurs are capable of teaching. It is obvious that only reasonably-good operators — meaning good fists rather than high speed — should be allowed to handle the code classes, so that no poor sending habits will be transmitted to students; we want to turn out a product far superior to some of the mass-production non-amateur Army field operators we often hear.



The new War Emergency Radio Service needs many trained operators. Sixty-nine YL's graduated June 28th from AWVS radio classes under the supervision of Leonore Conn, W2NAZ, and are now awaiting their amateur licenses from FCC. Reeve Strock, W2GTZ, deputy radio aide for New York City, was right on hand to sign up the gals for participation in WERS.

You will need a classroom, of course. The principals of local schools should be willing to help you out; in fact, they may wish to offer the course as part of their regular evening-school training. If this source is not productive, contact civic clubs, the YMCA, chambers of commerce — we're certain you won't need to go further. (You need not be particular, but if there is a choice between classrooms choose one which has the most sound insulation.)

Above are pictured some examples of amateur-sponsored community training classes in radiotelegraph code and theory, designed to give both stay-at-home civilians and future Army selectees preliminary knowledge of radiocommunication.

Upper and center left: The Bamberger classes are held in the WOR studios, with Ed Oberle, W2LCA, instructing in theory. Lower left: Troop of Rock Springs, Wyoming, Girl Scouts receiving code instruction from John Duffy, W7DIE. Upper right: First graduates of the Navy League Service radio class, instructed by Walter Faries, who will be remembered as the winner of the Cairo Survey Award. Center right: The St. Paul Radio Club's 15-minute radio program goes on KSTP to teach code to Twin Cities' listeners; left to right, Leo Hartig; J. L. Hill, W9ZWW; A. E. Swanberg, W9BHY; R. N. Runyon; Dorothy Swanberg. Lower right: Dr. E. F. Murphy, age 68, and Glenn Still, 12, learn code from Willard Coder, W9HWS, president of the St. Paul Club.

Has *your* club started a training program yet?

If your town has a population greater than 50, you need have no fear of the success of your course. If publicity should appear in a local paper you probably will need a police guard to handle the crowds around the registration point you name! Of course, a large number of applications is a desirable thing; you can reserve the right to select students on your own specification, and can thereupon proceed to choose first those for whom induction is imminent, and so on.

Training Aids

Adequate training literature in the form of student texts for both code and theory classes is available from Hq. In addition, we shall be glad to send to any club without charge a mimeographed set of material containing hints to code instructors, together with some practice material. There is also available, gratis, an outline of a theory course based on the *Handbook*, though the current *QST* series is much more elaborate and detailed.

Equipment is not much of a problem in code classes, for an adequate oscillator may be built from nearly every amateur junk box. Procurement of new headphones and keys is not always possible, but students can be informed that they must bring their own 'phones, along with the suggestion they scout around, inquiring of friends and acquaintances for old pairs; they exist in many attics and cellars and usually will fill the need. Telegraph keys can be acquired in the same manner, while early receiving practice is under way; keys may be shared, too, so that a supply equal to the class enrollment is not necessary. As a last resort only, if sufficient 'phones are not available, buzzer sets or a loud speaker may be used. The equipment problem becomes more complicated for classes on theory, but here again the junk box may be source number one, for the *QST*-course series utilizes demonstration units constructed to a great extent from just that type of gear.

General

In any class, but particularly in one aiming at the radiotelephone third-class operator permit, you should plan to turn out *operators*, not just licensees. If you happen to be instructing members of the Civil Air Patrol, for example, make certain they get classroom practice simulating airport control station and aircraft contacts, so they will learn voice technique in a snappy manner. Give your code students practice operating in networks, alternating the control station assignment, and let them handle dummy messages. Trainees should receive guidance in copying to typewriter, ten-to-the-line. In theory classes, allow as much time for "laboratory" work as possible; nothing is more abstract than radio technique when only a paper knowledge exists.

To any affiliated club wishing to conduct code tests, ARRL will be glad to send a supply of proficiency certificates upon receipt of an application accompanied by a description of how the competition will be conducted, equipment used, etc. The awards are issued in the name of the sponsoring group, and can be used for sending or receiving ability.

By no means least, keep us informed of your activities. Let us know how many persons you are training and to what end, so we may list you in the "Honor Roll." We want amateur radio to do a bang-up job in community radio training, and we want to chronicle it in *QST*'s pages.

"High Q"

BY WHITNEY S. GARDNER,* W3IBX

You've been planning that new 80-meter coil for three months. The question was — should it be wound on a ribbed form, a bakelite tube, or air wound? You decide to plunge and make it air wound. Wire, celluloid strips, the family rolling pin and other accessories are assembled and, since the XYL is out to a Ham Widow's bridge, you have an entire evening ahead of you. What more could you want?

The celluloid strips are arranged around the rolling pin and held down with numerous rubber bands. The winding starts. Three turns go on

nicely and then you discover a sharp bend in the wire. Unwind it and take out the kink. Start again; you only lost five minutes. Five turns are on. The telephone rings. Are you just going to drop it and run down stairs? Or, can you take it with you? You might ignore the telephone. No, that won't do. Maybe the XYL got a flat tire on her way over to Elsie's. She knows you're home.

(*Continued on page 94*)

* 4627 Briarclift Road, Baltimore, Md.

QRR Off Malaya

A Short Story

BY H. FRANK JORDAN,* W5EDX

THE radio operator aboard the destroyer crouched over his mill. Turning up the audio gain, he pressed the cans closer to his ears and listened intently. The wavering, chirpy signals were fading and growing weaker.

He was sure he had copied it correctly. QRR QRR QRR DE W4MCS — then silence. Slowly he turned the dial on the Super Pro. Nothing doing; the signal was gone. He waited another minute; then, quickly glancing over the copy in the mill, he jerked it from the machine and shouted to his relief, "Take it, John!"

The destroyer was rolling and pitching heavily. Dark as pitch, showing no running lights, the vessel was plowing doggedly through a heavy sea.

"The old man'll give me hell for this!" the operator thought, as he ran along the narrow companionway. He burst onto the bridge. The commander was there, talking to another officer. Both turned quickly.

"Urgent, sir!" he said as he handed the radiogram to Commander Lackey, U.S.N.

The message read:

QRR QRR QRR SEVEN SEVEN OF OF US US ESCAPED ESCAPED JAP JAP PRISON PRISON CAMP CAMP ARE ARE ABOUT ABOUT TEN TEN MILES MILES SOUTH SOUTH OF OF SINGORA SINGORA THAILAND THAILAND PSE PSE PICK PICK US US UP UP QUICKLY QUICKLY QRR QRR QRR DE W4MCS K.

"When did this come in?" the commander demanded.

"Just a moment ago, sir. My shift ended at 4 A.M. I was just going off duty when I heard this signal spilling over on my listening channel. It was chirpy but readable, even though the static was terrible."

Commander Lackey studied the message.

"QRR is the American amateur's distress signal," the operator volunteered.

"Yes, I know it is," the commander replied absently. "I held a license many years ago myself."

The commander looked out into the black night, then back to the paper. Suddenly he thundered, "Have a signalman flash this to ZSC!"

Swiftly adding a few words below the typewritten message, he handed it to a seaman.

"You know, I believe that message is authentic," he told the navigator. "Sounds peculiar, but nothing is impossible these days. As soon as we get acknowledgment we'll be on our way!"

In three minutes the acknowledgment was in. The commander gave his orders and the destroyer heeled hard to port. Straightening out on a course, under forced draft she cut the waves sharply.

Commander Lackey bent over his charts. Two more hours of darkness remained. It would take about an hour and a half. Straightening up, he muttered, "Might be a trap." He grabbed a pencil as it rolled off the chart table, began to pace the deck. The destroyer was lurching and vibrating from the powerful engines and churning screw.

It seemed like hours, but it was only seventy-odd minutes later when orders were given to reduce to one-fourth speed. All men had been ordered to battle stations. Commander Lackey called for a signalman.

"Stand by the blinker and start calling W4MCS." The signalman ran forward to his assigned position and began sending:

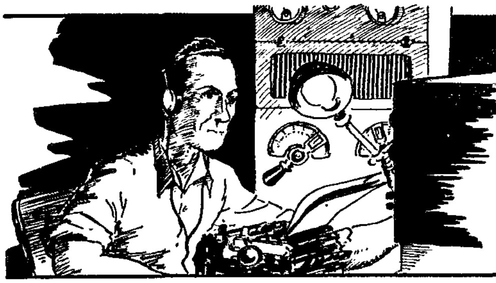
W4MCS W4MCS W4MCS DE ZUC

The call was repeated three times. Then he gave the "K" and stood by. All eyes were strained on the dark land mass now visible ahead. In a moment, out of the darkness came a weak flash of light slightly off to starboard:

ZUC ZUC ZUC PSE SEND BOAT SK DE W4MCS

The signalman turned to relay the message to the commander, but the Old Man was at his side and had copied it direct.

"Bos'n, man the auxiliary," he barked. "Take the usual crew, fully armed!"



THE WAVERING CHIRPY SIGNALS WERE FADING AND GROWING WEAKER.

In a few moments the fast little launch shot coastward. Slowly it grew smaller as it neared the shore. The sea had calmed and the sky was beginning to lighten. All eyes followed the boat and the officers were on the alert with glasses.

The launch slipped through the surf and was lost to sight. A few minutes later it reappeared.

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Bouncing up and down, it slowly gathered speed.

There were seven water-soaked men aboard, six of them in torn and dirty Australian Army uniforms and one in civilian garb. Aided by the willing hands of the destroyer crew, they clambered up the rope ladder.

Hoisting the launch aboard, the destroyer made about and headed back to the open sea away from the dangerous coast line. The rescued men were made comfortable. An hour later the commander called his steward to the wardroom.

"The soldiers are asleep, sir, but the civilian said he was feeling fit now and would talk to you right away, sir," the steward reported. Soon the young civilian walked in, looking fully restored to health in clean borrowed whites. He stretched out his hand and shook the commander's warmly.

"I'll never be able to thank you for answering my call," he began. "We'd just about given up hope. It's almost too good to be true — I can hardly believe it yet."

Commander Lackey motioned him to a chair. "Well, my boy, we are glad to be of assistance to you. And now, how about an explanation? If you feel up to it, we'd certainly like to hear about it."

The rescued man's face turned grave. "They say that truth is stranger than fiction, and I certainly agree," he said. "I think you will, too, when you've heard my story."

This is the story he told:

My name is Claude Godwin and my home is in Lewisburg, Alabama. I'm a buyer for a rubber concern back in the States, and amateur radio is my avocation. I've been licensed for about nine years. I was sent out here two months ago and my assignment was the Malay Peninsula, with headquarters in Singapore.

On the morning of December 7th I left Singapore by train. I was to meet a representative of the plantation owners the next day in Kota Bharu. My servant, whose name was Takasi (I called him Tex for short), was a Jap, a very smart and capable chap recommended to me by the hotel where I stayed. Tex was a wonder. He seemed to read your mind and know just what you wanted.

This kind of traveling was all new to me and, although I was told that arms were not necessary on these trips, I always carried a .45 automatic in my bag. On my voyage over from the States I had brought a small portable battery-operated transmitter and receiver. It operates on all the ham bands, and in addition I use plug-in coils for both the broadcast and ship bands. I used it coming over to listen to the boys back home on 20 and 40. Kinda made me feel good. I wouldn't go anywhere without it. It's very compact and so I stuck it in my suitcase with my flashlight, wrapped up in a towel.

Well, there we were on the train. I'm telling you, that was a ride. The train must have been built in 1900. The coaches were of wood and they creaked and groaned as though they were ready to fall apart. The weather was hot and dry. The jungles through which we were traveling were so dense the foliage was like a solid wall.

I forgot to mention that Tex seemed very enthused when I told him that we were going to Kota Bharu. I got out the latest copy of *QST* — it had come just the day before — and was glancing through the pages, when Tex exclaimed, "You a radio ham?" I looked at him in surprise; such language in this part of the world was unusual. I gave him my call and asked him where he got the idea, and he replied that he had noticed the word "radio" on the magazine, that was all. He turned his head and looked out the window. I was a little puzzled but it didn't seem important, and I soon forgot the incident and commenced reading. The rest of the trip by train was uneventful.

When we got off at Kota Bharu we asked the way to the hotel. I say "we" but it was really Tex who asked. He could speak the language like a native. Arriving at the hotel, we found the usual type of building — a two-story ramshackle affair. We settled down for the night after a dinner that was surprisingly good, considering the surroundings. Tex made me comfortable and tucked the mosquito net well around my bunk. It wasn't long before I was in the arms of Morpheus.

I couldn't have been asleep more than a short while when I awakened with a start. I felt that there was something or someone in the room, although I couldn't see a thing in the darkness. I heard soft steps, and then someone breathing. I lay perfectly quiet and tried to peer through the darkness, but I couldn't see a thing. Soon there was a metallic click, footsteps — and then silence.

I crawled out of bed and went to my suitcase. Taking the .45 and the flashlight, I took a quick look around, but I could see nothing amiss. Stepping out into the hall, there was no one in sight, no light anywhere. Tex's door was closed. Returning to my room, I looked around carefully and did not find anything wrong. Well, thought I, I suppose I'll have to get accustomed to peculiar happenings in this part of the world. I went back to sleep.

Morning found me quite refreshed in spite of the night prowler and a hard mattress. The little town seemed rather noisy. There was lots of shouting and hubbub. Tex usually came in and had my things arranged, but this time apparently he had overslept. I shaved and cleaned up at the portable "bathroom" — a pitcher of water and a basin — and started down the hall to Tex's room. Knocking, I waited, but there was no answer. I pushed open the door and walked in. No Tex. The bed was neatly arranged for sleeping, but no one had slept in it! I looked around for his funny little brown traveling bag, but it was gone.

Going downstairs, I noticed the hotel proprietor, a fat little Frenchman, standing with a group of men. All of them turned and looked at me as I walked into the café and took a seat. There were no other customers.

I opened the menu and was studying it, when a voice beside me said, "Sir, have you heard the news?" It was the Frenchman.

"What news?"

"The Japanese bombed Pearl Harbor about six hours ago!"

"Good God, that's suicide!" I exclaimed.

"It is true, however. We heard it over the news from W2XAD a few minutes ago."

He went on, telling me all that had occurred. I ordered and finished my breakfast.

"Have you seen my servant this morning, Mr. Bueche?"

"Why, no. He went out about midnight carrying some luggage and I haven't seen him since."

Strange goings on. Tex evidently had quit me two hours before Pearl Harbor was bombed!

I thanked the proprietor and went upstairs to search my room again. Not a thing could I find missing. Every article in my suitcase seemed to be intact. I stopped and looked around. By golly where was that copy of *QST*? It was gone!

My business appointment was at nine, so I started to leave the hotel. At the door I felt a hand on my shoulder. Turning, I saw a man in policeman's uniform. He wasn't a native.

"Sorry, sir," he said, politely enough. "But I must ask you to accompany me."

"Why? What is the meaning of this?"

"You are an American?" he asked.

"Yes."

"My orders are to bring you to headquarters."

It would have been dangerous to resist and there was no point in it, anyway. We marched down the narrow street and around a corner to the local constabulary. Entering, I saw several policemen and a small dark man sitting behind a desk. The dark man looked up. He muttered something I could not understand and the policeman began talking to him.

Things were beginning to look serious. Shortly the policeman turned to me and said that I was to be taken to Singora, which was in Thailand about 300 miles up on the east coast. I raised the devil. Such a procedure was unheard of — I would take it up with the authorities. But it was useless. They all acted as if they didn't understand me.

I was marched back to the hotel and allowed to collect my belongings. The place was deserted.

We boarded a train that was going north and chugged out of the station. A well-armed guard was at my side. He either couldn't or wouldn't talk English. All I could do was sit and think. It wasn't a pleasant trip.

Finally we arrived in Singora. A small car was waiting and we were loaded aboard, baggage and all. After about two hours we entered a small village. The natives stared at us. Jap soldiers were everywhere. We stopped in front of a one-story building surrounded by a high fence. A guard with a rifle was standing beside the locked gate. After a few words between the guard and my captor the gate was opened, and in we went. Down a corridor there was another guard and a locked door which was opened. I was shoved unceremoniously through and the door pulled to and locked. The room was dark; I could see nothing.

To my surprise they had not taken my suitcase, nor even searched it. I got my flashlight and looked around. It was a low-ceilinged single room with a dirt floor and no windows. There was a native bunk over in the corner. The door was the only entrance. The place smelled awful and was as hot as blazes.

I walked over and sat down on the bunk. The realization had finally come to me that I was a prisoner of war. I decided I might as well sit tight and await developments. I did not have long to wait. Soon I heard voices, and the key turned in the lock and the door opened. The light blinded me, but I did not need to see to know that the Japs were adding to their haul — and not without some trouble, from the sound of the struggle that was obviously taking place just outside my door. Finally several cursing, fighting forms were shoved into the room with me. The door closed. I sat on the bunk. I didn't know what to do so I just remained quiet.

"Well the ——— rats have us now!" came out of the darkness with an Aussie accent. I switched on the flashlight and the men turned warily. One of them spoke up: "Who in the 'ell are you?" I looked quickly at each of the six men. They were big fellows in torn and dirty Aussie uniforms, hatless and unarmed. They were as hapless a crew as ever I had seen.

(Continued on page 110)

★ QUOTE AND UNQUOTE ★

Experience in the application of fluorescent lamps has shown that they may give rise to radio interference under certain conditions. While the number of instances in which this has occurred is relatively small, in comparison with the total number of installations in operation, it can prove very annoying when it does occur and this has led to considerable study of its cause and elimination.

A recent publication [1] points out that radio interference from fluorescent lamps arises from the fact that the arc within the lamp must be reestablished each time the voltage wave of the alternating current supply passes through zero; i.e. 120 times per second on a 60-cycle supply. Each time this arc is established it results in the generation of energy in a form which, under certain conditions, may give rise to radio interference.

Experience has indicated that, if the lamps are properly installed and used with high-quality auxiliary equipment, only a small percentage will cause objectionable radio noise. By proper installation is meant that the auxiliary equipment should be enclosed in steel channel; the wiring should be made up with tight connections; the lamps and starters should be firmly installed in the sockets; and the fixture should preferably be grounded. It has been found that grounding the fixture to gas pipes, metal lath or metal ceilings often increases the interference. In many instances where radio interference is encountered it will be found that these precautions have not been observed and that the interference could be greatly reduced or eliminated by the use of properly-installed equipment.

Standard fluorescent lamp starters include a small condenser connected across the starter terminals as an aid in the elimination of radio interference, as shown in Fig. 1. During normal lamp operation, this condenser is in parallel with the lamp and aids materially in the prevention of radio noise.

[1] "Fluorescent Lamp Radio Interference," *Sylvania News*

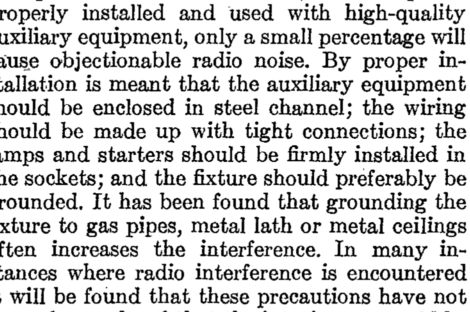


Fig. 1 — Circuit of fluorescent lighting unit.
S_1 — Line switch.
S_2 — Starting contacts.
C — Radio interference condenser.

In checking an installation which is causing radio interference, in order to locate and eliminate the cause, it is suggested that an effort first of all be made to determine just which unit or units are causing the trouble. In some instances it will be found that most, or all of the interference is coming from a single lamp or lighting unit. This can be determined by turning on the units one at a time until the offending unit is located. If the trouble can be isolated to one or two units in this way, the next thing to check is the condenser in the starters.

Perhaps the easiest way to do this is to replace the starter with a new one; if this does not change the noise level to any extent, then it may be assumed that the condenser in the original starter was operating satisfactorily. Another way is to remove the starter while the lamp is in operation. If this causes the noise level to increase, it demonstrates that the condenser in the starter was operating satisfactorily and it will therefore be necessary to look elsewhere for the cause of the radio noise.

If the lighting fixture is one in which the starter is mounted under the lamp in such a way that it is impossible to remove the starter without removing the lamp, the following procedure may be followed: With the starter removed and the lamp in place, the two contacts in the starter socket should be short-circuited with a short piece of insulated wire which has been stripped for about one-quarter inch at each end. This short circuit should be maintained until there is a definite glow at each end of the lamp, and the lamp should light when the wire is removed.

It will be found helpful to keep in mind that the interference may be reaching the radio in three possible ways, and that in any particular instance the noise may be due to any one of these or to a combination of any two or all of them. These three ways are:

1) Radiation direct from lamp bulb to the radio antenna system.
2) Radiation from the power lines supplying the fluorescent units to the radio antenna system.
3) Feed-back from the fluorescent unit through the electrical power lines to the radio.

These three types of interference and their elimination will be considered in the order listed above.

Direct Radiation

It has been found that the distance over which the direct radiations from the lamp are effective in producing interference is usually less than 10 feet and, therefore, this type of interference can be eliminated if it is possible to move the receiver and its aerial system outside the effective range. Of course, if there is a metal ceiling or extended metal work, such as pipes or beams located near the lamp, the direct radiations may appear to travel at greater distances than otherwise and the distance at which the receiver must be located will be correspondingly greater.

In checking an installation to determine if direct radiation is the cause, it is frequently possible to move the set and its aerial until it is at a distance of ten feet or more from the suspected lamp. A portable battery set is frequently helpful in making an exploration of this kind, since there is no possibility of line feed-back and any interference which is encountered from the lamps will be due either to direct radiation from the lamps or from the lines, as discussed below.

Line Radiation

The interference energy from the fluorescent lamp may be radiated from the line supplying the lamp to the radio antenna system and cause noise in this way. As with direct radiation from the lamp, this line radiation is not effective for distances greater than ten feet, and it can thus be eliminated if the separation can be kept above this figure or, if the antenna lead or the power line is provided with a grounded shield, in instances where they must be closer together.

It is also possible to eliminate line radiation by means of filters located at the lamp, as shown in Fig. 2. In many instances a simple capacitor filter is sufficient for this purpose, but in other instances an inductor-capacitor-type filter may be required. Filters of both types are available from most radio supply stores.

If it is found that direct radiation is the cause, but it is necessary that the receiver itself be within the range of the radiations, it may be possible to eliminate the interference if the aerial is kept well outside the interference range and is connected to the radio set by a shielded lead-in wire with the shield grounded. The radio receiver should also be provided with a good ground connection.

In the a.c.-d.c.-type sets the chassis usually is grounded to one side of the line and for that reason an external ground connection is not required. There are also some small a.c.-d.c. receivers which employ one side of the line as antenna as well as being grounded to the other side. In such cases it is a simple matter to disconnect this line-antenna connection and substitute a length of standard indoor antenna wire. It is also helpful to connect a 0.05-μfd. condenser across the line. Not only does this greatly reduce feed-back through the line from fluorescent installations, but is necessary in many cases to avoid feeding back when there is another set on the same line.

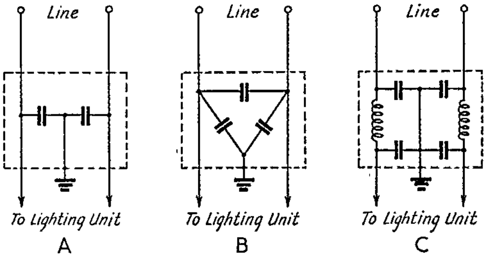


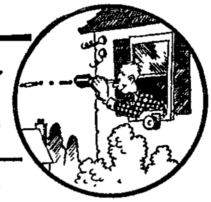
Fig. 2 — Line filters for use with fluorescent lamps for reducing radio interference.

It is possible in some instances where appearance is not of major importance to eliminate interference from direct radiation by shielding the lamps with a grounded wire-mesh screen. This method is frequently used in radio repair shops where it is desired to mount a fluorescent fixture directly over the work table and is sometimes practicable in radio displays lighted from concealed lamps. The mesh of screen should be large enough so that it will not cut out an appreciable portion of the light and some arrangement should be devised so that it can be readily removed when the lamps must be changed. One-quarter-inch mesh screen has been found satisfactory for this purpose.

Feed-Back Through the Lines

It is possible for the interference created by the lamp to feed back through the power lines supplying the lamps and reach the radio set in this way. In some instances where the distance from the lamps to the radio connection is long enough, this interference energy will not reach the set and it is therefore frequently worth while to try connecting the receiver at the most remote point which is practicable under the particular conditions of the installation. The ballasts for 30-, 40- and 100-watt lamps for 110- to 125-volt operation contains an auto-transformer which tends to cause some attenuation of radio energy and, therefore, this type of ballast is to be preferred in installations where radio receivers are used. Interference due to line feed-back can be effectively eliminated by means of filters. A single filter may be connected at the receiver, but since filters connected at the lamps are also a protection against line radiation they are to be preferred unless the aerial circuit has already been shielded against bulb and line radiation. A larger number of filters may be required if they are located at the lamps. Frequently, however, it will be found that filters are required only at the lamps nearest the set.

EXPERIMENTER'S SECTION



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

PROJECT A

Carrier Current

In response to the article on carrier current in the July Experimenter's Section, I have decided to inform you of the progress in this area.

There are six active stations, all working on similar frequencies. These stations, using initials prefixed by WW2, are WW2HMK and WW2DCW in Rochelle Park and WW2SRA, WW2JVH, WW2GEJ and WW2DC in Maywood, N. J. A seventh member, WW2CA, is expected to have his equipment completed within a short time. Contacts have been carried on among the six stations at practically any time, except when line noise is too great. The two most-distant stations are about 2 miles apart air line, or about 2½ miles by wire.

WW2SRA uses a 45 oscillator modulated by a 6F5 and 6L6, WW2JVH a 46 oscillator and 6K7-6F5-6L6 modulator, WW2GEJ a 6L6 oscillator modulated by a 6L6, WW2DCW a 46 oscillator and 6C5-6L6 modulator and WW2HMK a 6L6 oscillator modulated by a 6F6. WW2SRA, WW2JVH and WW2HMK have rack-and-panel outfits which include the transmitters, receivers, modulators and power supplies. These are fitted with handles for carrying and require only the plug connection to a 115-volt line for operation, so that they may be used at any location on short notice for any kind of emergency work. Provision has been made for either c.w. or 'phone operation.

All of this group offer their assistance to anyone caring to join in with carrier-current equipment in this area which includes Hackensack, Maywood, Rochelle Park and possibly Paramus. All communications should be addressed to Harry Kuhles, 33 East Pleasant Ave., Maywood, N. J. — *Harry Kuhles, WW2HMK.*

Not much in the way of results since I last reported. W6UCW is now working evenings and I have worked several Sundays, hence we have been quite hampered. However, several contacts have been made and I have made several recordings of them. I have been running an automatic transmitter on 150 kc. every evening I have had time to be in the shack, but no response thus far. One or two of the other hams in the vicinity have shown some interest but are not operating yet.

Incidentally, the automatic key used here consists of a six-inch phonograph record. Characters are recorded at 800 cycles from an audio oscillator. The signal is used to operate a voice-operated break-in system without the lag in the "turn-off" circuit. — *W6MEP.*

I have built the *QST* transmitter and converter and they both work well. The transmitter is built breadboard style, while the converter is built mostly from salvaged broadcast receiver parts. The variable condensers, for instance, are from an early-model Atwater-Kent with plates removed.

With this equipment, I have worked one way over a distance of about seven and one-half miles via the power line or about four miles airline. I operated the transmitter while a friend of mine, James White, operated the converter, which was hooked to a six-tube all-wave superheterodyne several years old. The transmitter was running with about 15 watts input. A sub-station is about halfway between the transmitting and receiving points. The signals are very good over this distance and there is almost no noise at any time.

I would like to hear from anyone near me who is interested in carrier-current work. — *Derwin King, R.F.D. 4, Box 253A, West Monroe, La.*

PROJECT B

Light Beams

W4HHK and W4HCU have been able to work a distance of four miles using light beams from automobile headlights. They were also able to work 1½ miles by signaling with car horns!

W6AM has wired a key in series with both horns and the spotlight of his car and thinks it may come in handy for short-range work in an emergency.

PROJECTS C & G

Audio-Frequency Induction & Earth-Current Communication

My main reason for writing is to refer to the Experimenter's Section of *QST*. I mean, of course, the letters on earth-current communication.

I tried this system about a fortnight ago with a friend who lives about four miles away. The results were fairly satisfactory. The equipment used for the experiment consisted of the output of a radio receiver fed into two earths 200 yards apart as the transmitter and a simple three-valve audio amplifier connected to two similar earths at the receiving point. The result was an R6 signal on 'phones.

In conclusion, I would like to have any ham write me with the object of swapping notes. — *P. Evans, Beech House, Redhill, Arnold, Nottingham, England.*

W3IYR recommends the book, *Geophysical Exploration*, by C. A. Heiland, published by Prentice-Hall, Inc., 70 Fifth Ave., New York, and obtainable in many libraries, as an excellent source of material on earth currents and audio induction. While the reference to these subjects is primarily in relation to geophysical explorations, much of it also applies to the possibilities of communication by these methods. Subaqueous, audio and supersonic signaling is also discussed with ranges of 20 to 90 miles mentioned as possibilities between points on the same body of water. It would be interesting to see what could be done by hams who have bodies of water available for experimental work.

PROJECT F — *Supersonics*

Since my last letter to the Experimenter's Section, I have not had a chance to do very much on the problem of supersonics. I did get this far, however: In a field near W2DIH, we set up a 6V6 oscillator with about 5 watts output, running at about 17 kc. and succeeded in hearing it at distances up to 270 feet by means of a crystal microphone and a converter. It took a little imagination to be sure of the signal at that distance, but at 200 feet it was quite evident. A cross wind was blowing and considerable fading was present, probably because of refraction effects. Standing waves were rather violent. No horns or reflectors were used and the sound source was a very cheap two-inch p.m. speaker. Efficiency was no doubt horrible and most of the 5 watts appeared in the form of heat. I fear that this sort of distance is about what is to be expected of simple equipment available to most hams.

In place of the commercial mike, I tried a Rochelle salt "twister" element supported at three corners and in the open, resonant at about 20 kc. At and above this figure it was somewhat better, but at 17 kc. the usual mike gave better results. Application of the crystal to a resonant low-loss bar has not been tried.

Also I have not tried to improve results by more efficient and powerful sound sources, nor by increasing the directivity. Assuming an attenuation on the order of 10 db. per hundred feet, together with the usual inverse-square loss as the distance is increased, it would seem that it would take very strenuous efforts to cover a distance of even a fraction of a mile. Further experiments will, therefore, be more entertaining than useful.

A good text on the subject, hard to buy, but available in libraries, is *Ultrasonics and Their Scientific and Technical Applications*, by Ludwig Bergman, translated by H. Stafford Hatfield, published by John Wiley and Sons. Some of the more pertinent data given there are an attenuation estimated at 3.5 db. per hundred feet at 20 kc. and 70 per cent humidity, greatest at 40 per cent humidity, quite a bit less for 100 per cent and for very dry air, and a record distance of 600 feet achieved with crystals at both ends by Yagi and Matsue. — *W2AER.*

In view of the fact that supersonic frequencies are transmitted much more readily through liquids, it has been suggested by William O'Niel and others that use might be made of water-pipe systems. Mr. O'Niel suggests that the nickel rod of a magnetostriction oscillator might be properly suspended in a section of pipe closed at one end and tapped onto the water-system piping.

PROJECT H — *Microwaves*

Extended hours in a local radio equipment plant engaged in war production have prevented the writer from accomplishing very much on the experimental work which was started for this project. A 955 oscillator has been tried with a number of simple circuits, primarily with the idea of finding out where the use of a tuned-filament circuit becomes a necessity. Thus far our efforts have been confined to seeing just how high we can go without any filament (or cathode) tuning. Regardless of what type of grid and plate circuit is used, we have been able to obtain good output up to about 375 Mc., with oscillation of sorts in evidence as high as 475 Mc., with pipes in the plate and grid.

Announcement of the establishment of this new project in the August issue has not been out sufficiently long to have elicited any response, and with the weather what it is as this is being written we doubt whether there is much microwave experimental work going on in many attics around the country! — *W1HDQ.*

Easy Lessons in Cryptanalysis: No. 3

BY JOHN HUNTOON,* W1LVQ

JIM BREMER stood breathless at the back entrance of the Wilson domicile, awaiting an answer to his ring. As the door opened he thrust a small object toward his host, rapier-like.

Ed Wilson reached for the ceiling in mock horror. "Git the shootin' irons, Nell — the varmints are after us again!"

"Cut it out, Ed. This is an alphabet slide I made in Dad's shop. It's got standard and reversed alphabets and provisions for others and —"

"Hey, wait a minute. Let's go downstairs and see what it looks like."

Jim demonstrated as they descended the stairs. "See, I made it of some odd pieces of square pine — two strips fastened by wood screws to a chunk of plywood with just enough room between them to allow a sliding third strip. Then I pasted two standard alphabets on the top fixed strip and two reversed ones on the bottom. I can put any alphabet on the sliding strip 'cause it has four usable sides. Not bad, huh?"

"It'll serve the purpose, which is the important thing. Good going, m'lad.

"But now let's get going on tonight's session. We're rushing through this stuff pretty fast, Jimmy, but I want you to understand the various types of elementary ciphers and where they fit in the general picture of secret writing."

"Okay — I'm ready."

"Last time we talked about simple substitution systems. They are extremely easy prey for the experienced cryptanalyst, though, and probably are never used in important communications work. A somewhat more complex class of cipher is known as *polyalphabetic*, meaning that more than one alphabet is used in encipherment. The letter **e** might be represented once by **J**, in another place in the same text by **D**, in another by **S**, and so on."

"I know — by using several different alphabet positions controlled by a keyword," Jim offered.

"That's about it. A Frenchman by the name of Vigenère many years ago set up a complete table, but the same thing in much simpler form is known as the St.-Cyr slide, consisting simply of our standard sliding alphabets. Instead of leaving the slide in one position during the entire encipherment of a message, its position is changed for nearly every letter. We designate one alphabet on our strips as plain, the other as cipher.

"Suppose we use a keyword such as **Victory** and a sample text such as **Buy war bonds and stamps.** To begin encipherment, we first set **a** at position **V** and read **W** for **b**; then we shift the slide so that **a** is set to the second keyword letter, **I**, and read **C** for **u**; then we set **a** to **C** and read **A** for **y**. Let's work it all out on paper:

V I C T O R Y

b u y w a r b
W C A P O I Z

o n d s a n d
J V F L O E B

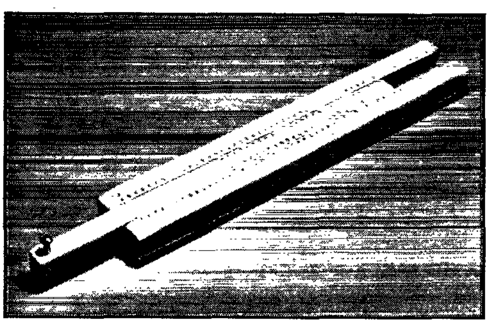
s t a m p s
N B C F D J

which gives us the cipher text **WCAPO IZJVF LOEBN BCFDJ.** See?"

"Sure," Jim confirmed. "But why not encipher every letter in one column first, then in the other columns, so you won't have to be shifting the slide every second."

"We do, in actual practice. Now note, Jimmy boy, that in this sample message **n** is represented by **V** and **E**; **s** by **L, N, J**; all depending upon which alphabet-setting happens to be in use at the time. The frequency count of cipher letters shows very little tendency to peak at some letters, slacken at others — unless the keyword is an extremely short one. This type of cipher is slightly more difficult of solution, wouldn't you say?"

"Don't look at me. You do the talking."



Jim's new gadget is a crude but quite satisfactory type of alphabet slide, indispensable in cipher work. The top strip carries two consecutive standard alphabets, the bottom strip two consecutive reversed alphabets. The sliding strip, being square in cross-section, can be used in any of four rotated positions, so that four different kinds of sliding alphabets may be used. The machine screw serves as a handle for the sliding strip.

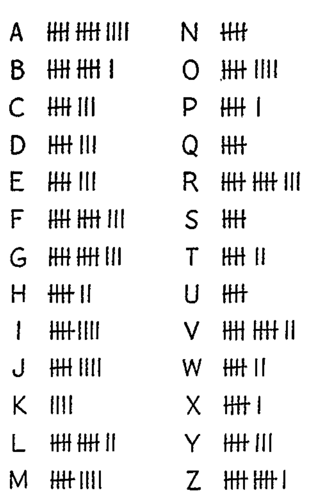
* Assistant Secretary, ARRL.

"Well, note that **a** has appeared twice in the fifth column — no cracks, please — and in both cases was enciphered as **O**; it will, in fact, be enciphered as **O** each time it appears in that column. In text of any length, sooner or later there will be a word such as **the** which will twice fall into identical columns and be enciphered with the same three consecutive cipher letters. And our frequent digraphs will do likewise. Attacking an unknown cipher prepared by this system, then, our first step is to try to find the length of the keyword, or *interval.* Once that is done correctly, we know that each column is enciphered with but a single alphabet setting and the rest of our solution is similar to simple substitution analysis. Let me show you an example."

Ed rapidly thumbed through a file as neatly-kept as his station gear. "Here's one from an AARS test some time ago:

RNVES ITRBV ZSPMG JAJMG YOXTR ZNFTI UERVZ PYRCF EAPMO UDUMG JAQLZ FCDBW FNVBC GFLZG KCDUF RWDAY VYZWF UAQLS CEYMB TOOCA ETUIB JPRAW KIRVG FLHBG YAYMG FMHIB JWHZG JEQLO ESZMF JTREZ ANGIG YWIQJ VADRH LLVIC BLDPC DAXAO JTRXO LGXAH KHLZH PIVLS RDOQB VFRZG FLXBW FNVOS KBXAM.

In case you don't know, we start out with a frequency count:



"Two hundred and twenty-five letters," mused Jim, "with the highest five forming less than 30% of the total, the highest ten forming . . . ummm . . . about 50%, and a lot of low-frequency letters. In fact, every letter is used."

"My, my, Mr. Aristotle. How come you weren't class valedictorian, with all that genius?" Ed jibed.

"Ran out of apples the first semester. But isn't that right?"

"Yep. Those are the general characteristics of multialphabet ciphers. So, let's look for repeated sequences and perhaps we can find the keyword length. We'll list them together with the number of letters between their recurrences, and also the smaller factors of that number. There's **JTR** . . . and **BWFNB** — when we find a repeated sequence that long we're pretty sure we're on the right track."

In a few moments, Ed had a table looking thus:

JTR	35			5		7			
BWFNB	155			5					
GFL	144	3	4		6		8	12	
AQL	35			5		7			
ZG (3)	65			5					13
	140		4	5		7			
	75	3		5					

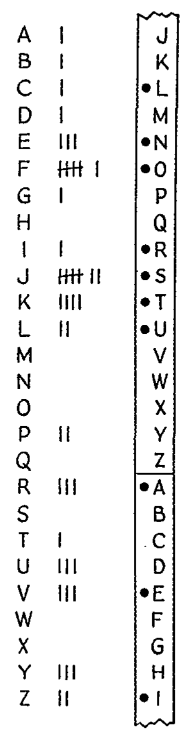
"I've ignored all factors over 15, since few keywords are that long. The factor 5 predominates, with 7 next. So *probably* 5 is our length. Now we list the entire cipher text in five columns." Ed wrote:

R N V E S
I T R B V
Z S P M G
J A J M G
Y O X T R
(etc.)

"Each vertical column is enciphered with one alphabet — right?" queried Jim.

"We've so assumed. If it's a mixed alphabet we're in for trouble, but if it's standard or reversed, we have a good chance of determining it quickly. First we make a separate frequency count of each column; then, with a standard alphabet of exactly the same dimensions as the one we used for the frequency count and on which the high-frequency letters **aeilnorstu** have been marked with a blob of ink for convenience, we attempt to find a setting at which the peaks of the frequency count jibe with marked letters on the second slide. Here are some strips I've already prepared. Now, let's look at column one. . . ."

(Continued on page 116)



Ed's probability test for Column 1. Present setting, a = R, shows promise.

WFIL Radio Code School for Navy Applicants

New Training Effort Made Possible by Ham Experience of Members of Station's Staff

A NEW idea in radio training was inaugurated when WFIL, Philadelphia broadcasting station, dedicated its Radio Code School for U. S. Navy applicants July 22nd. The idea — that of using the services of engineers on the WFIL staff, with classroom and instructional facilities being supplied by the station management — is one that might well be emulated by other broadcasting stations, radio stores and similar institutions employing skilled radio engineers.

The WFIL Radio Code School was called "an outstanding contribution to the United States war effort" by Commander Townsend of the U. S. Navy Communications Division, during the dedication ceremonies. The school owes its success in great part to the ham experience of its instructors, according to the executives in charge.

The School trains applicants in sending and transcribing code, training which qualifies each student to receive preferential consideration for the U. S. Navy rating V-3. Classes are held three hours a night, five nights a week. Although night classes make it harder for the instructors, they make it easier for men engaged in civilian jobs to enter the Navy without going through the usual period between leaving the job and being accepted in the service. Of even more importance, it saves the U. S. Navy three months of basic training for these men — a vital amount of time for the war effort.

Every part of the school is a voluntary patriotic contribution, from the tables, keys, headphones and other special equipment donated by Roger W. Clipp, vice president and general manager, to the services of its competent instructors — all volunteers from the WFIL staff.

Lou Littlejohn, director of the Code School and technical supervisor of WFIL, was for some years the guiding spirit of W3GJH and W35NE. He also had a great deal of commercial experience where his code knowledge was of vital use, as a radio operator on tankers, freighters and passenger ships and in a coastal station of RCA. Littlejohn is also vice president of the American Communications Association, in charge of broadcasting, and a member of the DCB subcommittee on broadcasting.

Charles Coleman, a WFIL engineer, has been in amateur radio for 23 years — since he was 14, in fact. W3QT, one of the outstanding DX stations in the U. S., having worked 166 countries, is Coleman's pride and joy.

Other instructors include Bill Neill, W3EWV, Tony Wheeler, W3ITA, and William Lorainy, ex-W8PWV. Lorainy gained valuable experience in copying Transradio news for KICA.

Fred Moore, also a WFIL engineer, the one member of the group who had no ham experience, had as its equivalent some 12 years of radio operation in the U. S. Navy — starting in 1917 in the battle fleet, then spending six months in the North Sea submarine patrol and several more months as radioman on a sub-chaser. He kept on in the Navy radio field for 12 years, during the latter part of which he was radio supervisor of the U.S.S. *Concord*, flagship of the destroyer squadron.

Dedication of WFIL Radio School for U. S. Navy Applicants. *Left:* l. to r., Chief Anderson, Navy Recruiting Service; Mrs. Stair, of WFIL, who acts as typing teacher; Lt. E. B. Emmonds, U.S.N., and Louis Littlejohn, WFIL Technical Supervisor and Director of the Navy school. *Right:* Code class in session.

How Recordings Are Made

No. 3—The Amplifier

BY CLINTON B. DE SOTO,* W1CBD

The recording amplifier should offer no particularly new problems as far as the amateur is concerned. Actually, the power amplifier required to drive the cutting head looks much like any other audio amplifier. Its principal qualifications must be ample power output and good regulation, low harmonic distortion and a frequency response adequate for the particular recording job at hand.

Power Output

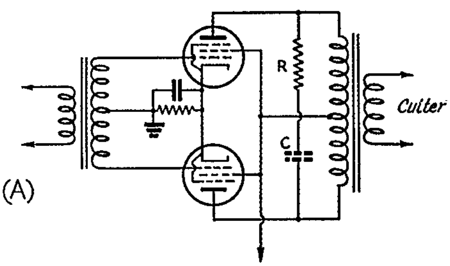
Although the average power actually consumed by the cutting head seldom exceeds one watt, the amplifier must be capable of delivering considerably more than this — something like 8 to 15 watts peak undistorted output ordinarily being used to ensure perfect regulation. Even this may not be enough where extreme high-frequency pre-emphasis is employed, as will be discussed later. In such cases the peak power requirement may reach as high as 30 watts.

For most work a pair of 2A3s or 6A3s, or more often in modern units a pair of 6L6s with inverse feedback, will do the job well enough, however. In fact, the inexpensive home recorders get by with as little as 3 or 4 watts of audio from a single pentode or beam tube, but this is at the expense of distortion and limited frequency range.

One reason for using high power is to minimize the effect of the wide variations in the effective load impedance of the cutter head. The cutter represents an almost purely reactive load (inductive in the case of the magnetic cutter, except at low frequencies where it is largely resistive, and capacitive in the case of a crystal cutter), and a head that has 15 ohms impedance at 400 cycles might be 175 ohms at 5000 cycles and 1 or 2 ohms at 50 cycles. The actual power required at the lowest frequency, therefore, would be 20 db. under that at 400 cycles and nearly 5 db. higher at 5000 cycles. By dissipating an appreciable portion of the audio power in an external resistive load, the actual cutter-impedance variations can be made to constitute only a relatively small change in the total. The better heads are equipped with compensators for this purpose, either self-contained or in an accompanying pack.

Even so, some load variation occurs, unless a disproportionately large amount of power is wasted. The best recordings are made with amplifiers having triode output stages, therefore, because of their greater tolerance to load variations. With pentode or beam tubes, negative feedback is used to realize the same advantages.

A magnetic cutter is nominally a constant-current device at the higher frequencies (constant-velocity characteristic), but becomes a constant-voltage device below the turnover fre-



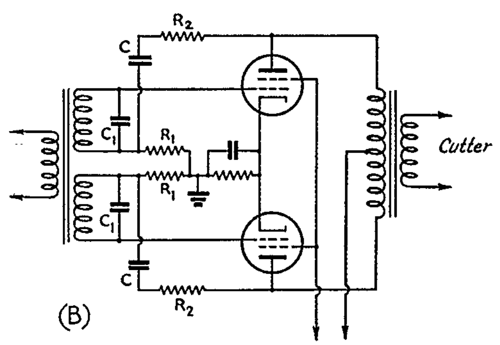


Fig. 1 — Power amplifier circuits particularly suited for use with pentode or beam tubes to provide low effective plate resistance and good damping factor.

(A) Use of resistance-capacity filter to improve regulation and reduce effective generator series impedance.

R — Equal to rated load resistance of tube(s).

C — Determined experimentally to give flat frequency response over operating range.

(B) Negative feedback circuit.

C — 0.1 μfd. or larger.

C_1 — 0.001–0.002 μfd. (used only if necessary to prevent oscillation due to leakage reactance of input transformer).

R_1 — / R_2 — Selected in ratio to give desired feedback, e.g., for 10 per cent feedback R_1 may be 5000 ohms and R_2 50,000 ohms. Use maximum feedback compatible with required power output.

*Executive Editor, *QST*.

quency. A crystal cutter is the opposite, requiring a constant voltage source in the higher range, and changing over below the turnover point if compensation is applied.

Recording Level

In making good recordings it is essential that the correct recording level be used. This means that the maximum and minimum amplitudes (i.e., peak swing and also volume range) must be closely controlled. The exact level depends on a number of variables throughout the system, and usually can be determined only by experimental test cuts.

There is nothing corresponding to 100 per cent modulation in recording. At low frequencies the groove spacing limits the permissible swing, while at higher frequencies the groove radius is the limiting factor. Thus such considerations as feed, depth of cut, record surface speed (and therefore groove diameter), type of recording blank, type, length and sharpness of stylus, the subject matter being recorded, the energy distribution with respect to frequency, whether high-frequency needle-loss compensation is employed, the type of volume indicator used and its dynamic characteristics (whether peak or average reading), the type of pickup to be used and permissible distortion all influence the maximum recording level.

Proper control of this level cannot be achieved either by instinct or by trusting to luck, even in simple home recording. It is always essential to use some form of volume-level indicator (VI) so that the amplitude from various inputs can be properly and precisely controlled. Recording at too low a level will result in increased surface noise, while excessive amplitude will cause overcutting.

The maximum cutter amplitude should be limited to about 0.002 inch, as determined by visual examination under the microscope. This and the minimum reproducible level can be established experimentally by making a series of test cuts of both speech and music, beginning with low amplitudes and the smallest groove diameter to be used. These test cuts may be checked to show where the modulation is lost in the noise level on the one hand and where distortion renders the quality unacceptable on the other. When these levels are established, they should be carefully noted on the VI and all recording held between the marked limits.

This does not mean that all recording should be done at precisely the same level. The skillful operator can achieve markedly superior performance by matching the peak swing to the character of the sound being recorded. Experience will show that certain types of sounds which seem louder to the ear will actually swing the meter less than others. In making recordings with intermingled speech and music, to use the most general example, it is often desirable to raise the maximum amplitude of the voice above that of the music; otherwise the voice will sound considerably lower in volume in playback.

Volume-Level Indicators

The actual type of VI used varies with the elaborateness of the equipment. So-called "DB" meters — copper-oxide rectifier or vacuum-tube voltmeters calibrated in db. above and below a standard zero level for a 500-ohm line — are used in 75 per cent of commercial and home-recording equipment.

No 'phone ham who has ever struggled with the problem of overmodulation needs to be told that the readings on such r.m.s. calibrated meters are often misleading, the meter inertia giving readings 6 to 10 db. below high-frequency peak swings. The vacuum-tube voltmeters, also commonly used, suffer from the same defect. Only the new "VU" meters of the broadcasters are really satisfactory in this respect.

The best level indicator is probably the cathode-ray oscilloscope. Unfortunately, accurate observation of peaks necessitates a fairly large screen, and that requires a bulky and expensive unit. The cheaper recorders using "magic-eye" indicators give good results, because the inertialess beam of the electron-ray tube responds to relatively brief peaks. Neon-bulb indicators, too, are satisfactory in this respect, despite their simplicity.

As far as the amateur is concerned, he should simply consider the recording VI as a modulation meter, and be guided accordingly (except that in recording he *won't* get out farther if he exceeds 100 per cent modulation on the peaks!).

Regardless of the type used, the volume-level indicator should be located as near the cutter head as possible, so that it will indicate the exact cutting amplitude at the output. In no case should the indicator be connected earlier in the system than the output transformer primary.

Intermediate Stages

There is not a great deal that can be said about the intermediate amplifier stages between microphone or other source and the power stage that isn't said in the *Handbook* section on speech amplifiers. Enough gain must be provided to drive the power stage easily from the source in use; the amplifier must be stable and free from regeneration; the overall frequency characteristic must be flat; hum and harmonic distortion must, as nearly as possible, be eliminated.

To achieve these ends, almost any type of amplifier may be used — pentode or triode tubes, transformer-, resistance- or impedance-coupled, balanced or single-ended.

The overall gain must, of course, be controllable; the usual volume-control potentiometer takes care of that. In addition, automatic level control may be used, either in the form of electronic volume-compression or peak-limiting circuits, or as a variable or tapped resistance linked mechanically with the feed system of the recorder to provide the increased overall level required toward the center of the record, as the groove diameter decreases.

It is vital that harmonic distortion be kept to the absolute minimum. There are plenty of other places in the recording system where distortion is introduced — cutter, pickup, playback amplifier — without complicating matters by adding it where it can be quite readily controlled. Distortion percentages that might be quite tolerable in other sound applications may be found highly objectionable in recording. It has been found that as little as 1 per cent distortion can adversely affect the quality of recorded music, through cumulative effects in the balance of the system — combination with other distortion in playback, cross-modulation, etc.

Certain forms of frequency distortion, too, may under some circumstances produce a harsh and unpleasant quality. This is particularly true if the variation in response is a sharp peak; where a gradual change in the characteristic amounting to several db. will not affect the apparent purity of tone, sharp peaks of only a few db. will be readily discernible.

Frequency Response

The recording amplifier should have a frequency response flat (within 2 db.) over at least as wide a range as the other elements of the system are capable of handling — the microphone or other sound source, and the cutting head. For good home recording this usually means from 70 to 7000 cycles, for the better instantaneous recordings from 50 to 8000 cycles, and for transcription quality from 30 to 10,000 cycles.

That is to say, the amplifier should have a *basically* flat characteristic over the required range. For proper versatility, however, the response characteristic should be controllable over wide limits by means of equalizers — tone controls, bass and treble "boost" circuits, frequency-correction networks.

In using such controls, the overall characteristic from source to cutting stylus must be considered, and the amplifier response varied to compensate for irregularities in the other units or provide any special overall characteristic that may be required. Thus, when cutting a constant-amplitude record with a good crystal cutter, the amplifier response should be flat, as would also be the case if a modified constant-velocity curve (Fig. 2-A) were being recorded with a suitable magnetic cutter (such as No. 1 in Fig. 2-B). But if any other type of curve were desired from either cutter, the amplifier would have to be modified to correspond.

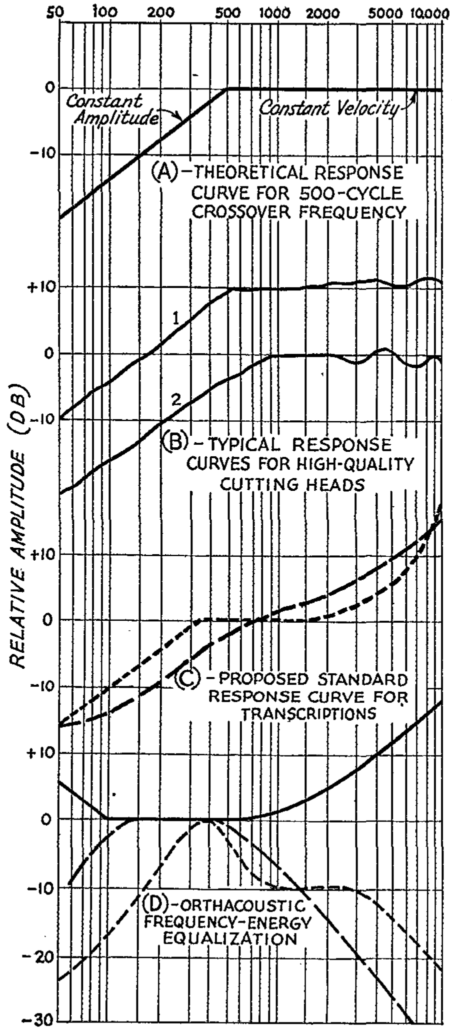


Fig. 2 — Frequency response curves.

(A) Modified constant-velocity type of curve used in standard commercial recording practice. Below a certain frequency (crossover or turnover frequency) recording is constant amplitude to limit low-frequency groove amplitude. Turnover frequency may be anywhere between 250 to 1000 cycles; 500 is average.

(B) Illustrating how actual magnetic cutters approximate the modified constant-velocity curve shown above. No. 1 is designed for 500-cycle turnover frequency, No. 2 for 1000. Standard practice allows 2 db. overall variation from true curve for high-quality recordings, with 1.5 db. curvature at turnover point.

(C) Dashed line shows proposed standard curve for lateral-cut electrical transcriptions; dotted line shows proposed standard for vertical transcriptions. For lateral recording, turnover point is 500 cycles, for vertical recordings 300 cycles.

(D) Solid line shows ideal amplifier characteristic for recording with "Orthacoustic" system. Dashed line shows peak energy per increment of frequency for human speech (average of male and female voices); dotted line shows typical energy in orchestral music.

The proposed standard curves for transcriptions shown in Fig. 2-C are a case in point. Individual equalization of each amplifier — and for each source and cutting head — is necessary to produce this standard recording characteristic. Even then it will be obtained only when the stylus is sharp and new, the disc material right and the recording space restricted to a large diameter.

Not only does the individual recording assembly require overall compensation, but it will be found that the characteristic changes between the inside and outside of the recording space. There will be an apparent loss of high-frequency response at the smaller disc diameter, caused by the sharp radius of the groove undulations for the steep wave fronts at the slower record speeds (which may be as small as 0.001 inch at 5000 cycles and 78 r.p.m.). Not only is the stylus unable to cut the full amplitude, but the playback needle, too, has difficulty following the grooves and therefore further reduces the apparent response.

The only answer is compensation — and more compensation. The relative h.f. amplitude must be increased as the recording diameter decreases. Such compensation should begin at a groove diameter of about 5 inches for 78 r.p.m. and 10 or 11 inches for 33 r.p.m. Certain professional recorders are equipped with mechanical compensating switches, linked to the feed assembly, which provide a progressively greater degree of compensation as the stylus moves toward the center of the record.

Special Frequency Characteristics

Throughout the history of recording there have been constant efforts to establish an ideal overall recording characteristic, beginning with the constant-velocity and constant-amplitude extremes, and with numerous combinations and variations thereof. These have been based both on the individual characteristics of the mechanical equipment employed (magnetic vs. crystal cutters and pickups, etc.), and on obtaining the optimum signal-to-noise ratio in the recording.

The mechanical considerations have been discussed previously in this series. Special equalization designed to increase the signal-to-noise ratio and thus obtain better overall performance is a separate problem, however.

The distribution of noise in recordings has been found to be mainly at the extreme ends of the spectrum, and is divisible into two categories. At the high-frequency end there is the scratch, surface noise manifest as background hiss, caused by slight irregularities or roughness in the groove, and at the low-frequency end there is the turntable rumble or mechanical noise caused by erraticisms in the driving system. The noise level is normally substantially flat between 500 and 1000 cycles, rising rather rapidly in either direction.

The characteristics of a constant-velocity system are such as to emphasize high-frequency noise, while a constant-amplitude recording fails to discriminate against low-frequency rumble. Yet the mechanical considerations ordinarily dictate that just these systems be used in the respective regions where they give the worst signal-to-noise ratio, as in the modified constant-velocity system of Fig. 2-A.

It would be a rather hopeless problem if all recording were done with pure sine waves of equal energy content at all frequencies. It happens, however, that with the speech and music customarily recorded this is definitely not the case. The energy content of sounds in nature is substantially higher in the middle frequencies than in either the bass and treble register, as shown in the curves for typical speech and orchestral music in Fig. 2-D. Therefore it is possible to increase the recording amplitude at both ends of the spectrum by a considerable amount without danger of overcutting on the low-frequency end or of too steep a wavefront on the high-frequency end. This is accomplished by pre-emphasis in the recording amplifier. Of course, in playback an equal amount of de-compensation is required to restore the high and low ends to their normal level.

Several systems have been devised based on this principle, ranging from the proposed standards for electrical transcriptions shown in Fig. 2-C to the NBC "Orthacoustic" system, the recording-amplifier compensating characteristic for which is shown in Fig. 2-D. This system is based on the assumption that the sounds to be recorded will, in general, have substantially greater energy content in the range of 100 to 500 cycles per second than at either end of the spectrum. Using an amplifier compensated as shown, together with a modified constant-velocity cutting head, an overall response curve is obtained which is substantially flat below 100 cycles, rises 6 db. per octave between 100 and 500 cycles and at a slower but gradually accelerating rate above 500 cycles. Thus an optimum relationship between noise and relative amplitude is maintained throughout the spectrum — provided no tones are encountered which violate the general rule. To avoid that possibility, in the NBC system the recorder amplifier is equipped with an automatic limiter similar to that used to prevent overmodulation in 'phone stations.

Equalizers

Compensating circuits or equalizers may be inserted either between the output circuit and the cutting head or in intermediate stages of the amplifier itself. Common practice is to use a simple fixed equalizer just ahead of the cutter for the purpose of giving it the desired characteristic according to its type, and then employing adjustable circuits in the amplifier to make the overall response conform to the special characteristic desired.

Fundamentally the process of equalizing consists of reducing the amplifier gain at a given frequency or frequencies. This is accomplished by incorporating a network of reactive and resistive elements in the circuit which discriminate against some frequencies more than others, depending on their values and how they are connected. In considering such circuits, it is convenient to view the reactive elements as resistances that vary with frequency.

As the simplest case, take Fig. 3-A. The circuit represents an input voltage or generator, E_I, with its internal resistance R_I and a parallel input load resistance, R_L, if used. The output voltage, E_O, is that appearing across the output resistance, R_O. Connecting the condenser across the circuit reduces the output voltage (shown by the solid line in the graph) progressively with frequency, even though the input voltage (dashed line) remains constant. This is, of course, because the

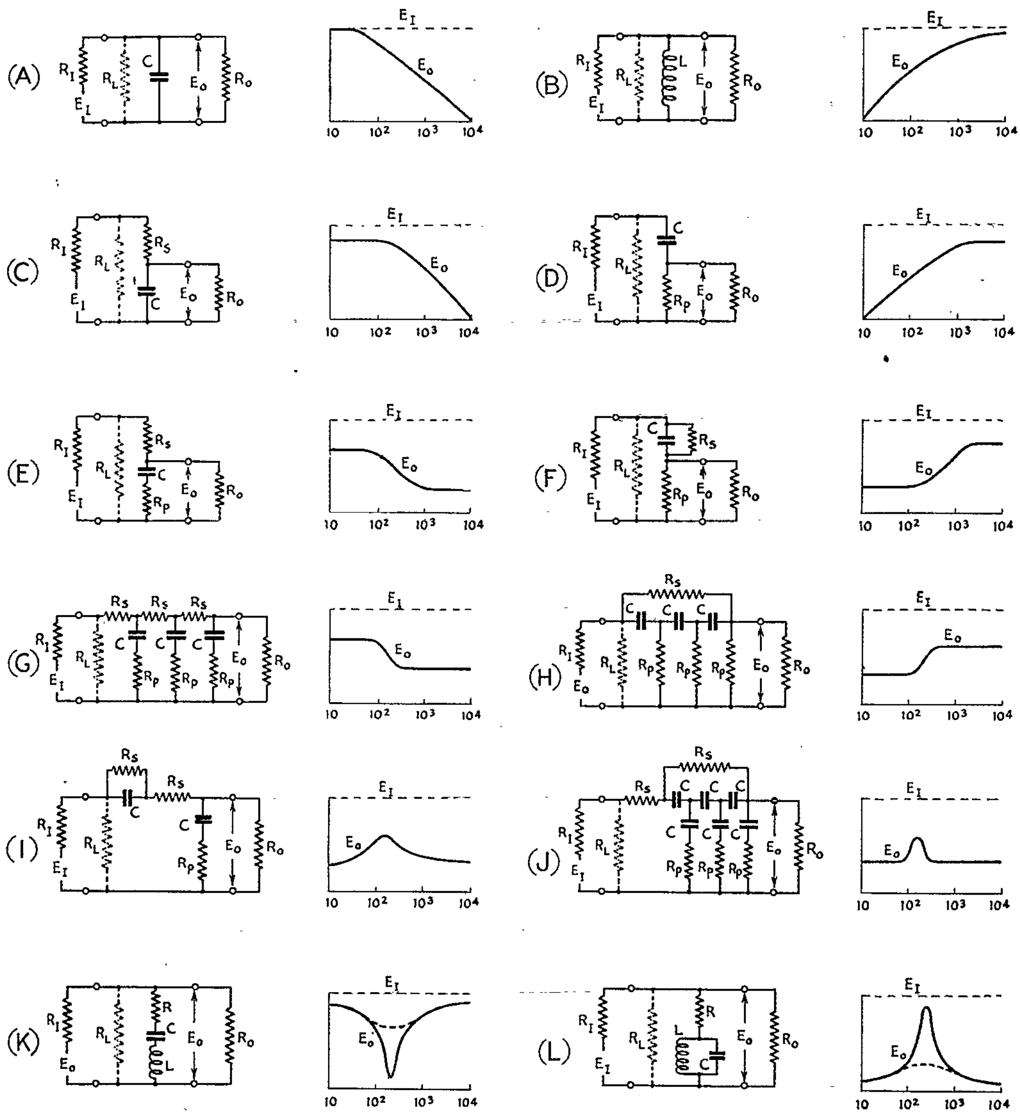


Fig. 3 — **Basic equalizer networks, showing configuration and typical frequency response curves. E_I = input voltage, E_O = output voltage. R_I = internal series generator impedance (plate resistance of vacuum tube, etc.), R_L = external generator load impedance (plate load resistor in resistance-coupled amplifier, etc.), R_S = network series impedance, R_P = network parallel impedance, R_O = network output impedance. In frequency response curves amplitude (vertical) scale is linear in db.**

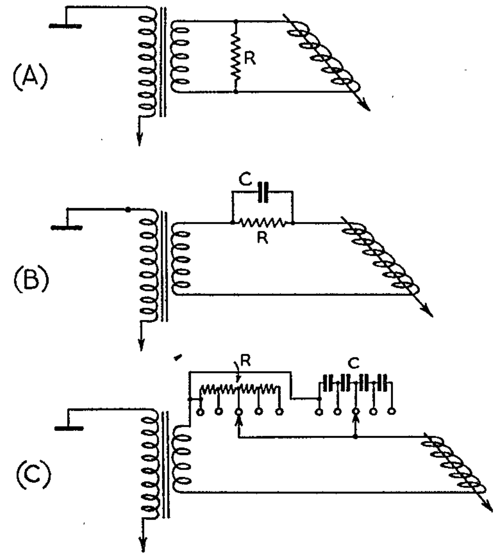


Fig. 4 — Coupling circuits for magnetic cutting heads. See discussion in text.
(A) R — 2 to 3 times cutter load impedance.
(B) R — 10 ohms (for 15-ohm head).
C — 0.5 μfd.
(C) R — 2.5 ohms each section.
C — 0.25 μfd. each section.

reactance of the condenser decreases with frequency, reducing the net load impedance. Changing the condenser to an inductance, as in Fig. 3-B, reverses the process; the output voltage increases with frequency. Alternatively, connecting either in series with the line will produce the opposite result from that of the parallel connection shown — i.e., a series condenser will give a response increasing with frequency, while a series inductance will decrease with frequency. Adding a resistance in series with either will flatten the curve, reducing the maximum attenuation proportionately. This is the familiar tone control circuit universally used in receivers.

So much for the fundamentals, which of course are out of the very first chapter, anyway. Going a step further, Fig. 3-C shows what happens when two elements are used, one in series and the other in parallel. This comprises an elementary form of filter, and the result is a considerably sharpened curve with increased attenuation of the higher frequencies over that of Fig. 3-A (and with increased insertion loss, as well, due to the effect of the series resistor R_S at all frequencies). Reversing the position of the elements, as in Fig. 3-D, reverses the curve, because the reactance is then in series instead of parallel.

Adding resistance in parallel with the reactive element, as in Figs. 3-E and 3-F, flattens the curve as a whole, retaining the knee in approximately the same place but reducing the spread between the two ends of the frequency range. This effect can be increased by adding additional elements, as is shown in Figs. 3-G and 3-H. By making the parallel resistance R_P variable, it can be made to give not only bass or treble attenuation, as with the simpler circuits above, but also treble or bass "boosting" in that as one end of the curve goes up the other goes down. By combining series and parallel elements (Figs. 3-I and 3-J) both ends are dropped down and only the center band of frequencies is passed.

Inductance and resistance combinations could also be used, the response characteristics then being approximately reversed. The use of inductance elements is generally avoided in non-resonant networks, however, not only because of the greater cost and bulk but also because the inductance may resonate with stray capacities in the circuit, causing instability, particularly if the circuit impedance as a whole is high.

When inductance is used it is usually as part of a resonant combination, either series (Fig. 3-K) or parallel (Fig. 3-L), comprising an elementary bandpass filter. By resonating the combination at any given frequency, its level with respect to the rest of the pass band can be controlled as desired by means of a variable series resistance, as shown by the dotted curves. The maximum sharpness and amplitude of the resonant peak will, of course, be limited by the Q of the combination.

In exceptional cases even more complex types of equalizers are used — multiple-section ladder-type resistance-capacity and wave filters, designed for low-pass, high-pass, band-pass or band-elimination purposes. It is seldom that these more advanced forms are required, however; for almost all recording applications some one or other of the elementary forms described will suffice.

An important point to be realized about any equalizer is that it accomplishes its result by dissipating more power at some frequencies than at others. Its use always entails some loss at all frequencies, however. Even the so-called bass- and treble-boost circuits accomplish their "boosting" only by lowering the middle-frequency response. Thus the amplifier must always possess excess gain and power reserve to make up this loss.

Practical Applications

So much for the basic networks. Now let us see how they are applied in practice.

First, the case of the equalizer inserted between the output circuit and the cutter. Here the problem is usually twofold — that of giving the cutter the desired characteristic and that of modifying the impedance variation with frequency to provide a more or less constant load for the amplifier.

Fig. 4 shows the customary treatment for magnetic cutters. As stated before, good cutters of this type are designed to have an inherent modified constant-velocity characteristic, provided they are treated as constant-current devices. With an amplifier having good regulation, therefore, it is often possible to get sufficiently good performance for home recording by connecting the cutter directly across the output-transformer secondary, as shown in Fig. 4-A. This is notably true of high-resistance (500-5000 ohm) units. However, high-quality work demands a simple compensating network, as shown in Fig. 4-B. The constants shown are for a typical 15-ohm cutter. Where exact compensation is required both as concerns amplitude and frequency response, the elements are made variable as in Fig. 4-C. Changing the resistance changes the sensitivity, while varying the capacity alters the high-frequency response. Changing the resistance alone does not alter the frequency characteristic appreciably so long as the total series resistance is not less than half the cutter impedance.

Equalizing for the crystal cutter is a somewhat different proposition. Being essentially a constant-voltage device, series reactive elements may be used. Then, too, the typical crystal head is a relatively high-impedance affair (50,000-150,000 ohms), meaning that the amplifier must be matched with an auxiliary load if it is to be the substantially zero-impedance generator required for constant-voltage operation. A step-down transformer which gives the required voltage (75-150, plus any drop in the equalizer network) at full power output is used to keep the series impedance as low as possible.

As with the magnetic cutter, the direct connection is the simplest. Since this gives a constant-amplitude characteristic, often considered the most desirable for ordinary instantaneous recording, no compensation is required. In practice, however, a series condenser is sometimes used as in Fig. 5-A. Inasmuch as the crystal element itself represents a capacitive reactance this does not disturb the frequency response. However, it does convert the cutter proper to a constant-charge rather than a constant-current device — and since the crystal sensitivity is not as dependent upon temperature with respect to charge as it is to current, the operation in general is more satisfactory. The capacity of the series condenser should be about the same as that of the crystal element.

While series capacity doesn't affect the frequency response of the crystal, series resistance does. The circuit of Fig. 5-B, therefore, represents an elementary equalizer. By using a suitable value of resistance almost any desired curve between constant amplitude and constant velocity can be obtained. If the value of resistance is determined by the following formula, a modified constant-velocity curve corresponding to Fig. 2-A may be obtained:

$$R = \frac{1}{6.28\, f_c\, C_c}$$

where f_c is the turnover frequency (usually 500 cycles) and C_c is the capacity of the crystal element.

In certain commercial recording systems this circuit is simplified still further by using the plate resistance of the power tube as R, with a specially-designed output transformer having the correct turns ratio and coupling coëfficient to give this resistance the required value.

One of the modified characteristics used in certain commercial recording and some transcription studios, claimed to result in reduced surface noise, resembles the curve shown for Fig. 3-E. Below a turnover frequency of 300 to 500 cycles as well as above 1000 to 2000 cycles the response is flat (constant amplitude), but the middle portion has a constant-velocity slope of 6 db. per octave. Such a curve can be obtained with the circuit of Fig. 5-C. R may be determined from the formula above, using the lower turnover frequency for f_c, while C will be in proportion to the capacity of the crystal element as the lower frequency divided by the higher. Equalizers for the "Orthacoustic" system may also be devised in this way.

In Fig. 5-D the output transformer is eliminated and a coupling choke used, correct matching and equalization being secured by a simple series

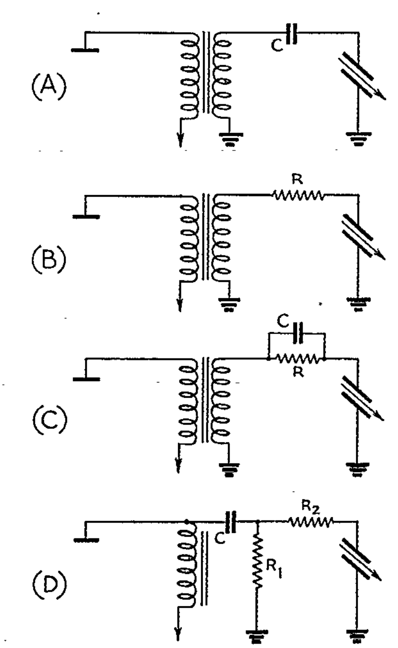


Fig. 5 — **Coupling circuits for crystal cutting heads. See discussion in text.**
(A) C — 0.01–0.05 μfd.
(B) R — 10,000–50,000 ohms.
(C) C — 0.001–0.05 μfd.
R — 10,000–50,000 ohms.
(D) C — 0.1–0.5 μfd.
R_1 — 50,000–150,000 ohms.
R_2 — 1 megohm.

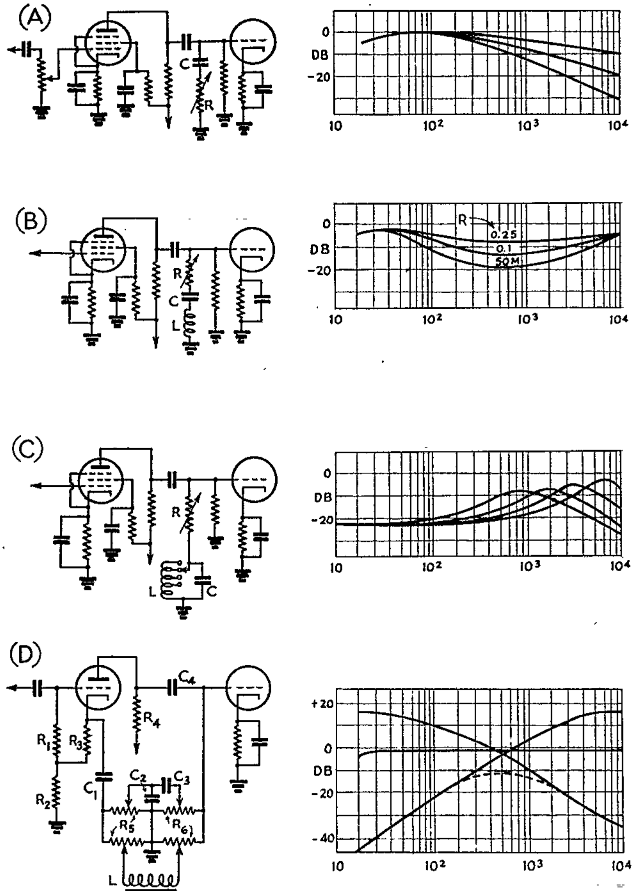


Fig. 6 — **Frequency-response compensating circuits for amplifiers. For unlabelled values see standard resistance-coupled amplifier tables (pp. 280–281, 1942 *Handbook*), selecting constants suitable for specific application.**

(A) Resistance-coupled pentode amplifier with shunt capacitance control.

R — 0.5-megohm variable.
C — 0.005 μfd.

(B) Pentode amplifier with series resonant circuit.

R — 0.5-megohm variable.
C — 0.01 μfd.
L — 2.5 henries.

(C) Pentode amplifier with parallel resonant circuit.

R — 0.5 megohm.
R_1 — 1 megohm.
C — 0.01 μfd.
L — 2.5 henries.

(D) "Dual Tone Control" with degenerative amplifier.

R_1 — 0.25 megohm.
R_2 — 20,000 ohms.
R_3 — 1000 ohms.
R_4 — 20,000 ohms.
R_5, R_6 — Special dual potentiometers (Thordarson R-1068).
C_1 — 10 μfd. 200 v.
C_2 — 0.01 μfd.
C_3 — 0.04 μfd.
C_4 — 0.1 μfd.
L — Tone control choke (Thordarson T-14C70).

network. In this case the plate resistance of the output tube and the series resistance R_2 together form the series resistance R; R_2 is determined by computing R from the formula above and subtracting the tube resistance. The coupling condenser C should have a value about three times that of the crystal capacity. This circuit is satisfactory only for use with triodes, unless negative feedback is employed.

Amplifier Compensation

As was pointed out, equalization in the amplifier itself is used to adjust the overall response of the system to match the desired characteristic. The equalizer circuits used therefore should preferably be continuously adjustable over a wide range of frequency and attenuation. In practice these circuits closely resemble the orthodox treatment applied to speech amplifier and sound systems.

From the many possible arrangements four typical combinations have been selected and are shown in Fig. 6. The most elementary is the typical "tone control" circuit of Fig. 6-A. A shunt capacity C in series with a variable resistance reduces the effective load impedance of the pentode amplifier tube with increasing frequency, thereby progressively attenuating the higher frequencies and giving an apparent boost to the lower frequencies. Changing the value of the series resistance alters the degree of attenuation.

For the converse condition, where the bass is to be attenuated and the treble boosted, the condenser C may be placed in series with the coupling condenser and the grid of the following tube. Connecting the variable resistance in parallel across the condenser again gives control of the degree of attenuation. Where only a gradual slope with control over a wide frequency range is required, these non-resonant circuits are quite satisfactory.

Where the middle frequencies are to be attenuated, however, particularly when there are fairly sharp peaks to be eliminated, the series-resonant circuit of Fig. 6-B is used. Again the degree of

(*Continued on page 118*)

HINTS AND KINKS FOR THE EXPERIMENTER

A.C.-D.C. TRANSMITTER-RECEIVER FOR TWO AND ONE-HALF

Fig. 1 shows the circuit diagram of a trans-receiver which has worked very well on the 2½-meter band. It was built around the "Tiny Knight" b.c. receiver whose case measures only 5¼ by 5¼ x 7½ inches. During the period between last July and the shut-down in November, I had over 300 QSO's while located in Baltimore. Being of very small dimensions, it is semi-portable, too. Although the high-*L* circuit seems to follow uncommon practice these days, the unit seemed to work very satisfactorily.

If a higher *C* tank circuit for transmitting is desired, capacity may be connected across L_2 with, of course, an appropriate reduction in the size of L_2.

— *Allen A. Burk, W3JPX.*

AMPLIFIER BLOCKING BIAS FROM THE OSCILLATOR POWER SUPPLY

Fig. 2 shows a simple circuit which will provide blocking bias for the power amplifier stage or stages without an extra supply for the bias, when a separate power pack is used for the oscillator plate. The main requirement for this circuit is an oscillator power supply which does *not* have a grounded negative.

Analysis of the circuit diagram will show that when the key is up the only ground connection to the oscillator power supply is through R_1 from the positive side. Thus, with the key up, there is no current flowing in R_1 and the plus side of the supply is at ground potential. By connecting the grid return of any following amplifier stage directly to the negative side of the power supply, the full voltage blocks the grid when the key is

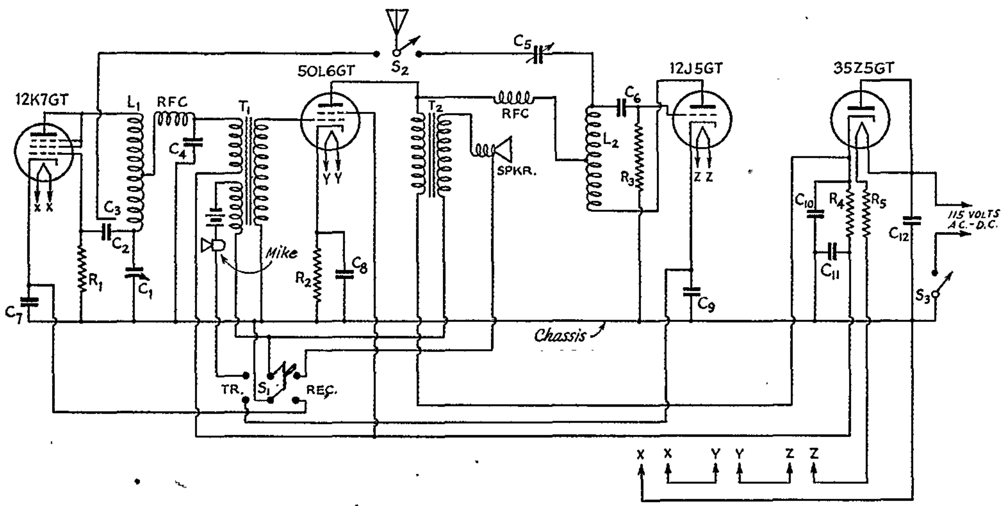


Fig. 1 — Circuit diagram of the a.c.-d.c. 2½-meter transmitter-receiver.

C_1 — 2-plate variable condenser.
C_2 — 40-μμfd. mica.
C_3 — Brass plate about ¾-inch in diameter spaced close to C_2.
C_4 — 0.01 μfd.
C_5 — 3- to 30-μμfd. trimmer condenser.
C_6 — 100-μμfd. mica.
C_7 — 0.001-μfd. mica.
C_8 — 25-μfd., 25-volt electrolytic.
C_9 — 0.001-μfd. mica.
C_{10} — 25-μfd., 150-volt electrolytic.
C_{11} — 10-μfd., 150-volt electrolytic
C_{12} — 0.01 μfd.
R_1 — 3.5 megohms.
R_2 — 250 ohms.
R_3 — 1000 ohms.
R_4 — 1500 ohms.
R_5 — 80 ohms.
RFC — 30 turns, ¼-inch diameter.
S_1 — Yaxley d.p.d.t. switch.
S_2 — S.p.d.t. switch.
S_3 — S.p.s.t. switch.
T_1 — Old audio transformer with 200 turns for microphone winding.
T_2 — Plate coupling transformer mounted on speaker.

up and, when the key is down, the amplifier grid return is grounded. One of the advantages of this arrangement is that it does not require placing the negative side of the amplifier high-voltage supply above ground potential. Grid-leak and cathode-bias resistors, if cathode bias is used for the amplifier, should be values which are normally used without external bias. However, if keyer tubes are used in place of the key, the voltage drop across them will appear as bias on the amplifier grid and should be considered when selecting grid-leak and bias-resistor values.

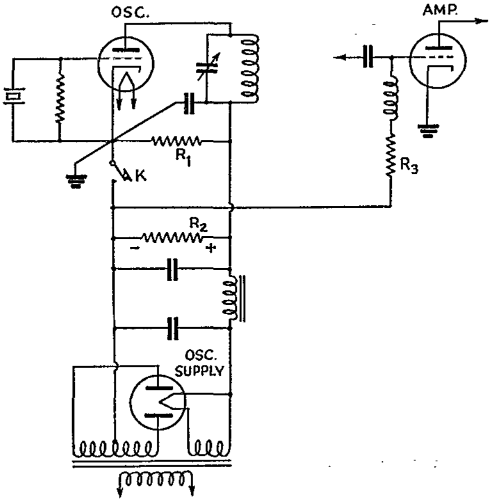


Fig. 2 — Circuit for obtaining cut-off bias for amplifier stages from oscillator plate supply. The only additional component required is the resistance, R_1.

R_1 may be any reasonable value which does not add too much load to the power supply. In oscillators using screen-grid or pentode tubes the screen voltage divider resistor can be used in place of R_1. R_2 is a high-resistance bleeder provided only for discharging the filter condensers when the key is open. — *William S. Grenfell, W7GE.*

—•••—

RE CODE PRACTICE FROM WWV

Some of those who have tried the suggestion made in a recent issue of *QST* regarding the use of the continuous signal from WWV for code practice have not been altogether successful because the capacity of the key in series with the antenna provides sufficient coupling to the receiver so that there is not a pronounced difference in signal strength when the key is closed.

As a remedy, W8BWK and W8SDU have suggested that the key be placed in series with the headphones or, alternatively, in series with the voice coil of the loudspeaker. A bypass condenser may be used across the key terminals to minimize clicks.

—•••—

MAKING IMPROVISED RESISTOR ALTERATIONS

Since it often happens that servicemen do not always have the exact value of resistor for replacement on hand during these times of parts shortage, the writer offers these few simple suggestions for altering carbon resistors which have given satisfactory results in numerous sets repaired at his shop.

If a carbon resistor lacks a few hundred ohms of a desired value, it can easily be increased in resistance by filing a little of the carbon off one or both sides between the two leads as shown by the dotted lines in Fig. 3-A. However, it must be remembered that this operation causes a decrease in the current-carrying capacity of the unit. The unit may be cleaned and relacquered, if desired, for protection against moisture absorption. This method is useful in obtaining exact resistance values from stock resistor units for volt-ohmmeters and other instruments.

A resistor of 1500 or 2000 ohms can thus be increased to 2500 ohms or more as tested on a direct-reading ohmmeter. Other values can be figured making resistor replacements a small problem. However, with resistors having an outside insulating jacket this idea is not practical.

Another suggestion for dividing voltage in low-voltage circuits for screen-grid tubes is to center tap a 2-watt type carbon resistor as shown in the accompanying sketch of Fig. 3-B. Here a small metal strap is made to fit tightly around the center of the unit with a dent in the center to make contact with the carbon unit. Test should, of course, be made with an ohmmeter between the center tap and each lead in order to ascertain correct resistance between terminals. — *James R. Limbeck, Glendale, Calif.* (From *The C-D Capacitor.*)

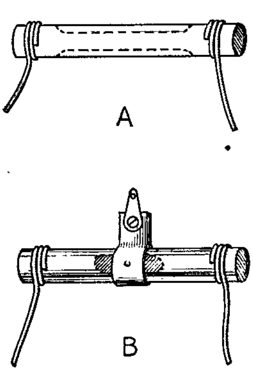


Fig. 3 — Certain types of carbon resistor may be accurately adjusted to the desired value by filing away a portion to increase the resistance, as shown in A, or centertapping as shown in B.

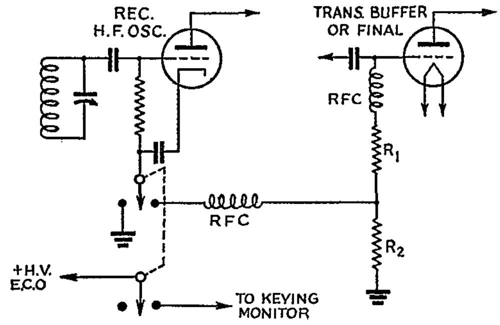


Fig. 4 — Circuit diagram of W8OKC's revision of W8NCJ's break-in system.
C_1 — 250-$\mu\mu$fd. mica.
R_1 — 1500 ohms, 10-watt.
R_2 — 1000 ohms, 10-watt.
R_3 — 50,000 ohms, in receiver.
S_1 — D.p.d.t. toggle switch.

RE AUTOMATIC RECEIVER BLOCKING FOR BREAK-IN OPERATION

A variation of W8NCJ's system for keying and break-in monitoring [1] may possibly be of interest to some operators who are using or contemplate using this system. The difference, as shown in Fig. 4, lies in the manner in which cut-off voltage is applied to the oscillator in the receiver. It will be recalled that the r.f. choke at the grid of the oscillator connects to the bias supply. In some cases this will result in a slight change in receiver calibration because the choke is not equally effective at all frequencies, especially if the receiver covers the entire short-wave spectrum. To avoid this effect, the bias voltage is introduced at the ground end of the oscillator grid leak which is at zero potential for both r.f. and d.c. voltages.

To do this the grid leak is unsoldered from ground and a lead attached which is run to a voltage divider tap in the grid circuit of a buffer stage capable of developing enough bias voltage to cut off the receiver completely. If the grid leak is connected across the grid condenser, it can be changed over without affecting the performance. C_1 serves to keep the ground side of R_3 at zero r.f. potential. An r.f. choke in the lead connecting receiver and transmitter may be found necessary in some cases if r.f. pickup is encountered. S_1 is used to check frequency or work 'phone.

In my case, 22 volts is required to disable the oscillator, although as high as 40 volts is developed, depending on the amount of excitation available at the grid of the TZ40. Also, the cut-off bias or value of voltage required to stop the oscillator varies slightly over different bands. The tube happens to be a 6J5G used in the SX16 receiver. To avoid placing a bias resistor in the filament center tap of a high-μ tube, the keying monitor voltage is obtained by keying in parallel with the e.c.o. of the transmitter.

— *W. B. Thompson, W8OKC.*

[1] *QST*, July, 1941, page 41.

A 4-ELEMENT CONTINUOUSLY-ROTATABLE ANTENNA FOR 112 MC.

In the many articles describing u.h.f. rotatable antennas I have been unable to find a design which permits continuous 360-degree rotation without feeder complications, except in the field of the more-expensive units. For this reason, I think perhaps the u.h.f. gang would be interested in a description of an antenna structure which I have just finished. The construction, details of which are shown in Figs. 5 and 6, is simple; the parts, with the possible exception of the elements, are either readily available or easily made without special tools, and the assembly, when finished, is very strong and stable mechanically.

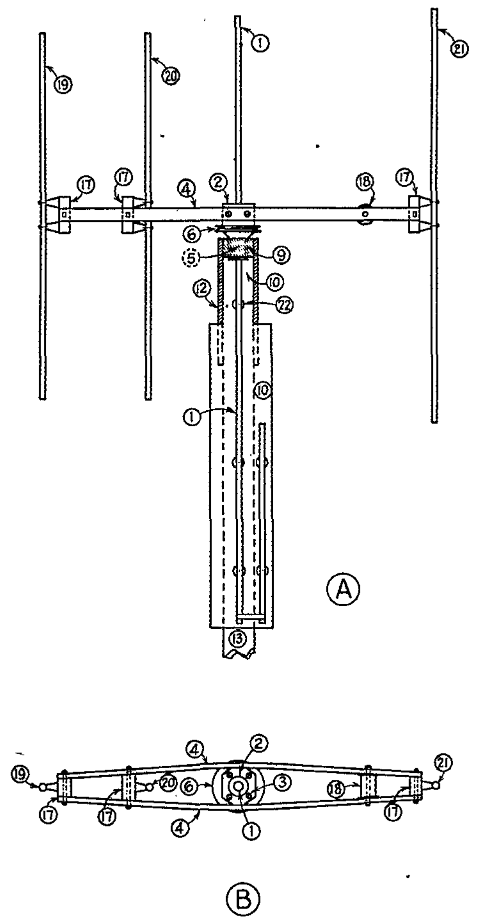


Fig. 5 — Sketch showing side and top views of W1GAG's 112-Mc. four-element continuously-rotatable antenna. The numbered details are identified in the text.

The general arrangement is shown in the sketches of Figs. 5-A and 5-B. My mast happens to be topped off with a section of single 2 × 4. Dimensions may be altered to fit a top section of other dimensions, or a short top section of the same dimensions may be added to any existing mast. The two 45-inch director elements (19) and (20), and the single 51-inch reflector element (21) of ½-inch copper tubing are supported on stand-off insulators fastened to spacing blocks (17) between two 1 × 2 cross arms (4) approximately four feet long. The additional spacing block (18) is weighted to compensate for the extra element weight on the opposite side of the cross arms.

At the center of the cross arms is a 2 × 4 block (2) to which the cross arms are attached. This is shown more clearly in the detail sketches of Fig. 6. A large clearance hole for the antenna element, about one inch in diameter, is bored in the center of the block. Long bolts (3) pass through this central block, through the five-inch V driving pulley (6) and also through (7), which is an inverted banister flange of the sort often used for mounting pipe fencework. This flange bears inside threads which will take a short section of standard one-inch pipe (5). This completes the rotating assembly.

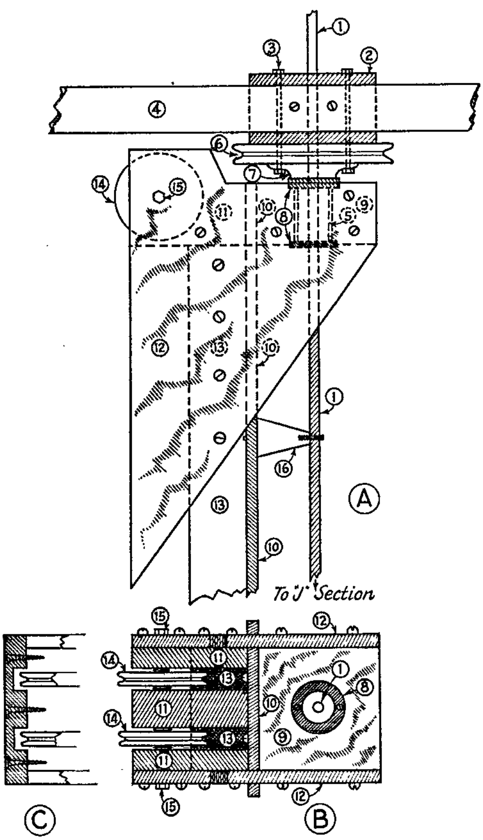


Fig. 6 — Detailed sketches of the rotating head of W1GAG's 112-Mc. directional antenna. A and B are side and top views, respectively. Similar numbers identify similar parts in Fig. 5.

On each of the narrow sides of the 2 × 4 top section of the mast (13) is fastened a triangular-shaped bracket (12) made from ½-inch plywood. Between these brackets is fastened a 2 × 4 block (9) through which is bored a hole slightly larger than the outside diameter of the pipe section (5). Centered over this hole, on each side of the block, are large iron washers (8) with an inside diameter which will provide the pipe section (5) with a loose bearing fit. These washers are fastened in place with countersunk flat-head screws.

At the upper rear corners of the triangular brackets (12) a shaft (15) is placed to carry two guide pulleys (14). The shaft may consist of a carriage bolt or long spike, while the two pulleys are 3 inches in diameter and are known as "screw" pulleys from which the screw mountings have been removed. The pulleys are kept in proper position by spacing blocks (11). The outer blocks are fastened to the inside surfaces of the triangular brackets, while the central one is fastened with long screws directly to the top of the mast. Washers on each side of each pulley keep the pulleys from binding against the spacing blocks.

A "J"-type antenna matching system (1) is used. This consists of a 49-inch antenna and a "J" section approximately 25 inches long. Thus, the longer tubing has a total length of about 74 inches, while the length of the shorter tubing is about 25 inches. The sections of tubing are mounted, by means of stand-off insulators (16) on a board of plywood (10) fastened to the front of the mast (13). The top end of the plywood board is cut down to fit between the two triangular-shaped brackets. This top end also goes between the pulley spacing blocks (11) and the bearing block (9). The antenna element goes up through the clearance hole through the rotating head assembly, its last point of support being the top stand-off insulator (22). The feeder line is tapped on at a suitable point along the "J" section.

The control rope, which rotates the antenna, passes around the driving pulley (6) and over the guide pulleys (14) to the control point. If desired, a cover, as shown in Fig. 6-C, may be fitted over the backs of the guide pulleys to prevent the rope jumping. — *Carroll O. Peacor, W1GAG.*

HOW TO MAKE ELECTROSTATIC SHIELDS

Although two circuits may be coupled ostensibly by some inductive means, most undesired responses to signals of frequencies higher than the operating frequency are brought in

(*Continued on page 106*)

CORRESPONDENCE FROM MEMBERS

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

W.P.B. ASKS YOUR HELP

War Production Board, Washington, D. C.
Editor, *QST:*

We have recently received from a licensed amateur radio operator of 12 years' experience, information to the effect that almost every amateur operator has an accumulation of obsolete, surplus and damaged metal — especially copper wire — which he is not currently using.

We understand that there are some 60,000 such operators, and our informant has estimated that each one has on hand approximately one pound of such material. With the amateur operator "off the air" for the duration he, furthermore, suggests that many transmitting antenna systems might be voluntarily dismantled in order to provide an additional few pounds of copper yield per amateur station. He, himself, states that he has available about six pounds of copper for contribution to the national war effort.

You are doubtless aware of the fact that there is a critical scarcity of No. 1 and No. 2 copper wire scrap as well as of other materials which these radio operators are likely to have on hand.

It would be an important supplement to the national salvage effort were you then, in your publication, to call to the attention of your readers the fact that, while each one's accumulation of these scarce metals may not be large, the sum total of all their accumulations would be an important factor in relieving the present situation.

Might we urge that you suggest to your readers that they donate their scrap metals, however small in amount, to a local charity which collects waste materials, or sell them (if they have enough to make it worth while) to a waste material dealer. We have salvage committees in some 12,000 communities, and should any operator desiring to dispose of his material have any difficulty in having it collected, he can get in touch with his local salvage committee.

— *E. H. Marks, General Salvage Section, Conservation Division*

MORE HAMS IN THE SIGNAL CORPS

7 S. Kensington Ave., La Grange, Ill.
Editor, *QST:*

Just finished "The Story of the Signal Corps" in the July issue. Seems as though the author slipped on one large group of the gang in the Signal Corps.

Most of us are civilian employees under civil service but still very definitely a part of the S.C. — the inspection group. You will find us in the various factories where the xmtrs, rcvrs and all the parts for same are being made. Our job is to check over the equipment before it goes on to the depots — and see that everything is "according to spec."

I wouldn't say that all of the S.C. inspectors are hams, but a great percentage certainly are. Some are ex-radio servicemen, some are ex-commercial ops, and some are former company inspectors. Because of regulations we can't tell you what we are doing (specifically), what plants we are in, how long we are going to be there — in fact if we say anything, it will probably be too much.

Anyway, at the blankety blank plant, inspecting some blankety blank Signal Corps equipment, somewhere in the Chicago area (that's a sufficiently large area to be "indefinite" — I hope) you will find Vernon Wright, jr., W9DST, and yours truly.

— *Chas. J. Bolvin, W8LVV, ex-W7GMA*

Editor's Note. — The story in question was prepared in the Signal Corps offices at Washington, so any omissions must be laid at official doors. Of course we are delighted to know of this additional phase of the war activity where hams are playing conspicuous rôles.

COURSE

4627 Briarclift Rd., Baltimore, Md.
Editor, *QST:*

Geo. Grammer's "Course in Radio Fundamentals" is the best thing you ever did — and that's saying something. . . .

— *Whitney S. Gardner, W3IBX*

1588 Second Ave., New York, N.Y.
Editor, *QST:*

I appreciate very much your sending me the June issue of *QST*. The reason for my wanting that copy was because of the first installment of "A Course in Radio Fundamentals" by George Grammer.

Some how or other I missed purchasing that copy from my newsstand and was irritated upon receiving the July issue that I had missed the first part of the course.

A friend of mine who is chairman of the electrical department in a New York City high school, an engineer, commented very favorably upon the course. . . .

— *Charles Hafner*

Box 111, Larimer, Penna.

Editor, *QST:*

I have been following George Grammer's "Course in Radio Fundamentals" in *QST* and I think it is excellent in all respects. I have a suggestion. . . . I would like to see the lessons as they are given in *QST*, when they are completed, bound in a single volume, so the amateur could use it as a study guide. . . .

— *E. Robert Dirling, W8WMQ*

Editor's Note. — How does the gang as a whole feel about producing George Grammer's course in book form? If there is enough interest, we'll do it. How about it?

MORE APPRECIATION

Portales, N. M.

Editor, *QST:*

Last night marked the first night of the Portales radio theory and code school, supervised by W5HJF and assisted by myself. Jake is teaching theory and other technical matters, while I am teaching the code. We use Bill Chamberland's method of sound teaching and the ARRL *Handbook* as a basic guide for the theory. Our students are taking it up and catching on wonderfully, and it is extremely gratifying to see their interest and know that we are really helping them.

What I am writing you for is to thank you! The League and its publications have practically taught us everything we know. It has given us the training that enables a two-man radio club to teach a good-sized class of people who know nothing about radio. Jake often says that the League is responsible for his being on the air, and I know it is for me. Next September I will reach my 17th birthday, at which time I will enter the Navy as a radioman and Jake will have to carry on alone. But he has the training to do it, thanks to the League. . . .

— *Jack Black, W5JWA*

Miller, Mo.

Editor, *QST:*

Although I am writing to you for another reason, I would not miss the opportunity to commend you and the gang at Headquarters for the splendid job you are doing in presenting the amateur "goings on" to the ham through *QST*. Even though activity is nil, *QST* comes to us each month packed full of valuable dope, interesting to old timers and beginners alike. Keep the good work going. . . .

— *Wan S. Hope, W9PAA*

ARMY SCHOOLING IS TOPS

Fort Monmouth, N. J.

Editor, *QST:*

I noticed in *QST* where you were interested in knowing of all hams in service. I volunteered for the Army March 3, 1942, at Dallas, Tex., was assigned to the Signal Corps and received my basic training at the new camp in Missouri. Then I was sent to Fort Monmouth to take the radio repairman's course. However, after completing about half the course I was transferred to the maintenance division of the Aircraft Warning School, where I am at the present time.

I am thoroughly pleased with Army life and think that the schooling received here is just about tops. After the war I'm going to enjoy ham radio much more for having taken this course.

Congratulations on keeping *QST* just as good as ever in spite of present conditions.

— *Pvt. Chester McKinney, W5JEP*

THE NAVY AND THE HAM

c/o Postmaster, New York City

Editor, *QST:*

Here's a little dope on Navy radio and the radio ham. From what I've seen the Navy is better than the Army when it comes to placing men, but it still isn't perfect.

As it is, the Navy doesn't waste radiomen on unrelated duties. If a ham enlists in the Navy he can be sure he will at least do some operating. The only catch is that the Navy sometimes tries to make a radio technician into a radio operator and vice versa. I know of one case where a ham had a very good technical background and not so much practical operating experience. He was stationed on a tugboat for a number of months. Probably the Navy finally realized his worth, for I see in *QST* that he is now in the Naval Radio Laboratory at Anacostia, D. C. Why couldn't he have gone to the Lab. in the first place?

On the other hand, there are radiomen who know all the answers when it comes to operating. Most of them can't get theory and don't want to, yet they are stationed in radio labs where all they do, probably, is solder joints that some one else has made.

There is talk of making two separate ratings in the Navy: radio operator and radio technician. This should have been done long ago. There have been so many changes in radio in the last five years that it is not possible for a man to be a good operator and technician at the same time. It takes years to train either, and I doubt if a man can be both. There are some radiomen, especially hams, who can hold down both jobs, but it will always be found that with equal training they will do much better in one than the other. This has been true in ham radio and is true in the services.

To those fellows in the Army who do KP duty instead of pounding brass or ironing the bugs out of a new transmitter, all I can say is, "You shoulda joined the Navy." At least you would get radio work.

— ——— ———, W1—*

SO MUCH TO WORK FOR

108 S. Gay St., Auburn, Ala.

Editor, *QST:*

You know, I have just begun to realize what ham radio and the ARRL mean to me. While we were on the air and everything was smooth sailing, I kept putting off joining the League. Just another case of procrastination.

Then, after the fateful December 7th, I began to feel more and more keenly the loss of the usual QSOs, the Sunday evening roundtables, the busy traffic nets and all the other pleasant pasttimes associated with ham radio.

Recently I began to read *QST* in a different light. Here, it seemed, was not only just a good magazine from which to get the latest technical dope, but a medium through which to keep up the old contacts with the gang. Especially after the re-introduction of the Experimenter's Section, the old enthusiasm seemed to return; and now I find I can resist it no longer. So — I'm throwing my hat into the ring along with those of the many loyal hams in ARRL. I hereby pledge myself to work with all my energy to bring about a bigger and better ham radio after the present turmoil is over.

With so much to work for, how can we fail?

— Richard H. Houston, W4GPW

HOLDING UP THEIR END

Somewhere in Africa

Editor, *QST:*

Just to let you know that we are holding up our end on this deep, dark continent. The ham fraternity is proving itself, as it has proved itself so often in the past, capable of really "putting out" when the need arises. . . .

I was in French New Caledonia, in the South Seas, when order No. 87 was issued, and during December and January passed through ZL, VK, PK, VS7, VU, RV, ST, ON, PY, VP2 and finally W4 and W1 land. Please excuse the old prefixes but we have only a 1932 *Handbook* here! Wasn't long enough in any of these places to look up any hams, much to my regret. . . .

W6OZA and W2GQM are also hereabouts. We get *QST* here and pass 'em along, so keep 'em coming.

— E. R. Leach, W6OLL

* Name deleted by request.

SILVER ANNIVERSARY

c/o WARM, Scranton, Pa.

Editor, *QST:*

Silver Anniversary greetings to you! . . . At the tender age of 16 I first dug very deep into the old sock for a buck to become affiliated with good old ARRL by subscribing to *QST*. Each year since I have performed a similar deed to insure an uninterrupted supply of fresh *QST*s. . . .

During three decades of playing around with wireless, starting with a Branley Coherer and E. I. Co.'s 10-cent detector, and for the past twenty years as a ham and in the professional end of the game, I have found *QST* a most valuable piece of equipment. I have also received much enjoyment from the articles in the lighter vein and I certainly miss the late Old Man whose stories helped keep many of us Young Squirts in line. Many times I have searched through *QST* and found the right dope on some new or old gadget, circuit or fundamental theory which I was unable to locate elsewhere, and I find that my stack of *QST*s make one of my most valuable reference files. . . .

It's a great game, with something new going on all the time and the future looking better than ever. Boys and young men who want to get into this game have all of the opportunities in the world, with Uncle Sam furnishing some of the best training and experience that can be had. My advice to all young squirts is to join up now. . . .

73, gang, and I'll write again in 1967 or maybe sooner. *— A. W. Oschmann, W8BKY*

(Continued on page 84)

OPERATING NEWS

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

FCC Resident Examinations. Good news for radio aides and others training personnel for WERS is the announcement by FCC that it will permit resident examinations for the third-class radiotelephone operator permit, under qualified local supervision. At any time after submission of an application for station license the municipality may 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). Application blanks and fingerprint cards will then be forthcoming; after execution and return of these, the supervisor will be sent the proper number of envelopes containing examination Element I. The papers themselves are returned to the FCC district office for grading, of course. This procedure will save a good deal of mileage and time normally consumed by license applicants in mass trips to the district office.

Schooling of personnel to meet the requirements of this examination is simple, and the FCC "license" issued will serve as technical qualification for a WERS operator permit. Four periods of two hours each should be adequate to instruct prospective operators concerning the commercial regulations with which they must be conversant. A preliminary period can be well spent in covering the general background of radio, the need for regulation, licensing, frequency assignments, specified operating procedure, and the like. From here study can be based on the booklet, "Study Guide and Reference Material for Commercial Radio Operator Examinations," available from the Superintendent of Documents in Washington at a price of 15 cents, no stamps.

EC Appointments Not Suspended. With the cessation of normal amateur activity, the Communications Manager ordered that all appointments except those in the Emergency Corps be suspended for the duration. Some of our field staff have erroneously believed this covered ECs as well. It does not. We know that our Emergency Corps will be the nucleus in many areas for local organizations of the War Emergency Radio Service, and it is therefore particularly important that the administrative leaders of this group — the Coördinators — be a highly active group. Appointments are for one year, and must receive annual endorsement of the SCM to continue in effect.

General. With a recent bulletin to ECs there was included a report form concerning use of the WERS. In assembling information on units throughout the country it is important that we have *yours*, if you have not already sent it in. . . . Because *QST* has discontinued sectional editions there are now but four to five pages of activities reports available each issue — far less than under the old arrangement. Let this not be discouragement to those who faithfully sent monthly news data to SCMs, but please bear with us if occasionally we must cut out some of the material to fit space requirements. . . . The First Fighter Command recently ordered that all emergency services in its area restrict transmissions to 30-second bursts with 2-minute silence periods intervening. As it is worded, this ruling unfortunately and inadvertently applies to WERS, but action is now being taken to remove WERS from its provisions. —*J. H.*

St. Paul Radio Club Code Classes

The same characteristic that delayed the American people in their intensive war preparation, inertia, also slowed up the beginning of code instruction in St. Paul, Minnesota. It wasn't until the April meeting of the St. Paul Radio Club, one of those meetings of hams at which everyone sits and suggests that "something ought to be done," that the full realization of the responsibility of hams at home to get under way with code instruction struck with full force. When it did, the St. Paul Club reacted in its usual "all-out offensive."

Today the St. Paul Radio Club is conducting code classes nine times each week. These sessions, operating on a graduated progressive system, are furnishing approximately 325 Twin City residents with a source of code instruction and practice. In addition, the club has a fifteen-minute radio program on the leading broadcast station of the area once each week, teaching code over the air in a serial story.

At present, two beginners' classes held at the studios of KSTP in each city — St. Paul and Minneapolis — serve as feeders for seven other intermediate and advanced groups meeting at the St. Paul YMCA, the Minneapolis YMCA and at the code table of the 1st Observation Squadron, Minnesota Defense Force. Under a regular promoting system the students are advanced from class to class as their skill warrants. Starting with an elementary introduction to code as a new manner of transmitting intelligence, the various instructors — all members of the St. Paul Radio Club — patiently teach the sound of the letters of the alphabet and follow on with extensive exercises in five-letter code groups. No plain language is transmitted for practice, all lessons being made up from a cryptographic cross-word sheet laid out by the Committee which provides for easy sending of five-letter groups containing any particular letters of the alphabet.

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 war radio training are eligible for the Honor Roll. Those groups listed with an asterisk teach both code and theory. Others conduct only code classes.

***Albany (N. Y.) Amateur Radio Assn.**
***American Women's Voluntary Services, Brooklyn (N. Y.) Unit**
Associated Amateur Radio Operators of Denver, Colo.
Baltimore (Md.) Amateur Radio Assn.
The Bell Radio Amateurs, Denver, Colo.
***Canton (Ohio) Amateur Radio Club**
Central New York Radio Club, Syracuse, N. Y.
Central Oregon Radio Klub, Bend, Ore.
Chicago (Ill.) Radio Traffic Assn.
***Columbus (Ohio) Amateur Radio Assn.**
***Cuyahoga Radio Assn., Cleveland, Ohio**
Dallas (Tex.) Amateur Radio Club
***Dutchess County Sheriff's Emergency Radio Corps, Poughkeepsie, N. Y.**
***Electric City Radio Club, Great Falls, Mont.**
The Electron Club, Denver, Colo.
Florida State Defense Council Message Center, Tampa, Fla.
Freehold (N. J.) Amateur Radio Club
Genesee County Radio Club, Flint, Mich.
Grand Coulee Dam R. C., Coulee Dam, Wash.
***Heart of America Radio Club, Kansas City, Mo.**
***Iowa-Illinois Amateur R. C., Burlington, Ia.**
***Joliet (Ill.) Amateur Radio Society**
The Married Men's Club, Denver, Colo.
***Mass. Committee on Public Safety, Boston, Mass.**
***Muskegon Area (Mich.) Amateur Radio Council**
Northern Minn. A. R. A., Unit One, Bemidji, Minn.
Purdue Univ. Radio Club, W. Lafayette, Ind.
Shy-Wy Radio Club, Cheyenne Wyo.
***Springfield (Mass.) Radio Assn.**
Tucson (Ariz.) Short Wave Assn.

Along with the code classes there is the radio program previously mentioned. Although this was the first of the committee's undertakings, it has been eclipsed by the magnitude of the code classes. Nevertheless, it is worthy of some consideration. For fifteen minutes each Sunday morning the St. Paul Radio Club takes the air for the presentation of a dramatic sketch, wherein a family of three undergoes the throes of learning the code. With the usual tribulations of the "soap opera" type of radio drama, the program has followed the members of a mythical "Strong Family" while they all learn the code. The mail response has been gratifying and several educators have endorsed the program. With the broadcasting of ten lessons in the series, which has taken the family through the whole alphabet in a leisurely fashion, the Committee has decided to withdraw the program * in order to put more emphasis on the various classes, where it more rightfully belongs.

Here, then, is the story of how one group of amateurs, their ranks severely depleted by the services and other phases of the national war effort, has met the challenge to do something worth while during the period they are off the air. It is the hope of every member of the St. Paul Radio Club that this account of their efforts may assist in urging others to emulate their activities and surpass their results. — *The St. Paul Radio Club Code Instruction Committee.*

BRIEFS

A fine article entitled "Conquer the Code with Rhythm" was reprinted in the July, 1942, issue of *Relay*, a publication of RCA Communications. The article was written by Ray Hutchins, the magazine's editor, and approaches the learning of the code by the "baud" system. There are a few copies of the article available for those who request them. Address requests to Ray Hutchins, Editor of *Relay*, 66 Broad St., New York.

* Transcriptions of this series (ten 15-minute broadcasts) suitable for presentation over any broadcast station are available from the St. Paul Radio Club. Address inquiries to J. L. Hill, 1138 Fauquier Ave., St. Paul, Minn.

ARTICLE CONTEST

The article by Mr. George Roullard, W1MQD, wins the CD article contest prize this month. *We invite entries for this monthly contest.*

Regarding subject matter, we suggest that you pick a topic of current interest. Amateur radio is a broad field and our ways of contributing to the war effort need discussion and emphasis. Perhaps you would like to write on Radio Training programs, club methods boosting code proficiency, Emergency Corps registering for CDC selections, organizing or running a radio club, getting local groups QSO by light beam or wired wireless or ground currents now radio is out!

Each month we will print the most interesting and valuable article received. Please mark your contribution "For the CD contest." Prize winners may select a bound *Handbook* (Radio Training Course or regular edition), *QST* Binder and League Emblem, or any other combination of ARRL supplies of equivalent value. Try your luck!

Between the Covers of QST

BY GEORGE ROULLARD, W1MQD*

I WONDER how many of you fellows really read your *QST* as it comes to you each month. I can hear a snort from here to Denver as you scratch your heads and wonder if I'm fit for the laffing academy. Well, I believe that there are those of you who don't get the full value of this publication, because you look at it, *not* read it. There's a great difference, you know.

* 219 Madison Ave., Skowhegan, Maine.

Each month, as soon as my *QST* arrives, I turn directly to the editorials at the front. There is something about this section that makes you stop and think. Each month you'll find witty philosophy or worthwhile, serious thoughts. Give this page serious, careful consideration.

As you go through the pages and come to the article on the construction of the thing-a-ma-jig that you never heard of before, don't blink and go on; take ten minutes off and read it through. You'll find that the writer explains the theory and construction down to the simplest detail. Chances are you'll find that the ten minutes was well worth the time and effort, and that you've learned something. Don't miss the amusing strays and cartoons either. You'll find that Gil's creations are often closely connected with some amusing moment of your own.

I think that most of you will agree with me that one of the most entertaining features of *QST* is the section devoted to members' correspondence. In it you'll find just about everything — humor, wit, ribbing, verbal wars and downright common sense. There's nothing like a bunch of conflicting letters to get something started. Perhaps you will find a letter which sharply ruffles the hair on the back of your neck. Well, go ahead and send one in and tell that mental black-out so. It may cost you your dignity, but I'll guarantee you'll have fun!

Many of you have no doubt found "Operating News" the most interesting section. While it is true that there is little actual on-the-air operating going on these days, this section of *QST* still contains vital and interesting information on club and individual activities. From it can still be derived ideas as to how best to serve your country during the emergency. This section is the most likely to contain something about you yourself, or something that vitally concerns you. In the sectional reports you can find out just what hams in your own locality are doing; such news items are more important now than previously because you do not have personal over-the-air contacts to fall back upon.

Consider the other departments. "USA Calling" may have detailed information on just the opportunity you have been waiting for. "Happenings of the Month" gives you the latest dope on legal and administrative developments. "On the Ultrahighs" tells of the latest preparedness activities of the u.h.f. devotees, along with some fine technical points by a man who knows what he is talking about. "25 Years Ago" tells of ham radio back when we were passing through a similar crisis. "Hints and Kinks" may contain an idea that is just what you have been looking for.

There you are, fellows. *QST* is your magazine. It contains things of interest to every radio-minded person. Between its covers you'll find a swiftly-moving, colorful pageant of ham life and accomplishments. So switch off the b.f.o., tune in the soft strains of your favorite orchestra, settle back in that easy chair and spend an evening with *QST*.

BRIEFS

Many complaints have been received at Headquarters from Navy Day letter winners who have not as yet received their letters. An inquiry at the Navy Department brought the information that all letters have now been sent with the exception of a few whose recipients are in the services. These will be delayed because they cannot be sent directly.

We receive a lot of letters from persons who wish to learn radio and code but don't know whom to contact. We fill these requests by giving them the names of individuals and clubs who are known to us to be conducting code and/or theory classes, but there are many such classes we do *not* know about. To facilitate the dispensing of this sort of information, the ARRL Communications Department has set up a new card file with information on every code or theory class known to us. We solicit more information to add to these files. If you are conducting a code or theory class, especially if the class is open to new students, drop us a few lines to let us know about it. It would be appreciated, not only by us, but by all those who want to learn and don't know how to get instruction.

Meet the SCM's

W9YMV

The Hoosier SCM, LeRoy T. Waggoner, W9YMV, was first exposed to amateur radio in 1922 when he met several hams while selling radio parts at F. W. Woolworth's, but marriage temporarily interfered and he actually acquired his first ham ticket in 1936. Shortly thereafter he participated in the communications emergency during the Ohio River Valley flood, and since that time has been active as OPS, OBS and EC of Indiana, organizing a state-wide emergency network just prior to the shut-down. At the present time he is president of the Indianapolis Radio Club, of which he has been an active and enthusiastic member since 1935. His station, located in the dining room, consists of an e.c.o. unit driving an 807 operating on the 1.75-, 3.5- and 7-Mc. bands, both 'phone and c.w., and an ACR155 receiver. Other hobbies include photography, hiking and swimming. Occupation: assistant foreman in the machine shop, Allison Engineering Division of General Motors.

In mid-June the Iowa-Illinois Amateur Radio Club of Burlington, Iowa, ran a notice in the Burlington *Hawkeye-Gazette* of the starting of a free radio class. The response was so great (120 persons responded, 40 of whom were women) that the classroom provision was inadequate and the class had to be moved to the high school. The class has now settled down with an attendance of 75, much more than had been expected. Just another example proving that the best way to obtain students for such classes is to run a notice in your local paper.

An opportunity to be of service in civilian defense presents itself in the Civil Air Patrol. This is a volunteer organization started by the private pilots to preserve aviation during the war, and it is now doing valuable patrol and training work in aviation. Amateurs are greatly desired to assist in training operators as well as to repair apparatus and operate base stations. W8AIZ, communications officer of Michigan Headquarters Wing No. 63, writes us that already several amateurs have been enlisted but more are needed. Requirements are a Class A amateur license for radio mechanic or a radiotelephone restricted permit for radio operators. Get in touch with your local CAP communications officer.

THERE IS, in calculus, a certain type of problem that runs something like this: A hundred people are in a small room with limited ventilation. Given the size of the room, the amount of fresh air admitted per hour, and so on, the problem is to find what the composition of the air will be at the end of three hours. Most of us can guess what the air would be like in there, and are very glad to go no further into the matter. However, if you must calculate it, you start by remembering that "what goes in must come out." Only when this rule is applied to the flow of air does the problem begin to make sense.

It is not our purpose to discuss the calculus here, but we like to think that the rule does have pretty general application. What you get out of a radio set at the end of three hours — or three years — depends on what is put into it. You can put in enough tubes to dress a dealer's window, and what you get will be window dressing. You can put things on the outside of the receiver until it is a gadgeteer's delight, and what you get out will be just that. Or you can burn the midnight oil working on the input circuit, and only you, your wife and the input circuit will know how many hours it was. But the signal coming through can guess, and it will proclaim your craftsmanship to all comers.

We have no brief against making the outside of a receiver handsome in appearance. Quite the opposite. Yet we think it is more important to have the controls fit the hand than to have them please the eye. Streamlining is considered a sovereign remedy for any second rate or over-age design, so much so that "streamlined" has come to mean the same thing as "modern." So we have streamlined hearses, though we cannot think of anything less important than wind resistance at a funeral. Of course, streamlining can be functional without having anything to do with wind resistance. The hen's egg is one of the most perfectly streamlined shapes ever produced, and this must certainly be a great comfort to the hen. But it is the contents of the egg that decides the quality of the omelet.

We hold that appearance, like everything else in a radio receiver, is primarily a matter of good sense, hard work and craftsmanship. We do not know any way to do a good job except the hard way, and we do not think there is any other way. At all events, that is what we put into National Receivers, and you know what you get out of them.

W. A. READY

Correspondence

(*Continued from page 79*)

TOO LATE FOR THE APRIL ISSUE

Weather Bureau Office,
San Juan, Puerto Rico

Editor, *QST:*

In a recent letter to *QST*, Mr. B. L. Toy relates that he heard described in a radio broadcast a radiotelephone transmitter constructed from a piece of quartz, some wire and a battery, and he doubts that a practical circuit using only these materials can be devised. Let me state that such a circuit is not only altogether practical, but that it has actually been built and put into operation by me.

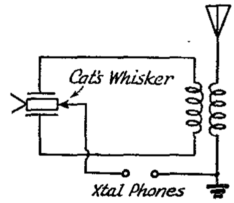


Fig. 1 — Circuit for applying multitudinous modes of vibration to piezoelectric crystal.

While I do not know the exact circuit used by the hero of the play in the radio broadcast, I feel certain that it must be quite similar to mine (see Fig. 1 for circuit diagram). This transmitter was inspired by the *QST* article, "Putting Dynamic Prognostication to Work," which appeared about a year ago. Immediately upon reading this article, I realized that further simplification of Mr. Rapp's admirable circuit was possible. This was done by eliminating the tube stage and the power supply, and using only the crystal stage. Not only was extreme simplicity achieved, but the problem of using the transmitter as a receiver was solved. In the final form, the transmitter developed by the writer uses a single quartz crystal and a few pieces of wire for the transmitter (including frequency control and r.f. power generation) as well as for the microphone, modulator, power supply and receiver.

The operation of the transmitter is very simple. Sound waves from the voice of the operator make the crystal vibrate along its longer axis, in much the same fashion that a crystal mike works. These vibrations in turn excite the crystal mechanically along the shorter axis, and by means of the piezoelectric effect these mechanical vibrations generate r.f. current at the resonant frequency of the crystal.[1] The amplitude of the r.f. output is of course governed both by the ampli-

[1] The theoretical ramifications of grinding the crystal to perform these multitudinous functions are quite complex and are probably best explained by the mathematical expression

$$\int_n^u \int_t^s \frac{x(e-1)}{m^x - ixy}\, dt's$$

The technically-minded reader is referred to the writer's forthcoming work on some of the more abstruse phases of piezoelectricity, entitled "Crystal Cracks."

(Continued from page 84)

tude of the exciting speech signal and its frequency. Thus we have an ordinary a.m. radiotelegraph carrier.

In the receiving arrangement, the diaphragm is removed from the crystal and a cat's whisker is placed against it, allowing it to function as a crystal detector. In the circuit diagram both the diaphragm and the cat's whisker are shown attached, but of course only one is used at a time.

Thus we have, I believe, very nearly the ultimate in simplicity of a radio transmitter. There is a slight tendency toward frequency modulation, but this can be minimized by careful grinding of the crystal. This fact probably explains the wide-band characteristics of the transmitter in the radio broadcast. With the crude tools available on a desert island, the builder was undoubtedly unable to use precision methods. Really, the only thing that puzzles me about the transmitter Mr. Toy derides is the purpose for which the battery was used. My transmitter works very nicely without any power supply whatever. Possibly it was used to operate a push-to-talk relay (to remove the cat's whisker and attach the mike diaphragm), although this to me seems an unnecessary refinement.

To be honest, I must admit that there are two defects in the system as I have so far developed it, although these will probably yield to further research. First, I have not yet devised any method of using it on c.w. All attempts so far have either resulted in m.c.w. or in no signal, either of which results is altogether satisfactory. And secondly, I still find it necessary to use a second crystal in the 'phones. This seems to be a useless duplication of parts, and doubtless, with subsequent experimentation, the second crystal can be eliminated and the function of the crystal in the headphones added to those of the principal one. I will keep you informed of any further developments.

— *John Spencer, KD4HOC/K4*

"I'D LIKE TO BE A HAM"

44 West Park Dr., Shelby, Ohio

Editor, *QST:*

I'm just a boy 12 years old. I'd like to be a ham.

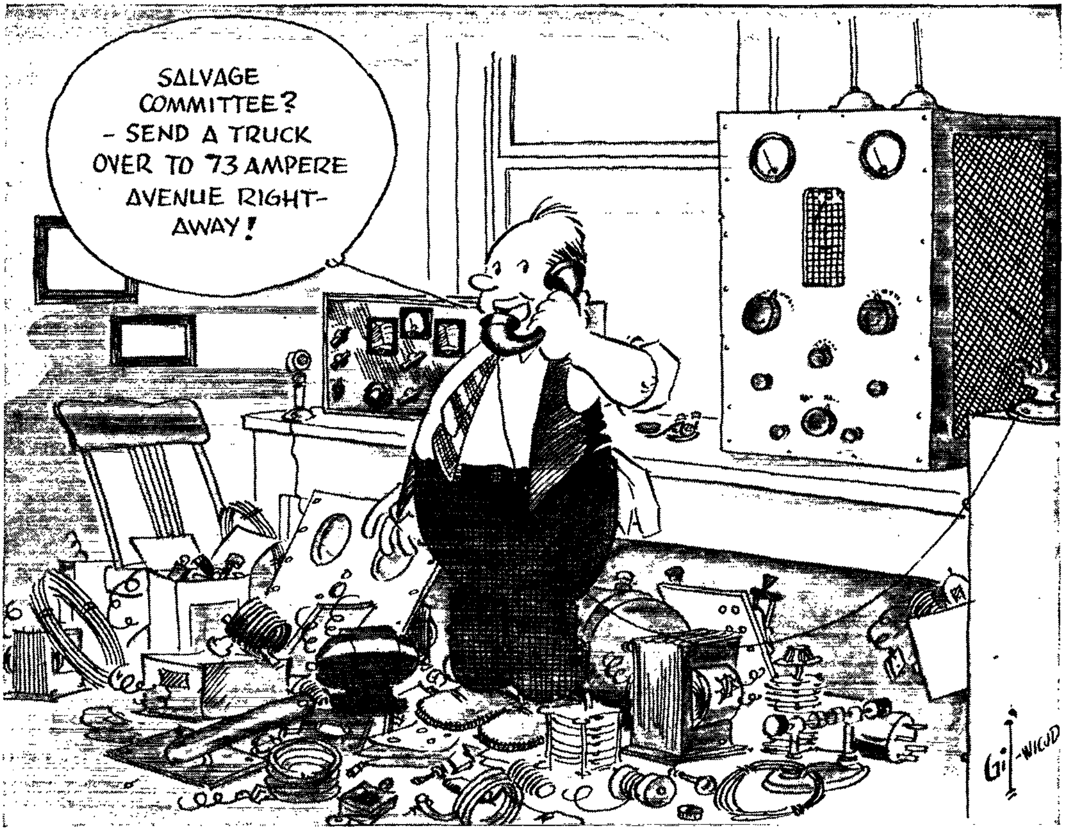
I have written a poem which I dedicate to all ham operators. They try to help boys like me. You may, and I wish you would, print it in *QST* as a message to them.

"Hams"

Now the hams are off the air.
It's pretty hard to stand,
But after all it's for the best
So let's take it like a man.

But don't forget
There're still guys yet
Who'd like to be a ham.
So take time out,
And help them out,
And hams we will never be without.

— *Robert E. Ellis*



BESIDE the general run of scrap metal found in most homes, hams usually have a fine assortment of old wire, aluminum, panels and chassis, as well as many other iron, steel and brass gadgets all of which can be turned into real active war material. . . . Do as Elmer has, "get in the scrap."

PRECISION PRODUCTS FOR BETTER RADIO

HAMMARLUND

THE HAMMARLUND MFG. CO., INC., 460 WEST 34TH ST., NEW YORK, N. Y.

Standard Frequency Transmissions From WWV

THE standard frequency service of the National Bureau of Standards station WWV has been extended to include another carrier frequency (15 megacycles). Temporary equipment is still in use while a new transmitting station is being built.

The broadcast is continuous at all times day and night from 1-kilowatt transmitters, and carries the standard musical pitch and other features. The radio frequencies are:

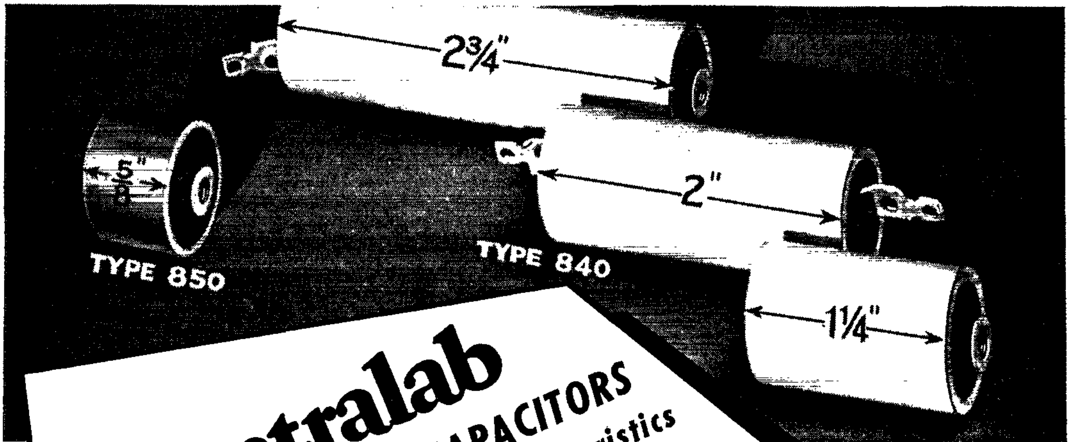
5 megacycles (= 5000 kilocycles = 5,000,000 cycles) per second
15 megacycles (= 15,000 kilocycles = 15,000,000 cycles) per second.

The standard musical pitch carried by the broadcasts is the frequency 440 cycles per second, corresponding to A above middle C. In addition there is a pulse every second, heard as a faint tick each second when listening to the 440 cycles. The pulse lasts 0.005 second, and provides an accurate time interval for purposes of physical measurements.

The 440-cycle tone is interrupted every five minutes for one minute in order to give the station announcement and to provide an interval for the checking of radio measurements based on the standard radio frequency. The announcement is the station call letters (WWV) in telegraphic code (dots and dashes).

The accuracy on the 5- and 15-megacycle frequencies, and of the 440-cycle standard pitch as transmitted, is better than a part in 10,000,000. Transmission effects in the medium (Doppler effect, etc.) may result in slight fluctuations in the 440-cycle frequency as received at a particular place; the average frequency received is, however, as accurate as that transmitted. The time interval marked by the pulse every second is accurate to 0.0000001 second. The 1-minute, 4-minute, and 5-minute intervals, synchronized with the seconds pulses and marked by the beginning and ending of the announcement periods, are accurate to a part in 10,000,000. The beginnings of the announcement periods are so synchronized with the basic time service of the U. S. Naval Observatory that they mark accurately the hour and the successive 5-minute periods; this adjustment does not have the extreme accuracy of the time intervals, but is within a small fraction of a second.

The service from the temporary transmitters will continue for some months. It will be continuous except for such breakdowns as may possibly occur because of the use of temporary apparatus. As rapidly as possible the Bureau is establishing a new station to provide more fully than in the past standard frequencies reliably receivable at all times throughout the country and adjacent areas.



Centralab

CERAMIC TUBULAR CAPACITORS with Temperature Controlled Characteristics

Another important Centralab development in tune with our present war efforts. These parts are definitely suited to high and ultra high-frequency circuits.

Your inquiries are invited for special capacity problems in which Ceramic capacitors are indicated.

TYPE 850 High Frequency, High Voltage Unit

Capacity ranges 10MMF to 100MMF and intermediate values. Available either Zero or Max. Negative temperature coefficient. Standard tolerances as to coefficients and capacity. Size ⅝" long. .765" diameter, exclusive of terminals.

Power Factor .05% does not increase with ageing. Voltage rating 5000 volts D.C. A.C. voltage rating varies with frequency.

Terminals available in two types; same as Type 840.

TYPE 840 High Capacity

Available in any temperature coefficient from zero to —.00075 mmf/mmf/C°.

(1) Zero Temperature Coefficient up to 1500 MMF.
(2) Negative Temperature Coefficient up to 3000 MMF.

SIZE: .780" diameter Steatite tube — length varies with capacity and temperature coefficient.

500 MMF NTC approximately ¾" long.
1000 MMF NTC approximately 1" long.
500 MMF ZTC approximately ¾" long.
1000 MMF ZTC approximately 1½" long.

Power factor of .05% — does not increase with ageing.

Voltage rating — 1000 volts D.C. Leakage more than 10,000 megohms.

Terminals — two types available:

(1) Lug .030" thick threaded for 6-32 machine screw, or conventional soldering.
(2) Axial mounting post with 6-32 machine screw thread.

CENTRALAB: Div. of Globe-Union Inc., Milwaukee, Wis., U. S. A.

Strays

New York sports-page headline: "HERTZ SUSPENDED FROM GRID LOOP!" So they are even using u.h.f. technique in football now! — *W1NVO, ex-W2ESO.*

A single antenna is used to carry simultaneously both CBS s.w.b.c. programs and Mackay's point-to-point radiotelegraph circuits to Europe. This operation is made possible by the use of a new discriminating device which prevents one transmitter from interacting with the other.

Coincidences that Come in the Spring

In going over my log, I noticed that one Spring I worked W3JAA and W3JBB in succession. At other times, the log shows a contact with W2MII followed by one with W2MGG, and one with W3HTC followed immediately by one with W3HTK. Later, I had a three-way with W4GTR and W9GTR and heard successive CQs on almost the same frequency by W1MOR and W2MOR. — *W3IEM.*

W4EJ, after taking commercial exam: "How far away were you from the answer to the third question?"

W4GW: "About four seats." — *The Arc.*

Tin cans, the problem of the scrap industry, are being put to work. The cans will be shredded and shipped to copper mines where the mine water, which contains copper sulphate, will be allowed to flow over them, depositing copper. It is estimated that at least 2000 tons of copper monthly will be obtained in this way. — *Ohmite News.*

The problem of an airtight seal between metal and glass in the manufacture of high-power transmitting tubes has heretofore been solved by the development of a special nickel-iron-cobalt alloy which has the same coefficient of expansion with temperature as the glass. Drs. Hull and Navais of General Electric Laboratories have recently reversed the technique by inventing a type of glass with the same coefficient as that of iron. Since nickel and cobalt are used in many ways for war equipment and their supply is extremely limited, the new invention is an important one.

W5FND is on civilian duty in Trinidad. Were he given his choice of two items to bring back to the U. S. A., he would pick two trees. They are as straight as telephone poles, 100 feet high and almost entirely free from foliage!

POSTMARKS

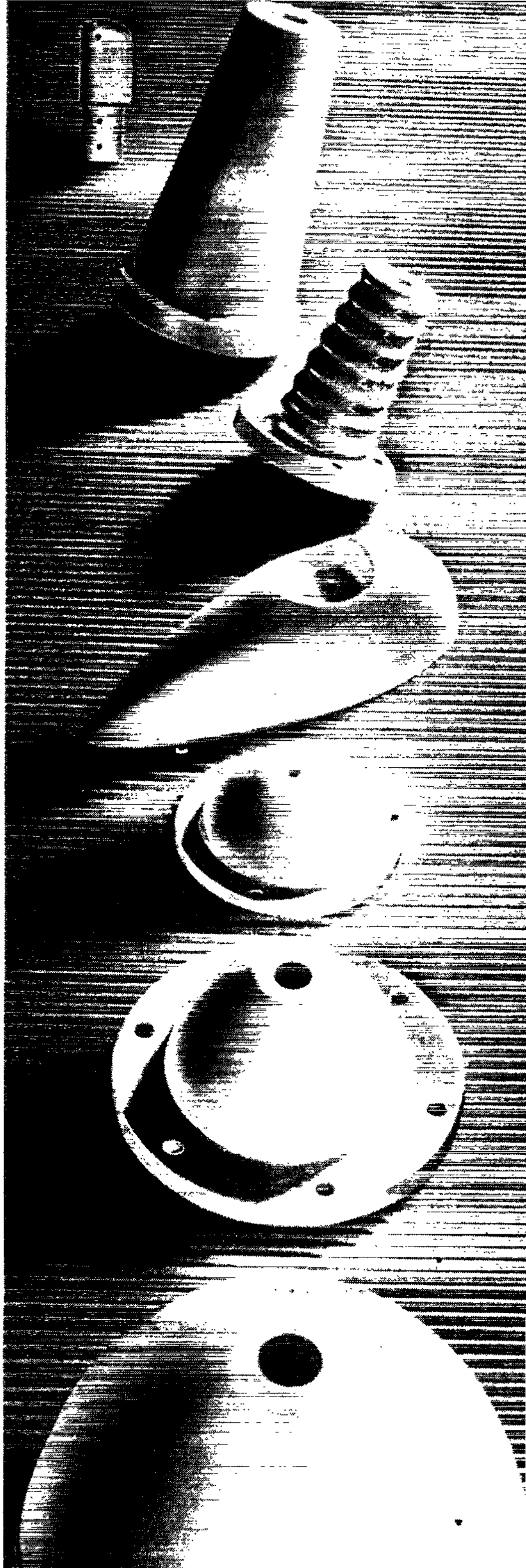
which no longer exist...

On many a shack wall, beside the dismantled rig, hang cards bearing postmarks which no longer exist.

During the past few years, many hams have had the heart-rending experience of suddenly not being able to work friends in nations trampled under by unprovoked aggression. War is very real, very close, when that happens. Perhaps that is one reason why our hams sprang so whole-heartedly into the war effort.

Few of us realized what a great asset Amateur Radio would be to a nation at war. Over the years its needs created a host of technicians, built large factories. Overnight, it furnished trained minds and skilled hands for our armed forces.

Truly, Amateur Radio is making a real contribution to the war. The war, in turn, will make great contributions to Amateur Radio. When it is over, new equipment of a type undreamed of two years ago, will be available. In that equipment you will find new applications of AlSiMag steatite ceramic insulation. AlSiMag insulation was built on research . . . and its dominant position has been fortified by the war effort.



ALSIMAG
Trade Mark Reg. U. S. Pat. Off.

AMERICAN LAVA CORPORATION

CHATTANOOGA, TENNESSEE

AGO • CLEVELAND • NEW YORK • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • BOSTON • PHILADELPHIA • WASHINGTON, D. C.

"Modern Design"

(*Continued from page 18*)

down there, but the condenser shaft is still causing the cabinet to bulge. That's because it is not in line with the hole. It should be moved one-half inch to the left. It doesn't slide. Better take it off again. That time you only ripped off the dial light wire.

Resolder it. Take a rest. That tin cabinet was on there once and it isn't going to whip you. There, on it goes and all shafts lined up. Just goes to show what clear, calm thinking will do. Attach knobs. Attach antenna and ground, plug in power cord and snap on the power. Nothing happens. That's because you forgot to put the dial light back in the socket. Oh, well, you always have the room light on anyway. But wait, no hum, no hiss. Well, naturally — you took out all the tubes, remember?

That narrow opening in the back is just large enough for your hand. There — six of them are in. You have one left. That's the one that goes up on the shelf near the dial light. You can't reach it. *Someone* put it in there; you ought to be able to. The awful truth dawns. It has to be inserted before the cabinet is attached!

"Hey, Marjie, what picture are they showing at the Strand to-night?"

Calculation of Variable Condenser Capacities

(*Continued from page 37*)

little too high (5% to 10%), but the error may be in the opposite direction in the case of a condenser with small, widely-spaced plates and heavy supports and end plates. The construction of the condenser with reference to the information given above should be studied in each case and a little common sense used if a correction factor is to be applied. It is recommended that a little practicing be done first on a condenser of known capacity.

In the case of small, well-spaced neutralizing condensers the apparent capacity will be appreciably increased if the condenser is placed anywhere near a metal chassis or shield plates when connected in the circuit.

Strays

There *is* something new in the news. WAKR, Akron, starts its news broadcasts with "QST QST QST stand by" at about 30 per on a bug. I suspect that W8FFK, who is on the staff, is taking advantage of an FB opportunity. — *W8TLQ.*

— • • • —

Don't neglect your antenna halyards during the present inactivity. You may wake up some fine day to find that a few bucks worth of new rope, or a linseed-oil bath for the old rope, at the customary intervals would have been child's play compared to shinnying that 60 footer.


we are Proud of this FLAG!
... Jensen men and women are giving their full time to war work and a portion of their pay as well ....
Jensen
RADIO MANUFACTURING CO.
6601 SO. LARAMIE • CHICAGO

"High Q"

(*Continued from page 54*)

You decide to hang onto the coil. You descend the stairs. The telephone is jangling. You hurry. Halfway down the coil is jerked out of your hand. That's because the other end of the wire was fastened to the door knob.

"Hello. . . . No, this is Uppercrust 7069, not 7096. . . . You're welcome. No, no trouble at all."

The wreckage is gathered up. Kinks are removed by pulling wire over one of the bedposts in the guest room. You wonder why the telephone hasn't been disconnected. Last month's bill is three weeks overdue. Can't they take a hint?

You get nine turns on. You discover that one of the celluloid strips is missing. You can probably slip it in under the winding — if you can find it. It must have dropped on the stairs. Ah, there it is — halfway down. You can just reach it. No, not quite. That's because you've got more wire on the form and the other end is still fastened to the door knob. Don't just stand there, do something. You unwind two turns. There, now you've got it. Oh, oh — the winding loosened. Well that will make it easier to put that strip back in. It's too loose, twist it. You move two strips out of place. That rubber-band idea wasn't so hot.

Let's see, now. How many turns are you supposed to have? Was it 22 or 28? What difference does it make? You can always take off a few. Make it 28. The wire isn't long enough; you can only get on 26 turns. It must have been 22. Take it down, anyway; someone's at the door.

"Why, it's you, Marjie. . . . You say Elsie is sick and the party is postponed? . . . No, she didn't call after you left."

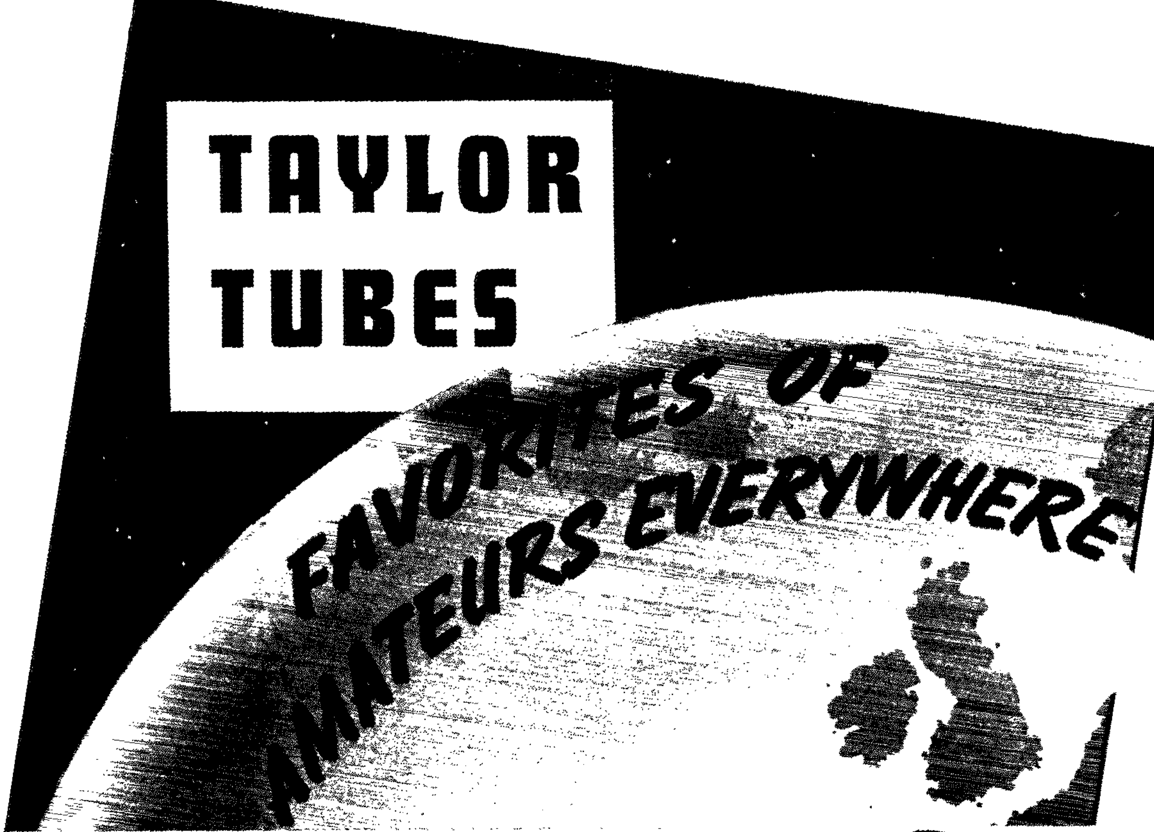
Over there on the desk is the slip of paper with the inductance calculation. You read it and go cold all over. It's 32 turns.

"Hey, Marjie, what picture are they showing at the Strand to-night?"

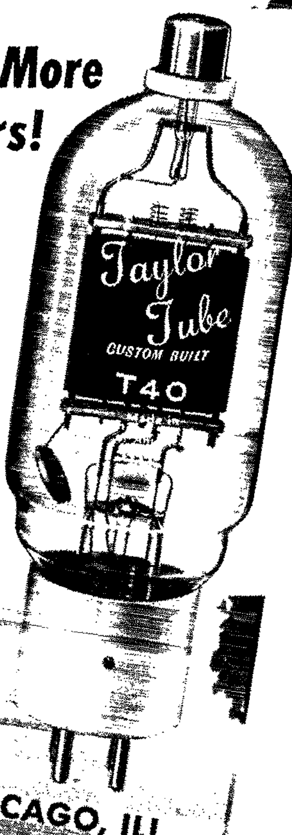
25 Years Ago This Month

(*Continued from page 22*)

and development work must stop if anything more than a lead pencil and a piece of paper are involved." T.O.M. has similar thoughts in "Something Rotten Somewhere," joining the editor in deploring that the authorities make no use of the general amateur's immense value as a systematic listening organization in the face of the knowledge of German radio activity. Dr. Zenneck, world-famed German technician and operations manager at Sayville, WSL, has been interned for the duration and T.O.M. points at the work of Charles E. Apgar, 2MN, in recording WSL's violations of neutrality and making the contribution that the government hailed as "the most valuable service ever rendered by a



When Peace Comes...There Will Be More Amateurs - - More TAYLOR Boosters!



In just a few short years, Taylor "Good Will" has spread to universal proportions. It directly reflects the measure of confidence based on the experiences of long operating service and dependability. It is a fundamental recognition of Taylor's famous "More Watts Per Dollar" policy.

When this war is won, thousands of new amateurs will join the ranks of enthusiastic Taylor boosters. To those we say — Taylor will continue to provide the finest tubes possible to build incorporating the latest and best available developments. Amateurs in other parts of the world, as well as those at home, can count on getting their full share of Taylor quality, dependability and value.

"MORE WATTS PER DOLLAR"

Now Licensed By RCA

TAYLOR TUBES, INC., 2341 WABANSIA AVE., CHICAGO, ILL.

(*Continued from page 94*)

radio operator to this country." Now amateurs aren't even allowed to *listen.* "We would like to make a little bet that if we amateurs were permitted to listen we would, between all of us, dig up some astonishing things and make it extremely interesting for those who are putting over the 'rotten' stuff evidently now going on."

The aviation section of the Signal Corps has been formed and Congress has appropriated the immense sum of $640,000,000 for aeronautics. The Signal Corps therefore joins the Army in looking for radio operators from amateur ranks, both for regular field service with its cart sets and in its new Aero Personnel Division.

You can't tell it from anything said in this issue but this is destined to be the last number of *QST* printed until after the war. Each member of the League shortly received a post card:

TO OUR READERS:

It gives us the biggest regret of our life to have to send out this notice that *QST* will have to be temporarily discontinued. There seems to be no alternative, however, and we must do what we can to make the best of it.

The cause of the discontinuance is that the Editor is going into the Service, and he cannot find anyone who will put up the money and also the work. The Editor has had to put up both and they are necessary. It is a fact that since we were closed up, it has taken more money to run *QST* than the wireless amateurs of the country will supply. 'Yours truly' has always had confidence that all he put in would some day come back, but he cannot find any one else who is willing to take the financial chances and do the necessary work in addition.

Therefore, we discontinue and proceed to take our crack at the Germans. As soon as amateur wireless braces up enough to support a magazine, the Directors of the A.R.R.L. will see to it that *QST* is republished. In the meantime, all unexpired subscriptions will be carried forward on the books.

73 until we meet again.

EDITOR OF *QST*.

Thus ends the saga of the pre-World War I *QST*, dear to all our hearts. Thus ends, too, for twenty-one months this column of 25 Years Ago — to resume on the 25th anniversary of the first post-war *QST*, that for June, 1919.

Strays

Nora: "Do you believe in Clubs for radio ops?"

Myrtle: "Yes, but only after kindness fails." — *The Arc.*

Copper tubing for u.h.f. gear may be obtained reasonably at any automobile junk yard. I purchased 10 feet of ¼-inch tubing the other day for 25 cents. — *W3IXH.*

A couple of years ago, W5HJF placed his Emergency Coördinator card in the dictionary in his shack for safekeeping. After December 7th, Jake discovered he had placed it right above the words "Rising Sun"! — *W5JWA.*

AMATEUR ACTIVITIES

ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES — On July 17th a general meeting of Philadelphia amateurs was called in City Hall which was attended by about 100, 84 of whom filled out a registration form pledging the use of their equipment. Subsequent meetings will show how much of this material is usable. 3IXC is in defense work at Philco. 3EON is joining the Navy as a pharmacist's mate. 3BES celebrated the Fourth of July by helping dismantle the beam antennas of 3HFD and 3FLH. 3GGC, 3HFD and 3EOZ just acquired new Abbott TR4 u.h.f. sets. 3DOU is radio aide for Lower Merion Twp. with 3HFD alternate. 3JVF has been appointed radio aide for Lansdowne. 3GEJ is radio aide for Lemoyne, Pa., and together with 3DFT, 3EYU and 3IID are instructing the auxiliary police in radio.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — SCM, Hermann E. Hobbs, W3CIZ — The Baltimore Amateur Radio Assn. is still holding its code classes on the first Tuesday of each month with eight beginners and twelve in the advanced class. Members are working on the WERS set-up. W3IEM is home for the summer and is working at Bendix Radio Corp. in Towson.

SOUTHERN NEW JERSEY — SCM, Lester H. Allen, W3CCO — Asst. SCM, ZI; Regional Coördinator in charge of Emergency Coördination, BAQ; Emergency Coördinators: Atlantic City, EFM; Camden, KW; North Plainfield, CGU; Vineland, GMY; Somerville, EBC. Just a reminder, fellows, there are a lot of our amateur friends in service who like to read about the section and it is up to us to do our part and keep the boys informed what is doing back home. You send in the items and I will see that they get in the column. The Delaware Valley Radio Association held a doggie-roast for its members and friends this month with 30 persons in attendance. ARN and BAQ gave a demonstration of code copying over a ¼ mile radius with the use of flashlights. EUH was chief doggie-roaster and EED chairman of the affair. The boys at the South Jersey Radio Association were greatly impressed by the talk on electrical theory by John Terrell, FDF. An ARRL *Handbook* and camera fully loaded with film were given away as kitty prizes. EED has changed his QTH to 839 Pennington Ave., Trenton. JJX reports from Chicago that he likes his new job with the Signal Corps. HWT is learning to fly at Pensacola and expects to have his wings in about two months. ABS' radio school is making FB progress. ZI is still traveling for the Signal Corps. Until next month 73.

WESTERN NEW YORK — SCM, Fred Chichester, W8PLA — W8SXR has added new QRR equipment to his shack. LYJ is now an operator at WOLF. AN has accepted a position as radio instructor in one of the evening classes at Syracuse University. A mass meeting of all the hams in the Syracuse area was held July 16th, the outcome of which will appear in our next report. Central New York Radio Club is still conducting its three code classes with an average attendance of 65. In a recent electrical storm PLA's mast was reduced to matchwood, no other harm done. JIW is conducting code-instruction for members of the Civilian Pilot Training Group at Colgate University. The Rochester Amateur Radio Association held their annual club picnic at Westminister Park on July 19th. MC's radio class in one of the Rochester schools has built quite a bit of 2½ meter equipment. He has eleven new ham ops and one commercial in his class. MC has been re-appointed EC for Monroe County.

WESTERN PENNSYLVANIA — SCM, E. A. Krall, W8CKO — Asst. SCM in charge of Emergency Coördination, 8AVY. The Amateur Transmitters Association of W. Pa., held its annual Field Day on June 30th. The event was "sans transmitters" but a good time was had by all. One of the features of the FD was the presence of RM2c KWA. WERS organization is shaping in a fine manner in Allegheny, Westmoreland and Warren Counties of W. Pa. In Allegheny a meeting was held at the home of the SCM in order to draft some definite plan, after which another meeting was held at the offices of Mr. Myers, OCD representative. At that time names of the proposed radio aides were turned over to Mr. Myers for his information and subsequent certification of the OCD. In Westmoreland County, VYU is doing a fine job of organizing for Mr. Carson, the OCD man for her county. Twenty-two amateurs attended a meeting at her home July 22. TTD and PER are both ECs of Westmoreland and are doing excellently. All amateurs of Westmoreland are advised to get in touch with VYU, 131 Talbot Ave., Greensburg, Pa. HKU has been appointed communications officer at the Warren County Air Raid Control Center. He is working closely with RMs TOJ and BOZ. Cambria County amateurs should contact AQT. AQT is president of the Flood City Radio Club at Johnstown and soon hopes to have all 28 club members League members. From Sharon two amateurs, Bill Fleckenstein and Sanford Schafitz have passed the first class radiotelephone exam. We desire to hear from amateur leaders in all 28 counties of this section regarding WERS work.

CENTRAL DIVISION

ILLINOIS — SCM, Mrs. Carrie Jones, W9ILH — AWA is new EC for Lee County replacing GNU, who expects to be called to active duty with the Army Medical Corps soon. PYQ is in the Signal Corps at Ft. Monmouth, N. J. SIJ is now with Hallicrafters. OFI is working at the Army Supply Depot in Chicago. YQE is a 2nd lt. in the Army. NQZ has joined the Army and is attending radio school in Washington, D. C. BCL is newcomer at Mt. Clive. MCW has been appointed radio aide by the Lawrenceville Defense Board. ZEN is now in Waukegan. QKJ has been appointed assistant radio aid for Decatur. QGN is attending school at Texas A. & M. AAY is a 2nd lt. in the Army. UNG is an Army airplane instructor. VYQ met 4LC while refueling at a gas station near Reelfoot Lake, Tenn. IBU presented radio plan to the Kankakee City Civilian Defense Corps and was given the go-ahead signal. YVY is employed by the Army Air Force and is located at Indianapolis, Ind.

INDIANA — SCM, LeRoy T. Waggoner, W9YMV — The War Emergency Radio Service is rapidly taking form in Indiana; Fort Wayne has had 30 transmitters and more than a hundred operators ready for some time. Mishawaka has six or eight stations built or building. Indianapolis plans to have thirty portable or portable-mobile rigs, and also six zone station transmitters as zone control stations. The LaFayette-West LaFayette area has had many difficulties, but these are rapidly being overcome. Many more around the state are busily engaged in building equipment and perfecting plans for participation in WERS work. If you are in doubt about who your local EC is, drop me a card. New ECs include W9s SNF, Highland; MML, Vincennes; WLV, New Albany; WXI, Greencastle; SAG, West LaFayette; KHB, La Crosse. ANH is instructing a class in radio for the Signal Corps at Terre Haute. JYP and 3DSD/9 form a committee of the Indianapolis Radio Club to assist in registration of transmitters for the FCC. 9HRW has been ordered to report for induction. SNF is communication officer for Highland Defense Council. 3DSD/9 is chairman of technical committee to standardize WERS equipment in Indianapolis. 9OUQ is taking officers' training course at Fort Monmouth. EEY found a fellow hoosier at Pan American; AJX is also radio technician. FOS has been named radio aide of the Indianapolis area. Nelson has chosen JYP and UEM as his assistants. JJA recently resigned as chief communications officer of the Indiana State Police to accept a position with Farnsworth. 8VQY is now 9DMW at Syracuse. RE is with Hq. Army Air Force, c/o Postmaster, Port of Embarkation, San Francisco, Calif. SAG says code classes conducted by the Purdue University Radio Club are coming along FB. NXU is due for wings in September. GOE is a captain. CRZ is off the continent. HZB and IUM are assisting in registering the transmitters of the NEIRC boys who are in service. LHF is lieutenant in Army Air Corps. DNQ reports plenty of AC/DC theory at Fort Monmouth. EHT indicates that WERS is under way in Terre Haute! ANH and ZHL are to be key men in the set-up. KBQ is now with Uncle Sam at Camp Pickett, Va. CYQ, 3DSD/9, 9JYP, JJC and ASJ went aboard the SS *Angus* for a week-end cruise from Grand Haven, Mich. This will probably be the last cruise of the *Angus* for the duration.

KENTUCKY — SCM, Darrell A. Downard, W9ARU — The Amateur Radio Transmitting Society decided to continue its meetings throughout the summer with a change of QTH. BEW, BOF, IXN and BAZ are our only ECs in good standing. Those of you not mentioned have had your appointments cancelled. PLEASE contact the SCM for appointment as EC in your district! Ky. should have more than four. The Eighty-nine Club spent a week-end at Clifty Falls, Ind., State Park and had a real old-fashioned outing with plenty of rag-chewing, resting and eating. CEK is communications manager for the OCD in this part of Ky. GNV is employed by Harlan Vocational Schools, teaching radio for the Signal Corps trainees. He is also radio aide in civilian defense work. TFG is attending the Mechanic-Learner Radio School at Grays Knob, Ky. In order that the Ky. boys in the service may be listed in the "In the Service" column, please notify the SCM of any of the gang who should be listed.

MICHIGAN — SCM, Harold C. Bird, W8DPE — 8AHV reports contact made with local OCD officials and operators and equipment listed with them preparatory to getting signed up for WERS and FCC licensing. NQ reports his local Office of Civilian Defense has been ready since early in December. A meeting was held and they were able to scare up about 5 transceivers. DYH has been trying to keep his contacts with the local OCD office and has everything in readiness. FX is building u.h.f. equipment. VQN reports all the hams in the city of Muskegon Heights deputized as special police officers. They are all going to take restricted radiotelephone license examination in about two weeks. The unit there will function along the lines of the Providence set-up. GUC reports they have their contacts all made with their local OCD and are now only waiting for further instructions as to what procedure to follow. The Oakland County Radio Club has held a special meeting to get more u.h.f. equipment under construction. Suggest that you fellows who already do not have an Emergency Coördinator in your locality select a man and submit his name to your SCM for appointment. This is the only appointment made by the SCM now and it is very important at this time. 73 — Hal.

OHIO — SCM, E. H. Gibbs, W8AQ — 8QOK resigns as EC for Bellefontaine as he is accepting a commission in the Medical Corps. The Bellefontaine fellows put on a 10-week, 40-hour course in code and theory with 30 registrants completing the course. JTW reports the Columbus club conducting code and theory classes and working on wired wireless for their annual boat race communications job usually handled on u.h.f. Canton club holds classes Mon., Tues., Thurs. each week at local high school. The club's address is Box 661. The Cuyahoga R. A. at Cleveland is starting a new series of classes meeting each Tues., 8 P.M., at Great Lakes College on Rose Blvd. This club now has 140 members. Congrats to LKU on being appointed controller in civilian defense. He has appointed PGQ as radio aide. MPG is now a civilian inspector of Signal Corps equipment, stationed at a plant in N. J. MFP has been appointed EC for Cinci. replacing JFC who accepted an Air Corps commission. FVW reports that nine of his original 18 AEC registrants have either joined the armed forces or moved to defense jobs in other areas. TGU took his Class A and B exams recently at Columbus. KNF has been appointed radio aide for Medina Village and DXB for rural Medina County in the CDC set-up

WISCONSIN — Acting SCM, Emil R. Felber, Jr., W9RH — UFX reports Dane County going to have a WERS set-up after all. The Four Lakes Amateur Radio Club and the ROTC Army Radio School have been coöperating on code-Army equipment, with club members as the teachers. The following are teaching at the U. S. Naval Training School here as civilian instructors: UFX, KTN, KTM, IJV, AVM, HVM, MFR, PCX, DBI. Assistants: WET, PCN, JEK, IMC, QCN, GOC, WEO. The skipper is Lt. E. H. Schubert, USN (W8NC). UFX has 17 now available and eight 2½-meter transmitters and receivers. The club had a QRM ham dinner at a steak and chop house June 27th for the XYLs and YLs. FHA will act as EC of Kohler only from now on at his request, and NVJ has been appointed as EC of Sheboygan. FHA plans to have 3 stations operating with 6 operators. The local committee is taking the plan under advisement. SZL reports plans for Racine are in the making. The Green Bay code and radio theory class at local vocational school conducted by GFL is now concluded with 6 new amateurs with operator licenses. Things progressing fine and expect 2 more 2½ transceivers to be available soon. WERS regs being studied and survey of existing facilities being pushed. Local club has had no meetings since Dec. 8th. GFL's 160-80-meter 400-watt 'phone rig has been rebuilt for emergency station for the police. SYT, NY, CDY, ONY and GSP making progress on the Milwaukee WERS plans and meet regularly every Tuesday night in a room provided by the local police dept. EC is surveying local 2½- and 1¼-meter equipment and operating personnel. All new Milwaukee amateurs who did not get a card contact Wendell Ciganek at 1723 W. Fond du Lac Ave., or 'phone Kilbourn 4982. UPM is a sergeant in the Signal Corps. BNQ is in Air Corps. FQO is a supply sergeant. NHG is a captain in State Guard, Hq. Div. LGO is a staff sgt. in State Guard. RSA and SQK have built new 2½-meter transceivers. AXR at Camp Grant. The MRAC picnic was held at Okauchee Lake, August 2nd with a surprising turnout. 73. — *Emil.*

DAKOTA DIVISION

SOUTH DAKOTA — SCM, P. H. Schultz, W9QVY — W9SMS moved to West Coast factory wiring bombers and installing radio equip. Has acquired an XYL. BZI enlisted in Navy and is in Chicago studying radio. DJM has Civil Service job in Nebraska. CYG is in Omaha waiting a call to duty. MBA is radio opr. on USS *Ranger*. SOB is ensign in Navy in radio work. SMV with U. S. Weather Service in Nebraska. SGI and ZAL have equipment all ready for emergency work. ILL expects to be an instructor in an air school soon.

NORTHERN MINNESOTA — SCM, Armond D. Brattland, W9FUZ — Unit One NMARA (Bemidji) had an official code proficiency run for the club members at its July 2nd meeting and Zona and LaVerne Booth qualified for 15 w.p.m. sending and receiving certificates. FUZ did the hand sending with ORT marking copy. BHY, a 1st lieut. in the CAP, paid an over-night call on FUZ. RLL has just finished taking a radio training course. From now on for the duration address me at the home QTH, Birchmont Drive, Rural Lake Delivery, Bemidji, Minn. Shall digest all reports and forward to Hq. not later than the 19th of each month. Mail news not later than the 16th of each month. 73. — Army.

DELTA DIVISION

ARKANSAS — Acting SCM, Ed Beck, W5GED — W1LVQ has our unanimous wish for his every success in his undertakings, both marital and otherwise. 5GNV has departed for a field of bigger and better undertakings. 9BOX and 9ULI dropped in on GED. 5FPU is permanently located in LR. HYS acquired Class A. ICN took advantage of the summer session at U. of A. JHL made Class A and at the same time took the first step up the commercial ladder. AY and PX are busy on the construction of a new commercial job. FXO is now residing in the Lone Star State and is doing a lot of experimenting. EVD is pursuing his CAP duties. BAP is attending radio school in "The City of Roses." BMI is kept pretty busy seeing that two police transmitters function properly all the time. CVO is now located on the West Coast in the performance of his duty. Don't forget, fellows, this is your column and there is no rationing on sending in reports, so give out with those ideas, activities, comments and what have you and we will try to keep the ball rolling. 73 — Ed.

LOUISIANA — SCM, W. J. Wilkinson, Jr., W5DWW — 5HQE is in Naval training school. CEW is assistant to ZS who is local defense communications chief. DWW is awaiting news from Civil Service exam. How about all you Louisiana hams, both at home and in the armed forces, dropping a line about the 15th of each month? 73.

TENNESSEE — SCM, M. G. Hooper, W4DDJ — 4HKQ now holds a Class A ticket. BDB has left our section and is with N.Y.A., in Marietta, Ga. at 301 Cherokee Street. The govt. has acquired an HRO receiver and Meissner Signal Shifter from DFB. PL reports that the Civilian Defense Council at Chattanooga has asked the local hams to provide u.h.f. communication along the lines laid out in *QST*. The Chattanooga Amateur Radio Club has accepted the responsibility, license has been applied for by the city and construction is under way. EEA is now at Frisco, after attending school in New Orleans and the Univ. of Okla. EXK is stationed at Atlanta, Ga. FNY is finishing his course at the Univ. of Tenn. BOZ has been one of the instructors in ESMDT radio course at the Univ. of Chattanooga this spring and summer. DUS is now stationed at Lexington, Ky. LU is doing radio work for the Navy. DIJ and ESQ are with the Signal Corps. DDG is with TVA at Wilson Dam, Ala. BDB is instructor-in-chief of an NYA school near Atlanta. ARE is in the Army. PL is pounding brass and shoving traffic for the U. S. Army Engineers. FFF has been radio operator for Eastern Airlines and is now joining the Air Ferry Service. He says that FCU is doing war work with Eastman Kodak, and that his better half

GFO, recently graduated a code class of 15 and sent them off for their exams. DEP is reported with Eastern Airlines at Atlanta.

MIDWEST DIVISION

IOWA — SCM, Arthur E. Rydberg, W9AED — Des Moines is reactivating their club for WERS work. QVA, reporting for Iowa-Illinois Amateur Radio Club, says their announcement of a free radio course brought in 120, of which about 40 were women; finally settled down to about 75 attending each week. 9WTD, TMY, FKA, SHY, NLA and QVA are doing CAP work. QOQ in Des Moines working for the Army in civilian capacity. CCY has almost completed technical training in his class, also reports nice visit with 4GBV. SWD reports two code classes per week and that IEX is now in Navy. OJD has left BC job in Fort Dodge to go to the Army. NKC and VKZ are ready to go with WERS. NMA taking ESMDT radio course. Iowa ECs should get busy with WERS. 73. — Art.

KANSAS — SCM, Alvin B. Unruh, W9AWP — 9OCJ is working in Wichita. CCA joined Navy. KPJ is EC for Zone 32: Norton, Sheridan, Decatur, and Graham counties. UWN reports fifth district MINK net held second annual picnic at Clay Center June 28th. The following are in military service or defense work: FHW, OWZ, FBY, FBZ, YUQ, NKM, NOH. OOZ is now 7ITA at Portland, Ore. LFB has been appointed EC for Sedgwick County; he was appointed radio aide for ham coördination by Wichita OCD officials. Ex-PPC is now with the U. S. Signal Corps in the British Isles, with rank of first lieutenant. A new radio theory class is being organized at Wichita U. through K. U. extension. PGL is renewing his ticket — a reminder to the rest of us! 73.

MISSOURI — Acting SCM, Letha Allendorf, W9OUD — 9AEJ is still pounding brass for the Army at Omaha, altho he intends to return to college this fall. GHD is in the Air Corps at Chanute Field. MFN has a monitoring job at Marietta, Ga. NSU is doing some monitoring at home for the wx bureau. FBG enlisted in the Army as 2nd class radioman and is attending radio school in Chicago. BHG is working for an aviation company in KC, as well as continuing his radio and electric shop in Excelsior Springs at which CWK is radio serviceman. KJC applied for a commission as an Army dentist. CJR couldn't make the Civil Service job because of the missing right paw altho he slings a wicked south bug. PAA has been drumming up interest in a radio class. SPY is taking over as EC for New Madrid County, replacing MFN. TYY passed his class A exam. CZI is doing auxiliary highway patrol work and has his u.h.f. equipment ready. JQE is also set for u.h.f. operation. UYD is building a preselector, studying mathematics, and has passed his physical exam for appointment in the Air Transport Command. VLP and CIB are doing radio work with the Navy at Treasure Island. QJY, WRD, KSR and ZWO are in the Army. SSG is with the Air Force stationed at Fairfax Field. 1st Lieut. PYS is now at Ft. Monmouth. LD and AHZ are heading the WERS in KC. BLS, LBB, YJS and WEE are teaching radio in a school conducted by the Heart of America Radio Club and are active in civilian defense. DBD, EXZ and PFO are expecting to graduate their present code class in August. HTR is going to help with the AWVS day class in St. Louis. OWD and UWY are both captains in the Army. FIN and JTX are in Norfolk, Va. NEV, engineer from KMOX, is in the Army. OWQ visited some of the YLs in St. Louis. Thanks for all your swell letters. 73.

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Edmund R. Fraser, W1KQY — Newly appointed Emergency Coördinators are NKZ for Glastonbury, CTI for Norwalk and AGT for West Haven. All are radio aides of their respective towns. NRV, former EC for Norwalk, is now in the Army. DDP has been advanced to staff sgt. JHN has enlisted in the U.S.C.G. as boatswains mate 1c. GMR is now in Signal Corps. WR has son who is 1st lieut. in the Air Corps. IM is filling in as maintenance man for the Bridgeport Pox. CGD has been assisting policemen in obtaining their licenses. HUI is constructing 112 Mc. equipment. LGA is now a naval inspector. KOY has moved to W. Hfd. APA, EC for Bridgeport and vicinity, gives us the following information: The business of BARA will be conducted for the duration by a board composed of APA, CCF, ACV, NEQ and MQM. This board meets once a month to handle any business on hand. Plans have been made to assist in the registration of equipment for hams away from home. WERS plan for Bridgeport and Easton is well under way. BIH, EC for Torrington, reports KXB, asst. EC has been appointed communications officer and radio aide. Their radio class now has quarters in the Elks Clubhouse. EYM, EC and communications officer for Fairfield, has WERS plan well organized. ECs JQK Hamden, BHM New Haven and AGT West Haven have secured necessary equipment (TR-4s) for WERS operation. NBY, now 2OKJ, says KFN, HCU and GRF are finding their new jobs very interesting. CSY has given up orchestra work for a job in G. E. Co.

MAINE — SCM, Ames R. Millett, W1BAV — 1LSK is an op on board ship. HUT has a new transmitter. IGW and LIZ are in the Signal Corps. Ensign IEB has been home for a short stay. LOZ is now a major in the Army. LPA and LTM are with the 43rd. IJX is with the Army Signal Corps. LYK has joined Company B of the State Guard and will soon teach code to the boys. DHH, LWX, MAP and NBD are at the Bath shipyards. KYO is in Washington. KXQ is with Northeast Airlines. MNR and AI are with the civilian section of the Signal Corps. MDK has left Millinocket for government radio school. MKF has gone with the armed forces. HSD is captain of the Millinocket company of the State Guard. KEZ has been appointed chief communications officer of his local civilian defense unit. The Millinocket coördinator has applied to FCC for permits for WERS. MGP is now a technical sgt. in the Signal Corps and likes it FB. LAP is somewhere in the Pacific.

EASTERN MASSACHUSETTS—SCM, Frank L. Baker, Jr., W1ALP—The main activity this past month has been the starting of the various forms and applications for the new WERS, with several already sent in. IBF has been doing a nice job for region 4 and the application for Lawrence and a few surrounding towns has been sent to Wash. A meeting for region 5D was held in Quincy with the following present: IHA, JCX, EAU, KQN, JXH, CCL, MD, FJN, ALP and ex-UG. IS is home again after a long stay in the hospital. KCP is now in the Army. LQ is married. KSA is new EC for Dorchester. Correction, MME is in the Signal Corps and not the Navy. He and HRA are both located at Fort Monmouth, N. J. EPE is now working for the government at Scituate, R. I. MMO is with the Signal Corps. NKW got his 2nd class commercial. IID is in England. MUU is also in his sub-section. NLK is going to school in Okla. IZT is in the Navy. Roger Pollock of Salem got his operator license. LTS is at Fort Monmouth. GID is a lt. in the Army. JNE is in the Army. LQQ is teaching radio in Boston. JNF is in Iceland. GWK has the following gang ready for any emergency: GDY, NOV, AMK, AYI, FH, KDF, NNS, NBE, NSH, BSX, AZF, APH and CWI. GDY is getting things going for the City of Boston. JDG is out of town on his summer job and BXC is acting as asst. EC. The various amateur courses are going strong around the state, in conjunction with the Public Safety Committee, with several new ones starting around Boston. The Quincy school has about 60 present twice a week at the Quincy YMCA. Each school seems to have at least one ham helping out.

WESTERN MASSACHUSETTS — SCM, William J. Barrett, W1JAH — At long last we are ready to get going on civilian defense radio. Developments to date show the following communications officers: Region 1, AZW; Region 2, HDQ. Directors, CD radio schools: Region 1, JAH; Region 2, BVR. In Region 1, radio aides are LUD for District A and JAH for District B. Radio classes in Pittsfield are under the direction of LPQ, with IZN, BKG and AZW assisting. North Adams instructors are MJD and FZI, while Adams has JAD, JAH and NAQ. FNY, ADF and FXO are with FCC. KVN and MKR are overseas with Signal Corps. Springfield Radio Association reports eight members meeting weekly for code and theory training with general technical discussions at each session. Drop me a card to help coördinate developments.

NEW HAMPSHIRE — SCM, Mrs. Dorothy W. Evans, W1FTJ — New Hampshire is in need of more ECs and AECs. Any of you fellows who can qualify please get in touch with the SCM or with AVJ. AVJ is working with the State House authorities. JZD was married recently. IUI has been re-appointed as EC for his locality. AVG is now in Washington. IP is working in Manchester on a Civil Service job there. OE has charge of local police radios in cruisers.

RHODE ISLAND — SCM, Clayton C. Gordon, W1HRC — 1MOK and CMG are civilian employees of the Signal Corps. Elmer Capwell seems to have the CD radio hook-up in West Warwick under control. The Providence YMCA has sponsored a radio code class which runs for 8 weeks, two nights per week, and which has enjoyed a large attendance.

VERMONT — SCM, Clifton G. Parker, W1KJG — Any amateur in Vermont having commercially-built transmitters or commercial units which they desire to sell to the military authorities may obtain blanks to be submitted by writing your SCM or Burtis W. Dean, W1NLO, P. O. Box 81, Burlington. The Burlington Club members are actively coöperating in the WERS set-up for Burlington. EC appointments endorsed this month are MJU, AZV, AD and CBW. Your SCM at this writing is busy with a section bulletin which will cover the summer get-together and will be in your hands before this report comes before you.

NORTHWESTERN DIVISION

IDAHO — SCM, Don D. Oberbillig, W7AVP — 7FIJ now working control tower, airport traffic control. AVP has been flying. DTJ has been teaching engineering radio class at Lewiston. GVN back in Boise. AYP has been transferred from Boise to a new station. DKY attending school in San Francisco. BMF has been Navy operator for several months.

OREGON — SCM, Carl Austin, W7GNJ — 7JN is the new EC for Portland. FNS, formerly EC, is in Kentucky. QP passes through on his way west. GLF is now tech. sergeant. IDJ made RT 2/c. AEM has a civilian military job in radio at San Francisco. Hear GTW is flying an airplane on the new Alaska road. IIK studying in Houston, Tex. From CORK we hear that Helen Roats is in Portland finishing off on code with WR. 20 w.p.m. certificate issued to Jerry Reece. Tommy Currier is radio op with Forest Service. HVX after 25 w.p.m. certificate. HHH has new code class up to 10 w.p.m. in 5 weeks. Club has 40 tough 3-minute tapes. John Carrol, secretary of the Pendleton club, is now in Quartermasters Corps, so MQ will take over his job. MQ is now EC for Pendleton. 73.

PACIFIC DIVISION

SANTA CLARA VALLEY — SCM, Earl F. Sanderson, W6IUZ — On Friday evening, June 19th, the regular monthly meeting of the Palo Alto Amateur Radio Association was held at the home of NHW. TBK outlined the new rules and regulations of the WERS. An inventory of available 2½ meter equipment showed that seven 2½ meter units were complete and 9 units were under construction. The following were present: FLE, TNG, PKM, QXO, AOV, GES, TAU, TFK, NHW, SXA, TBK and three associate members. DMY is leaving for the East to join the engineering staff of Western Electric. GES has his commercial ticket again. MOV is teaching radio classes in Oakland. IXJ and KPR are busy with radio classes in the San Jose area. IUZ and PVV had the pleasure of a personal QSO with 5HGC, now RM2c in the Navy. 73. — IUZ.

EAST BAY — SCM, Horace R. Greer, W6TI — ECs: OBJ, QDE; EC u.h.f., FKQ; Asst. EC u.h.f., OJU; OO u.h.f., ZM. The ARRL East Bay Section meeting which was held at the Leamington Hotel, Oakland, California on Wednesday evening July 15th, 1942 was entirely devoted to "WERS." The following were present: AFX, TNM, NZY, KTI, UFD, AHG, OAO, TJP, HGM, GFW, FKQ, THO, LGW, CRF, QW, UGH, NJJ, OJU, GIU, QDE, SFT, TAT, SHY, SEW, TBP, QGG, IMA, RCE, SK, SYO, PKP, JJB, THZ, EY, TI, JEE, L. Overhauser, J. Mitchel, C. Shephard, V. Macmorran, D. Youngs, H. McElroy, P. Baldinger, L. Kelsey, E. Downey, R. McGilson and H. Newnan. Complete details on WERS were brought out by TI and suggested plans were offered and discussed. A complete double postal card questionnaire has been sent out to all amateurs in the East Bay Section, and all information will be compiled. Plan on being present at these meetings the third Wednesday of each month.

ROANOKE DIVISION

WEST VIRGINIA — SCM, Kenneth M. Zinn, W8JRL — MZT, UVU, MOL and QFN are getting along fine with the radio technician course at Marshall College. CSF is doing fine at WWVA. AKH is now working at Portsmouth, Va. PQQ received his commission and is now taking a special course in radio communication at Fort Monmouth, N. J. KWI is now in his second course of radar training at Corpus Christi, Texas. ASI received his commission in the Navy as lieutenant, senior grade, and is now waiting for his call. New AEC registrants in the state are: MOL, UVU, LCD, VIY, VEU, MZT, QFN and WUH. TDJ/SPY and KWL are getting their civilian defense radio net set up in Morgantown. PZT is now on the police force in Baltimore, Md. RCN is taking radar training in the Navy. Every MARA member serving in the armed forces to date is a volunteer. AKG is a lieutenant in the Medical Corps of the Navy and is stationed at Springfield, Mass. 73. — Ken.

ROCKY MOUNTAIN DIVISION

COLORADO — SCM, Stephen L. Fitzpatrick, W9CNL — 9HWH is in the 12th school squadron at Scott Field, Ill. LLP has applied for a commission. PJM is working for Uncle Sam at Kingston, Texas, in one of the monitoring stations. OWP is studying advanced radio at Greeley, also teaching code in one of the ESMDT classes there. EZL enlisted in the Signal Corps last March. YCD is still at Brownwood and got a staff sergeant's rating. BQO is working on the Denver WERS. The new officers of the Associated Amateur Radio Operators of Denver for the next six months are as follows: QYU, pres.; 3JIN, ex-VTK, vice-pres.; 9BQO, secy-treas. AYV is experimenting on sound recordings. 73. — Stephen, W9CNL.

UTAH-WYOMING — SCM, Henry L. Schroeder, W7GZG — 6SID has returned to his regular summer job at Sawtooth National Forest in Idaho where he has charge of communications for the Forest Service. He reports 9EHC, former SCM for Colorado, with the Signal Corps at the Ogden Air Depot. 6QVY is a leatherneck now with rating of staff sergeant. 6UFJ has moved to Bakersfield, Calif. June 11th was examination date for the code class of the Shy-Wy Club at which ten students passed in 15, 20 and 25 w.p.m. speeds. On June 18th, the regular business meeting was held at which the main topic was on 2½ meter work with the OCD. EC 7EVH, 7EUZ and Charles Houge were appointed a committee to meet with Byron Hirst, chief air raid warden and Mr. R. J. Hofmann, civilian defense coördinator. The Club reports two new members, 9SIO and 9PFN. 7HDS reports a healthy interest being evidenced in her code classes broadcast over KFBC. EC 7EVH reports contacting the members of OCD in Cheyenne and reports encouraging interest on their part in the equipment and personnel available. 73. — Hank.

SOUTHEASTERN DIVISION

ALABAMA — SCM, Larry Smyth, W4GBV — Please drop me a card if you do not have an EC in your area or if you do not know his name. CIU has recently been made EC of Walker County. Birmingham has been made a temporary license examining point. GKZ and EW are stationed at Fort Monmouth, N. J. FMW is with the Marines. ECI says what's left of the Birmingham gang have several 2½ u.h.f. rigs and have held meetings to organize and formulate plans. 73. — Larry.

WESTERN FLORIDA — SCM, Oscar Cederstrom, W4AXP — 4BJF of the Fla. OCD is doing a swell job of it with the untiring aid and dynamic energy of his chief of staff, GTJ. MS is really using his time to good advantage from the looks of the gear he has. COG is now a lt. in the Army Air Corps. BMH is in charge of the transmitters of the CAA radio station at Slidell, La. CTZ, now 5JTC of Brownsville, Texas, reports BPI is radio service engineer for Pan-American Airways. BPI is in Brazil as radio technician for a subsidiary of Pan-American Airways. 73.— AXP.

SOUTHWESTERN DIVISION

LOS ANGELES — SCM, H. F. Wood, W6QVV — We should all give MQM a big hand for the fine work he did while in office. Activities of the AEC gang in connection with the Los Angeles Major Disaster Group are going forward under the new WERS set-up. 6PMA has just received his appointment as second lieut. in the electronics training group of the Signal Corps and has left for Fort Monmouth. MFJ has been studying radar on that windy island and reports wonderful training and experience. DIS also gone radar in Arizona. KCX switched from civilian flight instructor to Army Air Corps recently. SVK has sold his rig complete to the armed forces. RNN reports that of his group in the AEC OEF has gone out of Los Angeles County, RNQ is serving in the Navy, MUB is in the Army Air Corps, TGU moved East, TLN is with the Merchant Marine and PQL is expecting to be called. Hats off to BZN, ZCN and PTR for the many applications they have sent us. I would like to hear from any and all radio clubs that are still functioning in this district. Drop me a card giving any interesting dope you run across so we all can know about it. 73. — Ted.

ARIZONA — SCM, Douglas Aitken, W6RWW — An orchid to 6MLL for his fine job as Acting SCM. LYS has moved to Winslow as dispatcher for the RR. Sorry to hear of the death of MVG, this spring. TUX is working in a Calif. aeroplane plant. KWI is moving to Calif. BMC is chief operator and KWJ second op at KYUM. 8SDD and XYL visited 6SQN, PBD and RIA while touring through the State. Verde Club held a meeting and elected LJN as radio aide for the district. RLO has light-beam working a few feet and now working on apparatus to cover 8 miles. MSP is a lieut. in Signal Corps. The Tucson Club has elected a new president and is conducting a bi-weekly code class for 50, with GS, OUG, SLO, UNY and UPF as instructors. TJH is also conducting code and theory classes. EJN is a flying instructor. OZM bought a radio store. TXM now working for Uncle Sam. The Tucson gang reports 1¼ and 2½ "looking up." QWG turned down the chance for an instructor's berth at Gallups Island in favor of going to sea as radio op. Phoenix Club has suspended meetings for the summer. KSO is getting his pilot's license. MLL is building 2½ equipment for WERS, as well as holding radio classes. Send in reports on progress and local plans. Very 73. — Doug.

SAN DIEGO — SCM, Richard Shanks, W6BZE — The Santa Ana Radio Club is going strong. 6IBN is pres. and UFG vice-pres. and secy. in a recent election. BAM resigned as EC and has joined the Army. CFN is EC for Santa Ana. Lots of activity in Santa Ana in WERS. CNB is now RM2c and is located at Corpus Christi, Tex. FAT has been appointed radio aide for San Diego, and also EC. OIN has been experimenting with light beam transmitter and is looking for someone to work with. 9LLM/6 from Chicago has his u.h.f. gear in S. D. and is ready for action in the WERS. If you are available or have u.h.f. equipment contact FAT or BZE for information. Helix Radio Club is meeting regularly. The meeting nights are the second and fourth Friday. NBJ and ANU are building 2½-meter equipment. ANU is relieving at KGB for summer vacations. BZR is still teaching code and theory at his home. 73. — Dick Shanks.

WEST GULF DIVISION

NORTHERN TEXAS — Acting SCM, Gordon Ash, W5CY — Two new members of the supporting division of the AEC this month from Ft. Worth, ILY and BA. The following should be AEC before long: GKA, IEC, IFL, JSS and ND. More members are needed. IFL has a mobile 2½-meter rig complete with xmtr, rcvr and genemotor ready to go for civilian defense work. JEW has a 2½-meter mobile xmtr for same purpose. ATH has changed his QTH to White Have, Tenn., where he is to teach radio in a school. 6THK has moved to Ft. Worth recently from California and is interested in 2½-meter work. The Dallas Club is still holding Code Classes, with very good results in spite of mid-summer heat. 5CDU requests that all members of AARS who are in the service report to the net control station at their earliest convenience. GTL is in Air Corps Communications. JFF has been transferred. Bill Bailey, pres. of Dallas Radio Club, is registering transmitters.

SOUTHERN TEXAS — SCM, Horace E. Biddy, W5MN — JPC is new EC in Kilgore. GCJ and BGZ of San Angelo are in the Navy. BUV is code instructor at Army airfield in Texas. IHG is Assistant EC in San Angelo. FDR, as aviation chief radioman, U.S.N., reports from New Orleans but is likely to be most anywhere by now. KDZ is now aviation cadet at basic flying school in Texas. FGF wishes for someone to help him with WERS work. HPJ is now teaching radio in naval radio operator school somewhere in Texas. HZN is an aircraft radio inspector in the vicinity of San Antonio. IBY, now a 2nd lt., Signal Corps, reports from the British Isles. KEE is working for Wx Bureau at Ft. Worth. ILN and JPC are sailing with the Merchant Marine as "sparks." KQW is working for KELD in Arkansas. KJO is working at KRBA in Lufkin. 9BDL is working at a naval station on the Texas coast. FNA reports 33 WERS members as having 2½-meter gear ready or under construction. In addition the San Antonio Police Department has applied for construction permits and the following will be appointed special officers and work with the police net on 116.5 Mc. under the direction of Mr. Vic Gallagher: EOS, JKC, Ames Davis, Jr., FNA, FJX, SF, HCH, FAT, CDS, Ed. Case, EUL, EDX and Harry Campbell. FYP was re-elected pres. of the Galveston Amateur Radio Club with AQN as vice-pres., CDD as secy-treas. and CCS as chief opr. and asst. EC. CIX reports Cuero has two WERS members and Yoakum one and now available as aides to local OCD chief. BSF of Kerrville says FNH, TF, DSH and BSF are conducting radio school, teaching both code and theory. JAV, former president of Muskogee, Okla., Radio Club has moved to Kerrville. JKU, JVF and Alex Fabris, Jr., of San Antonio have registered with the AEC.

C. D. STAFF NOTES

Been wondering about the present activities of some of the Communications Department personnel who are on leave for war work? Here's some of the latest dope on their activities:

The Headquarters staff got a chance to observe Major F. E. Handy in uniform during a visit he made to the old stamping grounds in mid-July. Ed is very busy and is keeping young and fit with the Army Air Forces. His address is 3409 Fessenden St., N.W., Washington, D. C.

Lt. E. L. Battey, W1UE, is at present doing a lot of traveling inspecting Navy radio schools. Ev moves around so fast that he is hard to keep track of, but his latest address is 4412 Volta Place, N.W., Washington, D. C.

A recent letter from "Jeem" Buckler (W1NKC, ex-W9NFL) indicates that he is pounding a lot of brass for PAA on the dark continent and enjoying a cool summer. He can be reached through the Communications Department, Pan American Airways Africa Ltd., A.P.O. 606, Posmaster, Miami, Fla.

Joe Moskey, W1JMY, gets down this way from Boston once in a while, but most of his travel is in a more northerly direction. As far as we know, he hasn't married the gal yet. Address: 959 Massachusetts Ave., Cambridge, Mass.

Hal Bubb, W1JTD, is still kicking around town, working at United Aircraft in East Hartford. He reports he finally got that commercial ticket. Hal is living at 14 Gilman St., Hartford.

BRIEFS

A number of inquiries have been received concerning the meaning of "Z" signals commonly used by commercial stations. In most cases they are simply abbreviations preceded by the letter Z — entirely different from the "Z" signals used by War and Navy Department stations. Here are a few of the most used ones:

ZAN — *A*bsolutely *N*othing received.
ZAP — *A*cknowledge, *P*lease.
ZSH — Strong *S*tatic *H*ere.
ZHC — *H*ow are receiving *C*onditions?
ZSA — *S*top *A*utomatic traffic.
ZRO — Are you *R*eceiving *O*K?
ZHA — What are conditions for automatic reception? (*H*ow *A*utomatic?)
ZOK — We are receiving *OK*.
ZNG — Conditions unfavorable for code reception. (*N*o *G*ood)
ZWR — Your signals *W*eak but *R*eadable.
ZMR — Your signals moderately *S*trong but *R*eadable.
ZSR — Your signals *S*trong and *R*eadable.
ZSU — Your *S*ignals *U*nreadable.
ZWO — Send *W*ords *O*nce.
ZWT — Send *W*ords *T*wice.
ZLS — *L*ightning *S*torm here.
ZSJ — *S*top automatic transmission because of *J*amming
ZMQ — Stand by.
ZTA — Send *T*raffic *A*utomatically.
ZNN — Clear of traffic.

W6MLL comes forward with a suggestion for maintaining the contacts we all used to have on the air. Hams seldom write one another, but passing postcards back and forth has been a common practice. Why not, then, continue to do it now that we are off the air? Make some postcard skeds with hams you used to contact regularly and keep them conscientiously at regular set intervals, just as you did those skeds on the air. In that way you can keep in touch with the old gang, know what they are doing, where they are. You can swap short yarns and ideas. Hams in the service would probably appreciate it no end. Some of the more ambitious correspondents might be able to get a WAS collection. It wouldn't cost much to try, anyhow.

The Month in Canada

QUEBEC — VE2

From Lin Morris, 2CO:

F/O Don Hanna, 2CD, was last heard from in Batavia, N. E. I., at the beginning of this year. Best wishes go forward to Edith Varey, YL operator at 2GX, on the occasion of her marriage, which took place in July. Lt. Gordon Yull, 2GE, completed his course at Brockville O.T.C. 2DU reports QSOs with 2JV, 2BU, 2NR, 3JI, 3UO and 3MB in the course of his travels. Lt. Albert Altherr, 2GM, transferred from the RCAF to the army and is now on the instructional staff of the Canadian Armoured Corps. He asks any of the VE2 gang who go to Brockville to qualify for a commission to look him up.

ONTARIO — VE3

From Len Mitchell, 3AZ:

3LS reports that he is still stationed with the RCAF at Ottawa. He has managed to get himself an Echophone EC1 to keep himself company, but says that the amateur bands are pretty empty. 3SN, when last heard of, was overseas with the RCAF as a wireless air gunner.

ALBERTA — VE4

From W. W. Butchart, 4LQ:

Edmonton hams noted with satisfaction that 4PH, erstwhile DX-hound of the VE4s and now a captain in the Ferry Command, has been honored by the King. Before leaving Edmonton last year for his present job, Mac Vic. was ferrying Ansons around Northern Alberta for CATL. 4XE's wedding came off very nicely, and by the time this appears in *QST* Dick and his YF will have settled down to married life in earnest.

The NARC held a weiner roast at Victoria Park, Edmonton, July 2nd, and a good time was enjoyed by all. Among those present were 5AEB of Kaslo, B. C., now with the RCAF at No. 2 Air Observers School; 4HF, 4KK, 4EA, 4HM, 4WH, 4XF, 4NU and 4LQ. VO6D-VE2JK paid a short visit but had to scram early, so he missed seeing some of the boys. Wives and families, etc., of the members were also in on the festivities.

4LQ received a letter from a chap in England commenting on our little ole column. A former Edmontonian, Stan Rayner by name, he is doing war work in one of the British factories. He notes that he is working on an FB oscilloscope, but says that parts are hard to get.

4ZI of Barons kicked through with a swell bunch of dope: 4AQP, grain buyer, was bereft of his young daughter a short time ago (our sincere condolences, OM). 4ADY has been married a year and a half, now lives in Vancouver where he is employed as a welder in the ship yards. 4WZ bought a 10-in. screw-cutting lathe to keep his mind off farming worries. He got married last January; our congrats go out to him. 4PZ is still unmarried, and has taken up electric welding as a sideline to farming. He is badly bitten with YLitis! 4ARC was married just after the outbreak of war. He now has a junior op to help out with his work! As for himself, 4ZI says that he has discovered two similarities — the building of a ham rig is never finished, and neither is a house. Some piece or gadget can always be fitted or added to each. Oh, yes, boys, 4ZI tacks a note to the end of his letter to the effect that he has a daughter one year old! Thanks a lot. Ellwood, for all that fine dope. We can do with lots like it!

4ACS is operating his own radio repair shop in Lethbridge, and says that he is still "out of the red." (We'll bet he hadn't heard of the new taxes when he made that crack!) 4BW, 4HT, 4XE, 4XF and 4LQ were in camp at Sarcee for two weeks in July. 4US has taken a job at Canada Packers as plant engineer. He was working a shift out at CATL prior to the change.

MANITOBA — VE4

From Art Morley, 4AAW:

Now's the time to catch up on those QSLs. It may save you a red face. 4ARX, a Sgt. in the RCAF at Saskatoon, just finished accusing your SCM — and boy, is my face red. Got an interesting letter from 4ME, who is "somewhere over there." If 4VG sees this, Harry wants to get in touch with you. He reports that 4APL, along with 4DZ and 3WU, are with him. Understand that 4SO is around there too. There seem to be more and more floating around. Ran into 4ARY out near Portage; he's with the RCAF.

There are several hams out at Rivers, all in the RCAF; and while they have ranks from Squadron Leader down, they are still all hams: 4CZ, 3ACS, 4AGC, 4AEE, 3AQN, 3AHU, 3PF, 3AED, 3AUI, 5ADJ and (for DX) K7HYK. 4AAI is kept busy teaching radio to Junior Air Cadets. Saw 4ADM in uniform; he's a Sgt. with the Signal Corps. 4TQ has turned out several for the Air Force. He reports that most of the Dauphin gang are in one or the other of the services. 3AFH is chief instructor at an RCAF school near Portage. How about some news once in a while? Saw 4ADV, 4OK and a few others on the street but couldn't catch them.

BRITISH COLUMBIA — VE5

(Due to space limitations the following was omitted from previous reports:)

From C. O. Sawyer, 5DD

The SCM wishes to thank those who have contributed in the past and wishes more information was forthcoming from those who are in the field. The lack of information from this district has been mainly that your SCM has been exceedingly busy in other war work and has had no information sent in. We have come to the conclusion from reading these reports that most VE5s are in the eastern provinces anyway! Hi!

Reproduced below is a most interesting letter from the Junior Point Grey Amateur Radio Club, which speaks for itself. The loyalty of its members during these critical times is something to be proud of. Being all of military age practically the whole club is in the services in one branch or another, and as you will note they are all in radio work.

Vancouver, B. C.

Dear Cecil:

Here is the dope on the Junior Point Grey Amateur Radio Club:

5AAN is a radio operator for the B. C. Police. 5RT is at the National Research Council. 5TR is a commissioned officer in RCAF. 5AGP is a first wireless officer in the Merchant Marine. 5FB is in the RCCS. 5UZ is a civil service wireless operator. 5AFE is a wireless operator for Pan American Airways. 5RY is a shipyard worker. 5LO is a civil service wireless operator. 5ADF is a wireless instructor in the War Emergency Training Plan. . . .

5TN and 5AOT are both attending a pre-enlistment RCAF Wireless Operator Ground course. 5TN hails from Trail and 5AOT is a Victoria lad.

Well, Cece, this information should help to fill up some space in *QST*. At least nobody can say that the hams aren't doing anything to help the war effort. Hi! I would like to offer this list also as a sort of challenge to other clubs to produce a list of members doing war work that will equal our list.

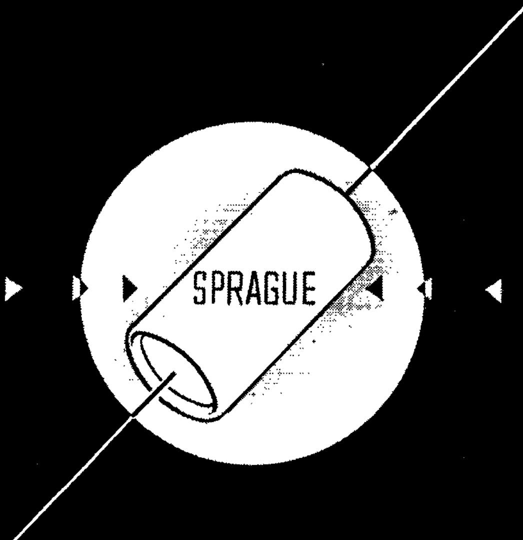
— *Bill Thompson*

MAILBAG

Here is the latest from one of our faithful correspondents, Dave Hutchinson, 3DU, of London, Ont.: "Enclosed please find renewal. . . . Do not want to miss any copies; even though we can't build transmitting equipment we must keep up with the ham game and also know what the boys are doing in the service.

"A lot of your boys have been up here but have never had the chance of meeting them, but 3IN who is a barber has had several over to his home for meals, as quite a few come to London during weekends. . . . I ran across ZL2RQ in our local paper in a list of 'Killed in Action.' He took his training in Dunnville, Ont. . . . We have had a lot of ZL boys trained here in London and sad to say a lot of them have already paid the supreme sacrifice with the Air Force. After this is over I am afraid the ranks of the hams are going to be sadly depleted, but we will have reason to be proud of what the boys have done for their countries.

"Had a talk with 3KC when he was home on leave at New Year's, and he left day after New Year's and he was going over the pond to take another course. He is now Lt. in the Navy. Had a long letter from 3AQK who is overseas with the RCAF. He is managing to find his way around in the blackout and has met quite a few of the gang overseas. There are as far as I can count 17 local hams in the services and I should say about 60% of the Inter-City Radio Ass'n are now on active service."



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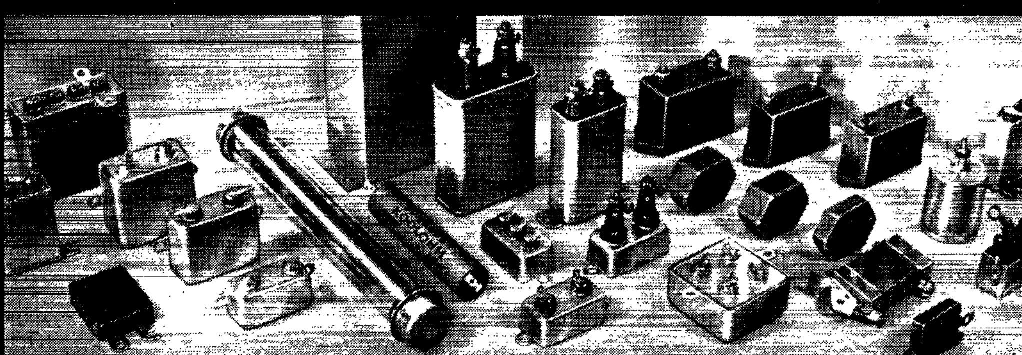

Book Reviews

(*Continued from page 36*)

Inc., New York City. 534 pages, 6 × 9; illustrated. Price, $4.50.

During the last year or so the shortage of highly-trained men in the u.h.f. field for the defense — and now, war — effort has been painfully apparent. To meet the need, representatives of forty-odd universities and colleges met at the Massachusetts Institute of Technology, in the fall of 1941, for the purpose of preparing a training course in ultrahigh-frequency techniques to be given selected senior engineering and physics students. As no suitable text was available for the course, Professors Brainerd, Koehler, Reich and Woodruff undertook to prepare one, with the present volume the result.

The title of the book is the same as that given the course, and is not wholly descriptive of the contents. In fact, the text is a rather complete treatment of radio engineering, emphasizing those aspects which form the basis for ultra-high-frequency work. Opening with a chapter on linear circuit analysis, much of the material to be found in radio engineering texts — fundamentals of tubes, amplification, modulation, detection, reception, transmission, wave propagation — follows. Transmission lines and radiation are treated much more completely than in the familiar engineering volumes, and there is a great deal of material on cathode-ray tubes, circuits for obtaining special waveforms, u.h.f. generators of various types, and wave guides. The treatment is mostly mathematical. A laboratory manual, outlining experiments to be performed as part of the course, is included.

In view of the nature of the book, it would seem that somewhat more space could be devoted to u.h.f. wave propagation, most of the chapter on that subject dealing with the paths of waves at lower frequencies. But otherwise, the amateur who isn't frightened by the interspersion of equations with plain language can get a tremendous amount of meat from it.

With time of first importance, the book was prepared at top speed, even the printing being done by the offset process to avoid some of the delays inevitable in regular printing. Considering the haste with which it was produced, there are relatively few typographical errors, most of them quite minor. Combining for the first time the basic material needed for advanced u.h.f. work, *Ultrahigh-Frequency Techniques* is undoubtedly a significant addition to the literature. — *G. G.*

Power Supply

(*Continued from page 27*)

It isn't pure by any means.
Its ripples need some smoothing.
Chokes and condensers serve for this;
The waves find these quite soothing.

The filter circuit works like this:
In a condenser-input filter,
Inductance and capacitance
Keep pure d.c. in kilter.

Pulsating d.c. also has
Some a.c. current flowing.
Condensers short the a.c. out,
And chokes keep d.c. going.

And so at last like Ivory Soap
Our current's pure d.c.
I must confess this whole darn thing
Has made a wreck of me, see?

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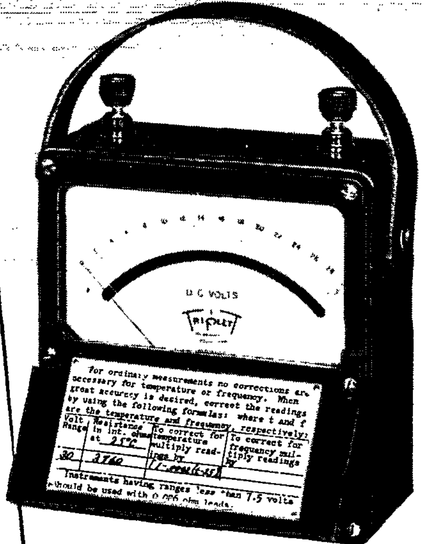
If you, like the writer of the letter quoted below, want to back up our armed forces with time-saving production practices, write for complete details on other Triplett Portables, panel electrical measuring and test equipment.

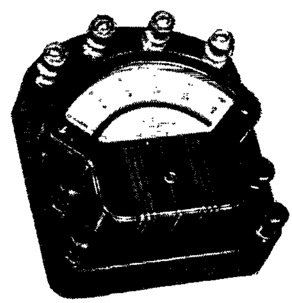
Excerpt from letter of a prominent manufacturer (original in our files):

"With the Ohm Meter we have on order we can do in . . . . seconds, what now takes a couple of hours."



Model 625

Models 625 D.C. and 635 A.C. Portables are unequalled for today's rush in production testing or the rigid requirements of laboratory checking. These highly attractive molded case instruments have long 4.58" hand calibrated mirror scales. The hinged cover closes when instrument is not in use, for added protection. Black molded case for D.C. instruments; A.C. is red. Size is 6" x 5½" x 2½". Has detachable leather strap handle.



Model 425

Another new Portable combining attractive symmetrical case proportions, a long readable scale, and requiring a minimum of bench space when in use. A real beauty in design for those preferring something different. Case and base are molded; base size 5" x 4⅜". Model 425 D.C. (3.12" hand calibrated mirror scale); Model 435 A.C. (2.88" hand calibrated mirror scale.)

THE TRIPLETT ELECTRICAL INSTRUMENT CO.
BLUFFTON, OHIO

Hints and Kinks

(*Continued from page 76*)

through capacitive coupling. These undesired responses may be transmitter harmonics coupled through from one inductively-coupled stage to another or, more seriously, from the output stage of a transmitter to the antenna circuit. Capacitive coupling is also often responsible for the introduction of spurious high-frequency signals in superheterodyne receiver circuits tuned to lower frequencies. Thus, if the capacitive coupling can be eliminated, the undesired high-frequency responses will also be eliminated, while the inductively-coupled path for the desired frequency remains unaltered.

The Faraday or electrostatic shield is designed to accomplish this objective. Such a shield usually consists of a plurality of closely-spaced parallel conductors, each insulated from the others at all points except at one end of each conductor, where all conductors are tied together and grounded. This shield is placed between the two coils in inductively-coupled circuits.

Shields for transmitter stages are not difficult to make, since large conductors, which are largely self-supporting, may usually be used. Small shields which will fit into receiver applications are often somewhat of a problem, however. After many attempts, a method has finally been worked out which is not too difficult to follow and which results in a good substantial job. The construction is illustrated in the sketch of Fig. 7. The form consists of a flat piece of ¼-inch board, or preferably Presdwood with the impressions on one side. The dimensions of the piece should be about an inch and a half larger all around than the desired size of the finished shield. Opposite edges of the piece should be rounded off with a file.

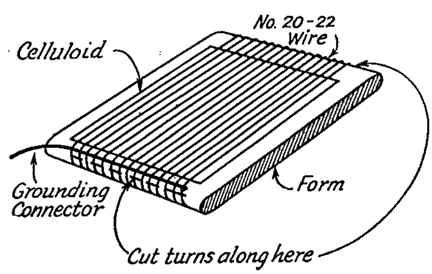


Fig. 7 — The electrostatic shield is "wound" over a ¼-inch thick form with rounded edges. Turns should be spaced approximately the diameter of the wire used.

The wire is then wound around the board, anchoring the starting end in a small hole drilled in the form. No. 22 or 24 wire is suitable and the turns may be spaced quite accurately by following the impression lines on the back of the Presdwood. The wire should be held with good tension during winding to keep the winding flat. The rounded edges of the form will help to keep the turns lying flat along the surface of the form.

When the desired surface area has been covered, the finishing end of the winding should also be securely anchored. It is advisable to extend the

Near technical perfection is achieved through use of scientific instruments but the trained eyes of skilled workmen inspect completed units before they are passed along to the pumps

An important reason why Eimac tubes set the modern pace in communications

In the fabrication of plates, sealing of stems and leads, winding of grids...every tiny part must pass the rigid inspection of trained individuals, precision testing devices. At the end of each production line sits a group of hardboiled inspectors. All this checking and testing takes place before Eimac tubes reach the vacuum pumps. That's one of many reasons why Eimac tubes possess such uniformity of characteristics . . . why their performance records have made them first choice among world's leading engineers.

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Eimac TUBES

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Export Agents: Frazar & Co., 301 Clay St., San Francisco, California, U. S. A.

Bead tester utilizes polarized light in search for stress points in glass beads which seal leads to bulbs

Polariscope is here used to inspect glass bulbs for flaws or strain which may occur during the shaping operations

General inspection bench where completed filament stems and assemblies are thoroughly checked for faulty construction

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(Continued from page 106)

winding a half-inch or so beyond the point which will cover the desired area, since the outside turns may be damaged before the job is finished. Close to one of the rounded edges of the form the insulation should now be removed from each turn (on both sides of the form) for a distance of about ¼ inch. A wire connecting all the turns together should then be soldered across the end of the winding on both sides of the form. This connecting wire should be extended sufficiently to permit connecting it to a convenient grounding point in the receiver.

Next, sheets of celluloid, slightly narrower than the length of the turns but an inch or so longer than the length of the winding, should be slid in between the winding and the form on each side, taking care not to disturb the winding. Judicious use of a thin knife will help to relieve sticking or binding as the celluloid is inserted. The turns may now be cemented to the celluloid sheets with Duco cement thinned with nail-polish remover. The cement should be allowed to dry thoroughly first and then the winding may be removed by cutting the turns at the edges of the board. This method produces two shields from one winding. After removal, the shields may be trimmed up and cut to the exact desired size with a pair of tin shears. The extended edges of the celluloid may be used for mounting, or the entire assembly may be cemented to a second sheet of celluloid or other material of larger dimensions. If the latter course is followed, the assembly should be clamped between boards in a vise until thoroughly dry to prevent shrinkage of the celluloid base and consequent buckling of the sheet.

Strays

An item in *Ohmite News* suggests that sheets of cellophane may be used over the surface of sheet metal to prevent marring during the process of bending or drilling. The tensile strength of cellophane is high and its transparency permits markings to show through.

— • • • —

W4EFX: "One of the restaurants here named a sandwich after me."

W4ECW: "Deviled ham, I bet." — *The (N. C.) Arc.*

— • • • —

Here's another ham family:

R. E. Ledbetter, W9WTT; W9QJS, brother; W9QJR, brother-in-law; W9KOD/6, sister-in-law; W9NRT, brother-in-law.

— • • • —

W5KOB wonders if he is the youngest W5 ham. He is 14 years old.

— • • • —

W9NVC is R. F. Burns of Beloit, Wis.

QRR Off Malaya

(*Continued from page 57*)

Well, it didn't take us long to get together and exchange experiences. We talked in very low whispers. They told me they had been stationed for several months as guards in a small village about fifty miles west across the border, at the request of British nationals. They had been ambushed by a platoon of Jap infantrymen and taken prisoners. The Japs had marched them on foot to our prison. They had not had a bite of food since the night before.

I told them of my experiences, and they were overjoyed when I told them about the suitcase. One of them suggested we remove the gun and transceiver and hide it under the bunk, which we did. A good thing, too — it wasn't very long after when a guard entered and demanded the suitcase.

Half an hour later another soldier — apparently an officer, from his uniform — looked in the door. "Mr. Godwin?" he asked, and when I said, "Yes," he handed me a small package from under his blouse.

There was something familiar in the accent with which he spoke, but I couldn't seem to place what it was. I took the package. We all stood in silence. He opened the door, passed through and locked it. Gingerly I unwrapped the brown paper while one of my fellow prisoners held the light. To our amazement, it contained a small collapsible spade. A piece of paper was tied to the handle. We looked at each other. I opened the note and read it.

"That was my valet who left me in Kota Bharu," I exclaimed. The Aussies were incredulous. It was obvious that Tex was trying to help me — why, they did not know. One of them suggested it might be a trap — merely a good excuse to shoot us for attempted escape. But I felt Tex was honestly trying to help me. At least, it was a chance — perhaps our only chance of making a getaway.

We decided to make a try. Picking a spot under the rear wall, we set to work, digging quietly. The ground was soft, and we would place the soil under the bunk in case a guard returned before we finished. We took turns about and soon had tunneled under the wall, making a hole large enough for a man to crawl through.

We held a council of war and agreed that we were going south along the coast. We all shook hands and wished each other luck, and one by one we crawled through the opening. I carried the flashlight, and two of the Aussies the revolver and transmitter. At the fence, which was made of large sharp-pointed vertical bamboo poles, we helped each other to the top and then jumped down on the far side. We all got over, although how we did without disturbing the guards I'll never know; it sounded to me like horses jumping down in the quiet and still of the night.

When all of us were over, we listened for the sound of an alarm. Hearing nothing except the

(Continued from page 110)

surf, we started north and struck the coast, then back-tracked in the water in a southerly direction so as to leave no tracks. It was hard walking, but we felt it the safest thing to do. Only once did we see a house. There were no lights, but we gave it a wide berth just the same.

We walked until 4 A.M. Then, realizing that it would be daylight before long, we stopped and rested. I decided to try to put the transmitter in operation. I changed coils, putting the oscillator up in the ship band. We uncoiled the antenna wire and tied a shoe to one end of it. One of the Aussies walked up the beach to a woody section where he threw the shoe over the highest tree we could find. Finally we were ready to try out the rig. I held my breath as I switched on the filaments. In the moment before the heaters began to glow I knew blank despair — but they were OK! I snapped on the plate voltage, and the hand in the small meter on the panel nearly wrapped itself around the pin before I got the final in resonance.

The Aussies grinned tense encouragement as I started sending, slowly and carefully. I knew the batteries were weak, and — well, you know that feeling when you think you're not getting out. I just kept on sending until the meter indication sank to zero and I knew it was all over. . . .

The narrator drew a deep breath and looked around the circle of intent faces. "Well, you know the rest. I must admit that I had just about lost hope when we saw your blinker, an hour later, though. We owe a lot to you and your men, Commander."

Commander Lackey answered with a smile. "Glad to do it, my boy. And let me congratulate you on the foresight you used in having that ham radio equipment with you. But I have just one question — what was in that note the Jap gave you along with the shovel?"

"Here it is, sir. Read it for yourself."

The commander took the soiled scrap of paper. Unfolding it, he read:

W4MCS:

OM, hr shovel. Dig under back wall. Tnx fr QST. U made me WAS in 1940. 73 es gud luck.

'Tex' J9—.

Strays

W6NVI, W8WVP and W9LIP are now doing civilian radio work at an undisclosed foreign base.

According to one technical magazine, *frequency* is defined as the number of *alterations* per second! — *W8JJJ.*

Air-cooled transmitting tubes are now being made in sizes up to 25 kw. The heat dissipated by one of the large tubes is sufficient to heat a six-room house in winter!

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MT. CARMEL, ILLINOIS

"PRECISION-BUILT PRODUCTS"

A Course in Radio Fundamentals

(Continued from page 47)

Assignment 8:

Q. 2 — 10 volts; 500 volts; 500 volts.
Q. 6 — 125; 55,000 ohms.
Q. 7 — Neglecting internal resistance: 11.4; 39.6 ohms. Including internal resistance: 10.4; 38.7 ohms.
Q. 9 — 4.55 μh.; 114 μμfd.
Q. 10 — The curve should go through the following points:

50 μμfd. — 41.4 μh.
100 μμfd. — 20.7 μh.
150 μμfd. — 13.8 μh.
200 μμfd. — 10.4 μh.
250 μμfd. — 8.3 μh.

Q. 11 — The curves should go through the following points:

C μμfd.	*Q* 10,000 ohms	*Q* 5000 ohms
50	11	5.5
100	22	11
150	33	17
200	44	22
250	56	28

Q. 12 — 3760 kc.
Q. 13 — a) 7120 kc.
b) 224.
c) 100,000 ohms.
d) 224 volts.
e) 1.12 volts; 0.56 amp.; 0.0025 amp.; 224 = Q.
f) 7400 ohms; error = 8.1% (could be neglected); 160%.
g) Neglecting internal resistance: 0.56 amp.; 0.0312 amp.; 17.9. Including internal resistance: 0.557 amp.; 0.0338 amp.; 16.5.
Q. 14 — 2.99 μh.; 42 μμfd.
Q. 18 — Same in both cases.
Q. 19 — 10 ohms.
Q. 20 — 63.3 μμfd.; 157,000 ohms.

Assignment 9:

Q. 7 — 135 μh.; 3.7 μμfd.; no; 1.35 μh.; 370 μμfd.; tap load down on coil.
Q. 8 — (For a frequency of 7120 kc.):

R	*Circuit*	*C* (μμfd.)	*L* (μh.)
10	A	224	2.24
20	A	112	4.48
70	A	32	15.7
150	C	200	2.5
600	C	100	5.0
2000	B	112	4.48
5000	B	44.8	11.2

Capacity values for circuit *A* are maximum, for circuit *B* minimum; fairly wide range of values can be used with circuit *C*.

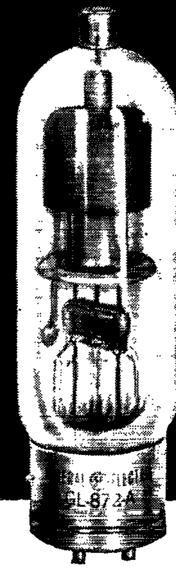
Assignment 10:

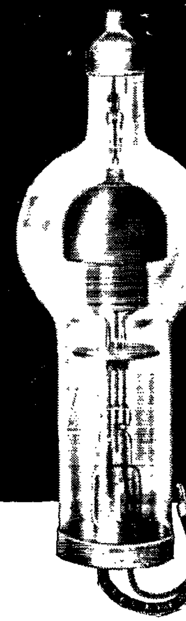
Q. 2 — 85.7 meters; 281 feet.
Q. 9 — 450 kc., 4450 kc.; 3901.5 kc., 3898.5 kc.; 1000 cycles, 14,299 kc.
Q. 14 — 19 μμfd. or higher.
Q. 15 — 32 μfd. or higher.
Q. 16 — 1.1 millihenry or higher.
Q. 17 — Yes (47,000 ohms); no (5650 ohms).

Strays

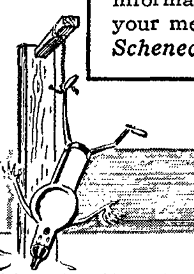
"WPB Orders 349 Tubes Dropped." Some boom!

How to Get Longer Life from Your MERCURY-VAPOR TUBES



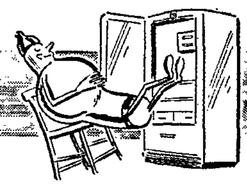


Here's a four-word formula to make your mercury-vapor tubes last longer—"Handle carefully; operate conservatively." Below are a few suggestions to help you put this formula into effect. They will help prevent many of the causes of tube failure, such as: loss of emission, high arc-drop, cathode bombardment, arc-backs, the liberation of gas, and cathode failure. These safeguards are applicable to such tubes as the following General Electric mercury-vapor rectifiers: GL-266B, GL-857B, GL-866A/866, GL-869B, GL-872, GL-872A. For more complete instructions on operation and handling, write for Bulletin GEH-977B. Also list the types of G-E mercury-vapor rectifiers you are now using. We shall be glad to send you complete service information designed to help you get the most out of your mercury-vapor tubes. *General Electric Company, Schenectady, N. Y.*

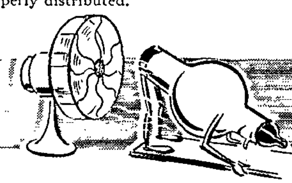


1 Keep tubes upright and avoid splashing mercury around. When tubes are first placed in operation, be sure to apply cathode voltage *alone* until mercury is properly distributed.

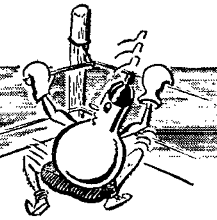
2 Keep condensed mercury temperature within limits recommended by tube manufacturer.



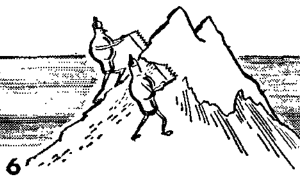
3 Be sure cathode base, not the anode end, is coolest part of tube. Don't let drafts blow on tubes. Never allow the mercury to condense at the anode end.



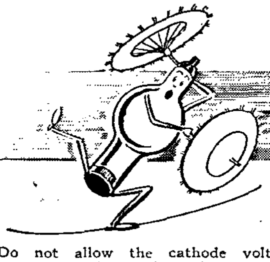
4 If you use forced air against the bottom of the tube, keep the blower on for a few minutes after shutting filaments down.



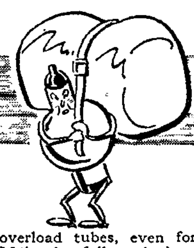
5 Allow plenty of filament warm-up time before applying anode voltage.



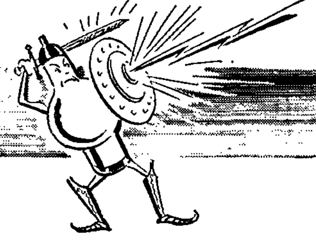
6 Keep peak inverse anode voltage and peak current as low as possible for satisfactory operation. Use adequate protective devices for overload and arc-back protection.



7 Do not allow the cathode voltage (measured at the pins) to deviate more than five per cent from the rated value.



8 Don't overload tubes, even for short periods. Maintain full cathode voltage during standby operation when tube is operated without load.



9 Protect the tubes adequately against the effects of r-f.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment.

GENERAL ELECTRIC

161-38B-8850

Cryptanalysis Lesson

(*Continued from page 68*)

"There!" Jim breathed, "down one more letter, with **a** equal to **F.**"

"Well, a possibility — but then there would be no **r's** nor **s's.** Let's look further . . . ahhhh, how about this one, with **a** set to **R?**"

"Okay, colonel. Let's try the second column. Looks fair in the starting position of **a** set to **A.** And **RA** is a good start for a keyword," Jim opined. "Lessee . . . **W** and **H** are also possibilities, but not good ones. You take it from there."

"Bremer to Wilson for a touchdown! I've got **a** set to **D** as a good prospect for the third column, so far giving us **RAD** for the keyword, and a good ham like myself doesn't have to be hit with a freight train to guess that it's **radio.**"

Jim scowled. "And you told me I should never guess. Well, let's put it on paper and decipher the first few lines:

R A D I O

R N V E S
a n s w e

I T R B V
r t o t h

which certainly makes good English. Gee, it's easy if you know how. But s'pose you can't find any repeated sequences, to begin with?"

"In that case you try repeated digraphs," Ed instructed, "or even repeated single letters. If your text is sufficiently long, you're bound to find some recurrences. Don't forget, too, that a reversed alphabet might have been used. Or even a mixed one, but that's a subject for some long winter evenings. Speaking of evenings reminds me — it's past your bedtime. Say, why the gloomy Gus? 'Fraid of the dark?"

"Nope," complained Jim. "I was just thinking what a shame it is that our straight English text should be written in lower case. Our first sample message most certainly should be in capital letters, like this:

"BUY WAR BONDS AND STAMPS!"

— • • • —

CFQSS UOUJE RRIAZ TTDPE IYAAR SLTNO PIEEW

DSOZD SOCOG OYSYQ SOHOY DSYXO ZXASY CLXOX
POOVP CDDZZ

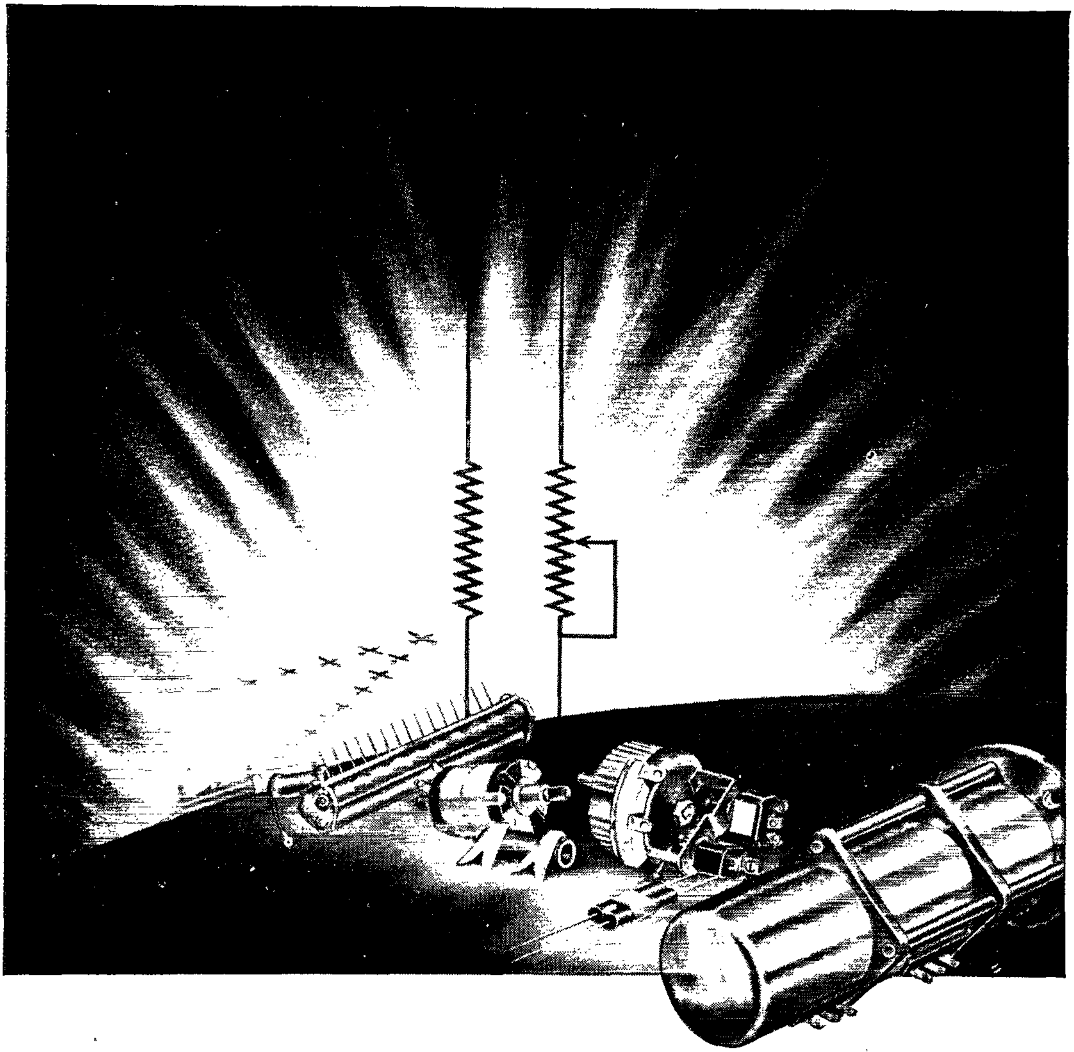
ENUWC PNOBU BMZCH WNNRT CEHJY FWNEN RQAQO
HYDYB VJQOH DBSKF HGLIH MEFTZ KRTUB TLSBN
RJGNB GQXTP DHYEE BSETH ELXLH OIMFH WFHGL
BSNNW XMZNJ DYNOX BKUWB WGLDO PWKOA IMNMS
YDYCL TCNQR HEYOU ULYLH ZTNCK BFGZE CDCXH
JBKBT BEQCX

—*ZCVA No. 33, 1941.*

— • • • —

Solutions to ciphers in May issue:

1) Examination for radiotelephone second class operators license. (Reversed writing.)



TOMORROW'S RESISTORS

The war has not stopped IRC engineering and development work. It has only intensified it. One exacting requirement after another has been met. New requirements will be met as they arise.

Thus, just as IRC has pioneered the most important fixed and variable resistor developments of the past two decades, you can look to IRC for continued leadership, both in resistor development and in the all-important "Know-how" of resistor application and use under all conditions and in all parts of the world.

Tomorrow's resistors are being born in today's crucible of War—and, as in the past, they will bear the trademark "IRC."

INTERNATIONAL RESISTANCE COMPANY

401 N. Broad Street, Philadelphia, Pa.

(*Continued from page 116*)

2) You won't find the rest as simple as this one. (Transposition, two columns; often called "fence rail.")

3) The other evening I sat on the front porch overlooking a beautiful scene in the valley a mile beneath my place of residence. (Simple substitution, alphabet keyword "Brasspounders.")

Solutions to ciphers in July issue:

1) Light beam communication is a fascinating study. (Transposition, three columns.)

2) Marconi lectured on current radiation. (Transposition, enciphered with spiral inscription.)

3) See, it wasn't so hard after all; perseverance accomplishes many ends. ("Nihilist" or columnar transposition, keyword "Minilog.")

4) While making deep excavations we found some quaint bronze jewelry stop. (Transposition, enciphered with alternate horizonal inscription, diagonal transcription.)

How Recordings Are Made

(*Continued from page 72*)

compensation is regulated by a variable resistance, as illustrated in the accompanying response curve. The width of the attenuation band is determined largely by the Q of the inductance, and can be varied by connecting parallel resistance across the coil.

The opposite case, where a parallel-resonant circuit is used to boost a particular section of the spectrum, is shown in Fig. 6-C. This is a type of equalizer extensively used in commercial recording amplifiers. The peak can be shifted as desired by switching the tap on the coil; the range may, of course, be extended by also switching in different values of capacity. Popular units have four frequency taps, giving resonance at 4000, 6000, 8000, and 10,000 cycles, and a tapped resistance varying the attenuation in steps of 2 to 5 db. each.

Again it is emphasized that all of these arrangements are "losser" circuits, and that the boosting of any one frequency is at the expense of all others. To maintain normal output from the amplifier, therefore, at least enough excess gain must be provided to replace that lost in the equalizer. The curves shown are only typical; variations in individual circuits and components, particularly in the case of inductances, may alter the actual results markedly.

In Fig. 6-D is shown a circuit that does not reduce the overall gain of the amplifier but which does provide an exceptionally wide and flexible range of control. This is the "dual tone control" based on the negative-feedback principle. It requires the addition of a triode such as the 6C5 as a degenerative amplifier. The circuit shown is that developed by Thordarson and now used extensively in a variety of commercial and amateur sound apparatus.

With both ganged dual-potentiometers at "normal" the 6C5 triode serves as a straight degenerative amplifier with an extremely large cathode resistor which, being un-by-passed, is highly degenerative. The gain in this stage, although small, is then flat for all frequencies in the audio range. Turning the bass control to the

(Continued from page 118)

left connects the inductance L across the cathode resistor, effectively shorting it out for the lower frequencies and therefore increasing the gain at those frequencies. Turning it to the right, on the other hand, shunts the inductance across the following-stage grid circuit, attenuating the lower frequencies. The treble control, likewise, connects the condenser C_3 either across the cathode for high-frequency boosting or across the grid for high-frequency attenuation. Thus by variation of the two controls it is possible to boost either bass or treble by 15 db. or more or attenuate either by 40 db. or more, giving a wide range of frequency characteristics as indicated in the frequency response curves.

In applying any of these circuits it must be emphasized that care must be used to avoid troubles with oscillation, transients and hum. It is advisable to install the equalizer between stages operating at a fairly high level to avoid hum and noise difficulties, but doing so increases the likelihood of oscillation and distortion due to transients. The best position is usually just before the driver stage, or where the signal level is between 1 and 10 volts. The greater the damping (i.e., the lower the Q), particularly of resonant circuits, the less likelihood there will be of trouble. All parts, particularly inductances, should be located away from transformers, chokes or other sources of humfields. Electrostatic shielding of parts and wiring is essential, and electromagnetic shielding of inductances in a heavy iron can may be desirable.

(*This article is No. 3 of a series. Previous articles appeared in the July and August, 1942, issues of* QST. — EDITOR.)

The Japanese Code

(Continued from page 25)

no other digraphs. These data can be used only after Japanese characters have been translated into Rōmaji, of course.

I	168	KU	52	SO	22	YU	6
MA	156	RA	52	YA	20	MU	4
SHI (si)	154	DE	50	RU	20	NE	4
O	150	KI	50	YO	18	DZU (du)	4
TA	144	GA	46	SE	16	HO	4
TO	124	RE	44	RO	16	GO	4
TE	92	E	38	HA	16	GU	4
NI	90	SU	36	BA	14	GI	4
N	82	A	34	FU (hu)	14	NU	2
NO	82	DA	32	DO	14	PO	2
NA	82	CHI (ti)	30	JI (di)	12	BU	2
KA	80	MI	26	BI	10	ZA	1
SA	76	U	26	ZU	6	PI	1
WA	76	ME	24	BE	10	PO	2
MO	60	HI	22	ZO	8	HE	1
RI	60	TSU (tu)	22	PA	6	ZE	1
KO	58	KE	22	GE	6	PE	1
WO	52						

The author is indebted to Messrs. Charles E. Holden and Frank L. Jackson, both of New York City, whose studies of the Japanese language have been helpful in the preparation of this article. The chart on page 24 is the work of Mr. Holden.

Echophone Model EC-1

6 tubes, 3 bands. Tunes from 550 kc. to 30 mc. Beat frequency oscillator. Bandspread logging scale. Self-contained speaker. Electrical bandspread on all bands. AC/DC. 115-125 volts.

ECHOPHONE RADIO CO., 201 EAST 26TH ST., CHICAGO, ILLINOIS

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(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.
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(3) The Ham-Ad rate is 15¢ per word, except as noted in paragraph (6) below.
(4) Remittance in full must accompany copy. No cash or contract discount or agency commission will be allowed.
(5) Closing date for Ham-Ads is the 25th of the second month preceding publication date.
(6) A special rate of 7¢ per word will apply to advertising which, in our judgment, is obviously non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Thus, advertising of bona fide surplus equipment owned, used and for sale by an individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League takes the 7¢ rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and all advertising by him takes the 15¢ rate. Provisions of paragraphs (1), (2), (4) and (5) apply to all advertising in this column regardless of which rate may apply.

Having made no investigation of the advertisers in the classified columns, the publishers of *QST* are unable to vouch for their integrity or for the grade or character of the products advertised

* * * * *

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* * * * *

QUARTZ — direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Drill Carbon Co., 719 World Bldg., New York City.

COMMERCIAL radio operators examination questions and answers. One dollar per element. G. C. Waller, W5ATV, 6540 Washington Blvd., Tulsa, Okla.

TELEPLEXES, Instructographs bought, sold. Ryan's, Hannibal, Mo.

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.

SWAP — New Abbott MRT-3 transceiver for late Meissner Deluxe Signal Shifter, also want crystal microphone, television receiver and multimeter. Karl Stello, W3IVZ, Beltsville, Md.

WANTED type 813 and RK48 tubes. Radio Station W-A-L-L, Middletown, N. Y.

WANTED: A versatile young man who is master of intricate electrical circuits, and gifted in the assembling and repair of delicate electrical apparatus to learn industrial instrumentation. Reply to: The Don C. Campion Laboratories, 9086 Alpine Ave., Detroit, Mich.

WANT National NSM modulator also National speech amplifier. Sell National NTX 30 transmitter. RME DM36 expander 5–10 meter bands. RCA TMV122B oscillograph 3". W5DLC, 4425 Bordeaux, Dallas, Texas.

SELL HRO, complete with power supply, speaker and coils. $85. W3JTN.

SWL'S? — Samples? W8DED, Holland, Mich.

SELL: RCA ACR175 $89.50, exceptionally good ACR155 with 2nd IF added, $59.50. Brand new, pr TZ40s, RCA 802; almost new 203Zs, 100THs, also power supplies, filament xfmrs, etc. for same. Bliley LD2s 3993.5, 3946, 3910.5, 1967.5 kc. xtls. Complete PA system 27 watts output, $95. 20% off catalog prices on all xmtr parts, & on Turner VT73, Brush 23, Astatic D104 mikes. Dwight Stebbins, Morris, Minn.

WANTED NC-200 for cash. Box 33, Coral Gables, Fla.

CASH for used radio test instruments and meters. Wanted: Oscilloscopes, volt-ohm-milliammeters, vacuum-tube voltmeters — RCA, Hickok, Supreme, Precision or equivalent makes. Also 0–1 milliammeters and 0–5, 0–10, 0–25 a.c. or d.c. ammeters, 3-inch size. Required in war training. Send equipment for liberal appraisals to Allied Radio Corp., Dept. 27-J-C, 833 W. Jackson, Chicago.

WE pay highest cash prices 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, 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.

CRYSTALS: If you are eligible for crystals under WPB M-146 order and can supply high priority with M-146 certification, place your order with us for earlier delivery. High quality commercial crystals suitable for frequencies between 1600 and 10,000 kilocycles are available in our new and smaller type E62 and E64 Steatite units. Crystal repair service available. Eidson's, Temple, Texas.

URGENT need for RCA type 828 tubes in broadcasting industry. Amateurs, put your idle tubes to work in an essential industry. KWIL, Albany, Oregon wants new or slightly used RCA type 828 tubes.

HIGHEST prices paid for your communication receivers or transmitters. Also, will buy meters, and test equipment. Write Leo, W9GFQ, 744 West Broadway, Council Bluffs, Iowa.

W9GFQ still has a large stock of EC1, EC2, EC3, Howard 435A, 436A, and 437A receivers. Also can supply 2½ meter equipment immediately. We still have a large parts stock and can give you delivery immediately on all the above without priorities. Send your order today. 744 West Broadway, Council Bluffs, Iowa.

WANTED: 902. Make offer. W9IWO.

KOLORKARDS — The most practical code memorizing method ever devised. Complete Lessons and Material — $1. KolorKards (W8RW), Bluffton, Ohio

CASH for your equipment. See advertisement on page 106. Let's win this war, quickly! Bill Harrison, 12 W. Broadway, N.Y.

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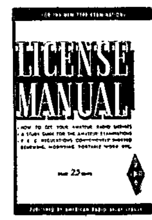
★ ★ ★

Hints & Kinks

Amateurs are noted for their ingenuity in overcoming by clever means the minor and major obstacles they meet in their pursuit of their chosen hobby. An amateur must be resourceful and a good tinkerer. He must be able to make a small amount of money do a great deal for him. He must frequently be able to utilize the contents of the junk box rather than buy new equipment. Hints and Kinks is a compilation of hundreds of good ideas which amateurs have found helpful. It will return its cost many times in money savings — and it will save hours of time. *Price 50 cents*

The Radio Amateur's License Manual



To obtain an amateur operator's license you must pass a government examination. The License Manual tells how to do that — tells what you must do and how to do it. It makes a simple and comparatively easy task of what otherwise might seem difficult. In addition to a large amount of general information, it contains questions and answers such as are asked in the government examinations. If you know the answers to the questions in this book, you can pass the examination without trouble. *Price 25 cents*

How to Become a Radio Amateur

Universally recognized as the standard elementary guide for the prospective amateur. Features equipment which, although simple in construction, conforms in every detail to present practices. The apparatus is of a thoroughly practical type capable of giving long and satisfactory service — while at the same time it can be built at a minimum of expense. The design is such that a high degree of flexibility is secured, making the various units fit into the more elaborate station layouts which inevitably result as the amateur progresses. Complete operating instructions and references to sources of detailed information on licensing procedure are given. *Price 25 cents*

Lightning Calculators

RADIO, *Type A* — This calculator is useful for the problems involving frequency, wavelength, inductance, capacity, etc. It has two scales for physical dimensions of coils from one-half inch to five and one-half inches in diameter and from one-quarter to ten inches in length; a frequency scale from 400 kilocycles through 150 megacycles; a wavelength scale from two to 600 meters; a capacity scale from 3 to 1,000 micro-microfarads; two inductance scales with a range of from one microhenry through 1,500; a turns-per-inch scale to cover enameled or singler silk covered wire from 12 to 35 gauge, double silk or cotton covered from 0 to 36 and double cotton covered from 2 to 36. Using these scales in the simple manner outlined in the instructions on the back of the calculator, it is possible to solve problems involving frequency in kilocycles, wavelength in meters, inductance in microhenrys and capacity in microfarads. Gives the direct reading answers for these problems with accuracy well within the tolerances of practical construction. $1.00

OHM'S LAW, *Type B* — With this concentrated collection of scales, calculations may be made involving voltage, current, and resistance, and can be made with a single setting of a dial. The power or voltage of current or resistance in any circuit can be found easily if any two are known. This is a newly-designed Type B Calculator which is more accurate and simpler to use than the justly-famous original model. It will be found useful for many calculations which must be made frequently but which are often confusing if done by ordinary methods. All answers will be accurate within the tolerances of commercial equipment. $1.00

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Everything for the Amateur

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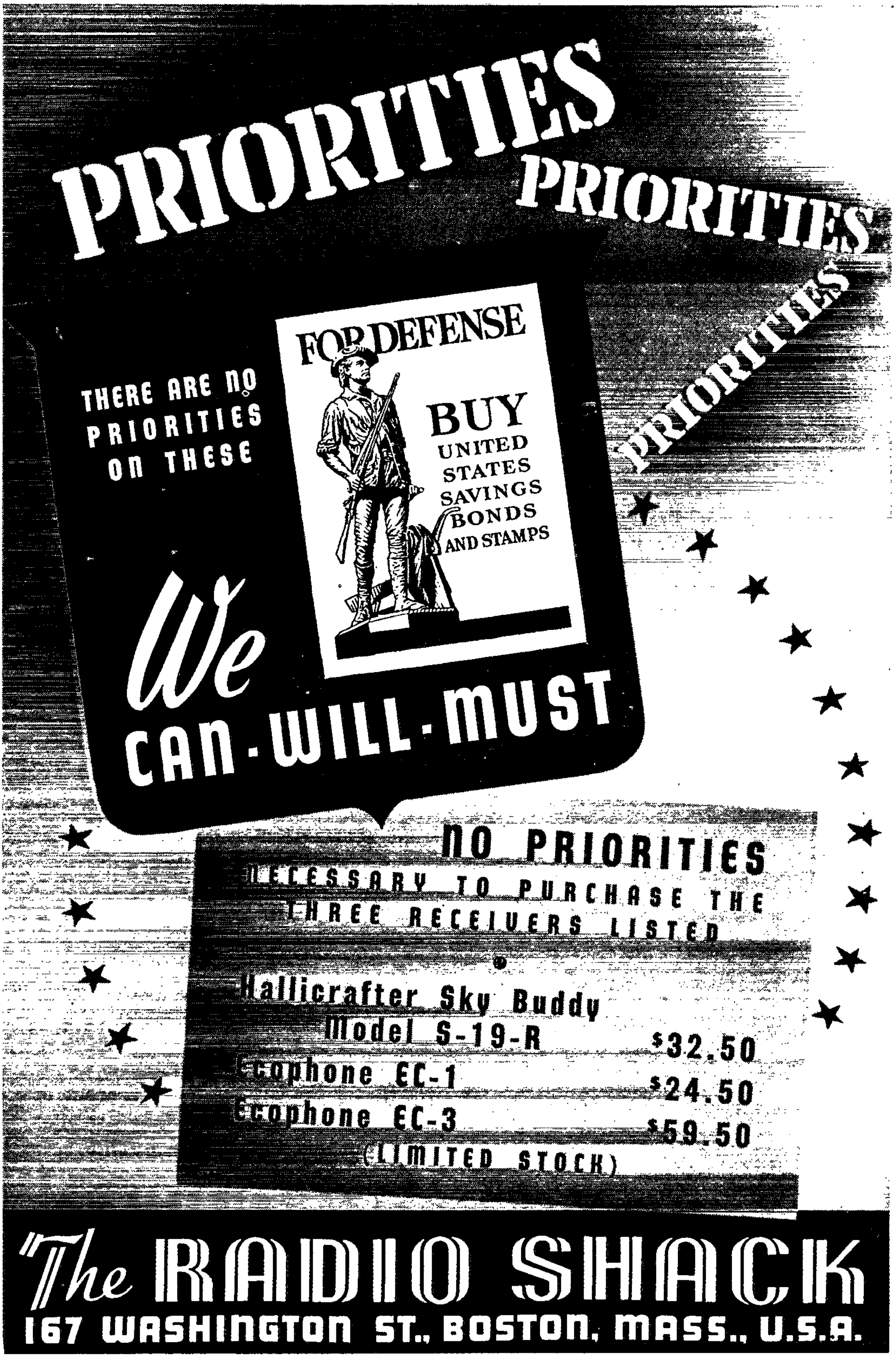
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CAN - WILL - MUST
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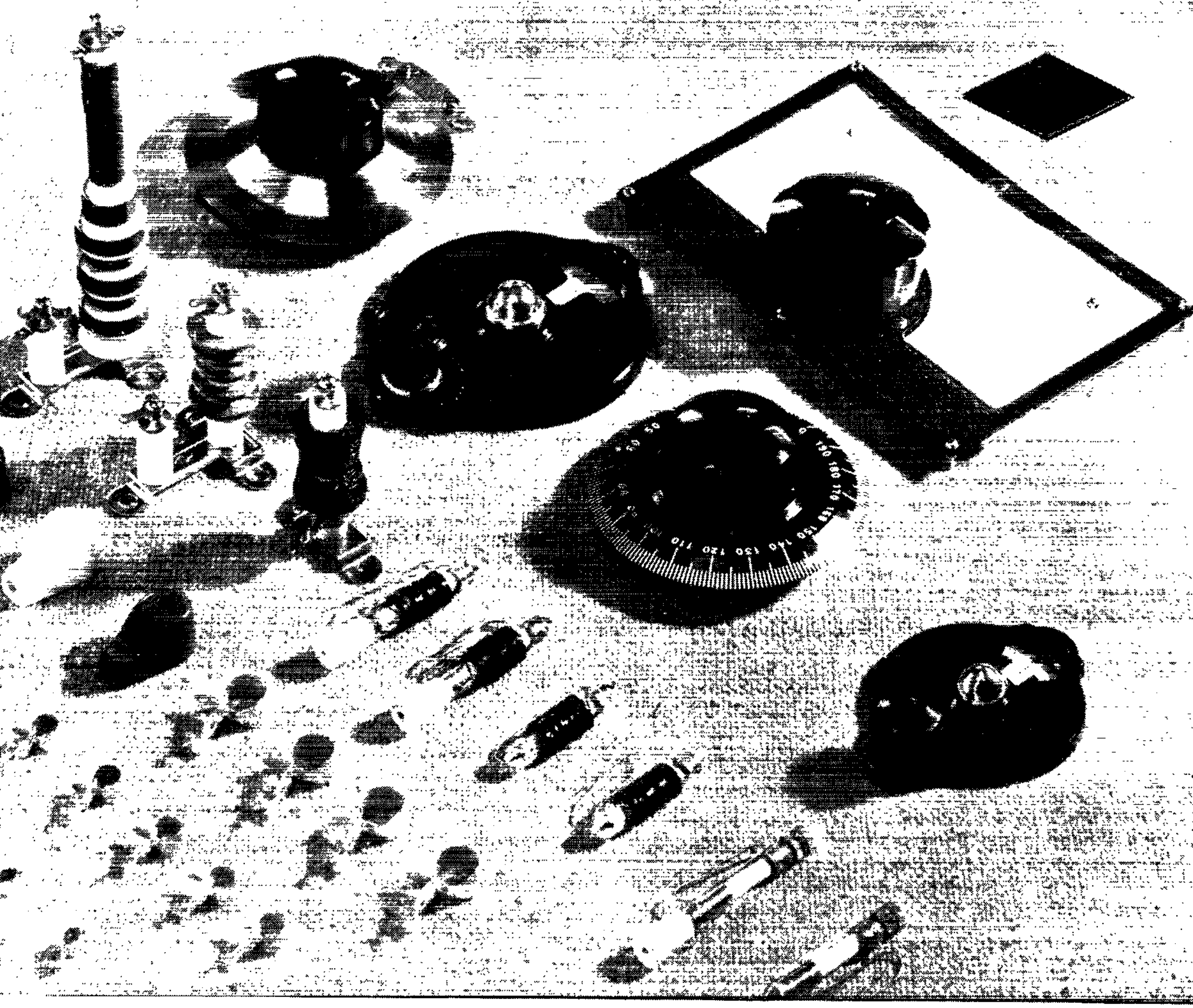

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You may have wondered. The fact is that all National parts are going into the War Program these days. On many items, National's facilities are taxed to the utmost in meeting the requirements of our customers. On other items, particularly those shown above, reasonable delivery can usually be made when the order carries a satisfactory priority rating.

NATIONAL COMPANY, INC.

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