QST

april, 1943
25 cents
35c in Canada

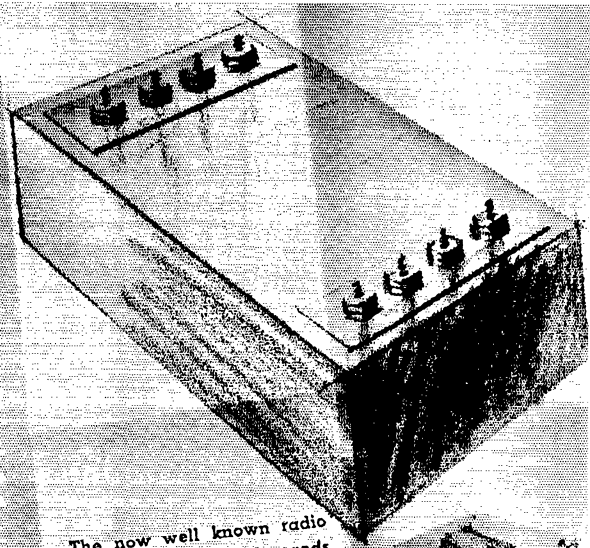
devoted entirely to

amateur radio

FILTERS—
Designed for war

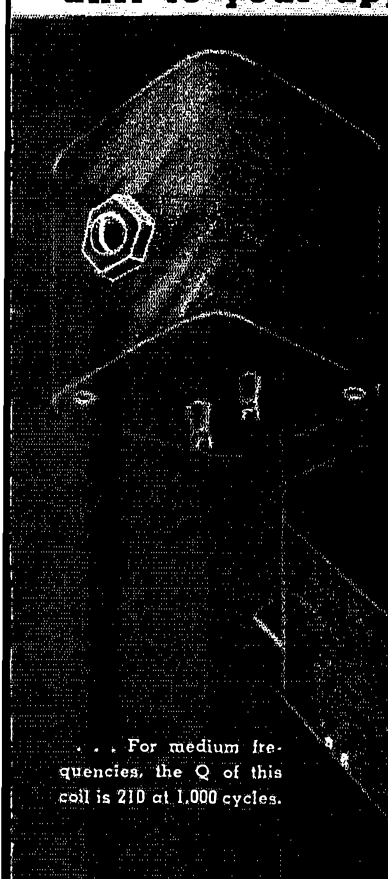
Unique characteristics of many UTC filters are the result of years of research on core materials and filter structures. We are proud of our part in the development of filters for wartime electronics. Here are a few typical elements, based on UTC design, which have led to UTC leadership in this field.

May we design a "Victory" unit to your application?

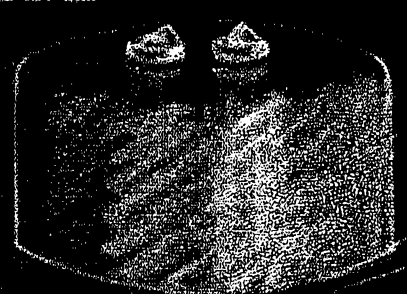


The now well known radio range filter weighed 36 pounds when it originally was submitted to us.

Continuous refinement by UTC has resulted in the modern radio range filter weighing only 1.6 pounds—a weight reduction of 95%.

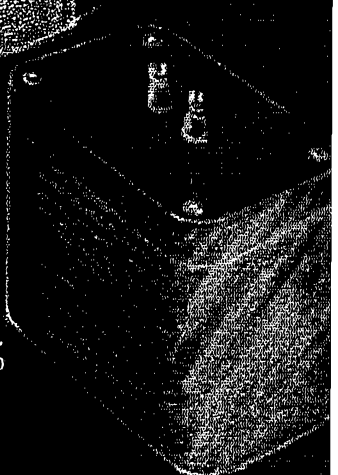


This UTC development is a tunable inductance, adjusted in the same manner as an I.F. trimmer.



Designed for high frequencies, the Q of this coil is 300 at 20,000 cycles.

. . . For medium frequencies, the Q of this coil is 210 at 1,000 cycles.



. . . For low frequencies, the Q of this coil is 80 at 100 cycles.

UNITED TRANSFORMER CO.

150 VARICK STREET ★ NEW YORK, N. Y

EXPORT DIVISION, 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLA

VULTEE AIRCRAFT SELECTS HALLICRAFTERS EQUIPMENT FOR RADIO FLIGHT RECORDER

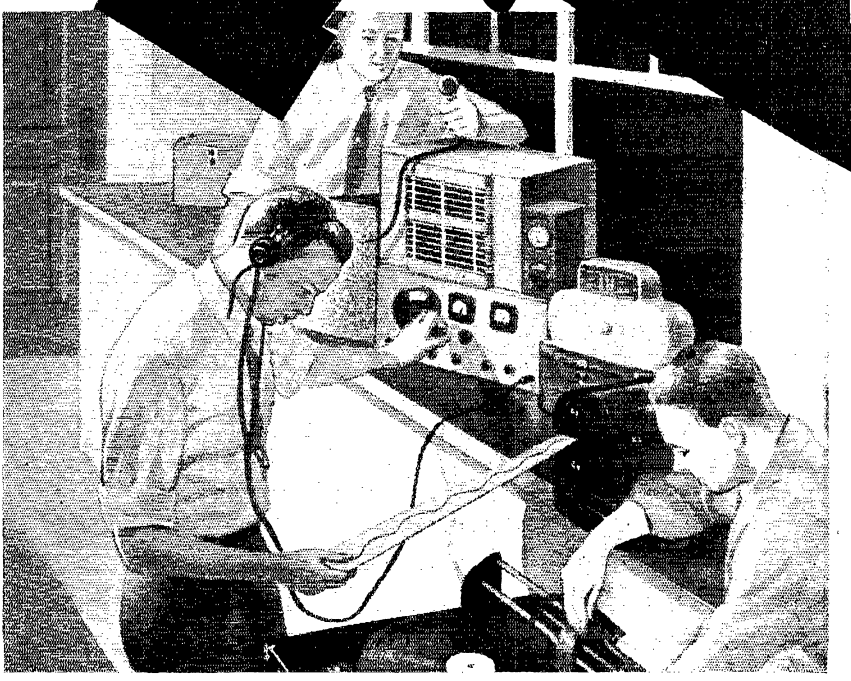
The ultra-sensitive ground-unit "brain" of Vultee Aircraft's new radio recorder is monitored by a Hallicrafters shortwave radio communications receiver. This test-flight unit, originated by Vultee engineers, gives multiple instrument readings flashed in split-second cycles through a Hallicrafters communications receiver to ground crew tabulators during actual test flights.

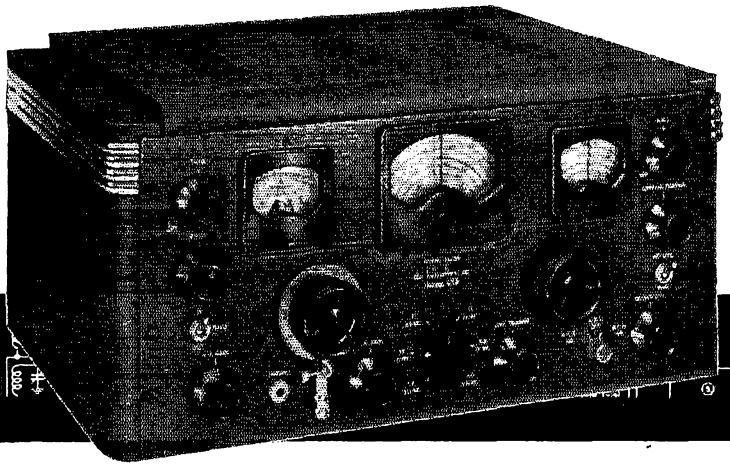
Hallicrafters communications receiver (illustrated) Model SX-25—12 tubes, 4 bands. Frequency range of 550 kc. to 42 mc.

Your post-war Hallicrafters communications receiver will be worth waiting for.

World's largest exclusive manufacturer of shortwave radio communications equipment

hallicrafters
CHICAGO, U.S.A.





Improved in War!

. . . for Better Peace-Time Reception

The rigors of modern warfare are the world's finest proving grounds for communications equipment . . . constant usage and unusual operating conditions in every climate are a severe test of the communications receiver. Hallicrafters equipment is proving its high quality performance capabilities with our armed forces.

Hallicrafters communications receiver Model SX-28 (illustrated) 15 tubes, 6 bands, delivers outstanding reception . . . your peace-time model will be worth waiting for.

hallicrafters

CHICAGO, U. S. A.

The World's Largest Exclusive Manufacturer of Short Wave Radio Communications Equipment

APRIL 1943

VOLUME XXVII

NUMBER 4

★

★

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QST *devoted entirely to*

AMATEUR RADIO

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

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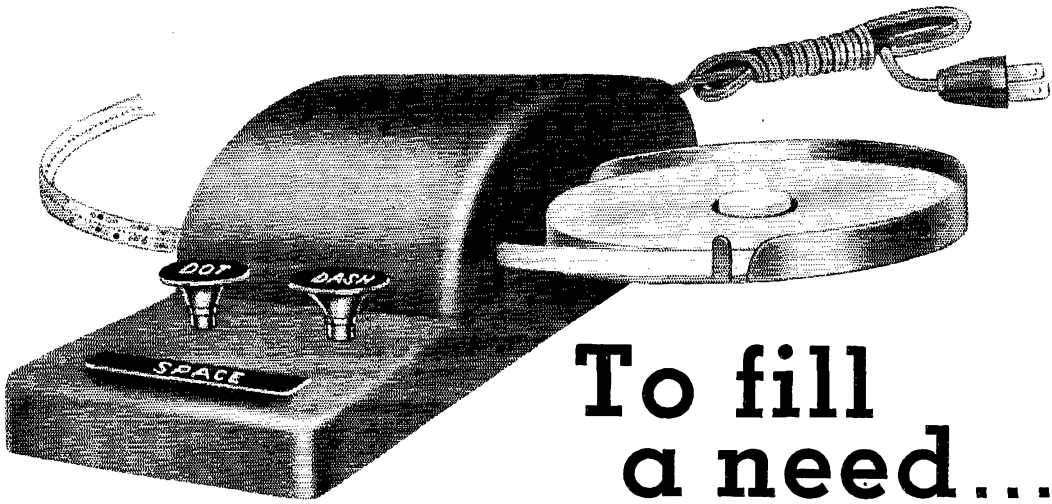


To fill a need...

McElroy Wheatstone Code Tape Perforator

Model PFR-443

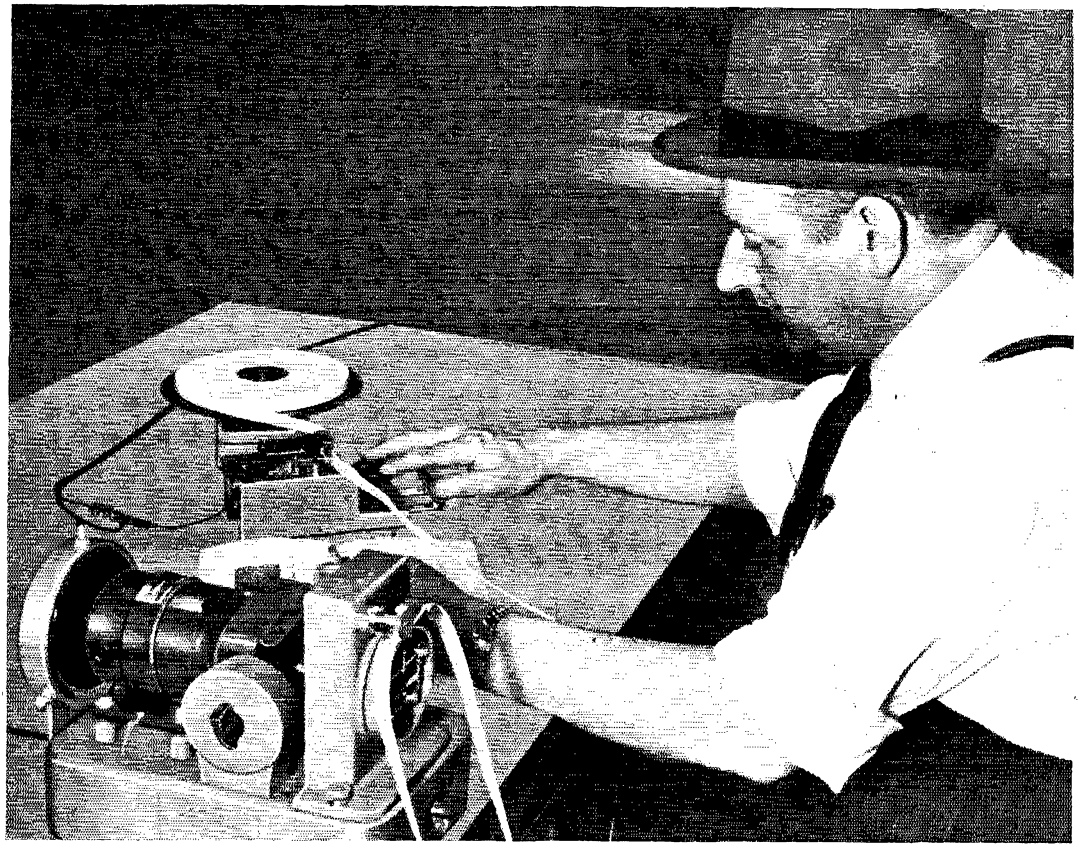
Normally, automatic radiotelegraph apparatus is employed by all services, commercial, military or governmental. But despite the present availability of sufficient quantities of this equipment due to McElroy design of simple and rugged units through mass production, communication has been impeded, in many cases, by the lack of simplified, efficient perforating devices. Intricate keyboard perforators, requiring the attention of specialized machinists and skilled operators have restricted quantity production of perforated tape.

Simplified in design, the new PFR–443 will produce tape as cleanly and as accurately as any complex keyboard perforator.

The McElroy Wheatstone Code Tape Perforator is actuated by 110 volt AC or DC current. May be operated with index finger, middle finger and thumb of the right hand, while unit is in similar position as a hand telegraph key. The feather-light touch on the dot and dash contacts and space bar closes electrical contacts. A powerful die mechanism, driven by a solenoid, perforates and advances the tape through the machine. When this tape, identical in all respects to others prepared by the most complex of keyboard perforators, is passed through *any make of automatic transmitter now in existence* it will execute signals with the precision characteristic of all professional automatic devices, *at any speed for which the transmitter was designed.*

Simple and rugged in design and construction, the McElroy perforator requires no critical adjustments. Parts are replaceable by any competent radio technician. Light in weight, it may be carried as a hand semi-automatic transmitting key. *When teamed with the McElroy Automatic Transmitter, XTR-442, the combination becomes a manually operated radiotelegraph station that is the equal of any mechanized station.*

T. R. McElroy, world's champion telegraphist and outstanding wireless operator of all time, operating a development model of the new perforator in conjunction with Tape Transmitter, Model XTR-442.



Unskilled operators have been trained more readily in the use of this perforator, than the standard keyboard of a typewriter. Any station with newly trained personnel may transmit its traffic with absolute accuracy, retaining the tape as a permanent file record of all communications. The McElroy Wheatstone Code Tape Perforator may be operated in conjunction with automatic transmitting equipment at maximum speeds—or with similar efficiency, at speeds of between 25 and 50 words per minute. It may be employed for *important communications circuits* as readily as for preparation of practice material *for radiotelegraph code schools.*

The McElroy factory is being tooled for production and orders are being accepted. Moderately priced at $375. First deliveries may be anticipated by the latter part of May.

As creative telegraphic engineers, we are leaders in our field. We are the largest manufacturers in the world devoted exclusively to the production of equipment for the transmission and reception of dots and dashes. We create. We design. We build. We do not imitate and we do not copy. And we can deliver.

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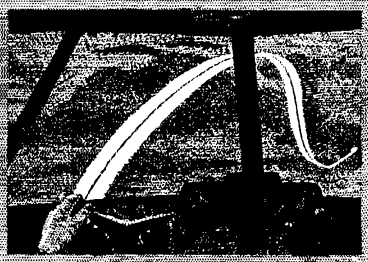
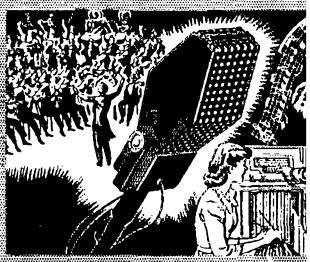


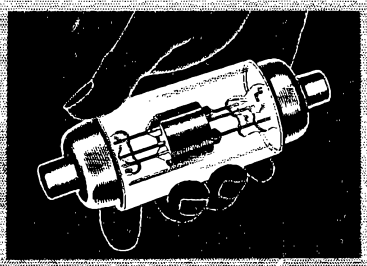


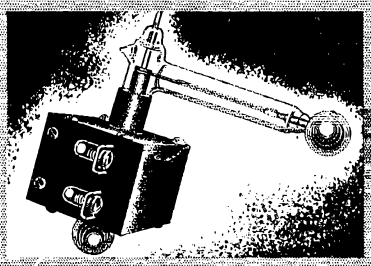
Eimac

ENGINEERING

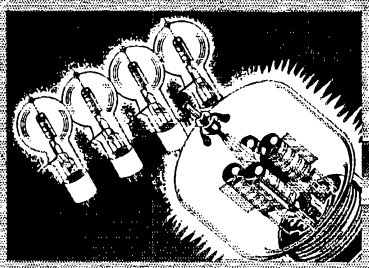
The cornerstone in Eimac's existence has been their advanced electronic engineering. The development of the gas-free tube, pioneering in the use of new materials, radical changes in existing tube design... all these things are the results of their research. During today's accellerated business situation Eimac engineers have developed and put to work many outstanding innovations. Number one on this list is the actual achievement of mass production of a product that heretofore was hand-made in a scientific laboratory. Today the most interesting of the other developments must be kept secret but the heads-up engineering is going forward apace. The services of this organization are available only for war problems now but will be offered to industry at large when peace comes. If you have a problem, the solution to which might involve vacuum tubes, write direct to factory.

EITEL-McCULLOUGH, INC. • SAN BRUNO, CALIFORNIA





ronic-Telesis

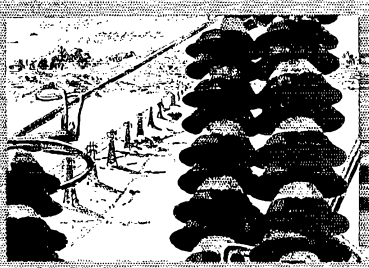


• **Eimac Tubes in the Ground Stations of the Major Airlines.** Eimac 450T tubes are in use by practically every major airline today.

• **Eimac Tubes in Instrument Landing Equipment.** There are several of these systems in existence which use Eimac tubes.

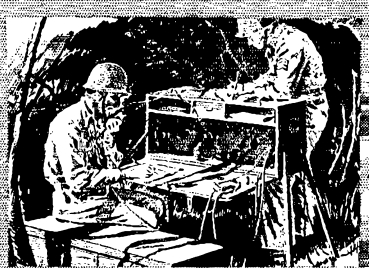
• **Eimac Tubes and Frequency Modulation.** FM and Eimac tubes have been close companions from the very start of Major Armstrong's experiments.

• **Eimac Tubes in Police Radio Communications.** Police radio engineers from Connecticut to California are loud in their praise of the service of Eimac tubes.



• **Eimac Engineered the Vacuum Condenser.** Small, compact tank circuits, made possible with the Eimac vaccum condensers helped increase the efficiency of many types of radio transmitters.

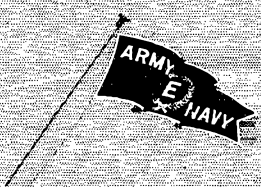
• **Eimac Developed the Vacuum Relay.** Handles 20,000 volts of RF potential without internal breakdown. Actually flashover will occur across outside terminals first even though contact spacing is but .015".



• **Eimac Developed the Multi-Unit Tube.** Triode units so nearly perfect that two or more can be placed in a single envelope. A revolutionary vacuum tube typical of Eimac's engineering leadership.

• **Power Transmission with Vacuum Tubes?** In the days to come many new uses for Eimac tubes will be announced. The use of vacuum tubes for power transmission may be one of them.

• **Eimac Tubes have gone to War.** With almost machine gun rapidity, Eimac tubes have been adopted by one after another of the peacetime services. Naturally Eimac was among the first to be drafted into war.



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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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British Columbia	VE5DD	C. O. I. Sawyer	2634 West 31st Ave.	Vancouver
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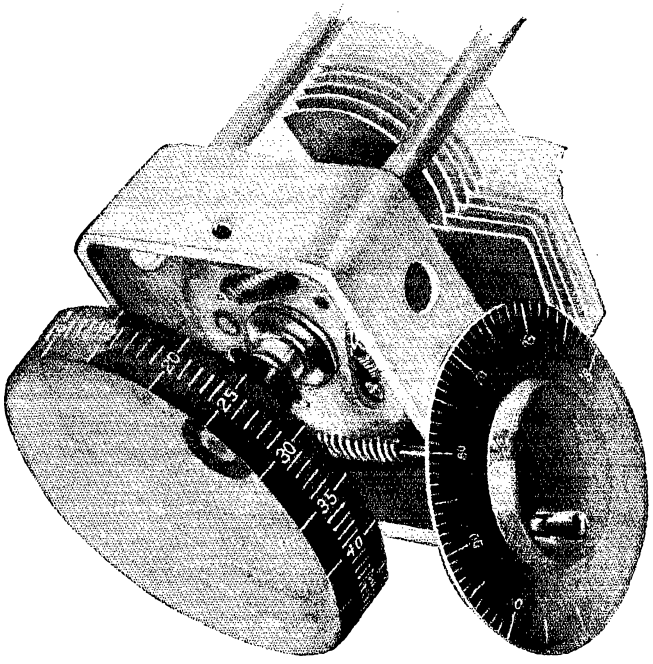
Saskatchewan	VE4SV	Arthur Chesworth	1071 4th Ave., N.W.	Moose Jaw

*Officials appointed to act until the membership of the Section choose permanent SCMs by nomination and election.



Maybe we're wrong

But we've a few ideas that, we like to think, are clearer realizations of fact. We can't be tempted into soothing self-praise, or boastfulness untrammeled by modesty or ordinary business conservatism.

Frankly, queries about what we are contributing to the nation's effort find us verbally unresponsive. We can't find room for back-slapping when all of our attention is given unreservedly to our small share in the dread realities of this war.

No, The Allen D. Cardwell Manufacturing Corporation is not old-fashioned, static — not standing on a record of past performances, though we have been a military facility ever since the previous war.

Rather, cumulative experience and sound counsel have added impetus and direction to creative ability and production enthusiasm. Our most effective service is being rendered by concentrating solely upon assigned tasks . . . design and construction of more efficient wartime apparatus.

CARDWELL CONDENSERS

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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.

All general correspondence should be addressed to the Secretary at the administrative headquarters at West Hartford, Connecticut.

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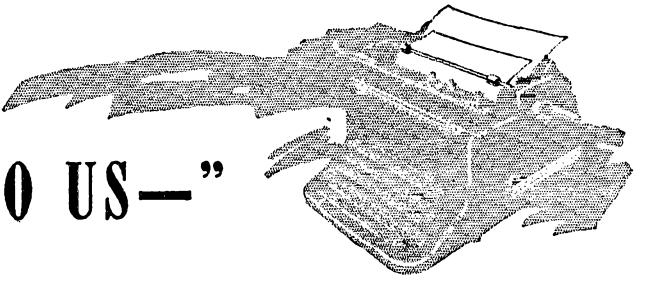
1026 Woodward Building, Washington, D. C.

On leave of absence. Address correspondence to the Acting Communications Manager, George Hart, West Hartford, Connecticut.



"IT SEEMS TO US—"

"WHEN DISASTER STRIKES"

DURING this time that amateur stations are closed, the only outlet for the operating energies of those of us still on the home front is in the War Emergency Radio Service. The emergency-communication jobs that were traditionally ours must now be done through WERS, and on u.h.f. only, to provide the necessary wartime controls. But WERS is made up mostly of us amateurs and our apparatus, and the responsibility for public service is still ours. Let's look at it this way: For a generation back, in time of peace, we fellows have lent our skill and our gear to the relief of our communities when they were in distress, and we have done the job in the name of amateur radio. *Nobody else can do that work and it is still our duty.* The only difference now is that we can't do it in the name of amateur radio; WERS is necessarily the medium during the war. After the war it will again be an amateur job; temporarily it's WERS. But it's still dependent on hams, ham frequencies, ham apparatus.

It does not seem to be properly appreciated that several classes of licensed radio stations, including WERS stations, are just as available for the relief of large-scale natural disasters as for the results of enemy visitations, sabotage and other wartime manifestations. The regulations of the FCC provide (in Sec. 2.63) that radio stations of any class (except amateur) may be used, under the control of the station licensee, in communication emergencies arising from natural disasters, provided notification be sent as quickly as possible to the FCC offices and to the district inspector, the operations be discontinued as soon as possible, and further word of their cessation be sent FCC and the inspector. Note, however, that a disaster is an affair of some magnitude, endangering many people and much property. Such facilities are not available for mitigating the minor annoyances of a community, but they are if the station licensee has knowledge that the emergency is serious from the viewpoint of public safety.

On this page last month we mentioned that the protective services of local civilian-defense organizations are increasingly being called out to relieve their home communities from the effects of such disasters. Now the Director of Civilian Defense, Dean James M. Landis, urges the immediate establishment of WERS networks to protect communities in natural disaster as well as to facilitate operations of the Citizens Defense Corps during wartime emergencies. Writing in *Civilian Front*, OCD's weekly newspaper, he says:

"Civilian Defense units are playing an increasingly major rôle in protecting their home communities against other than war emergencies — fires, hurricanes, floods and other disasters. In such emergencies — as in those arising from war emergencies — swift, dependable communications are absolutely essential. WERS provides such communications when telephone lines are down, when normal contact is completely disrupted, or when mobile units are at a distance from their control centers. . . . OCD strongly recommends that every community take steps immediately to give itself this added protection in case of emergency."

We have been surprised at the considerable number of cities which seem to believe that their inland location gives them immunity from acts of the enemy, and which therefore have neglected WERS. Perhaps the increasing use of CDC to protect us against the vagaries of Mother Nature as well as actions of the enemy, and the new realization that CD WERS installations may be used in such situations as well, will now impel them to embrace this opportunity. If you had never thought of the CD part of WERS as the means of carrying on our familiar emergency communications service, perhaps you now gain a new appreciation of its importance. No community is safe against enemy actions. And if your community is also tender to nature's miscarriages, there is double reason why you, as a local amateur, should do your utmost to bring the possibilities of WERS to the attention of local officials and assist in the creation of a useful system of emergency communication. Thereby you'll be participating in amateur radio's traditional rôle and discharging one of the most important duties of the stay-at-home amateur.

K. B. W.

★ SPLATTER ★

OUR COVER

THIS month *QST* features the fighting Marine radio operators, and our cover shows a typical devil dog in action. We see him concealed under a clump of foliage, maintaining communication with a detached outpost unit. It's only training now, of course — but a remarkably realistic brand of training that resembles in every detail the actual service he'll soon encounter.

PAPER POSTSCRIPT

ADDENDA from three *QST* departments to our note in the March issue concerning the effects of WPB's paper limitation order:

Editorial — Beginning with this issue you'll notice an enlarged type format on the editorial pages (longer columns, with narrower top and bottom margins). The resulting 6.5 per cent increase in reading space will be of aid in producing well-balanced issues.

Advertising — Effective March 15th, advertising space in *QST* is being rigidly rationed. The paper thus saved will be used in part to print more copies, helping to maintain distribution, and in part for additional editorial matter permitting an increased proportion of editorial matter in coming issues.

Circulation — Even with these conservation measures — lighter-weight paper, enlarged format, restricted advertising space — we won't be able to print enough copies to supply the growing demand. ARRL members will, of course, be assured of receiving their copies, but there will be no excess. Newsstand quotas are necessarily reduced. To make sure of getting your copy each month: If you're a member, *renew early* and keep your file intact. If you buy *QST* from the newsstands, get your copy from *the same dealer* every month. By so doing you will enable us to allocate the available copies to maximum advantage.

FOOTNOTES

ANY list of *QST* authors usually includes outstanding specialists whose intensive application in a particular field has resulted in something well worth passing on to the fraternity as a whole. This month's list of non-staff contributors is no exception. There's **F. E. Brooks, jr., W5JLZ-ex-W9SWK,** who freely admits that rebuilding the rig always interested him a lot more than working DX, so that in consequence he has no rare QSLs to brag about. (For results of the latest rebuilding, see p. 36) His home address is Austin, Tex. (wherefor the W5 call), but he was living in Kansas City when he got his first ticket (W9SWK — 1936). Four years later he graduated from the University of Kansas with a degree in E.E. Since then he has been doing graduate work and instructing in the E.E. department at Yale. Like many another ham he usually ends a conversation by boasting, "But wait till you see the rig I'm going to build after the war is over!" . . . **J. P. Gilliam, W9VSH,** had just the proper mechanical and radio background for developing so awesome a gadget as a siphon recorder (p. 18). Culminating a varied machine-shop experience, "Doc" is now chief electrical technician in charge of the G. C. Conn model shop at Elkhart, Ind. (that's right — band instruments). There he builds electrical and electro-mechanical gadgets, and — ssssh! (Military secret.) In radio he has always been a high-speed man, notably as Indiana's SNCS in the AARS (WLHM). An indefatigable tinkerer, he builds all the radio gear he uses — and a lot he doesn't use. Sole exception was the b.c. set his non-technically-inclined XYL wanted for the kitchen cabinet. For months she'd plagued him to build it, but he was always "too busy." Finally she gave up — and built it herself! That's one the OM never will live down. . . .

★ BOOK REVIEWS ★

Principles of Electronics, by Royce G. Kloeffler. Published by John Wiley & Sons, Inc., New York. 175 pages, 6 × 9; illustrated. Price, $2.50.

This is an introduction to the general field of electronics, intended for use as a text in a first course in electrical engineering. As such it is written for second-year students and consequently is largely descriptive rather than mathematical.

Opening with chapters on the electron, atomic structure, the electric charge and the mechanism of current flow in various media, the book proceeds to describe the construction and operation of various types of vacuum- and gas-filled tubes. Besides the familiar radio types, the reader will meet gas and vapor-filled rectifiers such as the Tungar, mercury-arc rectifiers, and cold-cathode rectifiers, as well as controlled rectifiers typified by the thyratron and ignitron. X-ray tubes, cathode-ray tubes, electron multipliers and magnetrons also are briefly described. The operation and application of copper-oxide and selenium rectifiers are covered, and there is also a chapter on photoelectric cells and photovoltaic devices. The book concludes with a chapter on electronic applications in the radio and power fields.

The purpose for which the book was written obviates the possibility of going into much detail in any one of the subjects considered, but this very fact makes it excellent reading for those who want an overall picture of present-day electronic devices and applications.

Fundamentals of Electric Waves, by Hugh Hildreth Skilling. Published by John Wiley & Sons, New York. 186 pages, 6 × 9; illustrated. Price, $2.75.

It was not so long ago that detailed study of electromagnetic waves was considered to be the province of the physicist rather than that of the engineer. But recent developments in ultrahigh frequencies, as exemplified by wave guides, have put new emphasis on the waves themselves as well as on the means for generating and detecting them.

To those not blessed with a natural aptitude for mathematics the subject of electric waves has many difficulties, but Prof. Skilling's book goes a long way toward making it understandable. Like many of the texts now making their appearance, it has been compiled — if that is the proper word — from notes accumulated in the presentation of lecture courses both in advanced training for war purposes and as part of college curricula. Previous knowledge of electro-

(Continued on page 48)

Official U. S. Marine Corps Photos

Fighting Marines Learn the Arts of Warfare at Camp Lejeune, N. C.

QST Visits the Marine Corps

BY CLINTON B. DESOTO,* WICBD

THE scene is anywhere. The time, to-day — or tomorrow, or the day before. The speaker, anyone who has seen the action in the Solomons.

"*Boy, those Marines are tough babies!*"

That's the way any description of the job done there by our fighting Marines always ends. You may hear their courage lauded, their smartness, their daring — but the crowning adjective is, "They're *tough!*"

Once that point is established — and it is deathlessly recorded on the Marine Corps' scroll in history, as their traditional characteristic in all the wars in which they have fought — the question comes: "What makes the Marines so tough?"

Marines were not born a special warrior class with leather for epidermis and puncture-proof guts — although you might think so from the tales of their doings on Guadalcanal. Before joining the Corps they were, like any cross-section of young Americans, average youths with normal frailties, quick to capitulate before fatigue and inclined to moan over minor discomforts even as you and I.

The process that transforms such lads into hardened, reliant, *tough* fighting Marines is not a mysterious one. When analyzed it comes down to the basic simplicities of spartan physical conditioning and thorough, intensive schooling in the skills of modern warfare. It is processing that imposes on the trainee the rigors of combat long before he reaches the battle line. Little that the prospective Marine encounters in a foxhole on battle-scarred atoll is likely to exceed in severity the later stages of his training period. This is logical procedure, of course; it weeds out the unfit, tempers those who remain into keen-nerved, spring-muscled instruments of war.

If it seems incongruous to speak of fighting soldiers and radio operators as one and the same, be reminded that it is the Marine Corps we are talking about. In the Marines every man is a fighting man — as ready and as likely to engage in personal combat as his fellows. In fact, there is a saying in the Signal Battalion at Camp Lejeune that the men are trained to be Marines first and radio operators second. Of paramount importance is that they know how to fight — to protect themselves and their equipment and to hold up their end in combat.

There's an interesting sidelight to this. Some of the new men assigned to radio training take less than kindly to the thought of spending twelve long weeks in school; they want to go right out and kill Japs. Yet, if they but knew it, that twelve-week training period is the surest and quickest ticket to active service they can get.

The reason is that Marines with radio ratings are assigned immediately to duty in combat areas. Riflemen and many of the other specialists may sit around for weeks or months at domestic bases before going overseas. And then some will be sent to hold down peaceful lend-lease bases, while others will go to shore stations; many will never see the smoke of battle.

But radio operators are so urgently needed that nearly every new graduate is rushed to a war zone as soon as he completes his training.

East Coast Training Center

We saw that training under way when we visited the main East Coast training center of the Fleet Marine Force at Camp Lejeune, New River, N. C.

Almost as remote as the battlefronts for which they are training, the 265,000-acre reservation is situated deep in North Carolina's wooded fastnesses. If you travel there by rail the nearest railroad point is twelve hours below Washington — leaving you still 60 miles from the camp.

The sleeper disgorges you into the cold blackness. Only an occasional drowsy straggler is about in the slumber-held village. There's supposed to be a bus, but when and where it leaves no one

* Executive Editor, *QST*.

seems to know. Eventually a friendly mail-truck driver, preparing to leave for the camp with his behemoth loaded tight with mail bags, resolves your dilemma.

Inside the cab of the trailer truck you roll noisily from village to village. Miles pass, and the sky lightens with a grey dawn. Then, rounding a residential corner still miles from the entrance to the post, you have your first glimpse of the training activity ahead. In the distance a silvery transport loafs along above the housetops, its speed so slow you feel it must be an illusion. Suddenly a white puff appears underneath. It hangs floating there — and then another appears, and another.

"Ah! Paramarines!" the answer dawns. A class of Marine parachutists is out for a few polishing-up jumps at low altitude.

The road becomes a two-lane highway, still under construction. More miles drift sedately by the mail-truck windows, and then you're at the entrance to Camp Lejeune — or New River, as you call the place if you want the local residents to understand.

For it seems that the base — construction of which was begun two years ago, the last permanent military reservation to be established before war struck — was originally called New River, after the wide-banked stream along which it lies. Later it was named Camp Lejeune (pronounced Lezhern, in Washington; Lejune, within its gates) in honor of Maj. Gen. John A. Lejeune, a former commandant of the Marine Corps. Now the camp, under the command of Maj. Gen. Julian Smith, rates as one of the best military posts in the country.

Beyond the pillared entrance and its vigilant guards lie more miles of construction — vast vistas of new building, with some 25,000 workmen on the job. The view culminates in a panorama of spruce red-brick barracks and administrative buildings, and white-cement structures housing utilities. Inside post headquarters the sergeant of the guard charts the maze, pointing out the Signal Battalion's headquarters — half a mile away down a broad barracks-lined street.

The Signal Battalion

It is the Signal Battalion we have come to see — and specifically the radio school. Radio, of course, is but one of the many branches of communications taught at Camp Lejeune, and communications is but one of the many specialties taught there — specialties ranging from paramarines, cooks and bakers, photographers, quartermasters, engineers, ordnance men and glider pilots to experts in amphibian tractors and barrage balloons.

Biggest of all these groups, however, is the Signal Battalion, with its three schools and eight courses — radio, telephone and aircraft detection — and its total of more than 2000 men in training at all times. Of these, some 800 are in the radio school.

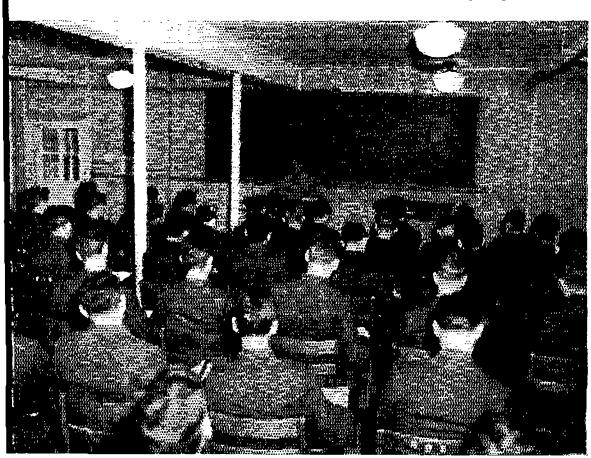
The moment we entered the headquarters building of the Signal Battalion we sensed the unmistakable atmosphere of the radio fraternity. On inquiring for the officer in charge, Lt. Col. R. L. Peterson, the executive officer, Major G. C. Ruffin, jr., told us he had stepped out to witness a test of a new British-model "walkie-talkie" just received.

Outdoors we found a group of officers clustered around one of the sets, in contact with another some distance away. The scene was a familiar one; except that the participants were in uniform, it resembled a dozen we've witnessed with hams as principals, enthusiastically playing with a piece of new gear. "Try this . . ." "try that . . ." "how about . . ." "turn up the gain . . ." "turn down the gain. . . ." 2nd Lt. M. J. Couts, chief of the radio school, was at the controls. Well up front in the ring of enthusiastic advisers was Col. Peterson — in his enlisted days himself a Marine Corps radio operator, later a godfather of W3ELN, until Dec. 7th the ham station at the Marine Corps' Quantico Barracks.

Reluctantly leaving their fascinating plaything, the officers one by one returned to their duties. We were conveyed into Lt. Couts' hands and embarked on our tour of the radio school.

But before discussing that tour, a word first about Lt. Couts. If ever a Marine Corps veteran of 22 years in the service — including 13 years in China — could talk from an amateur background, it was he. In fact, it was "Marcus" who set up famed AC8NA — later XU8NA — in Shanghai in 1925. Before that he had operated NPP/1 in the ham bands, and later he was instrumental in the establishment of AC2HN and AC2MJ in Tientsin ('27) and Peking ('31). Between times he was back at 8NA (in 1930, and from 1937 through 1940). Toward the end of that last stretch, you may recall, amateur XU8NA handled practically all the private and commercial traffic coming out of China to the U. S. A. — the Japs having cut off the commercial channels.

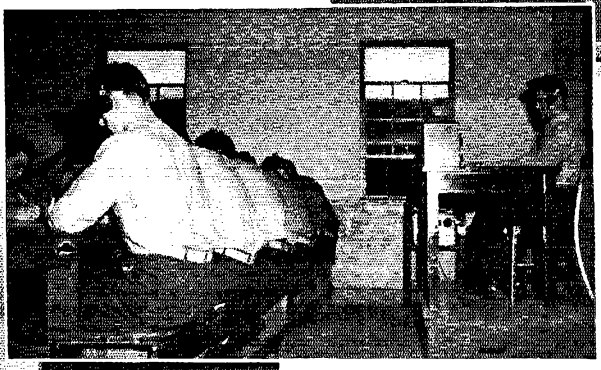
Also accompanying us on the tour was Lt. T. W. Hyland — the other end of the morning's walkie-talkie circuit, newly back from a Pacific island and now at the station awaiting orders. Another veteran Marine, Lt. Hyland was also associated with XU8NA. Of even more interest than his recountal of early amateur days, however, were his tales of recent actions in the South Pacific — but these must await the re-telling.

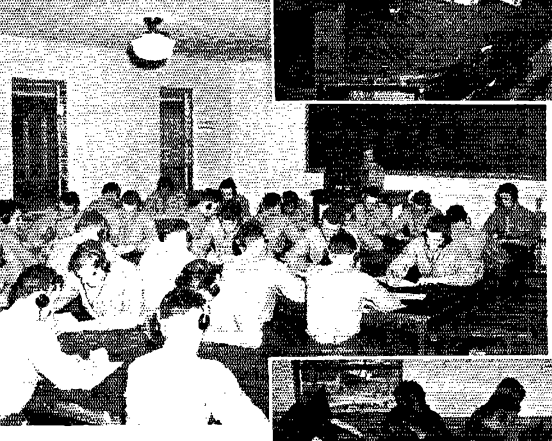


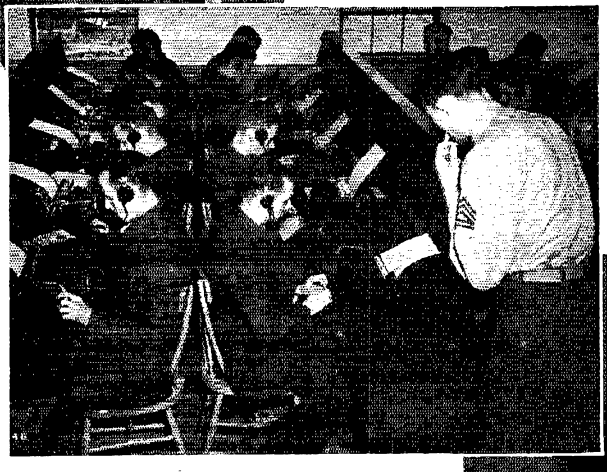
Typical theory class in session. Lectures are illustrated with blackboard diagrams, demonstration panels and examples of standard equipment.

While we're on the subject, we might as well mention some of the other hams on the staff we met — among them S/Sgt. R. A. Frye, W8VJZ, a Class-A amateur who has been instructing in electrical and radio theory at the school for the past year; S/Sgt. M. D. Honeycutt, W3JOG, also an instructor in electrical subjects, who returned from South American duty to teach at Quantico, where he was in charge of W3ELN; and Sgt. D. S. McKenzie, W8RLH, field radio instructor.

Top — Student Marines learning to copy with the "stick." *Right* — All code practice transmissions are hand-sent by experienced instructors.







Above — Basic code class where students learn individual characters. *Right* — Advanced code class for "mill" practice. *Lower right* — Instructor giving individual tutelage to an earnest young Marine. *Official U. S. Marine Corps Photographs*

As fighters these radio Marines must carry the radio gear (usually as two- or three-man crews) in addition to their regular packs and a complete complement of weapons. They're trained to set up stations and start brasspounding on a minute's notice wherever their outfit stops — and on even shorter notice they're prepared to drop 'phones and key and grab an automatic rifle in case of attack.

They're competent radio operators, these wiry leathernecks, capable of reading through the thunderous noise of battle as well as the QRM in the 'phones. Above all, though, they're fighters — the hardest, toughest fighters in the world. Before our visit is ended we shall see how they get that way. But first we examine the radio training they receive.

The radio operator's course has four basic subdivisions — sending and

The Radio School

The job of the radio school is to train radio operators — the specialized kind of operators the Marine Corps needs, not the kind who operate on shipboard or at large shore stations. These accompany combat units with small field outfits, usually hand-packed sets of a few watts output.

receiving code, U. S. Navy radio procedure, elementary electricity and radio, and training in the operation of Marine Corps field radio sets.

The entire course covers a total of 12 weeks, eight of which are spent in the classroom and four in the field. It is this latter third that distinguishes Marine Corps training from that of other services; the preliminary classroom instruction follows tried and proved formulas. The academic work is based largely on Army curricula, including the use of standard Signal Corps classification and aptitude tests.

Code Instruction

Code training is begun first. The student starts out in one of three basic code rooms, located in the converted barracks which serves as the main school building. There, seated at a conventional multiposition table, he hears the first seven code characters sent over and over in different combinations, at a speed of 4 w.p.m. The character speed is held at 20 w.p.m.

When these seven characters are mastered he moves on to the next room, where seven more characters are learned. Then he goes along to the third room for an additional seven, and finally back to the first room for the balance of the 35.

At first the student calls out the characters in response to the instructor's sending. When he has learned to identify the sounds he begins to write them down by pencil, printing according to standard procedure.

There are no tapes; it's all hand sending, either directly by the instructor or from permanent wax recordings played back on Telechords (special code-teaching machines developed by the Dictaphone Corporation).

The average student takes about five days to negotiate this basic instruction, but individuals are allowed to progress as fast as they are able. Of course, if a student already knows the code he's that much better off. A man with previous code experience can complete the academic and field phases of the course in ten weeks' time.

The principle of permitting the individual to progress as fast as his own ability permits is followed throughout the code training program, as we see when we go over to the "big code room" where advanced training is given.

That name — "big code room" — is a fitting one. Constructed to be used as a mess hall in the original planning of the camp, it is a huge, high-ceilinged room half a block long. Spaced throughout the interior are scores of code tables, divided into groups by speeds. Practice material is always transmitted at the same speed at any one table — 6, 8, 10, 12, 14, 16, 18, 20 and 24 w.p.m.

A student fresh from the basic code rooms starts in at the 6 w.p.m. table. He stays there until he masters that speed, then moves on to the next and so on. Tests are given every period, so he can go along as fast as his progress allows. Always he progresses according to his own individual ability, rather than according to a prearranged schedule or until the rest of the class catches up. It's about the simplest and most direct method of code training we've seen — and it seems to work, too.

In the big code room, again, all sending is by hand — either direct or recorded. Lt. Couts and his staff just don't believe in using practice tapes for training their kind of radio operators; after all, they argue, the sending the students will be required to receive when they get into active service is by hand, so why train them on something with a characteristically different sound? Which sounds logical enough.

Realistic Interference Effects

In the later stages interference is mixed in with the practice transmissions, to accustom the student to actual conditions — and not only radio QRM but the even more distracting noises of war. Recordings of Jap voices are fed into the 'phones along with code transmissions, for example. Other recordings of typical battle sounds — exploding artillery shells, machine gun fire, bombs — are reproduced through powerful loudspeakers as realistic external sound effects.

During both basic and advanced training each instructor sticks to one speed or group of characters. Each is on his mettle to turn out men with whom the next instructor cannot find

Harking back to the days of Indian warfare, the Marine team pictured on this page operates under a protective screen of concealing foliage. *Above* — One man turns the hand-cranked generator which powers the equipment. *Below* — The operator tunes the compact receiver with one hand while copying with the other. When his face is turned away, his forest-green uniform makes him invisible from a distance of a few feet. *Official U. S. Marine Corps Photographs*

fault. The "basic code" instructors — men carefully selected for their special abilities — in particular make very sure that the men who go to the "big code room" know each character thoroughly.

When the student emerges from this training he's supposed to be able to copy plain text solid at a minimum of 20 w.p.m. and coded groups at 15. He's also supposed to be able to send plain language perfectly at 17. However, those who fall short of these requirements by not more than 2 w.p.m., may still graduate. They'll pick up the extra speed fast enough in the field.

Which brings up one of the interesting facets of the Marine Corps' training philosophy. They don't claim that their graduates are perfectly trained, at least from the radio standpoint; instead, the job is considered to be perhaps two-thirds done. No school can provide the equivalent of genuine experience. That must come in the field.

It does, too — and not alone through "on watch" operation. We're told that code practice is one of the ways the Marines in the Solomons beguiled leisure time — when they had it. Lines were strung between tents and the keys waggled constantly. Nor was this pastime confined to the radio crew; other men became intrigued, and soon classes sprung up in which code was taught to whole companies.

Procedure Class

As soon as they have achieved reasonable code proficiency, the students begin work in the procedure class. Here they learn the technique of radio operating, including traffic-handling, network operation and U. S. Navy procedure.

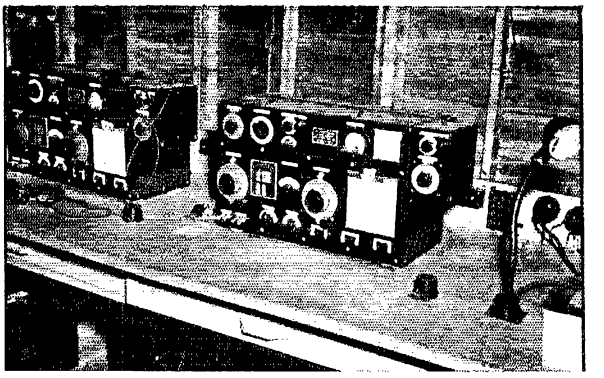
Each table in the two procedure classrooms is equipped as a net, with the instructor acting as net control. The second procedure classroom is also supplied with typewriters, to give students who have passed the 18-w.p.m. point a little "mill" practice. Typing skill is not a compulsory requirement, however. Marine operators expect to do most of their copying with a "stick"; there's no place for typewriters in foxholes.

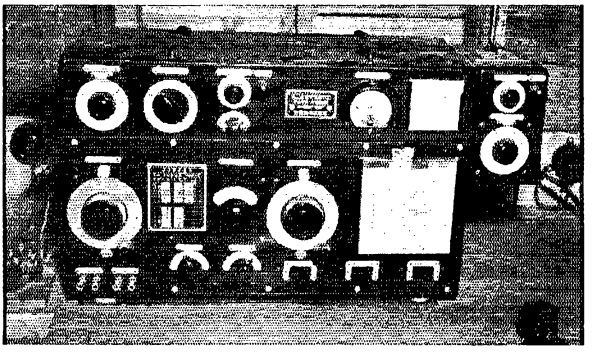
Again it must be emphasized that these men are Marines first and communications specialists second. All during their radio schooling their training as soldiers goes on. They shoot, take rifles apart and put them back together again, learn how to use knife and machete — receiving thorough grounding in all the tricks of the infantryman's trade. In short, they go out equipped to do their job — which is to fight as well as to carry on radio communication.

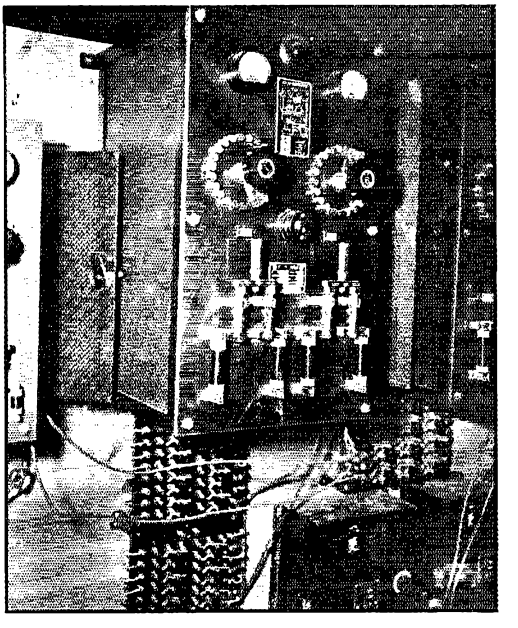
Theory Instruction

The elementary electricity and radio classes are handled as lecture groups. There is no lab work, but demonstration sets, display boards

(*Continued on page 86*)







Typical captured Japanese radio equipment. The gear pictured was abandoned by retreating troops when Marines made a surprise attack on a Jap base during the early fighting in the Solomons. Still intact and functioning, it was put to work by the U. S. forces. *Top* — Duplicate operating positions. *Center* — Panel view of combination transmitter-receiver. *Bottom* — Part of power supply assembly, showing elaborate switching. Jap equipment, largely copied from American designs, is efficient, substantially built and of surprising power and range. *Official U. S. Marine Corps Photographs*

A Siphon Tape Recorder for Radio Telegraph Signals

A Rugged Homemade Unit Complete with Play-Back System

BY J. P. GILLIAM,* W9SVH/WLHM

Among wartime projects we can think of few more attractive than this siphon recorder. To build it costs something in time but relatively little in dollars and cents, despite its elaborate appearance. If the construction of separate parts is farmed out to individual mechanically-minded members, the job should make an excellent club proposition. We have had an opportunity to see the unit in action and can vouch for its successful performance.

SINCE tape recorders are not common pieces of ham equipment, it might be a good idea to start this story by answering the question, "What *is* a tape recorder?" In its simplest form it is a gadget which may be used in conjunction with any receiver to record on paper tape the transmissions of any radiotelegraph transmitter capable of putting a signal of moderate strength into the receiver. Samples of typical tape recordings are shown on page 23. If the lower portion of the undulating line is blocked off, the dots and dashes will be easily recognized.

From the point of view of the amateur, one of the chief attractions of a tape recorder is its ability to record high-speed transmissions which may be transcribed at slower speeds. Commercial point-to-point stations always use recorders of this type, not only because they provide one way of making possible high-speed communication, but also because it has been found that it is easier to train an operator when transcription is by eye rather than by ear, and that average transcribing speeds are higher.

Inspiration for constructing this recorder was provided by an article by Fred Schnell, W9UZ, appearing in *QST* for April, 1936. The main points of construction were based on his description. While I was at it, however, I decided to add a few features which would make the unit more useful around the ham shack, as well as more interesting to play with.

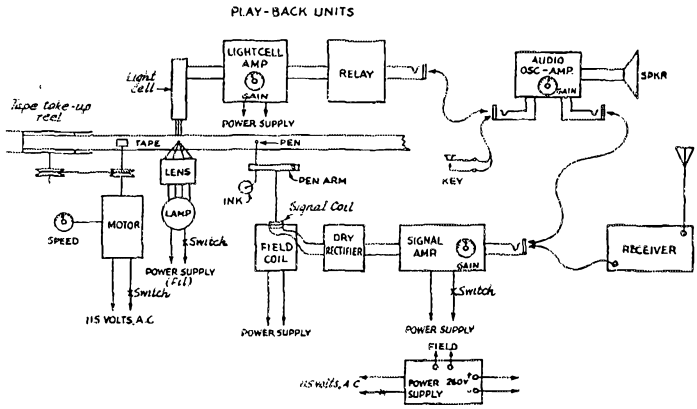
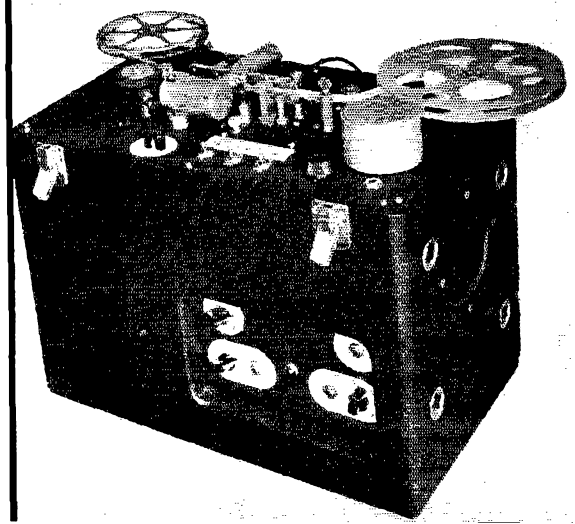


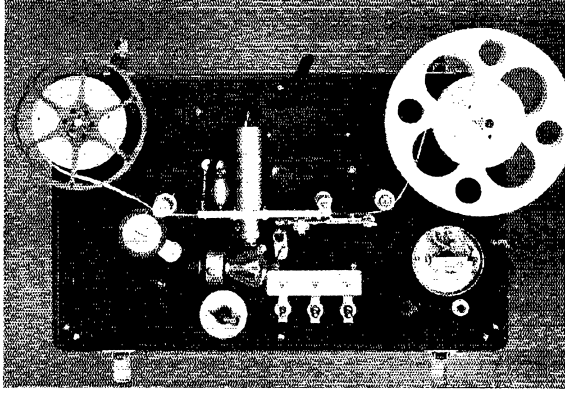
Fig. 1 — Block diagram of recorder. The receiver is not included in the unit.

A recorder is undoubtedly the best available device for testing one's fist; the lengths of dots, dashes and spaces can be measured with a ruler, and there are no ifs, ands or buts when it comes

*432 Goshen Ave., Elkhart, Ind.



Front view, showing the control and jack panel. The upper left-hand knob controls the audio oscillator switch and gain; the knob below is for adjusting the tone of the oscillator. Output from the oscillator is taken from the left-hand jack. The upper jack to the right is for inserting a key or the photocell relay contacts in the oscillator circuit. The lower right-hand jack and knob are for signal-amplifier input and gain adjustment, respectively. In this picture the covers for the exciter lamp and relay are in place. The various controls and switches are along the front edge of the panel. Left to right they are: motor speed control, exciter lamp switch, motor switch, signal-amplifier switch, photocell amplifier control and switch, and jack for relay contacts.



Top view of the recorder panel. The take-up reel is at the left and the reel for the unused tape at the right. At the center is the tape-guide assembly from which the photocell in its shield is supported at the rear, while the lens mounting projects from the front of the guide directly back of the lamp with cover removed. The tape guide is pivoted at the right-hand end and its position may be adjusted by the threaded-rod adjustment to the left of the light cell, while the coil spring provides tension. The pen arm and inkwell are immediately in front of the tape guide. To the right of the take-up reel is the take-up idler pulley working against the knurled puller wheel on the motor shaft. The other idler pulley may be seen to the left of the feed reel to the right. The relay operating from the light cell is mounted in the lower right-hand corner.

to comparing the recordings of individual "swings" with tapes made from perfect mechanical transmissions. Accordingly, when the gang found out that I had the recorder one of its most frequent uses was in checking fists over the air. This led to the addition of an audio oscillator, the output of which could be fed into the recorder instead of a received signal, so that I could check my own fist and do the same for anyone who happened to drop in. Since the unit is portable, the oscillator also makes it more interesting for club demonstrations.

To finish the job off I added a play-back arrangement so that any of the recordings could be used either to key the audio oscillator, coupled to a speaker through a single amplifier stage, or to key the transmitter with CQ tapes, etc.

From the accompanying sketches and photographs it may be seen readily that the building of a recorder is not so easy a job as most amateur constructional projects. Although most of the mechanical parts may be made from metal scraps of the most suitable size and shape, the builder must be handy with tools, unless he happens to have a mechanically-minded friend who is willing to do the work. Some of the parts require simple but accurate machining, so it will be nice if the pal on whom you bestow the honor of doing the work has access to a machine shop. Perhaps you can sort of ease him into the job by giving him a part every now and then to finish up. There is always more than one way to skin a cat, you know!

The System

Perhaps it will be best to explain first how the system works and just what parts will be needed. The system is most easily explained by referring to the block diagram of Fig. 1. The signal from the headphone output of a receiver is fed into the input of the audio amplifier marked *signal amplifier*, which is designed to compensate for a certain amount of fading; otherwise any audio amplifier with an output of 6 or 8 watts would serve equally well if fitted with a 500-ohm output transformer. The output of the audio amplifier is fed through a rectifier to a small coil, marked *signal coil*, which takes the place of the voice coil in a rebuilt loudspeaker movement. Attached to the signal coil is an aluminum rod which pushes an arm against a spring return. The end of this arm holds a short piece of fine metal tubing, one

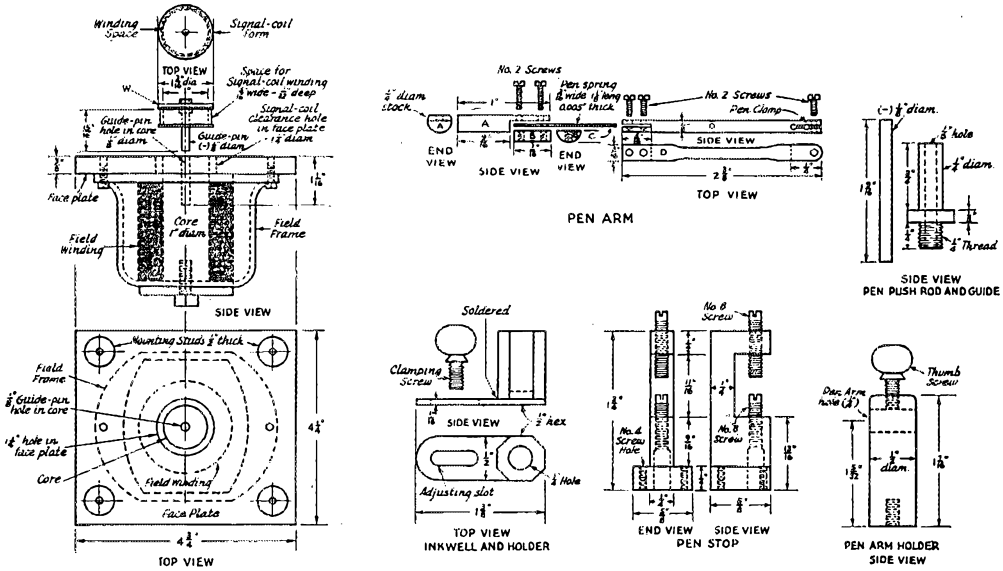


Fig. 2 — Pen and actuating mechanism. Details of assembly are given in the text.

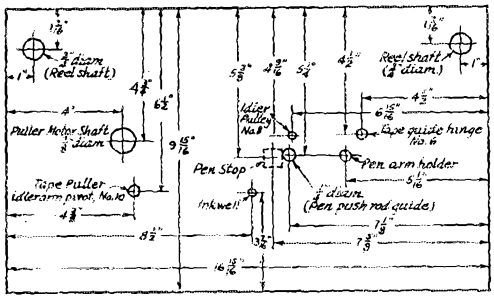


Fig. 3 — Panel layout, showing location of important hole centers. The panel in the original is ⅛-inch steel.

end of which dips into a small inkwell while the other bears against the paper tape to form a self-feeding pen. As the signal coil moves up and down with the signal the pen inscribes the dots and dashes on the moving tape. The rectifier is required to keep the pen from chattering up and down at an audio rate. The tape is pulled along by means of a friction-wheel arrangement driven by a phonograph motor. When you want to record a visiting fist, the output of the audio oscillator is substituted for the receiver output.

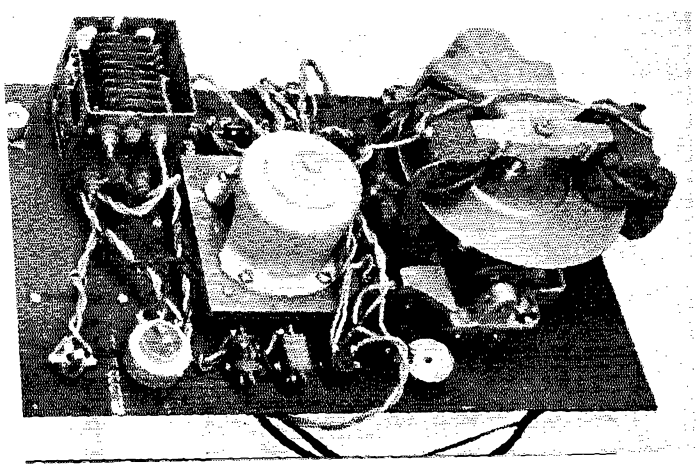
When a tape recording is run through for playback, the light from the automobile headlight lamp is focused on the ink line by the lens unit. Immediately behind the tape is a small aperture of a diameter slightly smaller than the width of the ink line. Behind the aperture is a photocell. The spot of light is adjusted to fall along the top of the ink line so that part of the light will pass through the tape where no ink appears, while areas of ink will completely blot out the light flowing through the aperture behind the tape. The photocell then serves to operate a sensitive relay which may be used to key the audio oscillator or the rig.

Pen-Driving Unit

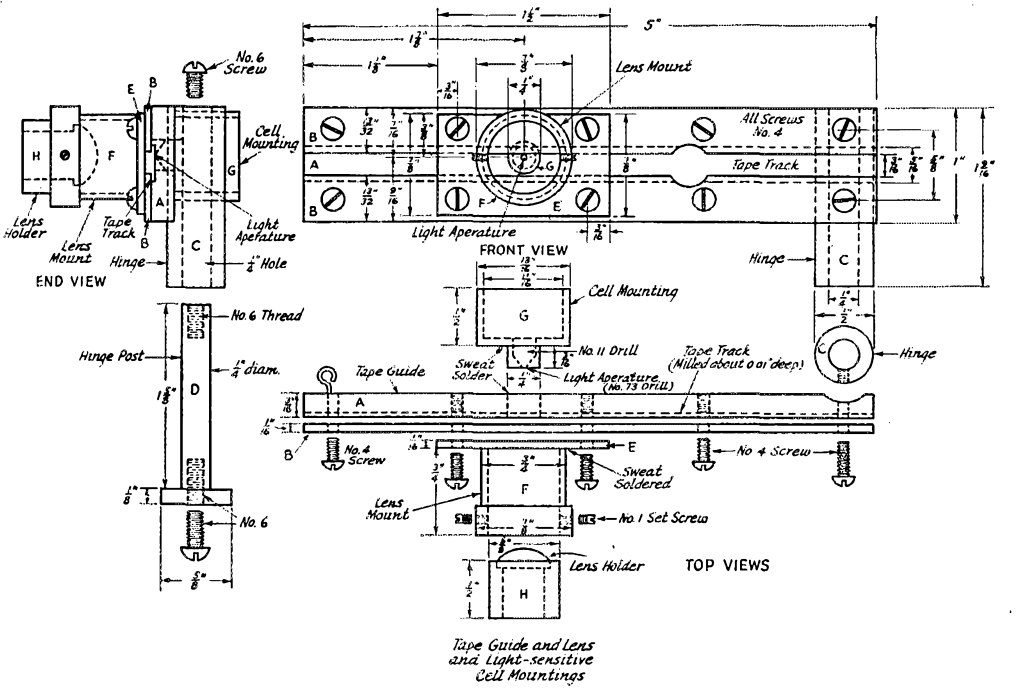
I doubt that anyone will be able to — or want to — duplicate the mechanical parts exactly, since available materials and facilities will influence details. There is plenty of room for individual ingenuity in arriving at the desired end, by one means or another. However, the drawings will make it easier to decide where liberties may be taken. Since the pen arm and its driver are the heart of the recorder, we might as well undertake the description of these first. Referring to Fig. 2, the driving mechanism is built around the "works" of an old 8-inch dynamic loudspeaker unit with a separately-excited field winding. The core must be removed, drilled and reamed accurately at the center to a depth of $1\frac{1}{16}$ inches at a diameter of ⅛ inch. The walls of the hole should be polished smooth to reduce friction. The field shell is then fitted with a face plate of soft iron, ⅜-inch thick, in which a 1¼-inch hole must be cut at the center. Other dimensions will depend upon measurements of the speaker unit used. Heavy studs or spacers are placed at the four corners of the face plate to space it from the under side of the panel when mounting.

The signal-coil form is turned from a small piece of bakelite tubing. The space for the signal-coil winding (1600 turns of No. 42 enameled wire) is 5/16 inch wide and 1/32 inch deep. A thin bakelite washer (W) is cemented over the upper end of the form so that a ⅛-inch-diameter (actually 0.120 inch) polished aluminum guide pin can be fastened at its center with a thin nut. The shoulder inside the form may either be turned on the guide pin, or it may consist of a second locking nut, although extreme care must be used to locate the guide pin at the exact center and square with the form. Flexible leads of 'phone cord are soldered to the ends of the signal winding and the junctions are anchored firmly to the top of the form with cement. While it will be noticed that the inside diameter of the coil form and the outside diameter of the field core are shown the same (1 inch) in the drawing of Fig. 2, either the top end of the core, or the inside of the coil form must be machined down so that there is a clearance between the two of about 0.010 inch to allow free movement of the form over the end of the core. Similarly, the guide-pin hole in the center of the core and the guide pin itself must be made to fit so that the coil will move freely, but without excessive play. Care must also be used in mounting the face plate to make the core central in respect to the hole in the face plate. This unit should be mounted centrally beneath the ¼-inch hole marked *pen push-rod guide* in the panel plan of Fig. 3.

The upper end of the signal-coil guide rod serves to push the pen push rod through the pen push-rod guide shown in the upper right-hand corner of Fig. 2, so the top end of the coil guide rod should be flattened so that the bottom end of the push rod will not have a tendency to skid. The

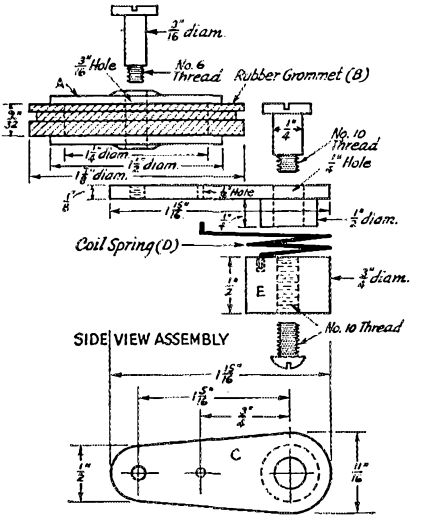


Underneath the panel, showing the phonograph motor, the speaker unit for driving the pen of the recorder and the oxide rectifier. The motor speed-control disk is to the left of the motor.



Tape Guide and Lens and Light-sensitive Cell Mountings

Fig. 4 — Tape-guide assembly. The top view shows various parts before assembly. The lens is cemented in the holder (H) which slides into the mounting (F), which in turn is fastened to the front of the tape guide (A) over the retaining strips (B) with machine screws. Photocell mounting (G) fits into the ¼-inch hole in (A), while the hinge (C), fastened at one end, pivots on hinge post (D). The lens and holder are not shown in the front-view drawing but they are shown in place in the end view where the shape of the tape track is more clearly seen.



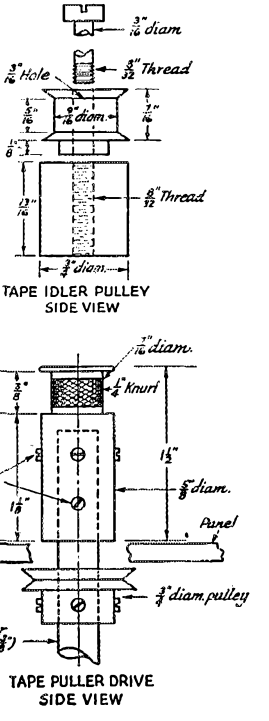
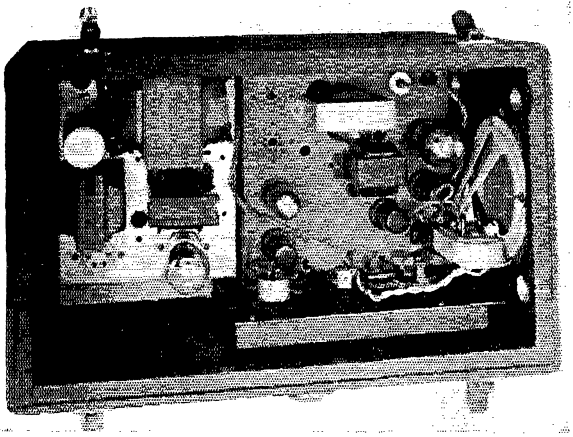


Fig. 5 — Tape-puller parts. The rubber-rimmed idler wheel (A) rotates on the screw at the end of the arm (C) which pivots on the stud (E). The coil spring (D) holds the idler wheel against the knurled portion of the puller-shaft fitting. The upper right-hand sketch shows the feeder-reel idler.



Interior view of the case, showing the power supply to the left and the audio oscillator-amplifier and signal amplifier on a single chassis to the right. The amplifier for the light-sensitive cell, removed for this picture, is mounted on a small metal shelf fastened to the back of the cabinet over the rear portion of the right-hand chassis. The speaker shown is a five-incher of the magnetic type. Vacant sockets are for interconnecting plugs. The control panel is recessed by spacing strips of wood.

push rod is also made of ⅛-inch aluminum rod and it and the push-rod guide should be made to fit accurately to allow the rod to slide up and down freely, but without excessive play. A clearance of 0.005 inch is suggested. The guide mounts in the hole marked for it in Fig. 3.

From this point on, we can breathe a little easier, for most of the other parts can tolerate somewhat less accuracy and, if you have patience and a steady hand, much of the work can be done with hand tools if need be. However, it should be borne in mind that the better job you do in fitting the parts, the less likely you are to run into troubles which are difficult to cure.

Pen Mechanism

The pen arm, which is pushed up and down by the push rod, consists of the four parts lettered in Fig. 2. The main part of the arm (D) is cut from ⅛-inch aluminum sheet. The slit with the lateral notch at the right-hand end forms a means of clamping the pen in position. The slit at the other end is for fastening one end of the flat spring. Both slits should be not more than 1/32-inch wide, so you may have to get a jeweler to do the job. The length of spring between the main part of the pen arm and the mounting piece (A) should be ⅜ inch. The mounting piece is formed from a short piece of ¼-inch brass rod. The piece (B) is used as a clamp for the left-hand end of the spring. I made the spring from a piece of steel clock spring. This makes it necessary to punch the screw holes, since the steel is too hard to drill. If you can't manage this, spring copper, which may be drilled, makes a pretty good substitute. Part (A) is filed flat on top, as shown in the end view, so that it may be clamped firmly by the thumb setscrew of the pen-arm holder shown in the lower right-hand corner of Fig. 2.

Naturally, we must have something to limit the stroke of the pen to keep the horizontal ink lines straight on the tape. The pen stop, shown in Fig. 2, takes care of this. The one shown is cut from a solid piece of brass, although there are doubtless other ways of making it. The only requirements are that its over-all size be kept small enough to fit in the space allotted to it on the panel and that the center of the space between the adjusting screws be central with the hole in the pen-arm holder. In mounting the stop the base of the pen-rod guide may have to be filed off on one side, since these two come quite close together.

The pen itself is a piece of stainless steel tubing such as that used in the manufacture of hypodermic needles, about 1½ inches long. The size which has been found most satisfactory is No. 24 Stubbs gauge, having an outside diameter of 0.22 inch and an inside diameter of 0.014 inch. One end of the pen is bent to dip into the small inkwell, which may be seen in the photographs just to the

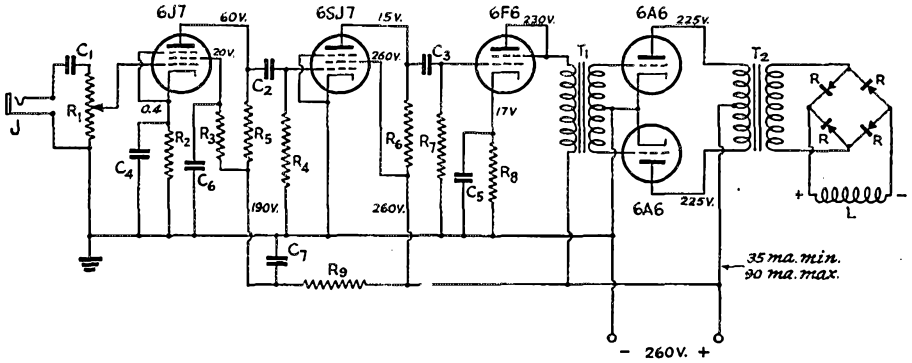


Fig. 6 — Circuit diagram of the signal amplifier.

C_1, C_2, C_3 — 0.1 μfd.
C_4, C_5 — 40 μfd.
C_6 — 0.1 μfd.
C_7 — 4 μfd.
R_1 — 3 megohms.
R_2 — 1000 ohms.
R_3, R_4 — 1 megohm.
R_5 — 250,000 ohms.
R_6 — 25,000 ohms.
R_7 — 500,000 ohms.
R_8 — 650 ohms.
L — Signal coil, 1600 turns No. 42 enameled wire wound on form shown in Fig. 2; resistance approximately 375 ohms.
R — Oxide rectifiers.
T_1 — Class-B input transformer.
T_2 — Class-B output transformer, 8000 ohms to 500 ohms.
J — Input jack, open-circuit.
All voltages measured with 2000 ohms-per-volt meter.

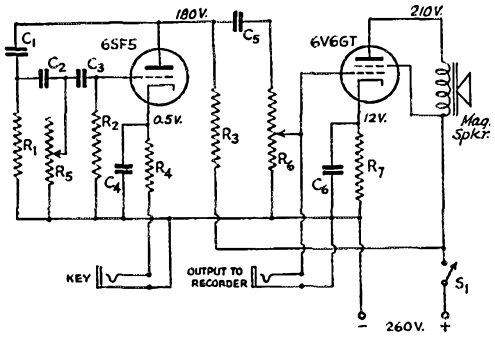


Fig. 7. — Circuit of audio oscillator and amplifier.
C_1, C_2, C_3 — 500 μfd.
C_4 — 1 μfd.
C_5 — 0.01 μfd.
C_6 — 40 μfd.
R_1, R_2, R_3 — 250,000 ohms.
R_4 — 1000 ohms.
R_5, R_6 — 500,000-ohm volume control.
All voltages measured with 2000 ohms-per-volt meter.

right of the headlight bulb, the construction of which is shown in Fig. 2. It consists merely of a piece of hex stock drilled out to form a small cup which is then soldered onto a length of 1/16-inch brass strip. The slot and thumbscrew allow the well to be swung out of the way when removing the pen arm. I added the extra feature of a threaded cap so that I could carry the unit around without spilling the ink.

Tape Guide

We now have the pen and its actuating mechanism ready, but we need something to hold the tape up in front of the pen. The construction of the tape guide is shown in Fig. 4. It may look complicated at first glance, but when you take it apart, there really isn't so much to it. A path

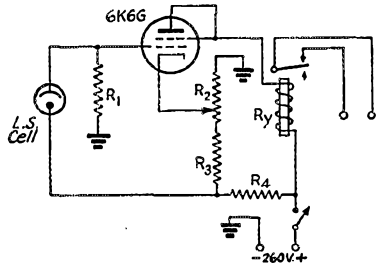


Fig. 8 — Photocell-amplifier circuit.
R_1 — 60 megohms.
R_2 — 10,000-ohm wire-wound potentiometer.
R_3 — 3000 ohms.
R_4 — 20,000 ohms.
L.S. Cell — Cetron WB CE22, Class E, or Class C.
Ry — Staco, MR5 5000-ohm back contact or similar sensitive relay.
The switch is incorporated in R_2.

♦

Right — Sample tapes made by the recorder.

5/16 inch wide and 0.01 inch deep is milled down the center of a piece (A) of heavy brass (3/16-inch bakelite might be substituted) 1 inch wide and 5 inches long, forming a track for the 5/16-inch paper tape. To hold the tape in the track, retaining strips of brass 1/16 inch thick and 13/32 inch wide (B) are fastened along the top and bottom of the track piece with No. 4 machine screws. These strips overlap the track by 1/16 inch on both sides. W9UZ avoided the milling job by placing spacing strips of shim material 11/32 inch wide under each of the retaining strips.

At its right-hand end the assembly is fastened to a piece of ½-inch brass rod (C), drilled its length with a ¼-inch hole, by means of a pair of No. 4 machine screws tapped into the wall of the rod. This rod then slips over a ¼-inch post (D) mounted on the panel to form a hinge on which the whole tape-guide assembly may swing for adjustment of the pressure of the tape against the pen.

Play-Back Accessories

One and seven-eighths inches from the left-hand end of the track piece a ¼-inch hole is

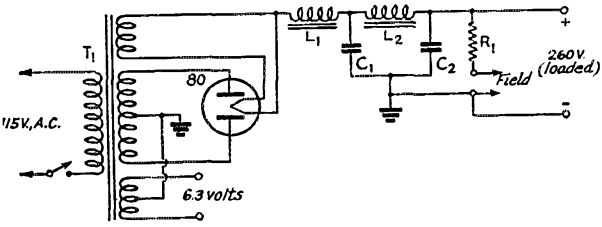


Fig. 9 — Circuit diagram of power supply.
C_1, C_2 — 8μfd. filter condensers.
R_1 — 15,000 ohms, 20-watt.
L_1 — 8 hy., 120 ma. (Thordarson T75C49).
L_2 — 12 hy., 150 ma. (Thordarson T17C00-B).
T_1 — 375 volts each side of center, 150 ma.; 5 volts, 4 amp.; 6.3 volts, 5 amp. (Thordarson T13R15).

drilled with its center 1/32 inch below the lower edge of the upper retaining strip. The hole is drilled through the 3/16-inch track piece only; it does not extend through the retaining strip. This hole is for mounting the photocell and shield of the play-back section. The photocell mounting (G) is turned from a piece of round brass stock whose diameter will depend upon the size of shield used for the photocell. The shield should fit snugly over the stock. Since the inside diameter of the tubing I used for the shield was 1 3/16-inch, stock of this diameter was used. The piece is hollowed out to make a cup ½-inch long with a 1/16-inch wall.

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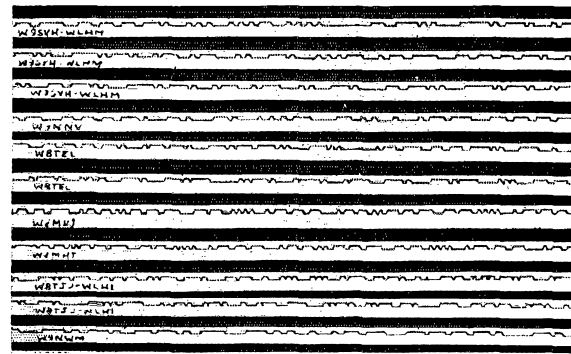


Some New Thoughts on WERS

A Supplement and Commentary on Recent Developments

BY GEORGE HART,* WINJM

TEN months ago *QST* presented OCD's new plan for civilian defense communication, the War Emergency Radio Service. Since that time every issue of *QST* has carried more details on WERS — how to go about organizing, suggestions for building and operating equipment, articles on typical WERS organizations among those first licensed, explanations and interpretations of new and amended rules. As the saying goes, much water has passed under the bridge since last July. We have had to absorb many changes in our ways of thinking, and to some of us the rapidly-changing situation has no doubt been confusing. We have had to make the best of many bad situations while fighting for better ones.

Actually, the WERS picture has not changed a great deal since then. ARRL and OCD recommended the district plan of licensing, and we still do, although FCC has been granting licenses to independent communities. Procurement of equipment and enlistment of personnel goes on as in the past, getting tougher all the time. Some communities have found it impossible to get started; others have progressed to the point of applying for licenses, only to find the license held up by FCC because some detail of the regulations was not complied with; still others have received their licenses, started operation and tests, and are ready for the first bomb to fall.

Stations in the War Emergency Radio Service are not necessarily civilian-defense stations. We knew this all along (State Guards were included in the original rules), but we continued to use the term rather loosely, for the most part scarcely recognizing State Guards as a part of WERS. Either it was WERS or it was State Guard. Now the Civil Air Patrol steps into the picture, and it is time that we revise our terminology. We must cease speaking of WERS when we mean civilian defense radio. WERS embraces all three categories, and we should speak of them, we suggest, as CD-WERS, SG-WERS and CAP-WERS. It is not inconceivable that still other categories will be included. As amateurs are taking part in CD-WERS, so are they taking part in SG-WERS and so will they participate in CAP-WERS. If any other new categories of WERS crop up, amateurs will likewise play a leading part; so let's start keeping them straight.

Aiding the Enemy

In conducting our operations in CD-WERS, a little common sense will go a long way in devising ways and means of keeping important information from the enemy in approaching planes or in our midst as saboteurs. We must assume that each approaching enemy plane will be equipped with receivers capable of hearing our signals and with direction-finding devices to tell where the signal is coming from. FCC has required that civilian-defense stations transmit their call letters at the beginning and end of each complete exchange; but even the transmission of call letters might tell an approaching enemy the general location of the station he is hearing. Army defense commanders now require that call letters *not* be announced during blackouts, and that all transmissions be not over thirty seconds in length and that the same station transmit not oftener than once every two minutes.

What to do, one asks? FCC says we must do one thing and the Army says we must do the exact opposite. Our course of action is clear if we will remember that the Army is supreme during wartime and that its orders supersede all others; and that such Army orders have effect only during periods of enemy action. In other words, CD-WERS stations *must* announce their call letters, in accordance with FCC rules, at all times during regular test periods, but they *must not* announce call letters or locations of any kind that might be useful information to the enemy during periods of enemy action.

What it actually boils down to is this: (1) CD-WERS is normally under the jurisdiction of FCC, and during normal periods (regular test periods specifically) call letters *must* be announced according to the FCC rules. Transmissions may be of indefinite length. (2) When the blue alert sounds, the Army is in power and Army orders are supreme. Until the all-clear, CD-WERS stations (a) dispense with all call letters and announcement of any locations and (b) each station may transmit only once every two minutes and that transmission may not be over thirty seconds in length. This means that classes training CD-WERS operators should train them accordingly — with and without call letters, and in 30 sec./2 min. bursts. It is just as mandatory to use station call letters at one time as it is not to use them at another.

Silencing

During a period of enemy action the Army, for one reason or another, may wish to silence all stations in the War Emergency Radio Service. This silencing will be done at the order of the controller of communications at the Army Information Center in the area nearest that wished to be silenced,

* Acting Communications Manager, ARRL.

and the order will be sent only to the central city of each district warning area. From that point on, it is the responsibility of civilian-defense authorities to silence the stations of their networks, and the silencing must be prompt and complete.

The silencing order will go from the Information Center to the d.w.c. city by wire. No provision has been made for any sort of radio communication between the two points. While this seems to us to be tempting fate, it behooves CD-WERS licensees to avoid, if possible, any further use of wires in receiving such orders. Even independently-licensed municipalities should establish radio contact with their d.w.c. cities as a supplement at least to any provision for receiving silencing orders by wire — such as, for example, modification of the station license to include a unit located in the d.w.c. city, and operated by an operator living in that city, as a part of *their* network.

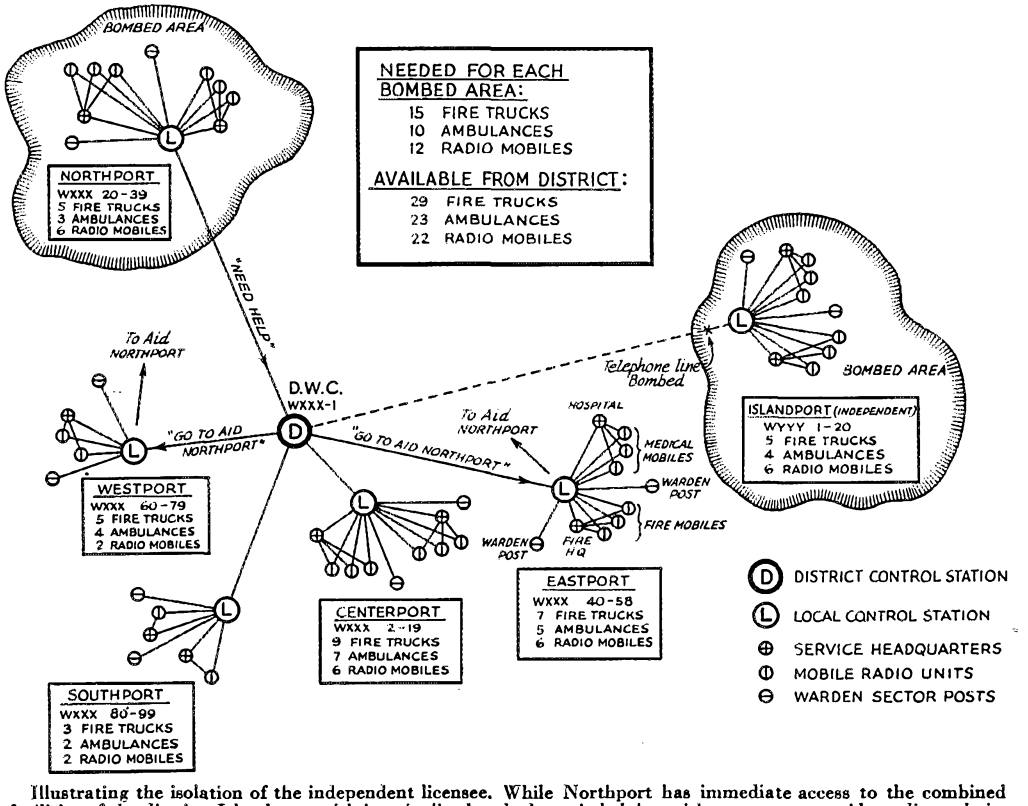
The use of "key" broadcasting stations as a means for receiving silencing orders is not considered applicable to CD-WERS, and should under no circumstances be the only provision made. It is expected that such broadcasting stations, after giving the 1000 c.p.s. tone and announcement of radio silence, will not be allowed to come back on the air until the "all clear," or if they do they will be of no value to CD-WERS licensees. We recommend that direct contact with d.w.c. be maintained in all cases.

Mobiles

We had previously thought of organized CD-WERS nets as consisting of a control station collecting reports from net stations operating in strategic sectors of the community. Thus air-raid wardens, unable for one reason or another to use the telephone to send in their reports, could file the report at the CD-WERS unit nearest their patrol area. While installation of such fixed units is still a part of the plan,[1] it is now recognized that the inclusion of mobiles of the various protective services will make a most valuable addition to the service that can be rendered by warden's post station units and the dispatch of facilities from the control point. In fact, mobile units of services such as fire, police, medical, etc., will comprise the most valuable elements of the whole system; for, while wardens can report an incident to the control station initially, fire can send its mobiles immediately to the scene of the incident and keep in contact, by radio, with those mobiles direct from the fire station; similarly police and hospital facilities. The local control center then becomes a place where the various services are coördinated and where an up-to-the-minute picture of conditions in the community is maintained.

(*Continued on page 76*)

[1] "The Tri-Part Plan," Feb., 1942, *QST*, p. 19.



Illustrating the isolation of the independent licensee. While Northport has immediate access to the combined facilities of the district, Islandport, with its wire line bombed out, is helpless either to summon aid or dispatch it.

HAPPENINGS OF THE MONTH

YOUR SERVICE RECORD?

As THE headquarters of the amateurs, ARRL is endeavoring to compile a record of all amateurs serving in the armed forces and elsewhere in the government's service. You fellows and YLs can see the immense value such a record will have for us all after the war. We want to be able to point at the amateur's contribution to this effort and cite the statistics. While we particularly want to know about those amateurs in the armed forces and the merchant marine, we should also like to know about those in war-radio work in the Civil Service. We're as much interested in you amateurs with operator license only as we are old-timers with station calls. And as much in VEs as Ws and Ks.

We do *not* wish any restricted data whatever; they are altogether unnecessary. But we do yearn almightily to build up our record, for our common good when peace returns. Won't you help? To assist you, we print a form on this page, which may be cut out or reproduced. It lists the essential dope we need. We believe it to be OK everywhere but if it calls for any data which are restricted in your organization, just leave that part blank. We'll also appreciate your mentioning the calls of your amateur associates (get the calls right!) and explaining to other amateurs the desirability of reporting themselves for our record. (And if you've had a promotion since you last registered, how about a new report?) Incidentally, that's the way we get our mentions for the "In The Services" department in *QST*.

This roster has only one purpose: to show what the amateur does in the war and to demonstrate that it is wise national policy for our countries to foster amateur radio. Let's have your data for the record — now, while you think of it! Address ARRL, West Hartford, Conn.

SIGNAL CORPS SEEKS AMATEUR GEAR

RADIO amateurs are requested to sell their factory-built short-wave communication equipment to the Signal Corps, Army Services of Supply. This equipment is needed both for training purposes and operational use, the War Department has announced.

The equipment needed consists of manufactured transmitters ranging in power from 25 watts to 450 watts and covering various bands, as well as the corresponding types of receivers; and especially desired are audio-frequency and radio-frequency signal generators and oscilloscopes, precision a.c. and d.c. voltmeters, ammeters and milliammeters, and other equipment for testing.

Used equipment will be purchased if it is in perfect operating condition or if it can readily be restored to such condition. The price paid for each item will be set by a Signal Corps inspector. Persons in possession of the desired equipment who wish to sell it for the use of the Army are invited to send a brief description, including name of manufacturer and model, to Captain James C. Short at the Philadelphia Signal Corps Procurement District, 5000 Wissahickon Avenue, Philadelphia, Pa.

The list of desired equipment follows:

Transmitters — Hallicrafter and Collins.
Receivers — Hallicrafter, National, RME, Hammarlund and Howard.
Meters — Weston.
Capacitors — Mica and paper.
Oscilloscopes, audio signal generators and r.f. signal generators.

AMATEUR WAR SERVICE RECORD

_____
Name

_____
Present mailing address

_____

_____
Rank or rating

_____
Branch or bureau: Signal Corps, AAF, Buships, WAVES, etc.

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

SERVICE

- ☐ Army
- ☐ Navy
- ☐ Coast Guard
- ☐ Marine Corps
- ☐ Maritime Service
- ☐ Merchant Marine
- ☐ Civil Service

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.

V.W.O.A. HONORS WAR SERVICES

FOR the first time, the chiefs of the communication services of the armed forces and the Merchant Marine sat down to dinner together, on the occasion of the 18th annual "dinner-cruise" of the Veteran Wireless Operators Association at the Hotel Astor in New York, on February 11th, in the presence of a distinguished audience of communications and broadcasting leaders. They were there to receive, at the hands of William J. McGonigle, W2ASN, the president of VWOA, that association's Marconi Memorial Honor Award Plaques on behalf of their respective services. The plaques commemorate outstanding service by radio men and provide space for recording the citation of those who particularly distinguish themselves in the present war. The awards were made to Major General Dawson Olmstead, Chief Signal Officer of the Army; Captain Carl F. Holden, Director of Naval Communications; Colonel A. W. Marriner, Director of Communications, Army Air Forces; Captain E. M. Webster, director of Coast Guard communications; Lt. Colonel J. P. Berkeley, director of Marine Corps communications, and Captain Thomas Blau, Commandant of the U. S. Maritime Service. The presentations and the acceptance of each officer on behalf of his command were broadcast. It was quite an occasion.

The chiefs of communications, with the VWOA plaques to radio men of all services. Standing: Captain Blau, Colonel Berkeley, Mr. McGonigle, Colonel Marriner. Seated: Captain Webster, Captain Holden, General Olmstead.

VWOA also presented a special commemorative medal to Major General Follett Bradley, Commanding General of the First Air Force, celebrating the historic part played by him as wireless operator in a Wright plane 30 years ago when radio was first used from a plane for the adjustment of artillery fire. The ground operator on that occasion was Major General J. O. Mauborgne, retired, former Chief Signal Officer of the Army, then a first lieutenant, who was also present as a speaker. Marconi Memorial Medals of Achievement were presented to two former operators who have attained top rank: C. J. Pannill, president of Radiomarine Corporation of America, and W. J. Halligan, president of Hallicrafters, both of whose plants fly the Army-Navy E Award. Kenneth B. Warner, secretary and general manager of ARRL, was elected an honorary member. On the latter occasion, paying tribute to the radio amateur, Mr. McGonigle, VWOA's president, said:

(Continued on page 56)

Bright stars in wartime communications, at the VWOA dinner-cruise. Left to right: Lt. Col. J. P. Berkeley, director of Marine Corps communications; George W. Bailey, ARRL president and VWOA special Washington representative; James Lawrence Fly, chairman of FCC and BWC; Maj. Gen. J. O. Mauborgne, retired, former Chief Signal Officer; Maj. Gen. Dawson Olmstead, the Chief Signal Officer of the Army, head of the Signal Corps; Capt. E. M. Webster, director of Coast Guard communications; William J. McGonigle, W2ASN, long-time president of VWOA; Capt. Carl F. Holden, Director of Naval Communications; Maj. Gen. Follett Bradley, Roosevelt's recent emissary to Stalin; Col. A. W. Marriner, Director of Communications, Army Air Forces; Capt. Thomas Blau, Commandant of the U. S. Maritime Service; A. J. Costigan (general manager of Radiomarine Corp.), VWOA's vice-president; Ted McElroy, world champion radiotelegraphist.

Elementary A.C. Mathematics

Part III—Average and Effective Values*

BY GEORGE GRAMMER,** WIDF

THE vector examples in the preceding discussion used arbitrarily-assigned values of phase angle for the various currents and voltages, with no indication as to how such angles could occur in actual circuits. It is natural, therefore, to ask how these phase angles are determined in the practical case. However, before considering this problem it is desirable to digress temporarily to examine a question which needs to be answered before very much practical work can be done. It is this: What overall "value," if any, can be assigned to a given alternating current when the current sometimes flows in one direction and sometimes in the other, and when the *amount* of current flowing is continually changing as well?

The conventional approach to a problem of this nature is to determine an *average* value. However, it is obvious from inspection of a sine wave that an average value will not be satisfactory. Since the positive and negative halves of the cycle are identical, the average of the positive half and that of the negative half taken separately must lead to identical numerical results. But one value is positive and the other negative, so that adding them together to find the total for the whole cycle gives zero as an answer. This is simply a statement of the fact that in any complete cycle, or any number of complete cycles, just as much current flows in one direction as it does in the other. Thus, on the average, the current in an alternating-current circuit is zero.

No other result could be consistent with the definition of an alternating current. If the average current on the positive half cycle is larger than that on the negative half, there will be a net flow of current in the positive direction in each cycle, and hence a net flow of current in the positive direction during the whole period while the varying current is flowing. This net flow constitutes a unidirectional current, so a current having such characteristics would be a composite affair consisting of an alternating current and a direct current combined in the one circuit. A purely alternating current cannot have such a d.c. component. If the definition of an alternating current excludes a d.c. component, then the average value of an alternating current of any waveshape whatever must be zero; in any complex a.c. wave the average current on the positive half cycle must be the same as that on the negative half cycle. The sine wave is simply an easily-interpreted case.

Nevertheless it is possible to find an average value for an alternating current, if we agree beforehand to adopt some meaning for "average" which will have a useful application. The meaning which has been adopted is this: The average value of an alternating current is the average value of the current flowing on *either* the positive or negative half cycle. This definition acquires utility when alternating current is rectified — when by some means the normal direction of current flow in one half of the cycle is reversed so that the current always flows in one direction.

Finding an Average

Although the average as defined above represents a specialized application, finding its numerical value is a relatively simple problem which can be used to illustrate a fundamental mathematical process. Consider for a moment the question of the average height of a group of men. This can be found by adding all the individual heights and then dividing by the number of individuals. As an example, let us suppose that ten men have the following heights, expressed for convenience in decimal parts of a foot:

No. 1 — 5.4 feet
No. 2 — 6.1 "
No. 3 — 5.9 "
No. 4 — 5.6 "
No. 5 — 6.0 "
No. 6 — 5.8 "
No. 7 — 5.5 "
No. 8 — 6.2 "
No. 9 — 5.9 "
No. 10 — 5.7 "

On dividing the total, 58.1 feet, by 10 (the number of individuals) we find that the average height is 5.81 feet. We interpret "average height" as the height each man would have if all the heights were the same, provided that the sum of all these average heights is the same as the sum of all the actual heights. We could attempt to apply the same process to the problem of determining the average value of one-half cycle of a sine wave, but would find ourselves faced with a difficulty right at the start. In the example above we had ten men to deal with, but how many "individuals" are to be found in the sine wave? The answer is, of course, that in completing a half cycle the current goes through an infinite number of values. It would hardly be feasible to tackle such a problem with only one lifetime to work on it. Nevertheless an approximate answer could be obtained by selecting values at equal intervals along the sine curve, adding them together, and then dividing by the number of values selected. We should expect that the greater the number of values selected — that is, the smaller the intervals between them —

*Part I appeared in *QST* for February, 1943, and Part II appeared in *QST* for March, 1943.

**Technical Editor, *QST*.

the more closely we should approximate the actual value.

However, it is illuminating to look on the question of finding an average from a different viewpoint. Going back to the height example, suppose we draw a graph on which each man is represented by a column (of any convenient width so long as all the widths are the same) drawn to a vertical scale such that the height of each man is in correct proportion. The columns are to be placed side by side, touching, as shown in Fig. 17.

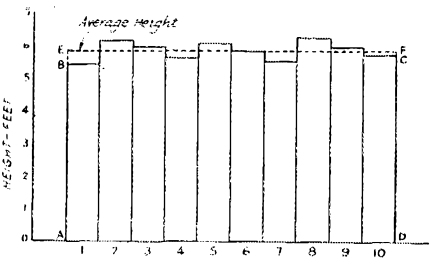


Fig. 17

Let us assume that each column has a width of one unit, so that their total width is ten units. Then the area enclosed by each column is equal to the base, 1 unit, multiplied by the height of the column. For example, column No. 5 has a height of 6 feet so that its area is 6 × 1, or 6 "man-feet." Without trying to interpret the meaning of "man-feet" other than to note that it is the result of multiplying men by feet, we observe that in the scale chosen one foot equals one vertical unit, which in turn is equal in length to one horizontal unit. Multiplying vertical by hoizontal units therefore simply gives us a certain number of *square* units.

Adding together the areas of all the columns will give us the total area bounded by the outside lines of the columns and the horizontal axis of the graph. This figure is formed by starting at point A, moving upward to B, then across the top of the first column to the edge of the second, up the edge to the top, then across column 2, down to the top of column 3, and so on until the complete path is traced through C and D back along the axis to A. The average height of the figure $ABCD$ is then defined as the height of a rectangle having a base of the same horizontal length and having the same area as the figure. In Fig. 17 this equivalent rectangle is $AEFD$. Its height, AE (or DF) is found by dividing the area by the length of the base. From this viewpoint the process of finding an average is fundamentally one of finding an area, the height of an equivalent rectangular area being the average value of the graph.

In the example considered the same numerical answer is secured by either method. However, the addition of heights in the first method is simply a special case of the more general method of finding an area. The first method *assumes* that each individual has unit width, so that the product of width times height is numerically equal to the height, but in many cases this simplifying assumption will not be true. For example, suppose that for some reason we are interested in knowing the average ratio of height to weight of the group of men. In such a case the width of each man's column would depend upon his weight. Of two men having the same height but different weights, the heavier would have the greater influence on the average because he would be associated with a wider column and hence would represent a greater area.

Average Current

At first sight the problem of finding the area between a half-cycle of a sine curve and the horizontal axis does not appear to be any simpler than adding up an infinite number of individual values. Mathematical methods exist for finding such areas, but as they are beyond our present scope we shall content ourselves with a graphical solution. The expression for the instantaneous value of a simple-harmonic alternating current is

$$i = I_m \sin (\omega t + a)$$

where I_m is the maximum value or amplitude of the current and the other notation is the same as that previously used. The phase angle, a, is of no particular concern because we are arbitrarily selecting an instant of time when a half-cycle is beginning, hence we can neglect a. I_m is a constant — that is, its value does not vary, once assigned — and as a matter of convenience we can assign it a value of unity, or 1. Then the instantaneous current, i, is proportional to sin ωt, and plotting sin ωt through a half cycle will give us the curve whose average value is to be found.

The curve should be plotted as accurately as possible on cross-section paper. A reasonably ample scale should be used. The original of Fig. 18 was on paper having 10 divisions to the half inch, with units of angle plotted along the horizontal

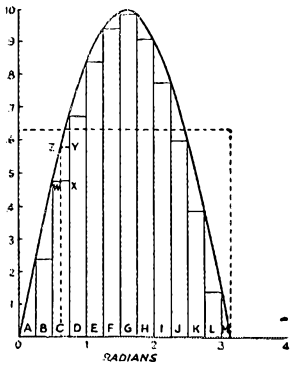


Fig. 18

axis on a scale of 20 divisions to one radian (0.05 radian per division), and with sine values plotted along the vertical axis on a scale of 100 divisions to 1 unit (0.01 per division). Each square division, or elemental block, therefore represented 0.05 multiplied by 0.01, or 0.0005 square unit of area. Since the radian measure of angle and the trigonometric functions are both ratios based on the radius of the circle, expressing the angle in radi-

ans leads to a consistent numerical result when the area is determined. The unit of area in this case is simply a number, having no dimensions itself because there are none associated with the sines and angles entering into its composition.

The area under the curve — in this case, the area enclosed by the curve and the horizontal axis between the points where the curve intersects the axis — can be found by counting the blocks so enclosed, making due allowance for fractional blocks (those which are partly inside and partly outside the curve). It is convenient to divide the area into strips, as shown in Fig. 18, and to form rectangles wherever the boundary line of a strip intersects the curve. The areas of the rectangles can be found quickly by multiplying the height by the width, thus restricting the actual counting operation to the irregularly-shaped areas between the curve and the rectangles. It is obviously not necessary that each strip have the same width, although in the figure all of them do have the same width except the one labeled *M*. It should also be apparent that the number of strips does not matter particularly, although there will be less actual counting to do if a large number of strips is used, and the accuracy may improve as a result.

If the work is done with reasonable care, it will be found that the area is within one per cent or so of 2 square units, 2 being the exact value as found by mathematical methods. To find the average value of the curve we then divide the area by the base (which is equal to π) so that

$$\text{Average value} = \frac{2}{3.14} = 0.636$$

A rectangle of the same area and width will have a height of 0.636, as shown by the dashed outline in Fig. 18.

In drawing the curve we arbitrarily assigned the value of unity to I_m, but since I_m may have any value the average value of a given current obviously will be proportional to I_m. We therefore restore I_m to its proper place in the equation, obtaining

$$\text{Average value} = 0.636\ I_m$$

It is well to emphasize once more that this "average" value has the special meaning previously given.

Effective Value

Since the average value of an a.c. wave as defined above is not useful so long as the current actually reverses its direction periodically, it is necessary to adopt some different definition to express the overall effect of the current. We know that, despite the fact that the average current over a whole cycle is zero, an alternating current nevertheless is able to do useful work. It is only logical, then, to examine the possibility of using work or energy as the basis for establishing an overall value for the current. Since the current is continually varying, the amount of work done also varies from instant to instant. However, if we can find the total amount of work done in, say, the time of one cycle, the average rate of doing work can in turn be found by dividing the total work by the time. Since the rate at which work is done is the definition of power, the average rate of doing work will be the average power associated with the current.

In d.c. circuits, Ohm's Law tells us that power is proportional to the square of the current flowing. If this is also true in an a.c. circuit, then we have a means for assigning a value to an alternating current. For if power is proportional to the square of the current then current is proportional to the square root of the power, and we can say that the "overall" value of an alternating current is proportional to the square root of the *average* power, based on the amount of work done by the current in a whole cycle.

Ohm's Law, the essence of which is that current flow is directly proportional to the voltage applied, was established by a series of observations on direct-current circuits where variations in the amplitude of the current, if any, were small and at a relatively slow rate. Can the law be applied to alternating currents, which vary rapidly in value and are continually reversing their direction of flow? Experiment shows that there are periods of time, even in direct-current circuits, when the current does not obey Ohm's Law. These periods are associated with storage of electrical energy in electric or magnetic fields, or with the return of such stored energy to the circuit. They are always associated with a *changing* current, but change is the outstanding characteristic of an alternating current. However, experiment also establishes the fact that storage of electrical energy is associated with inductance or capacity, but not with resistance.

This being the case, we can expect that Ohm's Law will apply to an a.c. circuit containing resistance only, since the electron is practically inertialess because of its extremely small mass, and therefore will respond instantaneously to a change in e.m.f. That is, *at any instant* the current flowing will be proportional to the e.m.f. acting *at that instant.* Also, the power at any instant will be proportional to the square of the current at the same instant. Of course it is impossible to have a *purely* resistive circuit — there is always inductance and capacity associated with even a very short length of conductor — but if the amount of energy stored is very small compared to the energy used up or dissipated in the resistance no appreciable error will result from assuming that the circuit contains resistance only. In determining the overall value of an alternating current we make this assumption. It is equivalent to saying that the assigned value (called the *effective* value) of an alternating current is the same as that of a direct current which will develop the same average power in a given resistance.

The first question to settle is that of the average power represented by a current of given magnitude in a given resistance. This problem is essentially the same as the previous one, since it involves finding an average. By Ohm's Law,

$P = I^2R$, and we expect this equation to give us the average power in a resistive a.c. circuit when the effective value of the alternating current is used for I. However, we know only the instantaneous values of current and power, so we write

$$p = i^2R$$

using the small letters for p and i to indicate that instantaneous values are meant. Since

$$i = I_m \sin \omega t$$

(neglecting the phase angle, since we are going to be concerned only with a complete cycle and not its instant of occurrence) we can substitute this value in the first equation and obtain

$$p = (I_m \sin \omega t)^2 R$$

Since the square of the product of two numbers is equal to the product of their squares, this can be written

$$p = I_m^2 (\sin^2 \omega t) R$$

This states that the instantaneous power is equal to the resistance multiplied by the square of the maximum value or amplitude of the current, in turn multiplied by the square of the sine of the angle representing the instant of time considered. The only factor in the right-hand side of the equation which is a function of time is $\sin^2 \omega t$; both I_m and R always have the same value. This being the case, both I_m and R are mathematical constants and can conveniently be disposed of by assigning the value of unity to each. If we do this we are left with the simple relationship $p = \sin^2 \omega t$. This is an equality only in the special case where both I_m and R are equal to 1; it is more proper to say that p *varies as* $\sin^2 \omega t$.

To find the average power in one cycle we therefore plot the curve $p = \sin^2 \omega t$ for one cycle, find the area under the curve, and then divide the area by the length of the cycle along the X axis, a procedure similar to that followed in finding the average value of the current. In this case, instead of plotting a sine wave we plot a curve in which the sine is squared at every point. The curve is shown in Fig. 19, with a sine curve plotted for comparison. It will be observed that the sine squared curve always is positive, even during the half-cycle when the sine curve is negative. Mathematically this is because the square of any number, negative or positive, always is positive. The physical interpretation is that power is being dissipated in the resistance at all times (except at those instants when the current is zero) regardless of the direction in which the current is flowing. In no part of the cycle, therefore, is energy being returned to the system after having first been stored in electric or magnetic fields.

The area under the sine squared curve can be found by dividing it into strips and adding the individual strip areas to find the total, just as we did before. The exact value of the area for the whole cycle is equal to π. To find the average power we then divide the area by 2π, the length of the base, getting $\frac{1}{2}$ as the answer. That is, the average power developed by an alternating current flowing in a resistance is one-half the maximum power (the maximum power in Fig. 19 has a value of 1 because of our assigning unity value to I_m and R). Restoring I^2_m and R to their proper places, we can now rewrite the equation for power as follows:

$$P = \tfrac{1}{2} I^2_m R$$

where P now represents the *average* power.

Rearranging the expression above gives

$$\sqrt{\tfrac{1}{2} I^2_m} = \sqrt{\frac{P}{R}}$$

while in the ordinary form of Ohm's Law,

$$I = \sqrt{P/R},$$

and we expect our alternating current to conform to the latter equation when I represents the effective value of the current. Hence

$$I = \sqrt{\tfrac{1}{2} I^2_m} = \sqrt{\tfrac{1}{2}}\, I_m = 0.707\, I_m$$

so that the effective value of an alternating current is equal to the maximum value multiplied by 0.707. It is this effective value which is usually meant when the current is specified numerically.

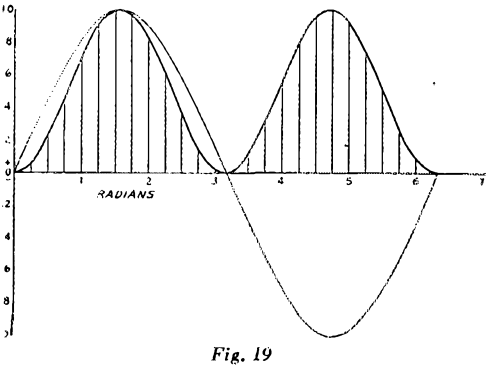


Fig. 19

Non-Sinusoidal Waveshapes

The numerical values for the average and effective current established above are for sinusoidal current only. However, exactly the same procedure would be followed in determining the average and effective values of currents having more complex waveshapes. If the exact shape of the wave is known, a half cycle can always be plotted to scale, the area under the curve measured, and the average value found by dividing the area by the base. Similarly, the *squared* values of the wave can be plotted to give the power curve, the area under the curve measured, and the average power found by dividing the area by the base. The effective value of the current is then proportional to the square root of the average power.

The expression "root mean square" sums up the method of finding the effective value. It indicates that the effective value of the current is equal to the square root of the average or "mean" value of the current squared, the power being

proportional to the square of the current. The expression is usually abbreviated to "r.m.s." The terms "effective value" and "r.m.s. value" are used interchangeably.

Phase Relationships

In direct-current circuits the direction of current flow is determined by the polarity of the applied voltage. This will also be true of a purely resistive a.c. circuit, since in the absence of energy-storage effects there is nothing to prevent the current from changing just as rapidly as the voltage changes. Therefore when the voltage is positive the current will be flowing in the positive direction, and when the voltage is negative the current will be flowing in the negative direction; also, when the voltage is zero the current will be zero. In the terminology previously used, the phase angle between current and voltage is zero, or the current and voltage are *in phase*.

This is a necessary condition if the power in the circuit is always to be dissipated. As we have seen, the curve showing the instantaneous power is always positive in a resistive circuit; i.e., when all the power is dissipated and none is first stored and then returned to the circuit. It can only be positive when the product of voltage and current is positive, since power is equal to the product of voltage and current. If the current is flowing in the negative direction the voltage must also be negative in order that the product will be positive, which is simply a mathematical way of saying that the current must flow in the direction determined by the polarity of the applied voltage. Thus we can say that "positive" power is *dissipated* power, or power taken from the source of energy and used up in the circuit.

If the current flows in the opposite direction to the polarity of the applied voltage, the product of current and voltage is negative; that is, the power is "negative." If, in dealing with direct currents, we should have a source of voltage connected to a circuit of unknown characteristics and measurement should show that the current

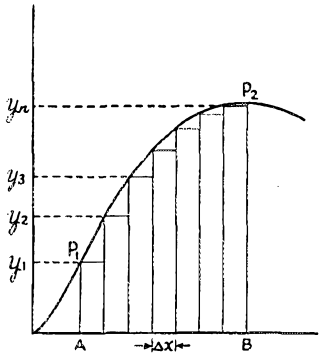


Fig. 20

flows in the wrong direction, as judged from the polarity of the voltage source, we should infer that somewhere in the circuit there is another (and larger) voltage source of opposite polarity. Our known source is therefore receiving power rather than furnishing it. Since the current is flowing in the wrong direction it is "negative" with respect to the voltage of the known source, so that the product of current and voltage, and hence the power, is negative. Thus the physical meaning of negative power is that energy is being supplied to the nominal source of power by the circuit. In an a.c. circuit the power is negative when energy stored in electric or magnetic fields is released and returned to the original source of energy.

Limiting Processes

The graphical method of finding the area under a curve is necessarily approximate, although if the work is done carefully and on a large enough scale the accuracy may be quite sufficient for practical purposes. Although the mathematical methods for finding the exact area frequently are complicated, the underlying principle is not hard to grasp. An understanding of the principle is helpful even though the technique of arriving at a specific result has not been studied, because the mathematical notation used to indicate the process is frequently encountered.

Returning to Fig. 18, it is evident from inspection that the sum of the areas of the complete rectangles under the curve (neglecting the irregularly-shaped areas) is an *approximation* to the actual area under the curve. (In the drawing, about ⅞ of the total area is contained in the rectangles.) If the number of strips is increased the width of each strip will be reduced, but the total area contained in the rectangles will be increased. This is shown by the dotted line which divides strip C into two parts; the block $WXYZ$, originally contained in the irregularly-shaped area above the rectangular part of C, now becomes part of the rectangular area of one of the narrower strips. Thus the remaining non-rectangular area is reduced and the sum of the areas of the narrower rectangular strips will be a better approximation to the actual area under the curve. The greater the number of strips the better the approximation becomes until eventually, when the width of the strips becomes vanishingly small and their number becomes infinitely large, the difference between the areas of the rectangular sections of the strips and the actual area under the curve becomes vanishingly small. That is, the sum of the areas of the rectangular strips approaches the actual area under the curve *as a limit* when the number of strips is allowed to increase indefinitely.

The mathematical notation used to indicate this process can best be shown by means of an example. Let us suppose that the relationship between two quantities x and y is expressed by the curve in Fig. 20, and that it is required to find the area under the curve between the points $x = A$ and $x = B$, corresponding to the points P_1 and P_2 on the curve. The area to be found is then

$$AP_1P_2B.$$

We divide the X axis between A and B into n parts, each having a width Δx (the sign Δ

(Continued on page 60)

IN THE SERVICES

AND NOW we on the home front want to say congratulations to all hams in uniform. You are doing a swell job and we are proud to be your organization.

No material for a Canadian section this month because the March issue is just out as this is written and as yet there have been no repercussions. Next month we hope to have a good showing of current information — but it's up to you, now!

Be sure to read "Happenings of the Month" in this issue. There's something of real interest to you men in the Armed Forces.

ARMY—AIR FORCES

A WORD to you men going in the Air Forces: Some preliminary knowledge of code is a big help. It saves time in teaching and you come out with more speed than a greenhorn! This is from an XYL instructor at Scott Field, none other than Mrs. Leta Bush, W9DBD.

1DJK, Keander, Pvt., Chicago, Ill.
1GFK, Wright, Pvt., Atlantic City, N. J.
1HUP, Blake, Lt., Victorville, Calif.
1JBV, Howard, Sgt., New York, N. Y.
1JTY, Dressler, Sgt., Bradley Field, Conn.
1LHI, Gray, Lt., Columbus, Miss.
1NEA, Duva, Pvt., Atlantic City, N. J.
1NNJ, Ingalls, Pfc., Gunter Field, Ala.
2EJI, Wooding, Sgt., Tuskegee, Ala.
2FID, Treadwell, Pvt., Wilmington, Del.
2IMM, Saperstein, Pvt., Truax Field, Wis.
2KIF, Reichenback, S/Sgt., foreign duty.
2KWU, Shanessy, Pvt., Truax Field, Wis.
2LSR, Palkowetz, Pvt., Sioux Falls, S. D.
2LZU, Gordon, 2nd Lt., Scott Field, Ill.
2MVJ, Selkee, Pvt., Sioux Falls, S. D.
2MWC, Danisher, Pvt., Chicago, Ill.
3FWZ, Fox, Sgt., Gardner Field, Calif.
3JAL, Ratliff, Pvt., Indianapolis, Ind.
3JEF, Shavell, A/C, Scott Field, Ill.
3JLJ, Rashok, Pvt., Sioux Falls, S. D.
3JUO, Krawczyk, A/C, Maxwell Field, Ala.
4DSL, Rose, T/Sgt, foreign duty.
4FEE, Chumley, Sgt., Westover Field, Mass.
4HMU, Davis, Lt., address unknown.
5ASG, Hall, Pvt., Maxwell Field, Ala.
5ATB, Durham, 2nd Lt., Corpus Christi, Tex.
5GBF, Colton, Perrin Field, Tex.
5HAD, Brady, Lt., address unknown.
5HIX, Vaughan, Pvt., Springdale, Ark.
5HMV, Waller, Sioux Falls, S. D.
5KBF, Nave, Sioux Falls, S. D.
5KJP, Glover, Pvt., Midland, Tex.
5KOA, Dye, Lt., Victoria, Tex.
6BKY, Bickel, Cpl., Victorville, Calif.
6EAT, Elkins, Pvt., Victorville, Calif.
ex-6ESD, Goelitz, Pvt., Victorville, Calif.
6FHN, Maddox, Pvt., Victorville, Calif.
6JWF, Johnson, Pvt., Scott Field, Ill.
6LVS, Woollum, Lt., Hondo, Tex.
6SLF, Allbright, A/C, address unknown.
6SOL, Anderson, Major, Washington, D. C.
6SXP, Cooper, Pfc., Williams Field, Ariz.
6USK, Wright, Pvt., Victorville, Calif.
8HNH, Reu, Pvt., Scott Field, Ill.
8IUG, Maynard, Pvt., Richmond, Va.
8IYQ, Saborsky, A/C, Gardner Field, Calif.
ex-8JDR, Gibson, Pvt., Sioux Falls, S. D.
8JEI, Erhardt, Pvt., Scott Field, Ill.
8LIV, Tobin, Pvt., Langley Field, Va.
8PWJ, Dewey, Major, Topeka, Kans.
8QAW, Smith, Pvt., Sioux Falls, S. D.
8QDD, Wittgruber, Pvt., Sioux Falls, S. D.
8RJK, Hile, Pvt., Truax Field, Wis.
8TVA, Bellavit, Pfc., Geiger Field, Wash.
8TXQ, Hennigan, Pvt., Truax Field, Wis.
8UFH, Hoffer, Pvt., Sioux Falls, S. D.
8UNV, Roettele, Cpl., Hunter Field, Ga.
8WLX, O'Lear, Pvt., Robins Field, Ga.
9DHT, Karl, S/Sgt., Indianapolis, Ind.
9EHZ, McDonald, Capt., March Field, Calif.
9FQJ, Dodds, Pvt., Biggs Field, Tex.
9FRH, Van Valkenberg, Pvt., Goodfellow Field, Tex.
9HEE, Reger, Pvt., Bryan, Tex.
ex-9KCW, Dolin, Cpl., Victorville, Calif.
9LRN, Schaaf, Pvt., Sheppard Field, Tex.
9MJL, Gamble, Pvt., Jackson, Mich.
9MYN, Briggs, S/Sgt., Salinas, Calif.
9NLS, Boyce, T/5th, Kansas City, Mo.
9NYO, Ankenbrock, Pvt., Scott Field, Ill.
9PER, Keshel, Pvt., Scott Field, Ill.
9PJF, Swearingen, Pvt., Sioux Falls, S. D.
9RQF, Hutton, Pvt., Buckley Field, Colo.
9UTK, Ferguson, S/Sgt., Orlando, Fla.
9WUG, Stockton, Sgt., Chicago, Ill.
9ZAT, Colby, Pvt., Tuskegee, Ala.
9ZFQ, Tingley, Lt., foreign duty.

Operator's license only:

Hammond, Pvt., Scott Field, Ill.
Muszynski, Pvt., Truax Field, Wis.
Rein, Pvt., Westover Field, Mass.
Ringel, Pvt., Truax Field, Wis.
Sassman, S/Sgt., Sioux Falls, S. D.
Stewart, A/C, Scott Field, Ill.
Stoller, Pvt., Madison, Wis.

A ham and his bivouac in the Aleutians. Since this picture was taken, Cpl. (now A/C) Al Faries, W7IXX, has been transferred to Santa Ana, Calif., and he is now taking further training at the Air Base there.

ARMY—SIGNAL CORPS

If you haven't found any hams at your camp, try carrying *QST* around! Sgt. Bill Eppley, W3BNK, did this at Camp Murphy and they swarmed around. (Our apologies, Bill, for not getting these in last month.)

1AKR, Sutherland, T/Sgt., foreign duty.
1CWV, Corbett, Ft. Monmouth, N. J.
1IDU, Leone, Ft. Monmouth, N. J.
1IKS, Handleman, 2nd Lt., Cambridge, Mass.
1ILN, Adams, 2nd Lt., Scotia, N. Y.
1JQH, Lonergan, Ft. Monmouth, N. J.
1JZS, Stoughton, 2nd Lt., address unknown.
1KFD, Drake, 2nd Lt., Scotia, N. Y.
1KJT, Bibisi, Cpl., foreign duty.
1KNZ, Walsh, Cpl., Ft. Monmouth, N. J.
1LBV, Finkle, Sgt., Camp Murphy, Fla.
1LDT, Ireland, 2nd Lt., Scotia, N. Y.
1LMC, Moore, Cpl., Kansas City, Mo.
1LTS, Cook, Sgt., Camp Murphy, Fla.
1NAM, Hanson, 2nd Lt., Ft. Monmouth, N. J.
1NTK, Savage, S/Sgt., Camp Murphy, Fla.
1ZZ, Wilson, Cpl., Ft. Monmouth, N. J.

Among the recent graduates from OCS, Ft. Monmouth, N. J., was F. E. White, better known on 20- and 40-meter ham bands as W2BCE. Lt. White also holds a commercial operator's license, is a member of the IRE, and president of the Harlem Radio Club, New York. *Official U. S. Army Signal Corps Photo.*

2BCE, White, 2nd Lt., Tuskegee, Ala.
2CRN, Beltran, M/Sgt., Ft. Monmouth, N. J.
2GBJ, McNicholas, Cpl., Ft. Monmouth, N. J.
2GFR, Lester, 2nd Lt., Scotia, N. Y.
ex-2GUI, Seymour, Cpl., Ft. Monmouth, N. J.
2HMK, Booth, Pvt., Scott Field, Ill.
2IMZ, Fredrickson, Cpl., Ft. Monmouth, N. J.
2INA, Becchetti, Pvt., Camp Crowder, Mo.
2JLB, Adelman, M/Sgt., Charlotte, N. C.
2KME, Hubach, Ft. Monmouth, N. J.
2KMJ, Peterson, Cpl., Los Angeles, Calif.
2KVY, Finkelstein, 2nd Lt., foreign duty.
2LEG, Rizzo, Cpl., Ft. Monmouth, N. J.
2LFZ, Breakstone, Pvt., address unknown.
2LNG, King, Sgt., Ft. Monmouth, N. J.
2LZV, Sterritt, 2nd Lt., Scotia, N. Y.
2MAT, Soldwedel, Cpl., Kansas City, Mo.
2MUT, Rand, Pvt., Ft. Monmouth, N. J.
2MXL, Abels, Cpl., Camp Crowder, Mo.
2NBR, Jamross, Cpl., Kansas City, Mo.
2NCQ, Offerman, Cpl., Camp Crowder, Mo.
2NLU, Stamler, Pvt., Rome, N. Y.
3APD, Nowrey, Cpl., Ft. Monmouth, N. J.
3DQS, Fogg, Pvt., Washington, D. C.
3EYO, Deily, 2nd Lt., Camp Murphy, Fla.
3FZK, Huntington, Lt., Arlington, Va.
3GYQ, Bulger, Lt., Cambridge, Mass.
3HRC, Stafford, Lt., foreign duty.
3HUS, Burhans, Cpl., Ft. Monmouth, N. J.
3HVH, Brown, Ft. Monmouth, N. J.
3HXD, Marshall, Capt., Ft. Wright, Wash.
3KT, Vieberman, 2nd Lt., Ft. Monmouth, N. J.
4AFZ, Gerrard, Sgt., Charleston, S. C.
4AHP, Troy, Pfc., Los Angeles, Calif.
4ALV, Duggan, Ft. Leonard Wood, Mo.
4DAU, Wood, Lt., Camp Murphy, Fla.
4DNF, Oglesby, 2nd Lt., Camp Murphy, Fla.
4DTZ, Noble, 2nd Lt., Camp Murphy, Fla.
4EEO, Taylor, Lt., foreign duty.
K4JI, Marino, T/Sgt., foreign duty.
5DKA, Bailey, T/5th, Camp Murphy, Fla.
5FTS, Wilson, Ft. Monmouth, N. J.
5GER, Morrison, Pvt., Camp Crowder, Mo.
5GGK, Lee, 2nd Lt., Ft. Monmouth, N. J.
5KLN, McCoy, Sgt., Camp Murphy, Fla.
6BRX, Schelb, Cpl., Camp Murphy, Fla.
7HLD, Johnson, Sgt., Camp Murphy, Fla.
8FAS, Karnath, S/Sgt., Camp Murphy, Fla.
8FTA, Dann, 2nd Lt., Camp Murphy, Fla.
9QPL, Struble, S/Sgt., Camp Murphy, Fla.
9QPZ, Granros, 2nd Lt., Camp Murphy, Fla.
9RBX, Cissel, Cpl., Camp Murphy, Fla.
9SAK, Fox, Sgt., Camp Murphy, Fla.
9WNL, Krohn, Cpl., Camp Murphy, Fla.
9WXY, Naylor, 2nd Lt., Camp Murphy, Fla.
9YBB, Hurd, Sgt., Camp Murphy, Fla.
9ZVF, West, 2nd Lt., Camp Murphy, Fla.
9ZXH, Koutnik, Sgt., Camp Murphy, Fla.

NAVY—GENERAL

Ex-W5HBZ, Robert H. Clarke, is ACRM at a Naval Air Station in Corpus Christi. His big desire is to receive a draft of two or three hundred ex-hams for training. How about that?

1ASN, Vatcher, San Francisco, Calif.
1EFQ, Frey, Ens., Cambridge, Mass.
1EVM, Kenney, Ens., address unknown.
1GXT, Nicholls, Ens., Ithaca, N. Y.
1ISC, May, Lt., Minneapolis, Minn.
1JBY, Matarazzo, RM2c, Great Lakes, Ill.
1KPS, Kelly, Ens., Boston, Mass.
1KYW, Welles, RM3c, New London, Conn.
1MCA, Hamlin, RT2c, New London, Conn.
1MQM, Sheasby, address unknown.
1NHE, Cale, Lt. (jg), Hollywood, Fla.
2JJ, Knight, Lt. Cmdr., New London, Conn.
2KEY, Geisler, RT2c, New London, Conn.
2LC, Rooke, Lt., New York, N. Y.
2LFW, Ruff, address unknown.
2MBD, Guerra, RM3c, address unknown.
2MSC, Conn, Lt., address unknown.
2MTR, Trautmann, Ens., New York, N. Y
2NWM, Alper, RT2c, New London, Conn.
2OJX, Morewood, Sea2c, Newport, R. I.
3DSY, Felt, Lt. (jg), address unknown.
ex-3EC, Carreras, CRM, New London, Conn.
3EEN, Nicholson, Cmdr., Washington, D. C.
3EQF, Meyers, RM1c, New York, N. Y.
ex-3GG, Gross, Lt. Cmdr., Washington, D. C.
3HAE, Etheridge, AS, Hampden Sydney, Va.
3HFE, Algeo, Lt. (jg), Bethlehem, Pa.
3IMY, Ebell, RM2c, Virginia Beach, Va.
3JDX, Anderson, Lt. (jg), Arlington, Va.
3JZP, Glunt, Lt., Washington, D. C.
ex-3LL, Foley, Lt., New Orleans, La.
3XAN, Bishop, Lt., Annapolis, Md.
4EJZ, Page, RT2c, Algiers, La.
4EXZ, Phillips, Lt., Corpus Christi, Tex.
4EYR, Taylor, RM2c, Norfolk, Va.
4GIU, Diaz, RM2c, Miami, Fla.
4GPJ, Archer, RM1c, Pensacola, Fla.
ex-4VC, Reynolds, CRM, New London, Conn.
5HCS, Harris, RM2c, Annapolis, Md.
5IVV, Chance, RM1c, Jupiter, Fla.
5JLT, Birdsong, RT2c, Algiers, La.
6FEX, Newman, RT2c, San Diego, Calif.

6GFY, Van Groos, Lt., St. Helena, Calif.
6NGB, Lewis, Lt., Alameda, Calif.
6OGZ, Service, Lt. (jg), Washington, D. C.
6QXE, Huffman, RM1c, New York, N. Y.
6TAQ, Berman, Lt., address unknown.
8IBR, Hayes, Lt. (jg), Washington, D. C.
8RY, Bates, Lt., Hingham, Mass.
8TFI, Crownover, Cape May, N. J.
8TUG, Yacenich, RM, address unknown.
8VCI, Dexheimer, RT2c, New London, Conn.
9AEZ, Fleming, AMM1c, Olathe, Kans.
9BLT, Gibbs, RT2c, Chicago, Ill.
9CVQ, McDougall, Ens., Cambridge, Mass.
9EIQ, Miller, address unknown.
9EWL, Kelly, Lt. Cmdr., Washington, D. C.
9GBG, Young, CRM, South Brooklyn, N. Y.
9GYW, Haake, RM2c, address unknown.
9IAH, Hockin, Lt., address unknown.
9KBB, Bennett, Lt. (jg), San Diego, Calif.
9NDM, Shell, Lt., Corpus Christi, Tex.
9NMP, Bliesener, RT2c, address unknown.
9PCN, Harris, Mid., Annapolis, Md.
9QNF, Fleck, Sea2c, Indianapolis, Ind.
9RDC, Nightenhelser, RT2c, Chicago, Ill.
9TDG, Tordella, Lt. (jg), address unknown.
9VNR, Kissler, RT3c, Chicago, Ill.

Operator's license only:

Crocker, RT2c, address unknown.
DeLuca, RM3c, Lakehurst, N. J.
Wintroub, RT2c, Chicago, Ill.

HAM HOSPITALITY

THE City of Belfast YMCA Radio Club, GI6YM, Wellington Place (3rd Floor), Belfast, holds a meeting every Wednesday night at eight, and any American hams will be heartily welcomed. We've had enthusiastic letters from Maurice Plasschaert, W9KGG, and Junius J. Bailey, W5FTW — and Frank A. Robb, GI6TK says, "For the love of mike, look some of us up or even write to us!" They subscribe to *QST*, too, so you may read us there when you call.

Some of the American hams in Northern Ireland have formed the American Overseas Amateur Radio Group to keep up interest in matters pertaining to amateur radio. John Grutzuis, W6FZ, of North Hollywood, is chairman and secretary.

A joint meeting of the two clubs was held recently, and twenty-six members of RSGB attended. They welcomed the newly formed AOARG and marked the occasion by presenting a cloth-bound RSGB "Handbook" to their chairman. Two further copies were allocated by ballot. W6FH described American licensing conditions and mentioned that he used an input of 990 watts. GI5SJ said he used the other 10 watts! During a discussion on amateur equipment, opened by W6LD, GI6YW expressed the opinion that the average British amateur, who had to build his own station, obtained greater satisfaction than the average American amateur who could buy a complete station at almost any radio store in the U. S. He was supported in this view by the "home side." They plan to hold further combined meetings so long as the Americans remain in Northern Ireland.

The following are some of the "W" hams on the Belfast Register: 2BCU, 2GXC, 2HYZ, 2IIQ, ex-2JC, 2MWA, 3FBC (Club call 3AQ), 4HEV, 5FSI/4WD, 5FTW, 5HKH, 6ASM, 6FH, 6FZ, 6LD, 6NEW, 6OYD, 6TFC, 8AVA, ex-8BLD, 8BZM, 8CST, 8DHN, 8GIS, 8KCG, 8WVS, 9KQQ, and 9NOP. Any of these boys may be contacted if you write care of the YMCA Radio Club.

Ham Hospitality in Northern Ireland (GI):

2KR, Wm. R. Kerr, 32 Kings Rd., Belfast. Phone BEL 54410.
3IA, Sydney Black, "Avondale," Antrim Rd., Glengormley, Belfast.
3KN, Albert T. Kennedy, 38 Donaghadee Rd., Bangor.
5HU, Robert S. Holden, 260 Grosvenor Rd., Belfast.
5NJ, Frank R. Neill "The Whins," Whitehead, Co. Antrim, N. I. Phone: Home, WHITEHEAD 121; business, BEL 26704.
5QX, Jack N. Smith, 19 Hawthornden Drive, Belmont, Belfast. Phone BEL 63323.
5SJ, Stanley Johnston, 10 Cyprus Ave., Belfast.
5ZY, Tommy Smith, "Belair," York Ave., Whitehead, Co. Antrim, N. I.
6YM (Op. No. 7), Rev. Edwin Davey, 61 Antrim Rd., Lisburn, Co. Antrim, N. I.
8GK, Russell Watson, 53 Knutsford Drive, Cliftonville, Belfast.
8LF, E. O. Byrne, Ulster Bank House, Clogher, Co. Tyrone, N. I.

Could this be tea of a Wednesday evening at the Belfast YMCA Radio Club? *L. to r.*; J. N. Smith, GI5QX; G. H. Ramsden, G6BR; 2BFC (QRA?); T/Sgt. R. F. Lauzoni, W3FBC; W. J. Page, G3PA; T/Sgt. J. J. Bailey, W5FTW (who sent us this picture); and Frank Robb, GI6TK.

A Crystal-Controlled Transmitter for WERS

A Simple Exciter Circuit Also Used as a Frequency Standard

BY F. E. BROOKS, JR.,* W5JLZ

The successful operation of the New Haven WERS net is at least partly attributable to the methods used to maintain the various stations on their proper frequencies. Part of this story is the crystal-controlled transmitter at the District Warning Center; the other part is the crystal-controlled frequency standard used to set the local net frequencies. Here's the dope on the transmitter and frequency checker.

WHEN the War Emergency Radio Service was set up for the New Haven District, it was decided that the district warning center station should have a crystal-controlled transmitter. The reasons for this decision were, first, that it would be the frequency standard for all the other stations in the district, and second that, being crystal controlled, it would always be on frequency and ready to operate in an emergency.

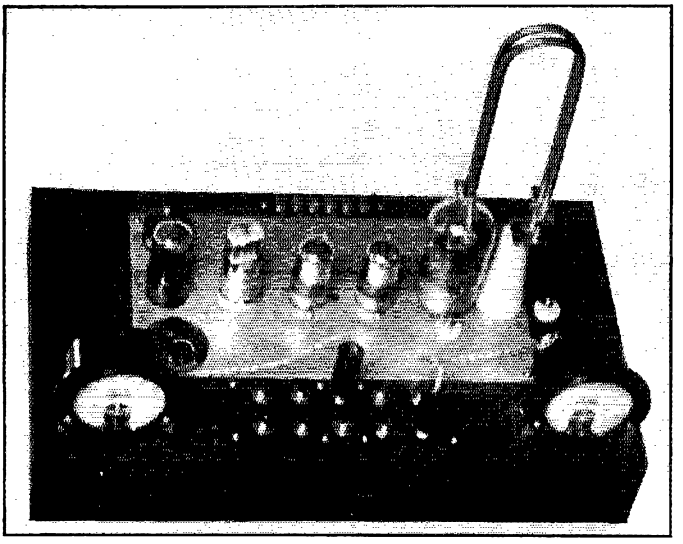
The design and construction of this transmitter was turned over to Robert Ungvary, W1KSK, a senior, and F. E. Brooks, jr., W5JLZ, ex-W9WSK, an instructor in electrical engineering at Yale University. The transmitter has a number of unique features and, for the most part, uses components which can still be obtained. Add to this the fact that the transmitter has now been in operation for over a month and has proved itself equal to expectations and satisfactory in all respects, and you will understand why we thought it would be of interest to other WERS organizations.

* Dunham Laboratory, Yale University, New Haven, Conn.

The most novel part of the transmitter is the exciter, the circuit of which is included in Fig. 1. It consists of a 6V6GT Tri-tet oscillator using a 7-Mc. crystal with output on 14 Mc., and driving a 6J5GT doubler giving output on 28 Mc. This is followed by two 7A4s, each doubling, giving final output on 112 Megacycles. The output is more than sufficient to drive the 815 at full input.

The Tri-tet oscillator is conventional. The cathode circuit is tuned by a mica compression-type trimmer condenser and the plate circuit is tuned by a 75-$\mu\mu$fd. variable air condenser. These are the only variable condensers in the transmitter. The first doubler is coupled to the oscillator by tapping the oscillator plate tank coil, the tap being adjusted for optimum excitation.

The three doubler stages of the transmitter are all similar except for the grid coupling of the first doubler and, of course, the sizes of the tuned circuits. 6J5GTs were originally used for all doubler stages, but some improvement in efficiency was noted on substituting 7A4s, the loktal equivalent, in the two higher-frequency stages.



The entire r.f. unit is on one chassis, built on an aluminum sheet which fits over a cut-out. A bakelite jack board at the front permits measurement of plate and grid currents in the various stages. Tuning circuits are mounted below the base, right at the tube sockets.

One of the reasons why ordinary tubes are inefficient at ultrahigh frequencies is that the output capacity is so large, relatively speaking, that by the time a tuning condenser is added in parallel with it the coil must have so little inductance that the tank-circuit impedance cannot be made high enough. The best way of overcoming this difficulty is to make use of resonant lines or resonant cavities for the tuned circuit, but these are difficult to build and take a lot of space. Another solution is to make the tank series-tuned instead of parallel-tuned, as described in the *Handbook*. This requires r.f. chokes and is difficult to adjust.

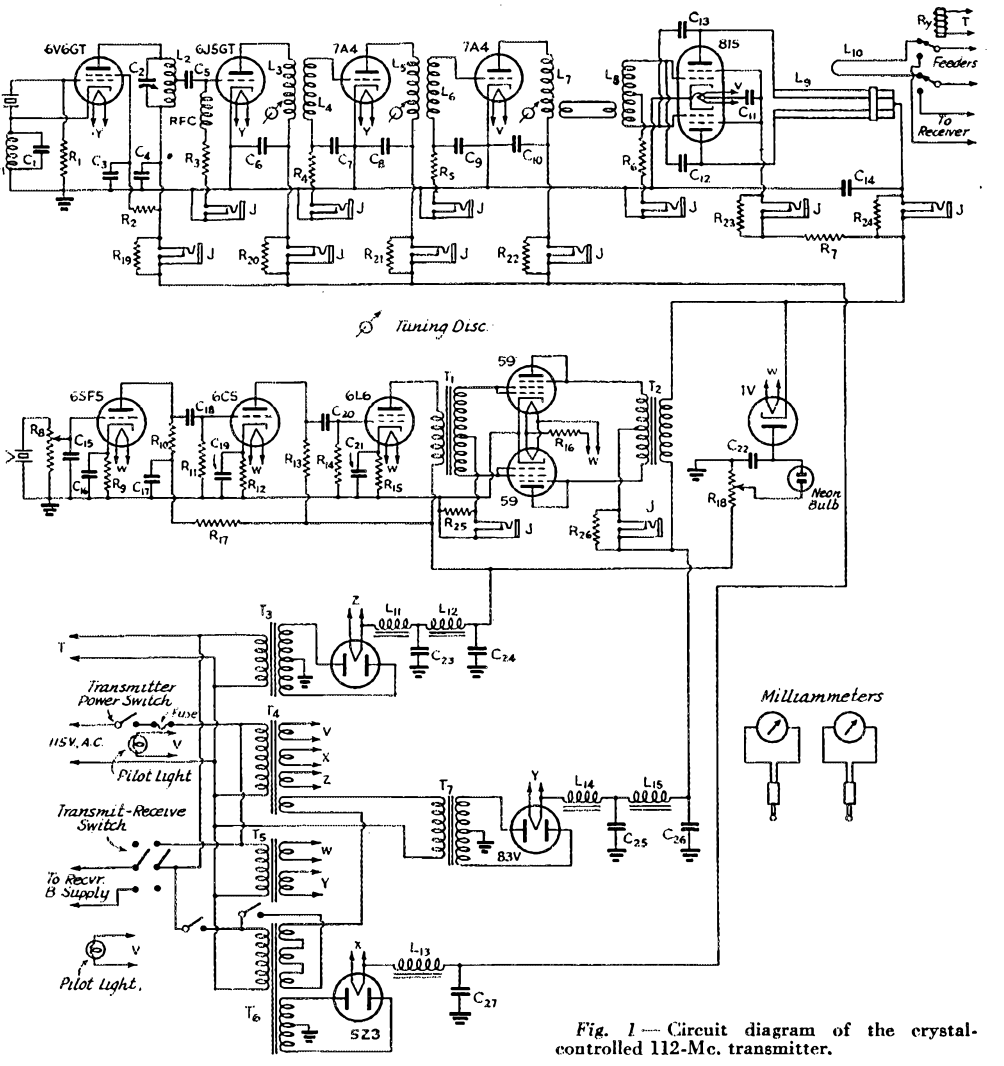


Fig. 1 — Circuit diagram of the crystal-controlled 112-Mc. transmitter.

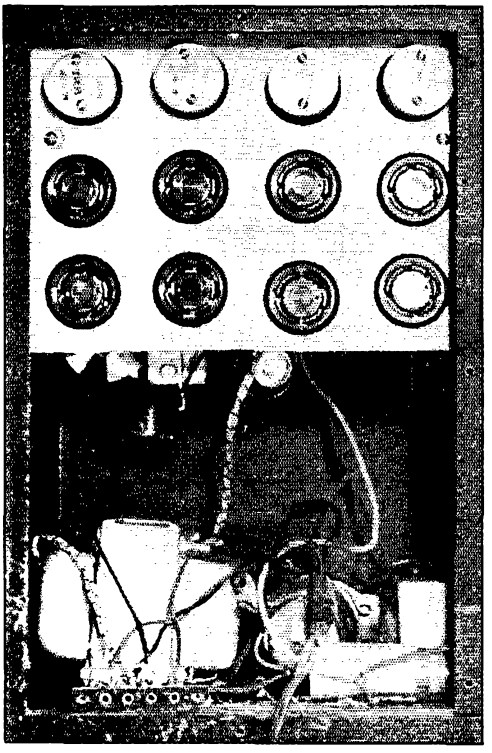
C_1 — 150-$\mu\mu$fd. mica trimmer.
C_2 — 75-$\mu\mu$fd. variable.
C_3, C_4 — 0.01-μfd. paper, 600 volts.
C_5-C_{11}, inc. — 100-$\mu\mu$fd. mica.
C_{12}, C_{13} — Neutralizing condensers (see text).
C_{14} — 100-$\mu\mu$fd. mica.
C_{15} — 400-$\mu\mu$fd. paper.
C_{16} — 10-μfd. elect., 25 volts.
C_{17} — 8-μfd. elect., 450 volts.
C_{18} — 0.005-μfd. paper, 400 volts.
C_{19} — 10-μfd. elect., 25 volts.
C_{20} — 0.01-μfd. paper, 400 volts.
C_{21} — 10-μfd. elect., 50 volts.
C_{22} — 0.1-μfd. paper, 600 volts.
C_{23}, C_{24} — 16-μfd. elect., 450 volts.
C_{25}, C_{26} — 2 μfd. paper, 600 volts.
C_{27} — 16-μfd. elect., 450 volts.
R_1 — 60,000 ohms, 1 watt.
R_2 — 50,000 ohms, 1 watt.
R_3 — 30,000 ohms, 1 watt.
R_4, R_5, R_6 — 15,000 ohms, 1 watt.
R_7 — 20,000 ohms, 10 watts.
R_8 — 0.1-megohm potentiometer.
R_9 — 5000 ohms, ½ watt.
R_{10}, R_{11} — 0.5 megohm, ½ watt.
R_{12} — 2500 ohms, ½ watt.
R_{13} — 0.1 megohm, 1 watt.
R_{14} — 0.5 megohm, ½ watt.
R_{15} — 500 ohms, 2 watts.
R_{16} — 0.65 ohm.
R_{17} — 50,000 ohms, ½ watt.
R_{18} — 0.1-megohm potentiometer.
R_{19}-R_{26}, inc. — Shunts to convert 10-ma. meter to 100 ma.
J — Closed-circuit jacks.
Ry — Antenna change-over relay.
L_1 — 7 turns No. 22, diameter ¾ inch, length ¼ inch.
L_2 — 10 turns No. 18, diameter 1 inch, length ½ inch.
L_3 — 10 turns No. 22, diameter ¾ inch, length ¼ inch.
L_4 — 12 turns No. 22, diameter ¾ inch, length ¼ inch.
L_5 — 9 turns No. 18, diameter ¾ inch, length ¼ inch.
L_6 — 7 turns No. 18, diameter ¾ inch, length ¾ inch.
L_7 — 4 turns No. 14, diameter ¾ inch, length ½ inch.
L_8 — 3 turns No. 14, diameter ¾ inch, length ¾ inch.
L_9 — Quarter-wave parallel-rod tank circuit.
L_{10} — Hairpin coupling loop.

The simplest method — the method used in this exciter — is to reduce the shunt capacity of the tank circuit to the very minimum by eliminating the tuning condenser entirely and tuning the tank circuit by varying the inductance. The tank-circuit capacity is then made up of the interelectrode capacity of the tube plus the stray capacities of the coils and wiring. Two methods are used to vary the inductance. The first is to couple the coil to a solid metal disc, and thus reduce its in-

ductance. A piece of copper about the size of a penny is convenient and works well. This can be soldered to a piece of wire which can be bent closer to or farther away from the coil until the circuit is tuned to resonance. The second method of adjusting the inductance is to spread or squeeze the turns of the coil, thus changing its inductance.

In the top view the oscillator tube is at the left, with the plate-tuning condenser mounted on the aluminum subpanel just in front of the tube (the tuning knob can be seen in this photograph) and the crystal just behind it. (Unfortunately, a suitable photograph of the underside of the r.f. unit is not available, but in general the wiring layout follows the circuit diagram.) The oscillator plate coil is mounted right on the variable condenser, and the cathode-tuning condenser and coil are mounted between the tube and crystal sockets. A small baffle shield is placed directly across the middle of each of the doubler sockets so that the plate and grid circuits of the same tube are isolated from each other. The coils are between these shields in each case.

The last doubler is coupled to the grid of the 815 final by means of a short link. The grid circuit of the final is tuned by squeezing the turns of the coil. Lead-through insulators at each side of the 815 socket support the neutralizing condensers (described later). All by-pass condensers are mounted so that the leads are as short as possible — in most cases right on the tube socket — making use of blank tube socket prongs for connecting the by-pass condensers and tank coils.



The portable frequency standard uses the same circuit as the transmitter exciter and is provided with four crystals to mark the local operating frequencies.

The only circuit components above the chassis, aside from the tubes and crystal, are the neutralizing condensers and the final tank circuit. The neutralizing condensers are simply small rectangles of copper soldered to a length of heavy wire. The capacity is adjusted by bending the wire. The plate of the tube forms one plate of the neutralizing condenser. The final tank circuit is a resonant line with a shorting bar for tuning.

The two meters have 10 ma. full-scale range. Shunts for the meters are soldered to the jacks in circuits where the current is more than 10 ma., so that when a meter is plugged into those jacks it reads 100 ma. full scale.

The doubler stages of the transmitter operate with a grid current of about 5 ma. and plate current between 20 and 30 ma. The final has a grid current of 3 to 4 ma. and a plate current of 70 ma., making the plate input nearly 25 watts at 350 volts on the plate. Twice this input could be handled without overloading the tube.

A word or two about tuning would not be amiss. When the filaments are first turned on the tube elements expand somewhat, causing the interelectrode capacities to change. The exciter should therefore, be tuned up only after it has warmed up for about five minutes. Since unneutralized triodes are used in the doubler stages, the tuning of the plate circuit affects the tuning of the grid circuit. Some retuning of the grid circuit after tuning the plate circuit is, therefore, necessary. The tuning of the final is conventional and neutralizing is not at all critical.

The circuits of the audio-frequency section and the power supply are also shown in Fig. 1. They are conventional in most respects. Unused filament windings on the transformers are used to adjust the voltage of the final-stage power supply. A negative-peak modulation indicator is built into the a.f. section, providing visual indication of 100 per cent modulation.

Frequency Measurement

A circuit similar to that in the exciter of the transmitter was used in the frequency standard shown in another photograph. The power supply is the haywire in the bottom. Four crystals are shown in place, with sockets provided for eight more crystals. The oscillator plate circuit and first doubler plate circuit can be seen just below the crystal-mounting panel. The frequency meter gives more than sufficient output on our district net frequency of 112.1 Mc. and the other local net frequencies of 114.7, 115.0 and 115.3 Mc.

Two methods are used in setting the frequencies of our transmitters. The most common is to calibrate the National 1-10 receiver at the district warning center from the frequency meter, and then listen to the transmitter to be set and guide it to the proper frequency. The second and more accurate method is to listen for the beat note between the frequency meter and transmitter in a field-strength meter equipped with 'phones.

U.S.A. CALLING!

RADIO ENGINEERS AND PHYSICISTS

UNDER the above heading we had an item on page 35 of our March issue announcing the availability of the League president, George W. Bailey, to enter into confidential correspondence with engineers and physicists who, although enjoying good business connections, are not convinced that they are doing their full duty in the war effort and who would appreciate an opportunity to investigate quietly the opportunity for more important employment of their talents without meanwhile disturbing their present connections. The national need for highly-trained men at the top of the picture is so great that such persons should consider seriously whether they are absolutely essential to their present programs.

There has been a favorable and considerable response to this solicitation and Mr. Bailey wishes to renew the invitation. Engineers and physicists are asked to see the article in our previous issue and to address letters to the personal attention of Mr. Bailey at the Office of Scientific Research & Development, 2101 Constitution Ave., N. W., Washington.

ELECTRONICS TRAINING GROUP REOPENED

FOR a short time in the recent past, applications for commission in the Electronics Training Group of the Signal Corps were not accepted. Some amateurs may have received letters to that effect. If you are one who did, you should now apply again to G. W. Bailey, 2101 Constitution Ave., N. W., Washington, D. C., to take advantage of this reopening.

You all know what this work is — "secret military radio devices." Successful candidates are commissioned second lieutenants in the Signal Corps, and receive very special electronics training of a fascinating nature. Some go to England and train with the RAF. Eventual duty is service with our troops in the installation, operation and maintenance of these devices. Candidates must be graduates of an accredited college, either in science with a major in electronic physics or in electrical engineering. Amateur experience helps a lot. New age limits, 18 to 35; prime physical condition, fit for combat — no waivers. You'll meet more smart amateurs in ETG than in any other branch of the Army. Send full particulars of your history to Mr. Bailey.

NAVY COMMISSIONS

THE Navy continues to seek acceptable candidates for commissioning as volunteer specialists in its aviation, engineering and communication classes. Applicants must possess a college degree in engineering; age limits are 18 to 45. The AV(S) group is concerned with the you-know-what secret devices; the EV(S) class with the engineering aspect of both this and communications apparatus; and the CV(S) class with duty as communications officers. For particulars, write with full information on yourself to The Commandant of your Naval District, or if you need advice write to ARRL's president, G. W. Bailey, 2101 Constitution Ave., N. W., Washington.

OTHER COMMISSIONS

YOU can still get a commission in the Marine Corps if you are the healthy holder of a college degree in EE or radio engineering, between the ages of 20 and 45. College graduates with other kinds of degrees are also eligible if they have received special training in physics and math; and sometimes the possession of considerable practical experience in these fields will substitute for two years of college. Candidates normally are commissioned second lieutenants in the Aircraft Warning Service, but occasionally higher ranks are available for the exceptionally qualified. After receiving special technical instruction, these officers deal with AWS in both the ground and the air forces of the Marines. Give full particulars on yourself to The Commandant, Headquarters, U. S. Marine Corps, Washington, D. C. If uncertain about your qualifications, ask advice from G. W. Bailey.

Commissions are also available in the Signal Corps, the Navy and the Marine Corps, for well-qualified men over 35 years of age, for duties concerned with the designing, installation, operation and maintenance of various kinds of radio installations. Candidates must either be college-bred engineers or possess long experience with the technical side of commercial radio. There are some interesting opportunities here. If this interests you, you are invited to exchange particulars with George W. Bailey, 2101 Constitution Ave., N. W., Washington.

ENLISTED WOMEN

THE Marine Corps has opened both enlistments and an opportunity for commission to women. Both the requirements and the duties are very similar to the WAVES. The Marine Corps has not bothered with a fancy nickname for its women: they are Marines, the same as the men. Information from your local recruiting office.

The Army's WAACs, the Navy's WAVES and the Coast Guard's SPARS also continue to be open for enlistments, with excellent opportunities for qualified YLs and good radio training available for those interested in communications. The purpose, of course, is to relieve men for duty at the firing line. In all these services, qualified

candidates have an opportunity to apply for officer-candidate training.

The Signal Corps has given preliminary radio training to many thousands of women, for civilian employment. They are now being invited to join the WAAC and receive further training. This is where the WIRES (Women In Radio and Electrical Services) come in. A WIRE is a woman who is going to be a WAAC and serve as such in the Signal Corps. She is enlisted in the WAAC and placed on inactive-duty status while the Signal Corps trains her. She is called a WIRE during that time. When her training is completed she will go on active duty in the Signal Corps as a WAAC. The first such training school has been set up at Trinidad State Junior College, Trinidad, Colorado. Sounds good.

See your local recruiting officer for data on the service that interests you.

F.C.C. NEEDS HELP!

THE field service of the Federal Communications Commission has over 150 vacancies directly connected with the war effort. Qualification requirements range from Class B ham experience to a college degree in EE. The following vacancies exist: associate radio engineer, $3200 per annum; radio inspector, $2600; assistant radio inspector, $2000; assistant intercept officer, $2600; junior intercept officer, $2000; radio operator, $1800; recording monitor, $1800 and $1620. To these salaries should be added about 21 per cent because of the 48-hour week.

Detailed information and forms from your post office, or a Civil Service Regional Office. Applicants should complete CS Application Form 57 or 8, and Application Card 4006-ABCD or -ABC. The application should indicate draft classification, technical education, radio-electrical experience, lowest acceptable entrance salary, geographical location where employment is acceptable, code speed receiving and transmitting. Applicants will be certified for the highest position for which they qualify.

The position of Radio Intercept Officer is a new one in FCC. Their duties are to participate with Army Air Forces in effecting radio silence, to organize tests to determine efficiency of control, to monitor during silence and insure compliance, to maintain watch on distress channels, to participate otherwise in monitoring assignments relating directly to the war effort. For the $2600 grade, applicants must have either a four-year course in EE or physics, or four years of technical experience in engineering or teaching, or any time-equivalent combination thereof. Class A amateurs who have designed, constructed and operated their own transmitters may substitute two years of such ham experience in the foregoing; and engineering or radio study at a recognized institution counts similarly. Code speed of 20 w.p.m. is required. For the $2000 job, requirements are approximately half of the foregoing, with code speed at 16 w.p.m. No written tests. Minimum age, 18. See CS Announcement No. 288.

Radio Inspectors are concerned with the enforcement of the Communications Act and treaties. They inspect stations on shipboard and on land; make frequency runs, harmonic analyses, field intensity measurements; monitor, record and analyze emissions; examine operators. Details of the requirements are given in CS Announcement No. 280. They are approximately the same as for intercept officers. Code ability at 16 code groups per minute must be demonstrated within six months. Same recognition of Class A amateur license, but no credit for Class B or C experience or service work. Must be able to drive inspection car or mobile laboratory. Applications will be accepted from engineering or physics students who are within four months of qualification.

All these appointments are for the war or six months beyond, but there will be permanent careers in radio administration available for many of the better qualified.

COMMERCIAL OPPORTUNITIES

WHILE this is being written, the latter part of February, calls for radio men and women continue to come from defense industries and Civil Service to the ARRL Personnel Bureau and registrations are being received at an ever-increasing rate. This is encouraging all around.

As reported in the March issue, industrial needs for radio personnel are of widely divergent types, some simple enough for any Class C amateur to qualify, some for commercial licensees and electronics engineers only. Whatever your past radio experience, education, age or draft status, we urge you to register with the Personnel Bureau without delay.

Simply complete and mail us the Registration of Personnel Availability on page 38 of the October (1942) *QST*, or typewrite a copy or ask us for a blank. There is no obligation on your part and you do not even have to be a member of the League. Your radio experience is needed in the war effort and the League is ready to help you in every way possible to get located to the best advantage.

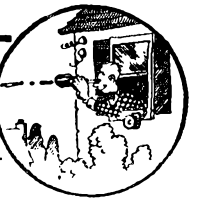
MORE CIVIL SERVICE JOBS

POSITIONS listed below are newly announced by the Civil Service Commission. Obtain further information and forms from the CS local secretary at any first- or second-class post office, or from the CS's Information Office, 801 E Street, N. W., Washington. No written tests; applicants rated on training or experience. No maximum age limits. Salaries do not include overtime; for present 48-hour week, add 21 per cent of first $2900, not exceeding $5000 total. War workers not wanted unless they may use higher skills.

Trainee, scientific and technical aid, $1440 — Especially women, with at least one unit of high-school study in physics or science. In government labs in Washington, eligibles will be paid to learn techniques necessary to work in such agencies as Bustands, Weather Bureau, etc. Written test required.

(*Continued on page 64*)

EXPERIMENTER'S SECTION



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

PROJECT A

Carrier Current

SINCE I last reported, a new development has presented itself. A two-way contact has been established between W3ITZ and W3GGC, who lives in Overbrook. The distance (airline) between the two stations is approximately 2½ miles; I have no idea what the distance is by wire. It seems that W3ITZ's signals are all being "squirted" out that way, and I am wondering if there isn't someone else out there with a w.w. outfit also in operation who hasn't contacted anyone from this area.

We have been building a complete w.w. station and at the present time it looks like we will be "on the wires" in about another week. The rig finally decided upon is a 42 oscillator, the coil being tuned by a 1400-$\mu\mu$fd. tuning condenser (four 350-$\mu\mu$fd. sections in parallel), and a converter built to conform with the specifications outlined in March, 1942, *QST*. Both are to be mounted upon the same chassis.

When we get our gear suitably housed, we will have it photographed and will forward the photograph to you. We still have a lot of "bugs" to get ironed out!

— *Bob Freeburger, W3IBB, West Philadelphia Radio Assn.*

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Concerning the project on carrier current, I would like to correspond with anyone who has had any experience with line noise. There are a few fellows here besides myself who are operating the rigs shown in March, 1942, *QST*, and we are all having great difficulty with line noise. We are always able to hear one another (a distance of about 3 miles by wire) on c.w., operating at 169 kc., but the noise level makes it impossible to copy.

I suppose some of the other fellows have had the same experience and thought perhaps I could get some dope on reducing the noise.

We are operating with from 20 to 35 watts input. We use ten turns on the output coil instead of four as was shown, since this loads the circuit a little better.

If any of you fellows know the answer on line noise, I would appreciate hearing from you. Any correspondence concerning wired wireless is welcome.

— *Ward Lantis, 1217½ S. Washington St., Marion, Ind.*

PROJECTS C & G

Audio-Frequency Induction & Earth-Current Communication

I SEE in the December issue of *QST* that W6EA and W6EB covered a distance of about a quarter of a mile on 'phone with a spark coil and a pair of headphones before the last war. It may be of interest to those investigating audio-frequency transmission to know that, in 1920, Carroll Zimmerman of Taylorville, Illinois, and myself conducted similar experiments.

I discovered that, by opening the grid-to-filament return circuit on my Audiotron-detector 1-tube receiver, I could hear conversations on the telephone line. In an effort to construct apparatus which would talk back to the telephone line by wireless, we hit upon W6EA's idea of using a battery, microphone and Ford spark coil. We used a 4-wire flat-top aerial, 100 ft. long and 40 ft. high. It failed to talk back to the telephone line, but we were able to hear it half a mile away on a receiver consisting of two tubes in a straight audio amplifier. We used a receiving aerial about 100 ft. long, connected directly to the grid of the first tube, and grounded the filament. Volume was excellent for about a quarter mile, but weak at half a mile.

I believe the range could be considerably increased by using an audio amplifier for a transmitter, with a high-impedance output transformer connecting to aerial and ground. The range would probably be determined by the interference and power noise picked up on the receiver, which should be another audio amplifier. I have often thought that a small town could be covered very effectively with such a system using a kilowatt or so of audio power. — *James C. Corn, W6GZ.*

Strays

Few of us ever stop to realize the value of ordinary things which we now take for granted because of modern production methods. Joseph Henry, who made some of the most important discoveries in connection with induction, was forced to insulate bare wire by hand with silk from his wife's dress to obtain the large inductances with which he worked! — *Ohmite News.*

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Don't let your operator's license expire!

Who Killed the Signal?

A Radio Mystery Serial

BY CLINTON B. DESOTO,* WICBD

Chapter 3—"The Great Impersonation"

Synopsis:

The characters in this story, which interprets radio principles in the guise of a detective-mystery yarn, are radio parts living on the chassis of a receiver standing silent and dark, dust-covered from disuse. The Signal is dead — murdered by an unknown hand. The Great Sleuth, an amateur detective and therefore a good one, was called in on the case, along with his three assistants — Ohm Meter, Volt Meter and Milly Am Meter. At first, lanky, brown-complexioned Power Cord seemed a logical suspect. Then Volt Meter discovered Cord's helper, Power Plug, asleep on the floor beside the wall socket — a derelict from duty. Even when Plug plugged himself in and the lights gleamed again inside the cabinet, however, the set still refused to function. Following the path of the current, the Sleuth continued his investigation, interviewing in turn Power Transformer, Rectifier Tube and finally Filter Choke and Filter (Miss "Electrolytic") Condenser. At first the rumor Ohm Meter picked up that Filter Condenser had been serving "rough" current to the set seemed like a promising lead, but then Volt and Milly Am Meter themselves tried some of the current and found it pure. Swallowing their disappointment, the Sleuth and his minions resumed their search, tracing the complicated maze of wiring.

The story continues. . . .

BEFORE long the Sleuth's steps began to slow and a puzzled look grew on his face. "It's too much for me," he muttered absently. "Too many paths. . . ." His voice trailed off.

Then he stopped short. "Wait here a minute," he ordered. "I'll be right back." He stalked off with a determined air.

The Meters, adjusted to retain their balance regardless of their position, waited composedly until his return. When the Sleuth came back a few minutes later he was carrying a huge bundle of paper. They stared curiously while he unrolled it. It was a large blueprint covered with mysterious lines and symbols.

"What have you got there?" Ohm demanded.

"It's a circuit — a schematic diagram of the Receiver," the Sleuth responded absently.

"What's it for?" asked Milly, wrinkling her pretty nose.

"So we can find our way around the place without getting lost in this mess of wiring and having to ask questions of every Tom, Dick and Harry," the Sleuth replied impatiently.

"You mean it's a kind of a map or chart of the set?" Volt inquired, standing up to peer over the Sleuth's shoulder.

"That's just what it is. See, here's Power Transformer and Rectifier Tube — "

"And Filter Choke and Filter Condenser!" Volt broke in excitedly.

"Yes. And here's the path the current travels. See, this line shows where it leaves Filter Condenser."

"But then it seems to branch off in different directions," Volt said doubtfully.

"Well, we'll start with the shortest route. First it goes to this fellow here. Output Tube, he's labeled."

"Output Tube? Who's he and what does he do?"

"I don't know, but we'll soon find out," the Sleuth declared grimly. He rolled up the circuit diagram and motioned to the Meters to follow him. Tugging at his lapels, his pipe puffing furiously, he led them down the path.

In single file the quartet walked back to the rear wall of the chassis and climbed upstairs. The Sleuth quickly identified Output Tube as the near neighbor he had observed eavesdropping so intently on their previous interview with Rectifier Tube.

"Output Tube?" The Sleuth's greeting was genial, designed to allay suspicion. Output Tube hesitated a moment, then acknowledged his identity.

"Perhaps you know what we're here for?" the Sleuth continued on an interrogatory note.

Output Tube shook his head.

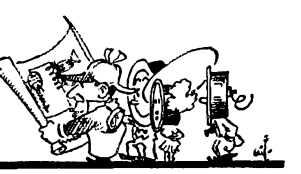
"We're here to investigate the death of the Signal," the Sleuth told him. "I think you can be of help to us. Would you answer a few questions?"

For a moment Output Tube looked at them without speaking. Then, apparently deciding that an appearance of collaboration was the best policy, he shed his reserve and began to speak.

"Of course. I'll be happy to tell you anything you want to know." He spoke with an air of conscious power.

"To be frank, we are working on the theory that the Signal died from electron starvation," the Sleuth said. "We have traced the current that supplies the electrons this far. Now I wonder if you'd tell us what you do with it — in fact, tell us all about your job here."

Output Tube considered. "First of all let me say that I think your theory is wrong," he said, a high-voltage smile on his plate. "However, that's not what you wanted to know. As for my job —



*Executive Editor, *QST*.

well, the most important part of it has to do with the Signal, rather than with the current you've been tracing so far. I take the Signal when it is weak and helpless and build up its strength so it can go out into the world and perform useful work."

"Would you mind explaining that?"

"Perhaps it will save time if I point out first that, physically, I am not dissimilar to my cousin Rectifier Tube over there. I have the same general appearance — the glass envelope, and so on. I have a cathode, too, except that mine is the indirectly-heated type. Instead of emitting electrons directly from my filament, I have a cathode sleeve which is heated by an internal heater. Like cooking in a frying pan instead of broiling directly over the fire," he smiled.

"Why all the extra fuss and bother?" Ohm challenged.

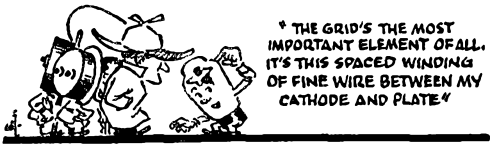
"Simply because an indirectly-heated cathode does a better job." Output Tube's tone was superior. "My cathode has the same potential from one end to the other. Before I got it I used to have an annoying habit of humming to myself, I've been told. But that's all cured now."

"Your plate is similar to Rectifier's, though," the Sleuth remarked. "Except that you've got only one."

"Yes. But I have one other thing he hasn't — my grid."

"Your grid? What's that?"

"Ah, that's the most important element of all. It's this spaced winding of fine wire between my



cathode and my plate." He leaned over so they could see. "The grid is really a kind of valve. It controls the flow of electrons from the cathode to the plate much as you control the stream of water with the faucet on a water pipe. Except that the grid works differently. It's more like a venetian blind than a valve. Observe — when it's open the electrons can get through and when it's closed the current stops completely."

"I don't see anything," Ohm complained. "The wires don't even move."

"Of course not. You can't see electrons move and neither can you see the negative electrostatic field that repels the electrons and keeps them from getting through."

"You mean that an invisible electrostatic field in effect opens or closes the spaces between the grid wires?" the Sleuth asked slowly. Output Tube nodded. "Then the wires are merely there to support the field — I suppose when a negative charge is applied to them?"

"That's exactly it. Quite an accomplishment, isn't it?" Output Tube glowed with pride.

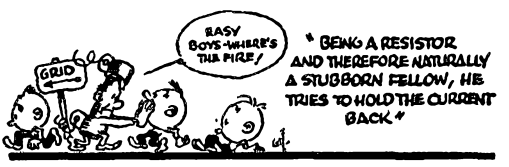
"It's simply wonderful!" Milly exclaimed. "I just don't see how you ever do it."

"Neither do I," Ohm grunted. "Do you turn that valve or grid or whatever it is yourself, or does someone else do it for you?"

"You might say that the Signal turns it — that's how the Signal gets strong."

"You mean you're sort of a muscle-builder?"

"I prefer to be called an amplifier," Output Tube said with dignity. "I'll describe the process



for you. Normally my grid is kept about half closed by a steady d.c. charging voltage, which of course supplies the electrostatic field. I call this voltage my bias."

"Where do you get it?" asked Volt, who always responded to anything having to do with voltage.

"Oh, there's a little Resistor in series with my cathode return circuit who makes it for me. In that position, of course, all my cathode current has to flow through him. Being a Resistor, and therefore naturally a stubborn fellow, he tries to hold the current back."

"And the voltage drop that results is what you use for bias?"

"Precisely. Now, to get back to the Signal, when it comes to me it's in the shape of a weak a.c. voltage. It gets on my grid and varies my grid potential up and down, opening and closing the blinds — excuse me, I mean the electrostatic field — according to its amplitude and frequency. My plate current — the electron flow from my cathode to my plate — changes correspondingly. In other words, my plate current then looks exactly like the Signal current."

"Yes, I can see that," the Sleuth acknowledged readily. "But I still don't see how that makes the Signal stronger."

"It's this way," Output Tube explained patiently. "When my plate current varies it changes the effective voltage on my plate, too, because of the drop through the external load impedance they make me work into. And the plate-voltage change resulting from a given change in plate current is so much greater than the grid-voltage change causing it that, when the Signal has passed through me and leaves my plate, it's many times bigger than when it came to my grid."

"It may be bigger, but I don't see how it can be stronger," Ohm argued.

Output Tube frowned. "But it is, because I amplify the power as well as the voltage. You see, this big cathode of mine emits many more electrons than those of the smaller tubes around here, which means that my plate current is much bigger. *Current* multiplied by *voltage* equals *power*, and — well, there you are."

At this Volt glanced significantly at Milly, who shyly dropped her eyes. The Sleuth gazed at the pair benignly for a moment before continuing.

"Hmmm. Well, this still leaves me a little confused, I'm afraid," he admitted meditatively. "It's hard for me to think of the Signal as an a.c. voltage or a pulsating stream of electrons. If only it wasn't so *invisible*. It would be so much easier to work if we could only find the body and see just what killed it. . . ." Then, shrugging, "However, maybe I'll be able to visualize the case a little more clearly as we go along."

"Oh, I'm sure you will," Output Tube replied condescendingly.

"Thanks!" The Sleuth's tone was acid. "In the meantime, can you supply any witnesses to corroborate what you've told us?"

Output Tube was offended. "You don't mean to say that you suspect *me* of killing the Signal, do you?" he demanded. "Why, I gave it life! I made it strong. I . . ."

"Yes, yes — I know. But can you prove that?"

Output Tube hesitated. "Why, you can ask almost any of the Parts, I suppose," he answered uncertainly.

The Sleuth unrolled the circuit diagram. "According to this you deliver the Signal to Output Transformer," he said. "Will he vouch for you?"

"Why, yes. I — I suppose so."

"All right. I guess that's all for now. But we may be back," the Sleuth warned. Turning to the Meters, he said impatiently, "Come along. We've got work to do."

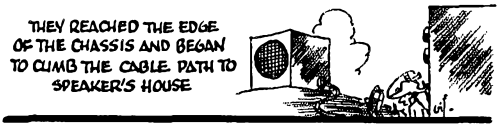
"Where to now?" Volt asked, his short legs trotting to keep pace with the Sleuth's long swift strides.

"Output Transformer receives the Signal from Output Tube. That makes him next on our list."

"But Output Transformer lives way out with Loud Speaker, doesn't he?"

"Right." The Sleuth lapsed into the moody silence they knew from long experience not to break.

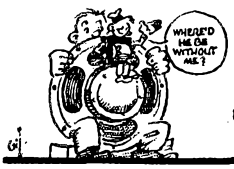
For a while the quartet walked in silence. They reached the edge of the chassis and began to climb the cable path to Speaker's house. The path seemed to stretch on endlessly.



"Did you say we were going to follow the most direct route?" Ohm growled, puffing with exertion. "Seems more like a mountain-climbing expedition." Milly, too, appeared to be in distress.

"It won't be long now," the Sleuth encouraged them. Almost as he spoke they reached the top of the path. They made the short descent into the metal housing. There they found Output Transformer, dwarfed by his huge associate, Loud Speaker.

They were an unusual pair — an Edgar Bergen-Charlie McCarthy combination in reverse. While it was Loud Speaker, the big fellow, who appeared to talk, the sounds were actually supplied by Output Transformer. Without him Loud Speaker was mute. Instead of the traditional dummy sitting on the ventriloquist's knee, however, it was Loud Speaker who held Output Transformer on his lap — if that protuberant pot could be called a lap.



Output Transformer explained all this when the Sleuth stated the purpose of their call. "So how d'you want me to talk to you, pal?" he concluded. "In my own voice or in my pal Loud Speaker's voice?" As he spoke his voice changed from his own sharp, metallic tones to a thunderous, resonant rumble that began in the depths of Speaker's cone and resounded around the room.

"In your own voice," the Sleuth assured him hastily. "At least it will be more private."

"Even if it doesn't sound so good," Ohm muttered. Each of the meters exhibited an unusual tenseness. Even Milly seemed to have lost her customary blithe, carefree air. "That Loud Speaker's a bad, bass man," she whispered to Volt, as the latter slid a protecting arm around her waist.

The Sleuth, on the other hand, seemed to feel that Output Transformer was the more dubious member of the pair. He was puzzled by the sharp contrast between the idiom the Transformer affected when speaking in his own character and the cultured cadence that issued from Loud Speaker's full-toned larynx.

Temporarily reserving his doubts, the Sleuth proceeded with the interview in routine fashion. Output Transformer readily confirmed Output Tube's story. Then he went on to describe his own work and that of Loud Speaker.

"Between us, my barrelhouse pal here and me take the Signal as that ickey Output Tube slips it to us and change it into noise, so that all those stooges out there they call 'people' can hear what kind of cough medicine to buy or 'how's my modulation' or some of the other clinkers the long underwears go for." His rasping falsetto dripped contempt.

"Sounds simple enough — almost too simple," the Sleuth observed quietly. "Just how do you do it?"

"Oh, so you want me to get technical, huh? Okay, sonny boy, here goes. Output Tube told you that when he gets through with the Signal it's nothing but an a.c. voltage superimposed on his d.c. plate voltage — right? But did he tell you that the way he gets his plate voltage from the power supply is through my primary winding? No? The slug! Well, anyway, he does. I pass him the d.c. without saying a word — just let it go right through my primary as though it wasn't there. But the a.c. — well, that's a different piece of jive. That boogie-woogie beat (back and

(*Continued on page 58*)

CURING CROSS-TALK IN CODE-PRACTICE TABLES

THOSE who have constructed code-practice tables for group instruction and have had trouble from cross-talk between circuits when using the usual type of high-resistance headphones will be interested in the results of an investigation of the problem made by J. R. Ortiz, W2KEV, in connection with three tables patterned after the model described in the Defense Edition of *The Radio Amateur's Handbook* and also in *QST* for May, 1941. The original circuit is shown in Fig. 1.

Three code-practice tables, each containing ten positions, were wired strictly in accordance with the diagram. Each table developed cross-talk trouble; that is, the table could not be divided into several independent communications circuits without interference between circuits. Capacity between key contacts was first suspected and several tests were made to determine if this was responsible for the trouble. All keys were disconnected and removed entirely. The cross-talk still prevailed, indicating that the key capacity was not responsible. Next the keys were replaced and all switches removed. Since the switches are open when it is desired to send to oneself, removing them entirely did not upset the wiring. The tone background immediately disappeared. The trouble reappeared when the s.p.s.t. toggle switches were restored, however. The toggle switches were then replaced with knife-type switches in which the contacts are quite distant from each other. The tone background reappeared but it was very, very weak, indicating that it was the capacity between contacts of the toggle switches that was responsible.

While playing with the tables, W2KEV went a little farther. Two tables were wired with the knife switches; these are giving satisfactory service. In the third table, the toggle switches were again installed and the tone reappeared as expected. One by one the ten operating positions were cut out until, even with the toggle switches, the tone disappeared entirely. This occurred when five of the ten positions were out. With six positions, the tone reappeared; with seven, the strength increased, and with eight, it was as strong as before. Thus it would appear that five positions is the limit when toggle switches are used.

Most of the difficulty with amateur-built code tables comes from the use of the usual type of high-impedance headphones. While this type is the most commonly available, since they usually come from ham shacks and low-impedance 'phones are not obtainable locally, their use makes it possible for the signal to feed through very small capacities. Cross-talk in this case can be eliminated only by reducing stray capacities as much as possible, as W2KEV has done. Apparently the keys used by W2KEV were of low-capacity construction. Other types may cause trouble.

If the signal is sufficiently strong to allow some reduction, cross-talk may be reduced by shunting the headphones with as low a resistance as practicable.

While on the subject of code-table circuits, a slightly different arrangement is shown in Fig. 2. With this circuit any combination of stations

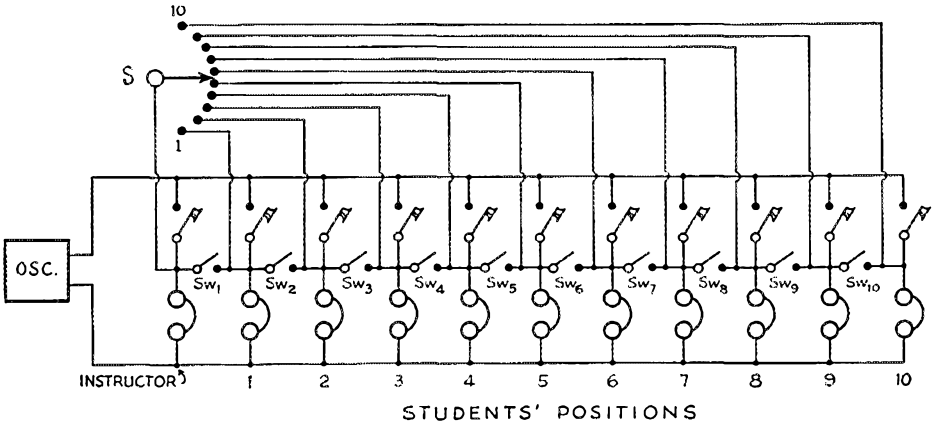


Fig. 1 — Circuit diagram of the code-practice table wiring arrangement discussed by W2KEV. Switches marked *Sw* are the toggle switches discussed.

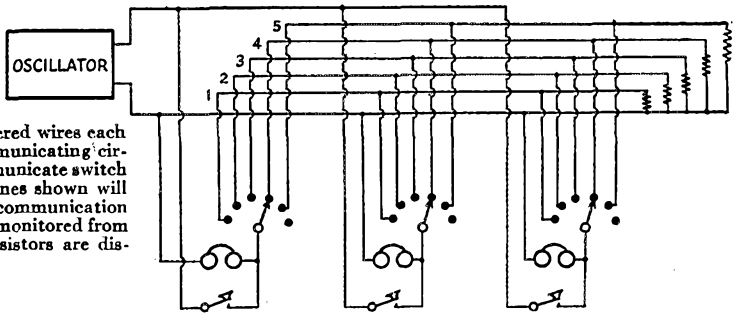


Fig. 2 — This arrangement provides greater flexibility than the one shown in Fig. 1. The two outside wires transmit the steady signal from the oscillator to each station, while the numbered wires each provide an independent communicating circuit. Stations wishing to communicate switch to the same line. The seven lines shown will take care of five independent communication circuits and any line may be monitored from any position. The loading resistors are discussed in the text.

may work together on the same circuit or on different circuits. Each additional line provided will furnish an additional independent circuit. This arrangement is an improvement over that shown in Fig. 1 in that stations which are not adjacent may work together independently of stations in between. For instance, with the circuit of Fig. 1, should station No. 10 wish to work station No. 8, it would be necessary for station No. 9 to be included in the circuit also. With the system of Fig. 2, any stations wishing to communicate merely switch to the same line. Those working on other lines are not disturbed. Monitoring of any circuit can be done from any position, and a student may send to himself without disturbing others by switching to the "off" position. The tap switches should be of low capacity, or a system of clips and screw contacts may be substituted. Each line should be loaded with resistance if cross-talk occurs. For a system of ten positions, a value of a few hundred ohms should be sufficient.

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SOLDERING-IRON PROTECTIVE WARNING

No doubt many members of the fraternity have at one time or another left their soldering irons with the current on and discovered the fact only after many hours. Even when one has rigged up a nice separate outlet and switch equipped with a pilot light he is likely to use the soldering iron at some other outlet or location and then forget all about it, only to find it hot a day or two later.

Fig. 3 — Warning light for soldering iron.

Here is a practicable method of avoiding such oversights which both my son, W9INN, and I have used with full success. First, we got one of those plug-in multiple outlets which can be plugged into any wall socket. This one has a screw-socket opening into which one of the very small dime-store red bulbs can be screwed. Next, the soldering-iron plug was also plugged into this same outlet, as shown in Fig. 3. Now we have a red light bulb at the plug end of the soldering-iron cord. This plug-in socket and bulb are never separated from the soldering-iron cord. When the iron is disconnected the whole assembly, plug-in socket and all, is just pulled out of the wall socket, and when the iron is again used the whole thing is simply plugged into the wall socket. Thus, no matter where the soldering iron may be used, the red light always shows when the current is on. If an outlet of the type described cannot be found there is also available in many dime stores a candelabra socket for Christmas-tree size bulbs, fitted with a two-prong base which may be plugged into a standard three-way plug-in outlet. — *H. A. Fanckboner, W9BPS.*

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RE MODEL-T FORD AS EMERGENCY POWER SOURCE

I note in your Hints and Kinks section in the January issue of *QST* the recommendations of W3EZL concerning Model-T Ford motors. In regard to his suggestion that the timer be cleaned thoroughly with kerosene, I wish to supplement this by adding that the timer should then be well lubricated with a medium grade of clean motor oil. I know this will sound foolish to those who have been drilled in the school of keeping all electrical contacts free from oil, dirt and grease, but any old-time Model-T owner will agree with me — and those who don't and try to run one of the things without oil in the timer will find out quickly enough. In fact, an inspection of a genuine Ford timer will reveal an oil hole with a spring cap on the upper side. While many substitute timers were made for this motor by various manufacturers of auto parts, some of which were designed to operate clean and free from oil, the ones put on at the factory must have oil in them. I'm not so sure that the motor will fail entirely at a 20-mile-per-hour speed, but it will miss at any speed.

Here's another hint toward starting Model-T motors if they are used with the magneto ignition alone. It will help to see that there is not much end play, especially if the transmission is out and the clutch spring is not available to prevent thrust. End play allows the magnets on the flywheel to run with too much clearance from the core pieces on the stator coils.

— *W. W. Williams, W8WEG.*

CORRESPONDENCE FROM MEMBERS

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

"RADIONICS" VS. "ELECTRONICS"

6001 Dickens Ave., Chicago, Ill.

Editor, *QST*:

Right now the public is being confused in the press and on the radio daily by two terms which mean exactly the same thing — "electronics" and "radionics." Electronics is of British origin. Radionics has been used in our own country for some time, although I don't know who originated it.

Both of these terms deal with the application of vacuum tubes in electrical circuits not only for broadcasting and radio communications, but to radio receivers, television, aircraft detectors, photoelectric units, rectifiers, phonographs, hearing aids and other devices.

Let's take a quick look at these two words.

"Radionics" springs from the Latin "to radiate" and the Greek "ion" (to wander or travel) and thus we get the term "wandering or traveling radiations," which is much to the point and extremely descriptive.

The first syllable of "electric," "electricity," "electronics," springs from the Greek root meaning "amber." Therefore, I take it, electronics is wandering amber. Is that descriptive?

The term "electron," as thought of to-day, is of British origin, having been first used by C. J. Stoney in 1891. Since we did not adopt the British words "petrol," "underground," "bobby," "pub," "valve" and "wireless," but instead are using the Americanisms "gasoline," "subway," "cop," "saloon," "tube" and "radio," why should we adopt the word "electronics"?

Incidentally, in the early days of radio the same confusion existed in the American public mind between radio and wireless as now exists between radionics and electronics.

Even the physicists have said, "Radionics is more descriptive." Dr. Arthur F. Van Dyck, president of the Institute of Radio Engineers, said at the Chicago annual dinner of the Institute December 18th last: "Recently I heard a term for these new radio fields which seems apt. It is 'radionics.' That seems to be a good term if we want to find one which will win friends and influence people."

My point is, we have a good American word in "radionics," highly descriptive, looked upon with favor by engineers and physicists, and easily understood by the general public. A word that, in my opinion, is fit to describe the miracles now being wrought behind the secret panels of radionic laboratories — wrought for the winning of the war. . . .

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

HAMFEST IN CHINA

P. O. Box 172, Sar-Pin-Bar, Chungking, China

Editor, *QST*:

We have great pleasure to inform you that we (the China Amateur Radio League) are going to hold our fifth convention on May 5, 1943, in Chungking, our war capital. Every section of our League will participate, through our radio network. This is what we have done during previous conventions. May 5th is now known in China as the "China Amateurs Day." The annual convention is to be observed on that day throughout China.

In conjunction with the 1942 convention we sponsored a nation-wide amateur radio show at the same time. During the show there were displayed QSL cards of different countries as well as ham equipment and a number of radio products of Chinese manufacturing companies. Radio trophies, such as Jap-made hand generators, throat microphones, field sets, etc., captured in the field by our army, were also among the exhibits. What attracted our visitors most, however, was the "Radio Man," who could talk, answer questions and also wink his eyes. The 1942 convention was in reality quite a success.

We are planning to have another but larger show for the coming convention. It is larger in the sense that it will be a world-wide amateur radio show, instead of being only nation-wide. We are trying to collect anything possible in connection with radio amateur activities from all our allied nations. Anything of interest and value to us, no matter whether it is a book or a photo, a drawing or apparatus, a ham shack or a reel of movies, some forms of QSL cards or log sheets, no matter whether it is new or old, personal or belonging to a club, will be welcome.

As America has led the world in amateur radio, we do not hesitate to ask for your kind coöperation. Any assistance rendered will certainly be most highly appreciated. We want to make the forthcoming convention and show a success. This will not only help to promote the Chinese people in the study of radio science but also increase their interest and understanding of international relations, both of which are important and vital, especially during the present war against fascism and Hitlerism.

Nevertheless, we cannot succeed without the help and coöperation of our foreign friends. If you will be good enough to inform all your League members and kindly ask them to collect things for us, we shall certainly be very much obliged to you. Please have all the things sent to the China Amateur Radio League at the above address, attention Mr. K. T. Chu.

In closing we would like to add that we own and operate XUOA in our headquarters, and that this station has contacted quite a number of American ham stations. . . .

— *U. T. Hsu, President,*
China Amateur Radio League

MERCHANT MARINE NEEDS MEN

11455 Birch St., Lynwood, Calif.

Editor, *QST:*

. . . I notice most articles in today's radio magazines stress the need for radio operators in the armed forces. Don't you think the Merchant Marine has been neglected? There is a crying demand in this field for licensed men to man the thousands of new ships being built.

Here is a point worth bearing in mind. There are many men who are not physically able to meet the requirements of the branch they might choose. I, for one, was rejected by the Navy, but because my heart was set on serving on the water I tried the Merchant Marine and found them anxious to have me. Later I learned that many fellows who wanted to serve their country but had slight deficiencies were seeing action this way. Wouldn't it be a good thing to pass this suggestion on to the hams who . . . have been turned down?

— *Jay S. Epstein, U.S.M.M.*

FROM A W5 IN INDIA

APO 629, c/o Postmaster, New York City

Editor, *QST:*

. . . . Your magazine is still one of the most popular ones over here wherever radio men get together. Once in a while a copy gets through to us, and then all the men gather around to try to read it. Some are even content with just seeing another copy again. I did get a July issue with the big flag on the front, and believe me I'm going to hold onto it.

Since I've been in India I've met several hams. I try to get all of the calls copied down, but do miss some of them. So far I've met K4s, a few Gs, several VKs and about three VUs. I'm enclosing a picture of W9NJD and myself, W5GWD. When we were back in the States he was in Davenport, Iowa, and I was in Little Rock, Ark. We worked each other from those two locations, but had to get to India to meet each other. That is an unusual coincidence to me, and I thought you might like to know of it. I have also run into W5CVW of Fort Worth, Texas. We had worked each other, too. I don't have our picture yet, but will send it to you as soon as it comes from the photo shop. (It takes us four weeks to get pictures developed and printed!)

Here's wishing you all the success that you could possibly have, and please keep up the good work of trying to keep the ham bands for us. Right now about all most of us are looking forward to is getting back to our rigs and meeting our old friends again.

— *Lt. Charles E. Hall, W5GWD*

TO OUR ADVERTISERS

868 Whittier Blvd., Grosse Pointe Park, Mich.

Editor, *QST:*

I wish to express my personal appreciation as a member of our radio fraternity, the ARRL, to those advertisers who, through *QST*, have contributed their cold hard cash to help us maintain its high standards of technical and fraternal information. These great organizations, by their continued proof of faith in us, give us courage in the belief that as soon as "the lights go on again" we, too, will "go on again." I would like to suggest that we all use their products whenever possible, both during the war and afterwards, as a concrete expression of our gratitude.

— *Paul J. Palmer, W8UGR*

OBJECTS TO "AMERICANESE"

53 Newcomb St., Quincy, Mass.

Editor, *QST:*

As the mother of a "ham" in the service, W1KCP, I wish to say — straight from the shoulder — that I object to the term "Americanese" which you used in the article on page 56 of your January issue.

The language of our American soldier is plain, everyday *American*, and don't you — or anyone else — try to rig a tailpiece onto it! *An American speaks American* — and that's that! And we don't have to apologize for it, or change it — in any way — for anybody!

It so happens that my son is in the Signal Corps, stationed at Fort Monmouth, N. J., and I say right here — even without consulting him — that neither he nor any of his buddies will ever use the term for their speech which one of your editors so imprudently coined. Tell that editor to forget it!

— (*Mrs.*) *Doris Condon Saltus*

EDITOR'S NOTE. — The article in question was written, not by a *QST* editor, but at the Fort Monmouth public relations office.

According to Webster, "-ese" is "an adjective and noun suffix, signifying *of, pertaining to*, or *originating in* (a certain place or country); *native, inhabitant* or *language* (of a certain place or country). . . ." "Americanese" is not a dirty word.

Book Reviews

(*Continued from page 12*)

magnetic theory is not assumed, but college-grade physics and mathematics through calculus is necessary.

The early chapters deal with electrostatic and magnetic fields and vector analysis. (The chapter on this latter subject, incidentally, is an exceptionally clear presentation.) This leads to the introduction of Maxwell's equations, and thence to radiation and wave propagation. The book concludes with a brief discussion of antennas, transmission lines and wave guides.

The general impression one gets from the book is that it has been written for the sake of the reader rather than, as seems too frequently to be the case with texts dealing in relatively abstruse subjects, with the sole object of getting the facts presented in unassailably logical fashion. This certainly calls for a few cheers on the part of the man who wants to use it on his own and not simply as an adjunct to a formal course.

— *G. G.*

OPERATING NEWS

GEORGE HART, W1NJM
Acting Communications Manager

CAROL A. KEATING, W9WWP
Assistant Communications Manager

WERS Reports. A recent bulletin to ECs contained a report form to be filled in and sent to us for information on progress of local WERS units. They are coming back now, but not fast enough. Have you sent yours? If not, please do so, regardless of the state of WERS organization in your locality. If there is no activity we want to know it, and we would like to know why. If there is activity, we want the details on it for comparison with previous reports obtained the same way; object: a curve of progress for civilian defense WERS licensing and activity. If the person receiving the form knows nothing about local progress (he should — forms were directed to field officials who should keep themselves informed), he should place it in the hands of someone who does, or collect the information and send it in. Hw?

Operating Procedure. This reporter has observed that many CD-WERS networks use a loose and thoroughly ham-like operating procedure in conducting tests and drills. While it is true that FCC set down no specific operating procedure to be followed by civilian defense stations, nothing could be more damaging to the organization than to have networks, consciously or otherwise, revert to the old "sewing circle" form of operation. I say "revert" without meaning that there is, or was, anything wrong with the old casual kind of conversation. It was swell, in its place; but WERS is not its place. Let us resign ourselves to the fact that amateur radio on the air, as we knew it, is *out* for the duration. When the war is over perhaps we shall return to our former carefree ways. In the meantime, we have an important job to do. Civilian defense communication needs our most serious and sincere attention, and in some networks it is not getting it.

The trouble is that many of us need an education in snappy 'phone procedure. Take a listen to airways and police communication. You will see that they don't waste time, that there are no "ums" and "ahs," that they say what they have to say briefly, curtly, then go off the air. It is unfortunate that amateurs are not better trained in this method of operation. We are too used to clearing our throats, making long, pointless transmissions, giving useless details and calling the fellow at the other end by his first name. We set ourselves up as instructors and examples to be followed by CD-WERS trainees, but many of us need the training as much as do the students. It is not so much that we do not know *how* as it is that we have become so accustomed to haphazard operating techniques that we subconsciously fall into them.

The conclusion to be drawn is that network communication as we should now practice it is as new to most of us amateurs as it is to those we are trying to train; and therefore our attitude should perhaps be that of a fellow student with a little more experience than the other students instead of an instructor who knows all the answers. Devise your operating procedure, make it standard, take everything you can think of into consideration, then examine it carefully and see how much can be eliminated; and leave yourself open to re-

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.

* Burlington (Vt.) Amateur Radio Club.
* Central Oregon Radio Klub, Bend, Ore.
* Detroit Amateur Radio Assn., Detroit, Mich.
* Edison Radio Amateurs' Assn., Detroit, Mich.
* Hillsborough Twp. ARRL Radio School, South Branch, N. J.
* Jersey Shore Amateur Radio Assn., Long Branch, N. J.
Kalamazoo (Mich.) Amateur Radio Club.
Knoxville Radio Communications Club, Knoxville, Tenn.
Leland M. Barnett Post No. 123, American Legion, Cincinnati, Ohio.
* South Jersey Radio Assn., Merchantville, N. J.
Tucson Short Wave Assn., Tucson, Ariz.
* Withrow High School Radio Club, Cincinnati, Ohio.

visions brought about by experience. Make yourself sound curt and official. The fellow at the other end won't think you are mad at him if you don't call him by first name and ask him about the health of his wife and kids. End your transmissions with "go ahead" and start them with something like "control to 17," not "WXXX-1 returning to WXXX-17." This is a serious business. Let's make it sound like one. — *G. H.*

BRIEFS

During the intermission of a program which was put on for the soldiers in North Africa recently, Lt. George Craig, W9AGR, sent out a call for any of the brasspounding brethren present to gather at the message center for a hamfest. One by one all districts checked in with the exception of second, third, and fourth. A French beer barrel was tapped, and many tall stories and reminiscences were exchanged. The following were present: Capt. R. G. Andrew, ex-7AIC; Lt. W. H. Moloney, 9GRV; Lt. George H. Craig, 9AGR; Lt. A. R. O'Neil, 9PDS; Lt. G. H. Russell, 9ILN; T/Sgt. H. W. Thomas, 5BPL; S/Sgt. R. H. Gray, 7IOX; S/Sgt. J. E. Moran, 9RQO; S/Sgt. Charles H. Moore, 8GVN; Sgt. G. W. Bischoff, 9TCE; Sgt. F. W. Fiedler, 6IPH; Sgt. J. S. Lukacs, 8QPI; Cpl. J. T. Bibisi, 1KJT, and Cpl. John S. Holmes, 7CJG. They hope, and we hope too, that the day is not too far distant when they can encounter one another's calls on the ham-bands and say, "I know your call. Remember our hamfest in Africa?"

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W8PTE sends some interesting information to us regarding the appearance of W2NDG's QSL card in a recent edition of Zack Mosley's "Smiling Jack" comic strip. W2NDG is a close friend of Mosley, and it is his shack that is sketched when Mosley needs "ham" atmosphere. Mosley himself is a Civil Air Patrol pilot flying out of Florida bases.

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The hams of Fort Wayne, Ind., came to the fore recently during a surprise blackout in that city. In one case the telephone communication system was for half an hour unable to maintain contact between control center and one district control center. The WERS station in the district control center reported to the control center and within three minutes was handling all traffic on the circuit, thus forcefully demonstrating the need and practicality of WERS in an actual emergency.

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W2OKX reports that the New York City Fire Department has a station which transmits time signals on 'phone every hour on the hour. This station is WNYF and operates on 1630 kc.

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Station DLB on 6.9 Mc. has code transmissions which begin at 6:30 P.M. EWT. W3IMU says that the speed usually averages 22 w.p.m., but may vary from 20 to 25 w.p.m. The signal is generally 599X, and the fist is excellent. The transmissions take place every day except Sunday.

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W8FRC of Saxonburg, Pa., sold $14 worth of meters to the Signal Corps through ARRL and used the entire returns to buy War Stamps. He then dismantled his station, thereby contributing 100 pounds of steel to the scrap drive, and sold enough equipment to buy $400 more in War Bonds.

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A. P. Ludwig, C.R.E., USN (ex-W6BRG), has proposed a new method for mass code training. He proposes to have the tape sound sent to the student at the same time that he is watching the "blinker" version of the letter. The student then follows along on his own hand key. Thus he gets the proper timing, rhythm, and spacing if he is sending simultaneously with what he is hearing and seeing.

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W7ASG suggests that we sponsor a movement in our ranks to dig out the old logs and bring all QSLs up to 100 per cent both ways, received and sent.

ELECTION NOTICES

To all ARRL Members residing in the Sections listed below:

The list gives the Sections, closing date for receipt of nominating petitions for Section Manager, the name of the present incumbent and the date of expiration of his term of office. This notice supersedes previous notices.

In cases where no valid nominating petitions have been received from ARRL members residing in the different Sections in response to our previous notices, the closing dates for receipt of nominating petitions are set ahead to the dates given herewith. In the absence of nominating petitions from Members of a Section, the incumbent continues to hold his official position and carry on the work of the Section subject, of course, to the filing of proper nominating petitions and the holding of an election by ballot or as may be necessary. Petitions must be in West Hartford on or before noon of the dates specified.

Due to resignations in the Missouri, Eastern Florida and San Joaquin Valley Sections, nominating petitions are hereby solicited for the office of Section Communications Manager in these Sections, and the closing date for receipt of nominations at ARRL Headquarters is herewith specified as noon, Thursday, April 15, 1943.

Section	*Closing Date*	*Present SCM*	*Present Term of Office Ends*
Alaska	Apr. 1, 1943	James G. Sherry	June 14, 1942
Southern Minn.	Apr. 1, 1943	Millard L. Bender	Aug. 22, 1942
Western Penna.	Apr. 1, 1943	Elmer Krall	Sept. 20, 1942
No. New Jersey	Apr. 1, 1943	Edward Gursky, Jr.	Oct. 15, 1942
West Indies	Apr. 1, 1943	Mario de la Torre	Dec. 16, 1942
Mississippi	Apr. 1, 1943	S. Benton Cain	Feb. 15, 1943
Missouri	Apr. 15, 1943	Robert C. Morwood (resigned)	.....
Eastern Fla.	Apr. 15, 1943	Carl G. Schaal (resigned)	.....
San Joaquin Valley	Apr. 15, 1943	Antone J. Silva (resigned)	.....
Hawaii	Apr. 15, 1943	Francis T. Blatt	Feb. 28, 1941
Sacramento Valley	Apr. 15, 1943	Vincent N. Feldhausen	June 15, 1941
Nevada	Apr. 15, 1943	Edward W. Heim	Nov. 1, 1941
Oklahoma	Apr. 15, 1943	R. W. Battern	Nov. 1, 1941
New Hampshire	Apr. 15, 1943	Mrs. Dorothy Evans	Sept. 1, 1942
Utah-Wyoming	Apr. 15, 1943	Henry L. Schroeder	Oct. 1, 1942
N. Y. C. & L. I.	Apr. 15, 1943	E. L. Baunach	Apr. 22, 1943
North Carolina	May 3, 1943	W. J. Wortman	Mar. 18, 1943
East Bay	May 14, 1943	Horace R. Greer	May 26, 1943
Washington	May 14, 1943	Carl F. Hofmann	May 27, 1943
Vermont	May 14, 1943	Clifton G. Parker	June 2, 1943
Maine	May 14, 1943	Ames R. Millett	June 7, 1943
No. Minnesota	June 1, 1943	Armond D. Brattland	June 15, 1943
So. New Jersey	June 1, 1943	Lester H. Allen	June 22, 1943

1. You are hereby notified that an election for an ARRL Section Communications Manager for the next two-year term of office is about to be held in each of these Sections in accordance with the provisions of the By-Laws.

2. The elections will take place in the different Sections immediately after the closing date for receipt of nominating petitions as given opposite the different Sections. The Ballots mailed from Headquarters will list in alphabetical sequence the names of all eligible candidates nominated for the position by ARRL members residing in the Sections concerned. Ballots will be mailed to members as of the closing dates specified above, for receipt of nominating petitions.

3. Nominating petitions from the Sections named are hereby solicited. Five or more ARRL members residing in any Section have the privilege of nominating any member of the League as candidate for Section Manager. The following form for nomination is suggested:

(Place and date)

Communications Manager, ARRL
38 La Salle Road, West Hartford, Conn.

We, the undersigned members of the ARRL residing in the .....Section of the.....Division hereby nominate.....as candidate for Section Communications Manager for this Section for the next two-year term of office.

(Five or more signatures of ARRL members are required.)

The candidates and five or more signers *must* be League members in good standing or the petition will be thrown out as invalid. *Each candidate must have been a licensed amateur operator for at least two years and similarly, a member of the League for at least one continuous year, immediately prior to his nomination or the petition will likewise be invalidated.* The complete name, address, and station call of the candidate should be included. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon of the closing date given for receipt of nominating petitions. There is no limit to the number of petitions that may be filed, but no member shall sign more than one.

4. Members are urged to take initiative immediately, filing petitions for the officials of each Section listed above. This is your opportunity to put the man of your choice in office to carry on the work of the organization in your Section.

— *George Hart, Acting Communications Manager*

ELECTION RESULTS

Valid petitions nominating a single candidate as Section Manager were filed in a number of Sections, as provided in our Constitution and By-Laws, electing the following officials, the term of office starting on the date given.

Michigan	Harold C. Bird, W8DPE	Feb. 3, 1943
Western New York	William Bellor, W8MC	Feb. 15, 1943

THE use of electron tubes for purposes other than communications is almost as old as radio. Many of the early examples of electronics were brilliantly conceived, well engineered and commercially successful. Nevertheless, there was a general feeling in industry that a tube was too frail a bit of glass and wire to handle anything more substantial than a voice. The really new thing about the art of electronics is that a lot of people have decided that it is practical. This is big news, and electronics is heading for a boom after the war. It is hard to say just how much is being done right now, because those who are doing the most are saying the least. Probably there is plenty doing, if we can judge by the radio magazines. Some of these, in their anxiety to cover both radio and electronics, now find themselves with a foot in each field and an ear to the ground; a posture which is apt to become rather trying if held for a long time.

We know of one case where an electronic device was installed in a factory to control the flow of steam to a drier. The device failed after six months, and production was halted until a trained man could arrive to fix it. He found the trouble: someone had shut off the steam. It is easy to say that someone at the factory should have found the trouble, but they knew nothing of electronics and wisely left the whole system alone. In another plant we know of, the maintenance men did try to find the trouble. They started by taking a photoelectric cell apart. (They did, so help us!)

From the above cases, it is clear that the new electronics industry is going to need equipment of extreme reliability, plus an army of maintenance men who know their stuff. These men will be electronic specialists, as distinct from radio men as pattern makers are distinct from cabinet makers. The principles and the tools will be the same, but the job will be very different. It will be a good profession, busy, profitable and interesting. It will require large numbers of trained and resourceful men, and this is where you come in — a chance to capitalize on your Hobby. It is an opportunity worth thinking about.

There is one thing more we wish to say. National has built electronic equipment since the early 1920's, and we expect to keep on making it. But we have been serving the amateur even longer, and whatever happens, we do not mean to sell the amateur short.

W. A. READY

The Month in Canada

ONTARIO—VE3

From Len Mitchell, 3AZ:

3EB has recently joined the RCAF with the rank of pilot officer. When last heard from he was stationed at Hamilton.

3IX, who is with the RCAF in England, has recently been promoted to the rank of flight lieutenant. In a letter recently received he states: "I have now left the squadron and have an office and liaison job. It is a darn good job, too, as I get around an awful lot, and do I know this country now? Many is the local inhabitant that has said I probably know the country better than the average Englishman. . . . As you know, I came over here a ground man, and that was fine, and then to get into flying and earn a half wing, well, you can see that I am rather pleased about it all. I got some hours packed in, too. In some grand machines also. . . . I have a lot of friends that I have made over here and they sure treat me swell. Oh, yes, Charlie Boughner is down south of me and is now a pilot officer. I run into a lot of the boys when on my inspection tours, but most of them are recent arrivals and not many from good old Toronto. . . . Still meet the odd amateur, my C. O. being one. But we do not get a lot of time to think of those things except to file away in one's mind the ideas for after the show is over."

ALBERTA—VE4

From W. W. Butchart, 4LQ:

A letter from 4ZI at Barons throws some light on the activity of the local hams there:

4PZ "joined the Benedicts," November 9th, and expects to join the RCAF in December. Now there is a chap who believes in action! A junior YL op arrived at 4ARC's household on November 16th. The OM is literally "walking on air" these days. 4ADY, now a welder in the Vancouver shipyards, was back in Barons for a month's holiday. 4AQP has a nice little radio service business worked up in Barons. 4WZ wishes he had got married sooner. Married life must be agreeing with the lug. As for 4ZI, he says that he is fed up with this year's harvest. The weather just wasn't with us, I guess.

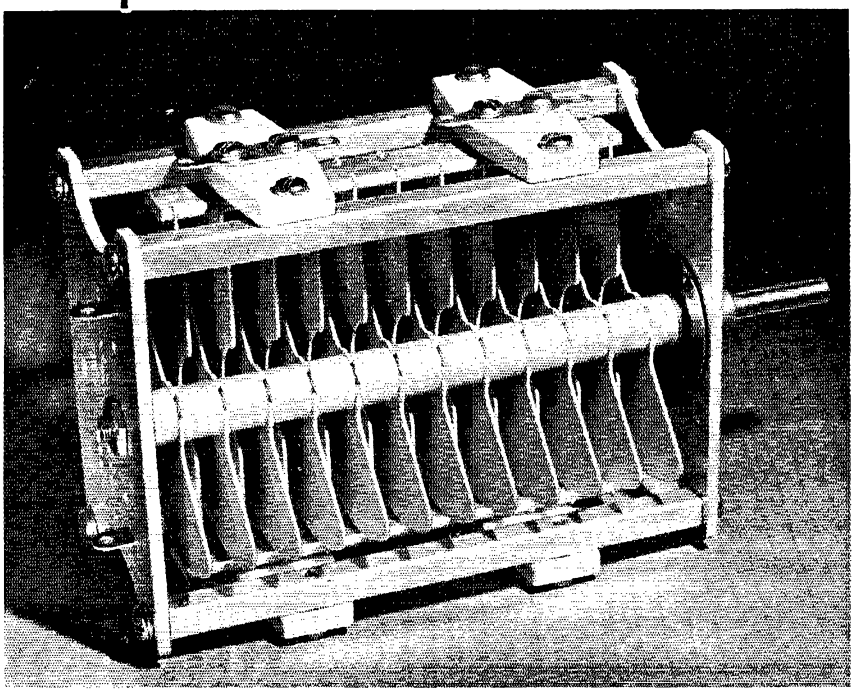
4OF is on the servicing staff of TCA. And while we are on the subject, Ted, how about a line from you? Frank Duval, 4AA is still pursuing his duties on the CPR. Say, Frank, do you ever see 4JJ on your trips down to Medicine Hat? If you do, drop us a line and tell us how "Jesse James" is faring? 4ACS closed up his Lethbridge service shop and is now with the CPR "somewhere in B. C."

When we look back over the "good old daze" we recall such calls as 4LA of Strathmore, Pop Smalley (4SN) of Calgary, 4GM of Hanna and Oscar the Flea, once of Sedalia and to the best of our knowledge now in Laird, Saskatchewan. There are lots more, but why can't we get a rise out of them? How about it? Drop us a line. The QRA is: W. W. Butchart, 10740 107th St., Edmonton, Alberta.

4ADW saw our query about him in this column and thought he'd better report in person. He was in Edmonton on "summer holidays" a week or two ago (what a time for summer holidays, with about 20 inches of snow on the ground and Edmonton's transportation system tied up tight!). Jack is looking fine and tells us that he is stationed at Moose Jaw. Some of his operating mates are 4TX and 4RZ. RZ is a former Sovereign, Saskatchewan ham. And speaking of Sovereign, isn't that the home of Gert, 4FL?

The Edmonton gang have run up against a slight snag in their efforts to organize an ARP net in the city, and will be held up until they get things straightened out. 4AAD and 4XE handled the exams for the Signaling School just completed. 4AAD is very interested in home movies as a hobby and boasts a very fine library. Mickey and Orton (4WY) are both in Edmonton. Orton is in the RCAF as a Tradesman. We're glad to get Mickey back here again. Now we can continue with our NARC socials! 4BW, 4HT and 4LQ are writing their Part 1 Qualification exams for 2nd Lts. in the Reserve Army. 4WX, the Old Weather Man of Calgary, former CPR telegraph op. in the "Cow Town," is now in Vancouver at school, trying for his commercial ticket, after which he is hitting the Merchant Marine as an operator. 4AKK was married the other day. Yes, sir! The call AKK will now be associated with "Bob and Betty." Our sincere congrats to both.

PREFERENCE



Condenser engineering at its best.

AT THIS critical point of battle, with VICTORY within our grasp, we must be doubly sure of our selection of fighting equipment. That is why leading engineers prefer Hammarlund products.

THE HAMMARLUND MANUFACTURING CO., INC.
460 West 34th Street, New York, N. Y.

U. S. A. Calling

(Continued from page 40)

Control specialists, $2000 to $6500 — For the administration of the Controlled Materials Plan, persons with engineering or industrial production experience in electrical and communications equipment.

Engineering draftsmen, $1440 to $2600 — Men or women with six months or more drafting experience, or who have completed appropriate training. Applicants with some training gained from commercial art, etc., will be considered.

Radio mechanic-technicians, $1440 to $2300 — Persons with appropriate experience or training to construct, assemble, maintain, overhaul, repair or operate radio equipment of all types.

Training specialists, $2600 to $5600 — Persons qualified to plan training programs for a variety of technical and professional personnel in government service, also to act as consultants on training policies.

Junior engineers, $2000 — College women especially. Those lacking previous engineering study may qualify by completing the tuition-free ten-week ESMWT course.

Silent Keys

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

John Q. Adams, W3FPK, Baltimore, Md.
P/O N. K. Adams, RAF, G5NM, London, England
Peter D. Barnhart, W4EUN, Deland, Fla.
Frank J. Bednarz, RM2c, USN, W1LQK, North Grosvenordale, Conn.
Clifford E. Boardman, W6ASK, Santa Maria, Calif.
James D. Brewer, W8DCG, Columbus, Ohio
Robert T. Duncan, R.M., USN, W9IWB, Lombard, Ill.
Herman G. Fritschel, Milwaukee, Wis.
William E. Hanson, W1LJU, Trumbull, Conn.
Lt. F. Horky, Czech Forces in Great Britain, OK2HY, Brno-Bohunice, Czechoslovakia
John D. Martin, W8FWX, Rochester, N. Y.
John F. O'Neill, W1JAT, Framingham, Mass.
L/Tel. H. V. Prince, RNVR, G3UF, England
Lt. M. F. Somerville, RN, G5SV, Yarmouth, England
Arthur Tomlinson, ZD2H/G2QN, Lagos, Nigeria
Grimes R. Waller, W2CTS, New York, N. Y.
Capt. Gorry Wilson, VS1AN/G4FG, Singapore
James H. C. Wood, VK2ZM, Grafton, Australia

ELMER is right! If everyone does his share by buying bonds, getting a war job and supporting the war program wholeheartedly in every way, we will do the job in half the time.

PRECISION PRODUCTS FOR BETTER RADIO

HAMMARLUND

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

Happenings of the Month

(Continued from page 27)

"The organization of the American Radio Relay League, and the training which it had given its members for many years, prepared the amateurs of the United States and Canada for the war effort and permitted 30,000 skilled amateurs to enter the armed services. They were of tremendous importance, not only as the nucleus around which the expanding communication services were to build but because they had to carry almost the whole load until the training schools were organized and began to turn out new men. Radio operation and maintenance in the armed forces were vastly expedited. Because the amateurs were ready, the communications branches of the armed forces were ready for service at least a year earlier than they would have been. No one can estimate the additional cost to this effort if the amateurs, under ARRL leadership, had not been available."

One feature of the evening was a personal-experience story by a former amateur who turned to sea-going operating. Lt. Leonard Marshall, USCGR, ex-1BEZ, of Stamford, Conn., was on a tanker when she was torpedoed. They got away safely, but when his lifeboat was distant a mile and a half the tanker, which was loaded with aviation gasoline, let go. Despite the distance, the men were so seared by the great sheet of flame that Marshall was hospitalized for 72 days. He is now rarin' for more sea duty.

The VWOA dinners always bring out a brilliant galaxy of radio talent. This year's was a new high.

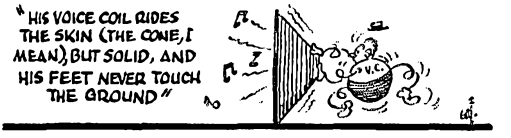
Who Killed the Signal?

(Continued from page 44)

forth, you know) sends my electrons with a one-two and right away they induce current into my secondary. You know what induction means, I hope?" he broke off.

"Yes, Power Transformer told us," Sleuth replied. "Go on."

"All rect, then. Well, that's about all there is to it. My secondary feeds the stuff to Loud Speaker's voice coil and Mr. Five-by-Five here starts jitterbugging so fast you can't tell whether he's a-comin' or a-goin'. His voice coil rides the skin (the cone, I mean), but solid, and his feet never touch the ground. The cone starts pushing air and that sets up sound waves. And there you are."



"I'm afraid I don't understand why the voice coil should start moving when you supply the current to it. None of the other Parts seem to

A laugh. A smoke. A last lingering look at the chart. It won't be long now.

You're rarin' to go, Tom. It isn't easy to sit back and tell funny stories . . . waiting for the call.

Maybe you're a little scared. Who wouldn't be? But you're ready.

You're ready because you're a fighter pilot with the best training, the best equipment and the best cause on earth.

There she goes, Tom! Good luck . . . and God bless you!

Overnight we changed at ALCO to the sort of setup that would get things ready for Tom. That meant going on a 24-hour basis, developing the speed, facilities, personnel for insuring maximum wartime production to the extent of ten times 1939 production. Unhappily, too, it meant deserting the AlSiMag needs of long-time ALCO friends of 40 years standing. We're geared to the war job now . . . and it's full speed ahead and all of it financed without government participation!

ARMY E NAVY

The ALCO plant was on the first list of 43 awards for excellence in quality and quantity of war producti

AlSiMag

TRADE MARK REGISTERED U. S. PATENT OFFICE

AMERICAN LAVA CORPORATION

CHATTANOOGA, TENNESSEE

(*Continued from page 56*)

have a mechanical reaction like that." The Sleuth was perplexed.

"A new one, hey?" Output Transformer retorted with delight. "Conversion of electrical energy into mechanical energy — that's what it is. You see, that pot of Speaker's is a big permanent magnet and the voice coil sits there in the middle of its field, halfway between the North and South poles. When I feed him a shot of current it unbalances the field and the magnetic attraction pulls the voice coil forward. The next half of the cycle yanks it back, and so it goes."

"Well, that seems clear enough. Now let me get it all straight. You take off the a.c. voltage from Output Tube's plate and feed it to Speaker's voice coil, which in turn vibrates his cone. Correct?"

"You're on the beam, maestro!"

"But why should Speaker need you there at all? Why can't Output Tube give him the Signal direct?"

"You sure ride a shallow groove, don'tcha, pal?" Output Transformer stared disgustedly. "Didn'tcha ever hear of impedance?"

"Impedance? No. Tell us about it."

"Easy to tell you never made the circuits! Why, that's our trade — the one thing all us Transformers have in common. We match impedances — any odds, high or low. In other words we take voltages and currents and multiply or divide 'em to make the answer come out right. Output Tube there delivers about 100 volts of a.c. at 20 mills — which means that he wants a load impedance of 5000 ohms to keep him happy. But Speaker can't use nothin' like that; it wouldn't push his cone any farther'n I could throw the chassis. His impedance is down around 5 ohms, meaning that it takes *puhlenty* of current to shake that voice coil of his. So I give him the same power I get from Output Tube — but at 33 times the current and only 3 volts or so."

"I understand now," the Sleuth nodded. "You change the voltage by having different numbers of turns in your windings, much like Power Transformer does."

"Yeah, I suppose so," Output Transformer acknowledged unwillingly. "If you want to compare me to a stuffy old longhair like him."

"That makes it clearer. I see now why Loud Speaker can't talk without you." The Sleuth proceeded with deceptive calm, "But it also occurs to me that this narrows down our search. Since the Signal was alive until it reached you, and since by your own admission Speaker talks only through you, by elimination it was you who killed the Signal!"

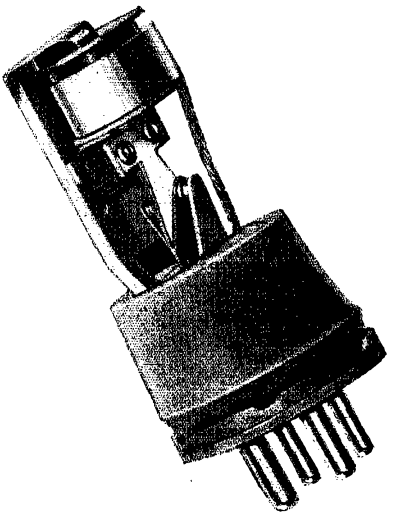
For the first time Output Transformer's expression of sneering disdain altered. "But the Signal *wasn't* alive until it reached me!" he protested. "It died way down the line!"

"We've traced the current all the way from Power Plug up through Output Tube to you, and it was okay everywhere else," the Sleuth objected.

(*Continued on page 60*)

MALLORY TECHNICAL DATA SHEET

Vibrator Operating Conditions



The modern radio vibrator is a miracle of endurance. Its tiny reed bends from side to side and back 115 times per second, 6900 times per minute, 414,000 times per hour. Under favorable operating conditions 1,000 hours or more of life may be secured, equivalent to over 414,000,000 double vibrations or cycles.

This amazing performance is possible only because a vibrator operates into a tuned circuit, so that voltage and current is at or near zero when the contact points make and break. The tuned circuit consists of one of the transformer windings, tuned by a capacitor commonly called the "buffer condenser."

Because it is so important to use the correct value of buffer condenser, wave form drawings will be shown in this and the subsequent data sheet. By comparing these with wave forms observed, the amateur can determine if his vibrator powered equipment is adjusted for maximum vibrator life. The wave forms can be viewed with an ordinary commercial service oscilloscope, connections being made to the primary winding of the power transformer.

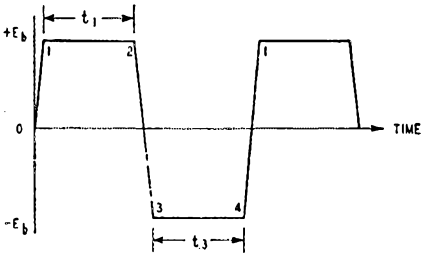


FIGURE 1

Figure 1 shows the "ideal" operating conditions. This wave form can be obtained in the laboratory, but is impractical in practice. The adjustment is excessively critical; furthermore this adjustment does not make allowance for the increase in contact spacing from wear.

The subsequent data sheet will give practical wave forms suitable for commercial use.

This advertisement is No. 4 of a series to acquaint you with the practical application of radio products.

(Continued from page 58)

"The *current*, yes — but not the *Signal*." A calculating look came over Output Transformer's sly face. "Listen, there's plenty of other Parts could have fingered the Signal before it got to me — or even to Output Tube. A regular Conga line of 'em!"

"But Output Tube said —"

At this point Ohm, who had been unusually silent, broke in. "Output Tube didn't actually *say* the Signal was alive until it reached him," he disputed. At this unexpected intercession by his usually overly-suspicious assistant, the Sleuth paused doubtfully.

"D'you know what you oughta do?" Output Transformer pressed his momentary advantage. "You oughta start investigating right where the Signal comes into the Set."

Volt started. 'That's right — the Antenna terminal. That was the third place we spoke of in the beginning, remember?" he prompted.

The Sleuth sighed. "Maybe you're right. It's true we haven't any direct proof that this — this zoot-suited character here did commit the crime — yet." He glanced around speculatively. "And I suppose we ought to look into every lead. There might be a connection somewhere. . . .

"But you stick close to your housing here," he flung back at the grinning Output Transformer. "If I find that there's anything distorted in your story, I'll heave you into the junk box so fast you'll wish you'd never been wound!"

(*To be Continued*)

Elementary A.C. Mathematics

(Continued from page 32)

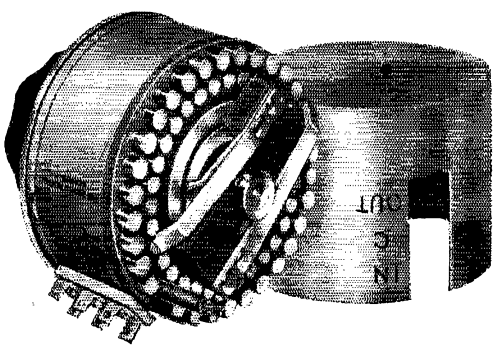
means "a difference," in this case the difference between the x values at the boundaries of each part), and erect ordinates at the boundaries of each of the parts. The first is erected at A and intersects the curve at P_1; its height is y_1. The second has a height of y_2, the third y_3, and so on until the nth ordinate, which has a height of y_n. Since we started at the left-hand end of the area, the height of the last ordinate, BP_2, is not considered; it forms the right-hand boundary of the last strip. Then from each point where an ordinate intersects the curve a horizontal line is drawn to the next ordinate, thereby forming a series of rectangles.

The area of the first rectangle is $y_1\Delta x$, the area of the second is $y_2\Delta x$, and so on to the nth rectangle, the area of which is $y_n\Delta x$. The sum of the areas of these rectangles is

$$y_1\Delta x + y_2\Delta x + y_3\Delta x + \ldots\ldots\ldots y_n\Delta x$$

the dots indicating that the remaining $y\Delta x$ products are to be filled in.

When a value is chosen for n, Δx is found by dividing the distance from A to B by n and the various values of y are found at each interval from the known relationship between x and y. Then substituting in the above expression and adding will give the approximate area. As n is allowed to increase without limit the width Δx of



U. S. Marine Corps Photo

STURDY

Our steel-nerved fighting men are making valuable contributions to world freedom in the strengthened battle lines of the United Nations.

With equal ruggedness, DAVEN attenuators, in actual combat zone equipment or in war production operation, are meeting the most critical standards for accurate and consistent performance.

A DAVEN catalog should be in your reference files. We list the most complete line of precision attenuators in the world; "Ladder," "T" type, "Balanced H" and potentiometer networks—both variable and fixed. Also, more than 80 models of Laboratory Test Equipment as well as Super DAVOHM precision type wire-wound resistors, with accuracies from ±1% to ±0.1%. A request will bring this catalog to you.

THE DAVEN COMPANY

158 SUMMIT STREET NEWARK, NEW JERSEY

(Continued from page 60)

the rectangles becomes smaller and approaches zero as a limit. The sum of the rectangular areas then approaches the actual area under the curve as a limit. This is indicated by writing

$$\text{Area} = \lim_{n \to \infty} \sum_{x=A}^{x=B} y\Delta x$$

The sign Σ indicates a summation, and the other notation shows that the summation is of all the possible values of $y\Delta x$ between the limits $x = B$ and $x = A$ when n (the number of possible values of y within the limits) approaches infinity.

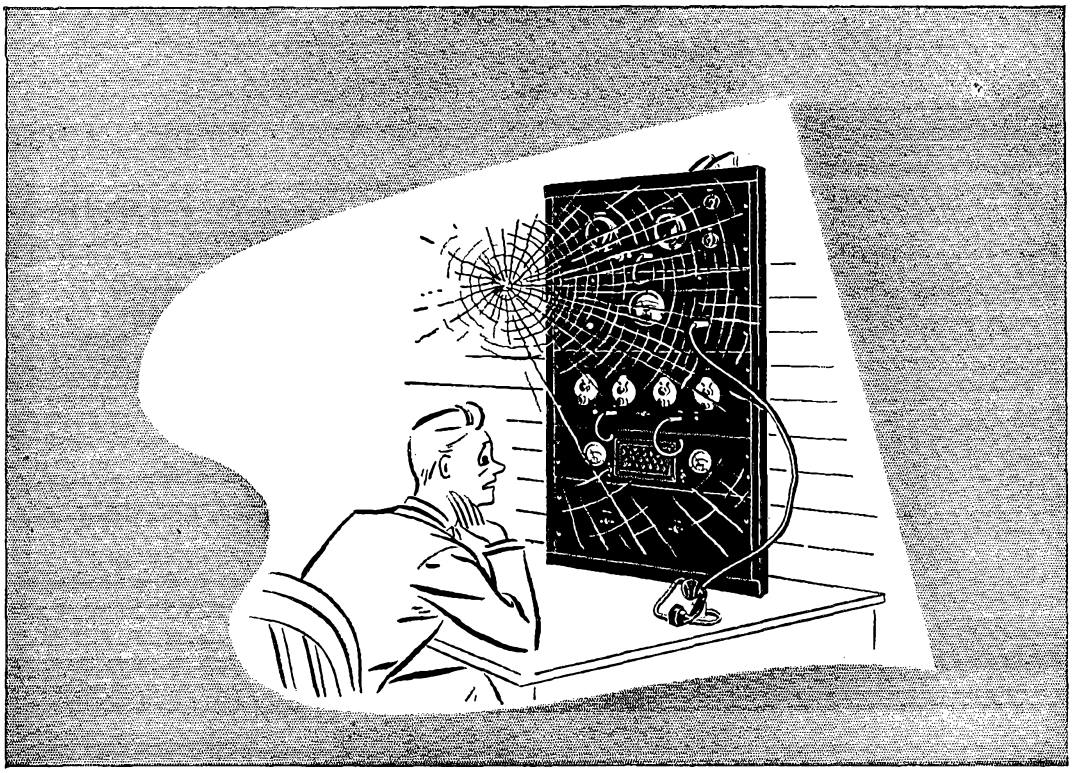
Since the value of y will depend upon the value of x (that is, y is a *function* of x) the expression $y\Delta x$ may be written in terms of x alone. The usual notation is $y = f(x)$, indicating that y is some (unnamed) function of x, so that $y\Delta x = f(x)\Delta x$. The actual function — for example, $y = f(x) = \sin x$, or $f(x) = x^2 + 5$, etc. — would be substituted in a specific case. The summation sign can be used as a "shorthand" way of indicating additions when n has a finite value, but in the case where n is allowed to approach infinity the limit can be indicated still more compactly:

$$\lim_{n \to \infty} \sum_{x=A}^{x=B} f(x)\Delta x = \int_A^B f(x)dx$$

The symbol $\int$ is called the *integral sign*, and the substitution of dx for Δx is made to indicate that Δx tends to zero. The right-hand member of the equation above is called the "integral of $f(x)dx$ from A to B."

The process of approaching a limit by summation of elemental areas is called *integration between limits*, and an expression such as that above where the upper and lower limits are indicated by writing them at the top and bottom, respectively, of the integral sign is called a *definite integral*. From the graphical standpoint, the definite integral always represents an area under a curve. The area must be interpreted physically from the known conditions of the problem. For example, the area under the half cycle of the sine curve which we found graphically in determining the average current is the product of current and time, the former being expressed in terms of the sine of an angle and the latter in terms of angle — which, as explained earlier, is simply a convenient measure of time. The product of current and time is a quantity of electricity, hence if appropriate units are used (amperes, seconds) the area represents a certain number of coulombs of electricity. Similarly, in finding the effective value the curve used showed the relative power at every instant of time during a cycle, so that the area under the curve represents the product of power and time. This product is work or energy, hence the area represents so many joules or watt-seconds when appropriate values and units are substituted.

(This is Part III of the article. Part IV will appear in an early issue of QST.*—Editor.)*



YOU THOUGHT THIS WORTH FIGHTING FOR ...WAIT 'TIL YOU SEE WHAT'S COOKING!

OF COURSE it isn't merely because he had to go off the air that the ham is fighting mad. Your amateur operator is a patriot first, and, the record shows, a (censored) good one. Yet that silent rig gathering dust in the old ham shack stands for a lot of principles the Axis would like to destroy. Freedom of speech, for one thing. Maybe that's why this country's radio amateurs are in the war up to the chin.

With their talents and skill, hams in our Armed Forces are handling traffic on some of the most important circuits. They're in factories and laboratories speeding production of radio equipment. They're in schools instructing urgently needed operators. They're in government stations and offices where their specialized abilities are helping to get the war over.

But even as the ham serves his country, things are happening to amateur radio. New ideas, improved equipment, advanced techniques — developments that, ordinarily, would not have come along for a generation — are in actual operation today, stimulated by war. And many of the brains responsible for these advancements belong to hams!

What the new developments in amateur radio are must remain a military secret. But this much can be told — you're going to have a "sweetheart" of a rig, OM, when this is over. One of the reasons is Isolantite*. With its unusual combination of properties — high strength, dimensional precision, electrical efficiency, non-absorption of moisture — this new-day insulation is destined to play an important part in post-war radio communication — for *it's in there fighting today.*

ISOLANTITE

CERAMIC INSULATORS

ISOLANTITE INC., BELLEVILLE, NEW JERSEY

*Registered trade-name for the products of Isolantite Inc.

ATLANTIC DIVISION

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — *SCM, Hermann E. Hobbs, W3CIZ — BAK* has moved to Wilmington, Del., 123 W. 30th Street. IRR located in Georgetown, Del., with public schools. AXP is a captain in the Air Corps and located in Florida, as instructor in instrument flying and navigation. Jean Hudson is teaching several code classes at the Manhattanville Girls' College in NYC. She is also teaching a class of air raid wardens and is active in the WERS with a walkie-talkie. 2MRL is with 17th sig. svc. co., room 5A, 882 Pentagon Bldg. 2LZR is with WU teletype repairs. 2LMN located in Washington, D. C. CVA was inducted into the Army on Feb. 2nd. EQK has WERS license and was appointed executive operator for Md. OCD.

> Many of us will miss John Q. Adams, W3FPK, who died at his post of radio dispatcher in the Baltimore Police Department on January 29th. He was 47 years old.

SOUTHERN NEW JERSEY — Acting SCM, Ray Tomlinson, W3GCU — Asst. SCM, ZI; Regional EC in charge of Emergency Coördination, BAQ. How about you fellows who hold active Emergency Coördinators' appointments dropping a line or two to me, so I can report your activities in the column? I know there is quite some WERS work in progress in different localities in this Section, but don't seem to be able to get any info on any of it except from a couple of communities. What say? It has been unofficially reported that some ECs have either moved from the Section, or have reported for duty in some branch of the fighting forces. Will some one please let me know who and where they are? Lt. Allen, CCO, upon returning to his post after a furlough last month, found himself replaced as base communications officer by another officer. Les can still be reached by mail at the same address previously reported. ARN has been transferred to Norfolk, Va., and can be addressed Anthony S. Rura, RT3c, D.C.O., N.O.B., Norfolk, Va. Tony is awaiting transfer to Navy radio school. ABS reports that all the students in his class at Hillsborough Twp. radio school have completed their studies, and one has his third-class 'phone ticket. Others are waiting for Stan *to give the exams after the Twp. has received its* WERS operating license. All these students desiring amateur licenses are building equipment to operate wired wireless to help them advance in code practice. ABS, ACC and several other non-amateurs are now operating on 175 kc. quite successfully over various distances. ASQ and several amateurs, also some prospective hams in and around Hamilton Square, are operating land-line rigs very successfully over distances covering approximately five square miles. ASQ and GCU are endeavoring to establish contact, but have not been able to do so because of capacitors on the lines at a transformer station between them. JNO and prospective hams in Trenton are getting fired up for land-line, and JAG is working out quite well. The regular monthly meeting of the South Jersey Radio Association was held at Hotel Walt Whitman in Camden, N. J., on February 18th. FDF continued with his radio code-theory class and an ARRL 1943 Handbook and two QST radio course booklets were given at raffle. ZI had a portable AC gas-driven plant, but after looking for it found the Briggs & Stratton engine perking on Ed Jr's skooter. We welcome Teresa Lanzalotti of Williamstown, N. J., into our ranks of YL ops. Teresa has been licensed for one year now, having been issued an op's ticket but no call, as yet. She is now working as a Navy radio inspectress at RCA, Camden, and hopes to be on the air plenty after the war. IOW says he is following things via *QST*, and appreciates receiving news from home. Tony is sgt. in charge of radio, somewhere with our Armed Forces. *Jimmy Hassal, another prospective ham, now in the Air Corps,* has been transferred, and letters will reach him addressed Pvt. Arthur G. Hassal, Hq. 314th Troop Carrier Command, Sedalia Army Air Field, Warrensburg, Mo. Jimmy is "pushing" airplanes up and down. We all join in sympathy with EED and his XYL, Charlotte, in their bereavement, the death of the new jr. op., age 1 month, 2 days. The February meeting of the DVRA was held at the home of the sgt. at arms, JAG. Plans were discussed, after which the shack was looked over, with much interest centered about Pierre's land-line equipment. BAQ has not been heard from for some time. GCU, who is a movie op, came across several amateur calls scratched on the metal reels carrying the film recently, which shows that hams will pass along their handle some way or other. The calls included four eastern states, New Jersey, Pennsylvania, Connecticut and Rhode Island. This also shows that there are several movie op-hams. GRW, ensign radio op. in Merchant Marine who was "silent" for so long, returned recently. Socony will route mail to correct ship. ITS is at Palmer Labs. Till next time, 73.

WESTERN PENNSYLVANIA — SCM, E. A. Krall, W8CKO — Asst. SCM, in charge of EC, Theresa McLaughlin, W8VYU. Amateur ranks continue to thin out in W. Pa., due to the call for men with radio experience. Any information in connection with boys in the service will be cheerfully printed on this page. Just send in their name, call, and branch of service. WERS work in the nine southwestern counties of Pa. is still rather slow in functioning and faces further delay because of Mr. D. A. Myers, radio aide, entering the service as a lt. We hope to see an amateur appointed in his place, one with aggressiveness and spirit, who will be capable in WERS activity. Dic Love, AEC, has been advanced to captain, and is on the staff of F. E. Handy. Wick, KWA, expects to be an ensign soon, and is in Chicago teaching radio. PFV is in the Navy and is chief radio serviceman for equipment on torpedo boats. He is stationed at the base on the Atlantic seaboard. OMG and OWF are both in the service, but we do not know where. TTD now has his XLY with him in Missouri, and had the pleasure of entertaining 7WR. NCJ and XLY are still copying code stations and both are busy on AWS and CD work. AMY is still doing strategic work in connection with radio and is located in Phila. Tom Thompson is attending radio school at Ft. Monmouth. Alec Linsay is also at Monmouth and is on the faculty as a lt. instructor. QAN is an instructor master sgt. at Keesler Field. TVA is at Camp Geiger. Emergency Coördinators should note the expiration date on their certificates and send to the SCM for renewal. We will hold off cancellation of appointments until the end of April 1943. Big things are in the offing so all ECs should send in for the necessary signature and appointment. Amateurs wishing to become ECs should contact VYU, 131 Talbot Ave., Greensburgh, Pa. My term of office as SCM expired September 1942. Amateurs of the League should, in order to have an official SCM, send in nominating petitions as outlined in *QST* and have an election so that the Section can be officially represented.

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES — The city of Phila. reports receiving their WERS license for seven fixed stations. The call assigned is WKIB. Their first test was run on February 21st. Some of the stations were putting out a swell signal as far as Ardmore, Pa., where they were R9 plus. Lower Merion received licenses for forty portable mobiles, some of which were tested Feb. 21st. Marple township has been on definitely, and it is rumored that Abington has their license. IKW was commissioned ensign in the Navy recently. Considerable activity continues on 160-kc. wired wireless, but few reports are received. News of your various radio activities is still invited for printing here. 73. — *Jerry Mathis, W3BES.*

CENTRAL DIVISION

INDIANA — SCM, LeRoy T. Waggoner, W9YMV — Indiana War Emergency Radio Service licensees now include Anderson, Fort Wayne, Highland, Mishawaka and Richmond. Application for WERS license has been made by Sullivan, Bloomington, and Gary. Numerous other communities have their license applications partially completed. Mr. Philip Gibbs, fifth regional communications coördinator; Lieut. Walter Mentzer, Indiana communications coördinator, and Mr. Zellon Audritsch, his assistant, recently made a tour through the southern half of the state in behalf of WERS. Included on their itinerary were stops at Evansville, Terre Haute, Vincennes and Jeffersonville. Prime purpose of the trip was to urge local CD Corps to

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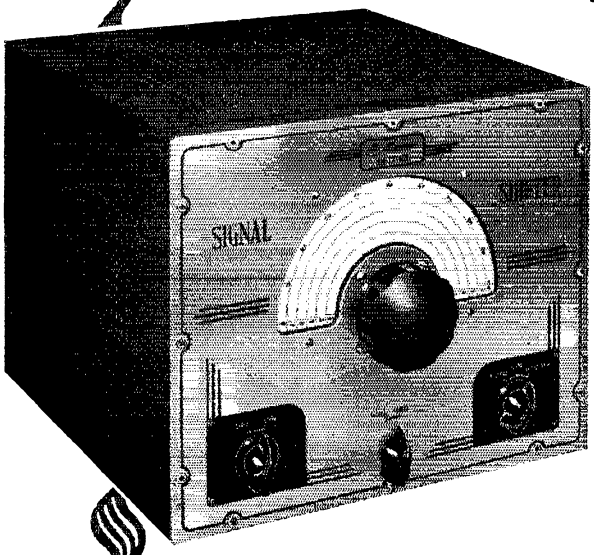

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avail themselves of the facilities offered for War Emergency Radio Service, and to extend aid in the preparation and submission of applications for WERS licenses. Favorable results are expected to follow this trip, as a similar trip in another part of the state a few weeks ago proved quite fruitful. Mishawaka has been assigned the WERS call letters WKBF. Elaborate plans have been formulated for WERS operation in Mishawaka, and many units have been constructed. The transmitter at the control uses an 80-meter xtal, tri-tet oscillator, two 6L6 doublers, and an 809 doubling up to 112 Mc. The rest of the rigs employ 6J5's, 7A4's, 7C5's, 6V6's and HY75. All are home built except one, which is a converted commercially built rig. Richmond has been running tests on antennas during test periods. Transmitter-receiver combinations were found more stable than transceivers. Highland has been assigned WKHY as call letters for its WERS setup. SNF informs us that two transmitters are authorized at present. Neil, recently appointed radio aide, has promised further details, and results there will show what may be accomplished in a small town by WERS. WQA is arranging to conduct a resident examination for restricted radiotelephone permits in Bloomington. NWN, radio aide at Logansport, says the city fathers have voted $500 for WERS. With that, he hopes to start the ball rolling with Abbott TR4 units. Indianapolis proposes to have 32 WERS units to begin, seven of which will be fixed stations and the rest portable or mobile. A comprehensive plan has been made for the operation and procedure of these units, and application for license will be submitted momentarily. Portable rigs using 7A4's or similar tubes as oscillators in transreceivers will be used. It will be interesting to learn if these low-powered rigs are successful. SVH has been appointed radio aide for Elkhart County. NKB advises that WERS is looking up in Michigan City. SWH, EC at Fort Wayne, writes that they are holding contacts with WERS over a radius of seven miles, which more than covers the city. They also communicate with New Haven, about six miles east of Fort Wayne. A number of new WERS operating permits have been issued to Fort Wayne hams. TCT is looking for help on WERS at Saint Paul and vicinity. HLO is now lieut. with the Signal Corps at Fort Monmouth. PQL was home on a furlough recently. Dick is now in Seattle, Wash. JIW, LYY, DPL, EED and HDB are teaching radio at Valparaiso. YWE is studying for a radiotelephone second ticket. HAI has been promoted to chief warrant officer with the Army Air Force. NZH was home on furlough. SAG has ideal situation for WERS in the Lafayette area with two cities on two hills, and any spot in between conceivably within coverage of a station on either hill. Lots of highly trained technical men at Purdue are available as operators until the draft calls them. Art hopes to have all WERS organization complete by the time he is due to leave for a position at M.I.T. MBV has found it necessary to resign as EC at Terre Haute. Doc has accomplished a great deal in organizing the hams of that area, and his resignation was accepted with regret. WOD, U. S. Army, is now a proud father. VGT is working in an experimental laboratory in Chicago. VFC is back in the States from Peru, where he worked for Pan-American Airways. NVP is a RR telegrapher at Colfax, Ind. DFE is now with RCA at Indianapolis. ZYK and AB tried out a newly built frequency meter and, at first test, got 14,500 kc. to 14,000 kc. on just 180 degrees of dial. GOE has been promoted to major. WDV is in Officers' Training School. NKB advises that four hams are on "the lines" with wired wireless in Michigan City. DDT visited NVA and compared notes about WERS. Ex-FSG was promoted to major recently. ESH, now in New Jersey, has a daughter added to his family of boys. BJT is fully recovered from his recent illness, and is back in school and one of the Mishawaka WERS operators. JJC is teaching drafting. WRC is getting WERS-conscious. Murray wonders about the possibilities of getting WERS started in Columbus. The draft situation presents a problem in maintaining a full roster of Emergency Coördinators. At a time such as this, it is imperative that every community have a qualified ham to act as EC. The following towns and cities are among those not now having ECs: Angola, Attica, Aurora, Bedford, Brazil, Charlestown, Clinton, Connersville, Crawfordsville, Danville, Delphi, East Chicago, Elwood, Frankfort, Gas City, Greensburg, Huntingburg, Jeffersonville, Kokomo, LaPorte, Linton, Madison, Monticello, Noblesville, Pendleton, Peru, Portland, Princeton, Rensselaer, Rockville, Rushville, Seymour and Shelbyville. If you live in or near any of these communities, drop me a line applying for the EC appointment. If you know of a qualified ham in any of these localities, recommend him for the post. If you are in doubt as to whether your own community is represented by an EC, drop me a card, and I'll be glad to pass along that information. Remember that from Norway, for instance, there is little difference in the flying distance to Seattle, Indianapolis, or New York. War Emergency Radio Service is important here as well as everywhere. A qualified Emergency Coördinator may be invaluable in the work of organizing WERS in his community. 73.— *Roy.*

MICHIGAN — SCM, Harold C. Bird, W8DPE — Now it can be told. The following cities in Michigan have been licensed in WERS. Detroit, Grand Rapids and Lansing, with Muskegon and Pontiac soon to follow. Grand Rapids: Lewis D. Brewer was appointed radio aide with RFW, IDZ, LAD, NCB, APO, LLP, SOO, BJD, AHM, ECO, SPX, SVR, AGN, KWF, OTG, MID and GEL. These men are all holding WERS certificates and are conducting tests. The call for Grand Rapids is WKHA. Lansing: Reports conducting tests on Sundays with very satisfying results. Detroit: Reports that tests are satisfactory and they are receiving nice publicity from the OCD. OCC writes he is doing maintenance work. Tried exams in electronics, but did not make the grade in math. Maurice reports no activity in WERS there as the sheriff's department in handling all the communication with their system. NVH, a familiar figure at hamfests, now with armed forces somewhere. He was a familiar figure at hamfests. AQZ, Sgt. Andy Reichert, reports that he is a chief opr. at one of our Army posts. Lee M. Fenton, formerly 9HGW, is now with armed forces and reports that he has WAACs helping him. He seems to be enjoying the task of instruction! UGR says he is affiliating himself with the Detroit WERS group. He is also working on an ECO for publication soon in *QST*. FWU writes he is anxious to get back with his friends on the ether. Following reports from DARA meetings: BIU wondering about his teaching assignment. GP reports arrival of girl born Jan. 20th. MCB also reports the arrival of a boy. DSQ still as good as could be and keeps plugging along. CLL says he is unable to take part in WERS because of his business. ILP sends in nice contribution to bulletin. WFA renewed his ARRL membership. TMN reports nice progress being made with their schools. One class graduated and another one is ready to graduate. The Legion, Edison Radio, and DARA are co-sponsors of this program. The Edison Company donated a room and equipped it fully for this work. They are also opening another school in the northwestern section of the city with possibility of another in Ferndale section. The Edison Club recently signed up nine members for WERS, in Detroit. VKU, Pvt. Joseph W. Mazur, sends in membership to ARRL. KOS says he has been in Benton Harbor for a year and has not met any hams yet. FX agrees with B. P. Hansen's letter in recent *QST*. CSL reports taking down his antenna and selling his meters. PYP reports HKT and old QMN'er are now sailing the broad oceans. He has touched many DX points. Ed is also QRL teaching several code classes. SDH is working for Consolidated in San Diego and training at Hollywood Beach Hotel. JZD is working in one of the local plants as electrician. LTS is working in electrical work on vital equipment. EGT is now with Radio Division of Conservation Department, and has been permanently assigned. UFH is now working for his uncle in AAF and is located in Texas. He now holds an officer's rating in his work. Muskegon says WERS very slow because of lack of personnel there. VQN joined the CAP as communications officer. 9IMU/8WXB is now aircraft communicator with the CAA at the Municipal Airport in Cleveland, Ohio. Thanks, gang, for your increasing reports. Keep them coming and this column will grow. 73. — *Hal.*

DAKOTA DIVISION

NORTH DAKOTA — SCM, John McBride, W9YVF — Interesting letter from ANL, who is now a 1st lt. in the Signal Corps, APO 709, c/o PM San Francisco, Calif., says that the North Dakota regiment, the 164th, was the first of Army troops to start the offensive against the Japs on a South Pacific island. Says the following hams deserve special recognition for a fine job done: UHM, HSR, IXC, FCC (Minn.), DUT, LWU, HRU, 4HQQ. Elmer would like to hear from the gang, especially RPJ, YOO and CHB. Your SCM is now a junior instructor in receivers at the Army Air Forces Technical School at Sioux Falls, So. Dak.

SOUTH DAKOTA — SCM, P. H. Schultz, W9QVY — To keep up our space in *QST*, I would like to urge each ham to send in any news of interest. It will be passed on to

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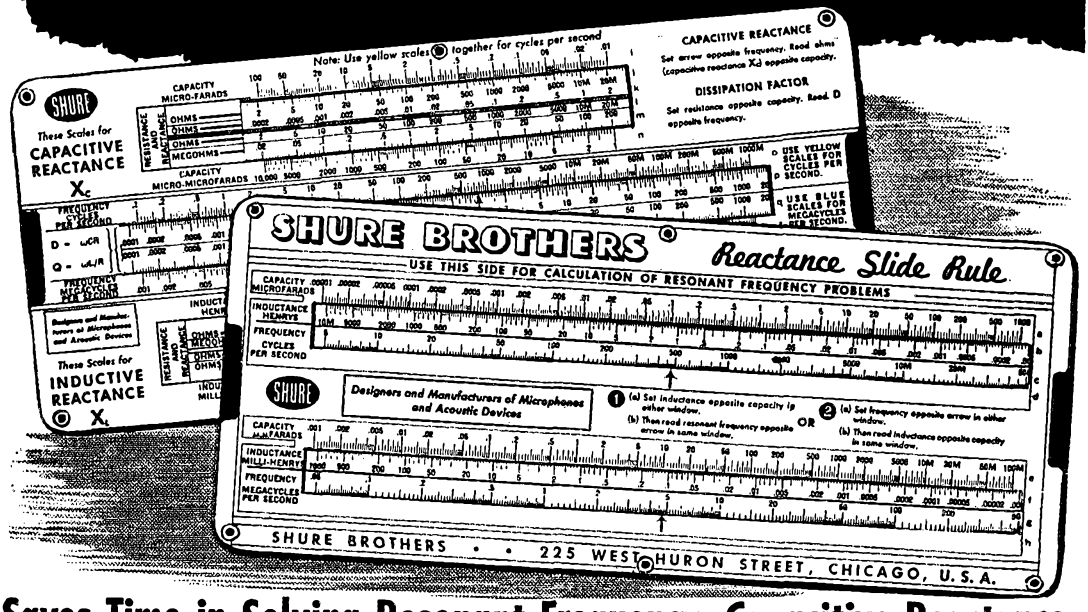

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Resonant Frequency problems	$\omega^2 LC = 1$	1. Resonant Frequency if L and C are known 2. Various L and C values for desired resonant frequency	**Frequency** 5 cycles to 500 megacycles **Capacitance** .001 mmf. to 1,000 mf. **Inductance** .00001 mh. to 10,000 henrys
BACK			
Reactance problems	$X_L = 2\pi fL$ $X_C = \frac{1}{2\pi fC}$ $Q = \frac{2\pi fL}{R}$ $D = 2\pi fCR$	Any single unknown variable, providing remaining variables are known in equations for Inductive Reactance, Capacitive Reactance, Coil "Q", Dissipation Factor	**Frequency** 0.1 cycle to 10,000 megacycles **Capacitance** 1 mmf. to 100 mf. **Inductance** .001 mh. to 100 henrys

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others if I have their location. Ex-SCM VOD is now Lt. A. L. Russell (DC), USNR, Naval Reserve Midshipman School, Northwestern University, Chicago, Ill. He is living at present at the Lawson YMCA in Chicago, and says they are keeping him pretty busy. He says "hello" to the gang. DNV is now at Murdo, and says that STI has charge of communications section radio and telephone at Camp Haan, Calif. STI's rank is tech. sgt., Hdqtrs. Btry. 109 CA (AA), Camp Haan, Calif. PVC, formerly in the CCC at Chamberlain, is now radio op. on a tanker out of Texas ports. Likes his work and wages, has good food and lodgings, but wishes his transmitters could be used in cases other than those of acute distress. His card was postmarked Corpus Christi, Texas. GZU is in radio training school with Signal Corps. OXC left on another defense job, after being in Pierre a while. JBL is now 2nd lt. in the 824th Signal Service Co. at Camp Crowder, Mo. He has been raised from a "buck private" to 2nd lt. after 11 months of Army training, and has acquired an XYL in that time. He says Lt. Mattison, USH, and NWP, have been in Ireland, and send their 73 to the gang. At last report, USH and NWP were both at Fort Monmouth. 73 for now, gang, and keep sending in the reports.

NORTHERN MINNESOTA — SCM, Armond D. Brattland, W9FUZ — Welcome reports this month have arrived from several sources, but more — many more, please! Craig Campbell (opr. license only) of Park Rapids reports that he is working on a mill to build up his code speed. RZX is working as inspector for a Chicago concern and recently acquired a 1st class 'phone ticket. ICU, a steady on '01 MSN, is still in New Jersey and in charge of his department. A report from JNC, now with Northwest up at Whitehorse, Canada, advises that TKX is their chief op. up there. Another pleasant surprise was a letter from ex-EPD, now Box 428, Mt. Vernon, Ill. Ken would appreciate a line from some of the gang. His big news is a jr. op, several months old. OPA reports UCA now at Corpus Christi with U.S.N.T.S. (A.R.M.), where he recently met JKO and WRX. They report YXL across. DEJ will soon graduate from Gallups Is. KVO is in radio as RT2/c stationed at Great Lakes. While there he met BRC who was waiting for assignment to another school. OPA, as usual, is busy training operators, and graduated a couple of radiotelephone ops recently and has more on the way. One item of welcome news is that many are renewing their ARRL memberships and keeping in touch. Don't fail to let your SCM know of those who have recently acquired amateur operator's licenses. A recent one at present is "Jim" Martinson of Ortonville, now employed in Mpls. Congrats go to PTU who returned from the South Pacific battle area, with a rank of Major in Army Air Corps and an Australian XYL, for a stay at home in Dilworth, Minn. Luck es 73. — Army.

SOUTHERN MINNESOTA — SCM, Millard L. Bender, W9YNQ — If you will drop a line, no matter where you are located, we will try and bat out a batch of news for all. We got a card from lt. (jg) F. C. Kramer, USNR in Brunswick, Me., where he is attending Bowdoin College. He likes the Navy fine, and says he and the Mrs. are living like royalty. The lad he sold his gear to is attending radio classes in Minneapolis. Larson, DH of Mpls., is there with him. He has met lots of fellows he had worked when he was on TL "A", and was surprised to see his QSL on the wall of the college station. He worked them in 1934. GSL is 1st lt. in the Army, located in California. We extend our sympathy on the death of his father. Martin Peterson (civilian) graduates from Air Force Radio Instructor School, St. Louis, Mo., Feb. 17th, then teaches in Chicago. ZAD is "deep in the heart of Texas," attending radio school. He reports it a rather stiff course, but has high hopes of making it. And from what we know of him, he will. He "dood it" about the middle of Feb., and got himself married. Then on top of that, he is a new uncle. A nice long, newsy letter from WAO says he is in radio work, stationed on the West Coast. WAA, RT1c, is located in New Orleans for the present. KHM, in Air Corps, is on the West Coast in radio. WWG is radio instructor at Army air base at Chicago. VPP is in Air Forces, branch unknown. LON is in the Signal Corps. Bob Cross and Clinton Knapp, former engineers at KROC, are both in the Signal Corps at Washington, D. C. The usually newsy letter from KUI, W/O in charge of communications at Camp Crowder, Mo., says: "Don't get a chance to get my bug in the circuits any more." KOB is hitting the ball at U. of St. Louis, studying for radio engineering. Kyle McClary graduated from his preliminary studies and now is attending the U. of M. WBL, HCY, IYJ, ex-ASF and ex-LDQ are all radio instructors at Signal Corps School, Lincoln H. S., at Mankato. KUI says it isn't any trick to get out on any company street at Crowder and whistle CQ, and have several hams answer. Most of them are instructors there.

DELTA DIVISION

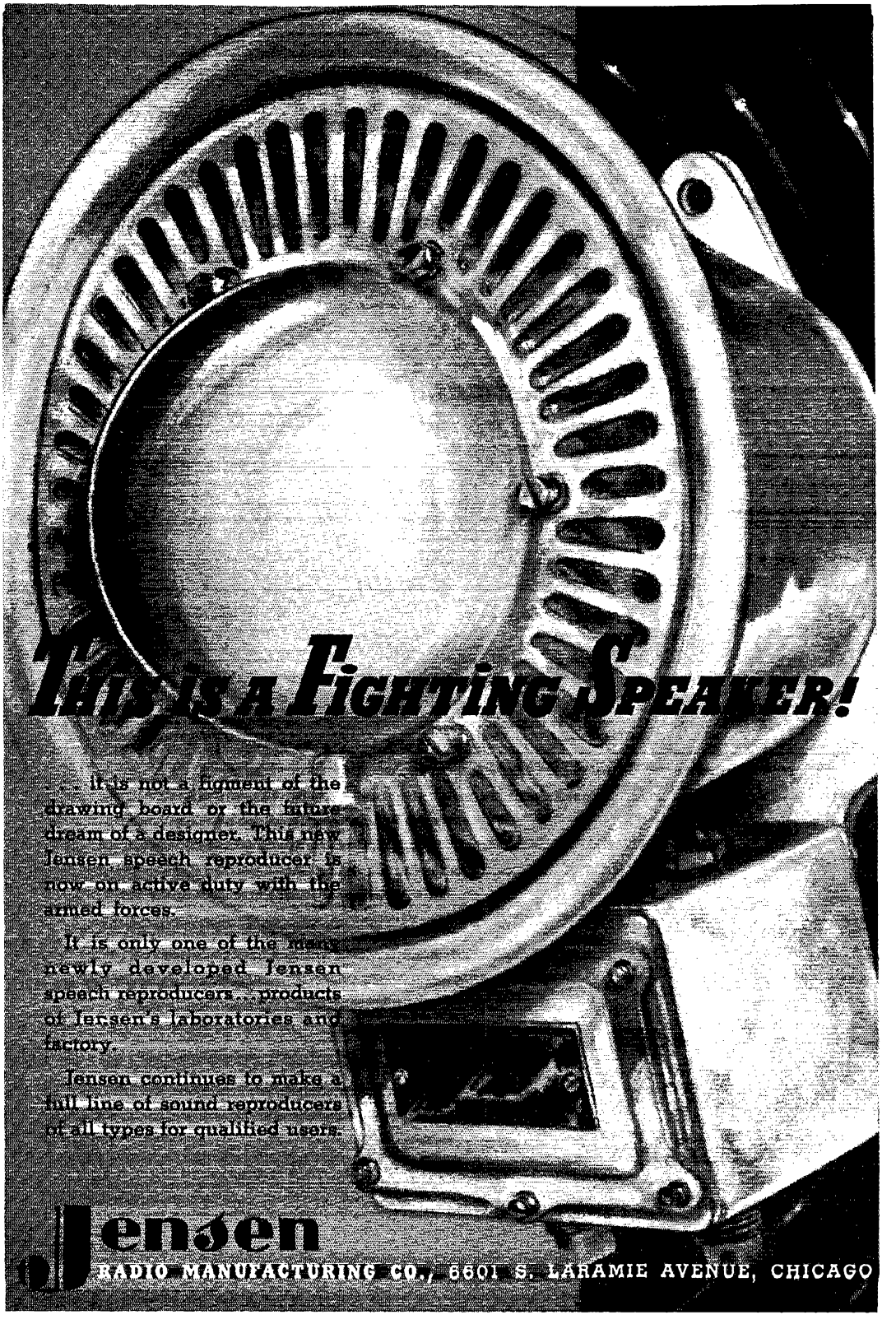
ARKANSAS — SCM, Ed Beck, W5GED — At this time we would like to drop a word of encouragement to those of you who may possibly be interested in becoming an Emergency Coördinator. As you may already know, this is the only appointive office remaining in the field for the duration, and it is also a very important one which can hold a lot of interesting work for any "live wire" amateur who is still interested in giving a hand to keep things stirring. At present the records show that there are no active EC appointments, and there is ample room for at least one in EVERY community. Think it over carefully, fellows, and if you are satisfied that you could and would like to assist in delivering the goods, just drop a line to your SCM and we will get together pronto. IDQ announces the arrival of a new YL Jr. op at the shack since last report. GYI and the XYL visited recently in Little Rock, for a few days, while the OM was on leave. Our sympathy again goes to JHL at the recent loss of his father-in-law. IEK changed positions recently and threw in his lot with the A.V.G. GNV is again performing as "cop op" while negotiating with FCC. FPU has finished his work in Monticello and is surveying the situation prior to his next move. LD was last heard to be with the Navy and attending school at Boston. At last account, CBK was located in the M.I.T. labs in Maryland. DQB, formerly with FCC in Little Rock, is now in the same line of work in San Leandro. CVO tells us he has annexed his other stripe and is deriving a great deal of benefit from his present work. Among his other undertakings, FXO has progressed to a point where he does a very nice job with a couple of different numbers on the piano. CPV says it may be a long time before he again treads Arkansas soil, because he is very contentedly located in the radio division of the Signal Corps at Ft. Monmouth, along with some of the rest of our boys. ICN recently broke away from his work long enough to visit home, but was rather unfortunate in having been attended by illness during the time. ENH is pounding brass for the Army while dickering with FCC for more desirable employment. 73 and all the best. — *Ed.*

TENNESSEE — SCM, James B. Witt, W4SP — GMX sent in his resignation as EC for Norris and Anderson County, as he expects transfer to employment in N. J. RO has taken a job with the University of California at Berkeley in the radiation laboratory. PGJ sent in nice report on the WERS setup in Kingsport. They received their license Nov. 9th, 1942, WJTV-1 through WJTV-9, and state that they are getting fb coöperation from the local CDC officials. The operators are GML, EUM, GFO, FCU, GHL, GNR, PGS, GOZ and IIM. Eight others have taken radiotelephone 3rd class examination in order to qualify for WERS, but have not heard from FCC. They are using a TR-4 at control station, and 8DK-3 portables equipped with vibrapacks and 350-watt, gasoline-driven, 110-v. AC generator for auxiliary power at control station. Knoxville Communications Club still have their code class going fb.

MIDWEST DIVISION

KANSAS — SCM, Alvin B. Unruh, W9AWP — HNI has accepted a radio job with Pan American Airways. OZN moved to Wichita; he expects to see service soon. TTU writes that he is having fun in Hawaii as one of Uncle Sam's doughboys. QQI works in radio department at Boeing's Wichita plant. DJL, HCU and others are working with wired wireless. KAM is radio operator with Northwest Airlines in the frozen Northland of B. C., Canada. He reports: "Most of the boys are hams, but not from Kansas." He formerly worked 7- and 3.5-Mc. bands in Neodesha. WKA is with Boeing and attends advanced ESMWT class. — *Abie.*

NEBRASKA — SCM, R. E. Olmsted, W9POB — If any of you ex-hams, broken-down teachers, etc., can teach radio theory, direct shop work in radio construction and servicing, and want a job, write to Mr. Arthur J. Sigel, our superintendent. Had a long letter from ex-SCM Sam Wallace, who says that he wishes he had taken up golf instead of radio. Since December 7th he has just pulled the plugs and let 'er set. "Likker" too high and no coffee, and working long hours for the UP. Sam owns the only 852 in the world that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works best without any grid mils. A card from Dean Hagemeister, KQX, states that he is aide for WERS at Potter, and WUV is working on equipment for the net. YYV is grinding xtals at Ogallala plant, and HAF is organizing WERS at Grant. YXR sold his Hallicrafter receiver to the Signal Corps. BXH writes from a southern post that he is in the Navy and will attend radio school. Since Dec. 7th he has served with FCC at Grand Island and Portland before "jining." Stan Sievers is on hand with a report, and says he is busy teaching CW to Arline, installing two-way radio in planes, and teaching defense classes. He also reports that MGV, IVT and LLP are in the Service somewhere, and that he has a yen to serve in the Signal Corps, cleaning out the pigeon lofts. MPY gives us the dope on several members of the NB Net: GHM at Wright Field; YMU with 7th Service Command; VBX at Hill Field; EGJ in Service on West Coast, and MPY at Peterson Field in Colorado. A fine letter from John Wieting, at Lakehurst, says YNO in Naval School on the East Coast; YRF working at Bureau of Standards; WGL recently married and also made an officer in AAF. OHU, transferred recently from Pueblo, is at U. S. Airways Stn. at Fort Bridger. PNX is with U. S. Airways Stn. at North Platte. Thanks for the offers of the radio parts we need so badly, but much more is requested. Regards to all.—*Pop.*

MISSOURI — Acting SCM, Letha E. Allendorf, W9OUD — If this turns out to be a column I'll probably owe some royalties to that course in short story writing that I took several years ago. Reminds me of the time CJR said he failed to turn in a report while he was SCM because he wasn't Edgar Rice Burroughs. It isn't quite that bad; I do have three cards and one letter and a few bits of gossip gathered from here and there. OWQ is teaching a class in code at the high school. The course is being offered seniors one hour each school day and has 22 members. 6HHY, ex-9JWI, is still teaching code at Fort Monmouth. 3JSL, ex-9ZJB, is with the Naval Research Lab. in Washington, D. C., and visited 9AHZ, who is with Bell Lab. in NYC. He wants to hear from all the KC gang, especially HIC, HCL, TCR, and JWI. KUI, operator Jim from 9BNT, is on his second year as a Missourian. He is located at Camp Crowder where he operates the post telegraph station and radio station WVCN. His first transfer from Omaha was to Ft. Leonard Wood in January, 1942. He says Captain Newhouse is in Australia. 4HLN, ex-9IGW, left PAA to take a job as op on a tanker bound for somewhere. Ex-9SRH is home again, plans a bit indefinite. OUD, with no skeletons to rattle, no traffic to handle, thinks of raising chickens to help the war effort. Or maybe you think she's just laid an egg as a reporter? Here's 73, and how about some dope for next issue? Good luck to you all.

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Edmund R. Fraser, W1KQY — JBV, formerly of Bridgeport, is now a sgt. in the Army Air Forces, located in New York. He has been in the service two years, and sends his 73 to the gang. EFW, former EC and nutmeg net member, writes from Maine, where he is serving with the CAP, that HVF is RM1c, USN, in Alaska; FKR is at sea; IKE, a former nutmeg net member, is now an ensign, USN; AH is lt. comdr., and GYT has fully recovered from a recent operation and is now back in Meriden. KKS, former EC and control on nutmeg net, writes from the West Coast, where he is working for FCC, that he recently met 6BAM and 6QG. Bill says he is going to drag back a couple of 200-foot redwoods for antenna masts, when he returns. Anyone knowing KKS wouldn't be surprised if he did. Hi. ALW, WERS district radio aide of Norwich, has 11 units in operation and is working very satisfactory. Examination of 20 candidates for restricted radiotelephone permits was recently held with 19 passing successfully. NRR has moved QTH to Philadelphia where he hopes to continue WERS activity as does MJC, who is now en route to Arizona for a two months' stay with her mother. Jean has been one of West Haven's WERS reliables. CTI writes that a 46-foot mast has now been installed for Norwalk's control station, and the results are very satisfactory. IM, Bridgeport's district radio aide, reports license has been received with call letters WKAO, and he has been busy getting units into operation. Several of these units have been heard consistently over 50 miles' distance. The New Haven district is now operating practically 100%, with the exception of two or three units. West Haven, Guilford and Hamden have held their examinations for restricted radiotelephone permits, with New Haven's being held this week. The former has already had 19 new operators licensed and participating in weekly drills. New London and Hartford expect to have their WERS licenses very shortly. We have no available information on other Conn. WERS districts. NEA left Hartford on Feb. 21st for pre-aviation cadet basic training at Atlantic City, N. J.

EASTERN MASSACHUSETTS — SCM, Frank L. Baker, Jr., W1ALP — JOX is now a married man and is moving to Melrose. More hams with the Signal Corps, as civilians, in Boston: VL, AUG, AHG, ex-9ARS, and NVB. GDI now with the FCC. LQO was home on leave for awhile from the Pacific. CED has a new jr. op. CTR now working for Raytheon. AGR and FXC are going to school in Lexington, Ky. FVJ, who used to live in this Section, is now working at Concord, N. H. BNU now at M. I. T. LNX has gone to N. Y. to teach. MPT was home for a short leave. We hear that Bill Lawrence, DTP, and our former R.E.C., is now a 2nd lt. in the U. S. Naval Air Reserve. FZX, who is now back at Fort Monmouth, N. J., reports that the English hams made his recent stay most enjoyable. He strongly recommends "electronics training group" to those qualified.

We are sorry to hear of the death of JAT, and wish to extend our sympathy to his family. John O'Neill was a member of the Framingham Radio Club and one of their best supporters and workers.

Congrats to FJN and XYL upon arrival of their second daughter. LAD reports that the town of Brookline has received their WERS license under the call of WQAZ, and that they are making tests around the town. Your SCM received a card from IID, who is now a 1st lt. and is over in Europe somewhere. He says, "We are having a wonderful time and wish all our friends at home could be here to enjoy it with us. We are all depending upon you to get our bands back after this affair has reached a successful conclusion." NBS has moved to Dedham. KSB is now in Middletown, Pa. NRS is in Macon, Ga. We hear that LO is now working in Colorado. IIM, ALP and AHG met IEB up in Portland, who is now an ensign in the Navy. JFR, LNO, NRX, MHE and NPD are doing radio war work. NIT reports that the handful of hams in his town held a meeting with the communications officer for Gloucester Comm. on Public Safety. NIT will handle the administrative matters, and NCT the technical. JGQ, our Lynn EC, reports that he has 21 fellows licensed so far for the WERS work. Charles A. McElroy has been appointed WERS radio aide for Somerville. KCP is attending Signal Corps Officer Candidate School at Fort Monmouth, N. J., at last report.

NEW HAMPSHIRE — SCM, Mrs. Dorothy W. Evans, W1FTJ — IQT writes that, during the recent cold weather, the crust in her town has been so thick at times that heavy trucks could travel across it safely. Trudy serves four hours weekly at the local observation post. BDN recently celebrated another birthday, and our hearty congratulations to her. KKQ spent the holidays with relatives in Massachusetts. MUW/JMY have been spending their week ends in Manchester. 1MWI/2 has been making hooked rugs this winter, in her spare time. FTJ is just biding time until the OM gets leave again. That takes care of New Hampshire's YL ops; so now how about some news from the OMs?

RHODE ISLAND — SCM, Clayton C. Gordon, W1HRC — We appreciate the thoughtful card from MKW, which says he is taking basic training at USNTS, Newport, and gives news that IRF is now with the Signal Corps in Kentucky. MEK is with the Army Air Corps in Idaho, and NCD is at A.A. radio school in Boston. A nice letter from the P.R.A. says that a service flag had been obtained by the P.R.A., and an appropriate ceremony is to be held when the club rooms are again habitable. The flag will be properly installed on the wall of the club room. A word of warning to those who have caught the spirit of the times and taken up the study of mathematics. As reported last month, some of us have started on Cook's "Mathematics for Electricians and Radiomen," and as some of us have already found, to our sorrow, it does not pay to skip the easy ones in the front of the book. The book, which is so highly recommended by *QST* and our good friend George Grammer, is an excellent text, and is also a heap of fun to wrestle with. Be sure and read the introduction and follow very carefully the instructions in the order in which they are presented. Mr Cooke, in his very clever and subtle way, makes very good

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use of his problems to teach many things in progression. A conscientious study of what appears to be simple stuff gives you the necessary fundamentals which are essential to understanding the more difficult parts which come later on.

VERMONT — SCM, Clifton G. Parker, W1KJG — CBW has reported as flight operator for the N. E. Airlines. LWN is to report for instructor's position at the school in Burlington within a few days. NLO has secured his Class "A" ticket and is working for WCAX at the station in Colchester. 2JUB graduated from U.V.M. in January from his course in mechanical engineering. GAE has forwarded new address, 1621 Owyhee Ave., Boise, Idaho. Burlington Amateur Radio Club is continuing its good work with its code classes and also helping out the school in the way of equipment, literature, etc. The radio school at Morrisville has progressed steadily, and has had exceptional attendance. Several students are already qualified in code and operating practices, and a theory section was instituted during January, covering fundamentals. The course as planned seeks to qualify each student in code, theory, law, etc., to the extent he can pass amateur Class A requirements. Your SCM has assisted as an instructor. The school wholeheartedly recommends the use of the "Handbook" and Grammer's course in "Fundamentals" as the structure on which to build a successful course. The war continues to hit close to our small Vermont group. Paul E. Hope, KOO, well known to our Vermont amateurs, and RM2c of the U. S. Coast Guard, was reported missing by the Navy Department on last February 11th. We are all hoping that time will reveal information of his safe arrival at some point. JRU and family, now located at Suffield, Conn., were in Vermont visiting friends and "hams" while arranging to move their household furnishings and the rig to their new home.

NORTHWESTERN DIVISION

OREGON — SCM, Carl Austin, W7GNJ — EC: JN. SD, with Army Engineers, back from Salt Lake, now transferred to Seattle. FAG enlisted in radio, made 95.5 in exam. Wallie Hageman, Army Engineers, is now an ensign in Navy and attending school in the East. HKI, ill a long time, is on the mend. FNS has been promoted to captain. AOY, with Kaiser Oregon shipyards, believes in "an eye for an eye" or a "letter for a letter." GUP is still teaching code at Medford, and says FMQ is still selling groceries, and that there is rumor of WERS in that city. DHZ is barnstorming for CAA. HWH is still a fire fighter. EQ is still with COPCO. FYL is taking advanced course at Harvard. DBZ is still at airport, Medford. GUP had a chance to snoop a little with Signal Corps equipment, and says it's fb stuff. Says they recorded his sending with a hand key, but he can't figure it out yet! (He learned on a bug.) GTW is locating a R.R. in Far North, and says it is quite warm at 20 below, but they don't work when it gets down to 40 below. BS is trying to build a super from his junk box. From CORK comes the following: GNJ re-elected pres., HVX elected v. p., and Roy Mickel, LSPH, secy.-treas. Leo Mickel passed Class B code test at Portland. Doug Ward, Bill VanAllen, Paul and Leo Mickel received radiotelephone 3rd permits, and are now waiting for WERS operator permits. CORK started a new class of 19 this month. KFNX, WERS in city of Bend, is getting good results. Nr. 1 station tested out OK. HVX built a xmtr.-rcvr. with 7A4s as osc's. GNJ has a 7-watter in glove compartment feeding a ¾-wave ant., and is now building a "handy-talkie." ARZ, radio aide, is now sporting a fb "J" in place of the BC antenna. GSI uses the audio of his car radio for modulating and receiving, and it surely talks right out. He uses a ¾-wave ant. made of ¾-inch copper pipe. Roy Mickel and GNJ have 3-wire folded doublets, fed with 2-inch line, on top their houses. The gang had some trouble getting the rigs on a spot. Seems best to re-set the frequency after the rigs are permanently installed and loaded. The complete set-up of KFNX, both planning and equipment, was handled 100 per cent by local amateurs.

PACIFIC DIVISION

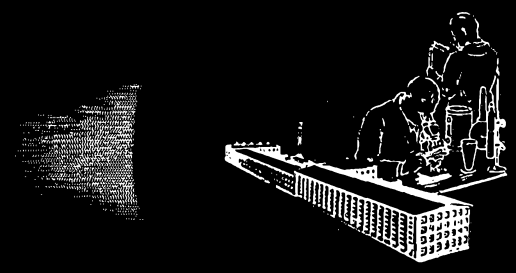
SANTA CLARA VALLEY — SCM, E. F. Sanderson, W6IUZ — RM: F. H. McCann, W6LLW. LUM is nearing the finish of his instruction course as Civil Service radio mechanic for the Signal Corps. CLV is in the Signal Corps, now stationed at a West Coast post. LLW is a radio operator with United Airlines for the Army Air Transport Command in Pacific operations. These are the first reports in four months, fellows. Since former regular radio meetings, in most instances, have been called off due to lack of time, transportation facilities, and personnel, how about dropping a line to the SCM so that your activities can be checked for club and WERS progress, as well as news about yourself and neighbor hams? Remember, this is your column. Let's pep it up. 73. — *Sandy.*

EAST BAY — SCM, Horace R. Greer, W6TI — EC: W6QDE. EC u.h.f.: W6FKQ. Asst. EC u.h.f.: W6OJU. OO u.h.f.: W6ZM. Sgt. and Mrs. E. H. Nickell, FCF, are happy to announce the arrival of Janice Louise on Jan. 12th. IZM, from Placerville, sends regards to everyone in a letter to me. In his V-mail letter, he claims everything is under control over in the Hawaiian Islands and that he likes Army life. ZM still has radio class going at Mills College in the evenings, just for the gals. Hi! Have you signed up for WERS yet? Better get in touch with EE at the Oakland City Hall. Worth your while to drop in and see the main control station, which is sure fb, anyway! Wonder if all the cw men will change over to 'phone after the war? Rag chewing over the telephone might give an idea to the brasspounders, or will they be tired of 'phone by that time? What's doing and what's new? Let me hear from you so I can pass on the dope to the gang. Another day closer to victory. Are we doing all we can?

SAN FRANCISCO — SCM, Kenneth E. Hughes, W6CIS — ECs: W. A. Ladley, W6RBQ; Gene Pera, W6DOT. The following men, either from this Section or connected with the SFN-CCN Net, are in the armed forces: SEI, QL, MGL, ZF, RAF, IPH, TYP, 9FA, JJS, KJ, WF, CIS, QDN, BAM, MQQ and MUF. The following are working directly in the war effort: SCR, AWA, WN, LV, PGB, WB, BIP, MZ, LCS, LMD, ADH, RFF, STY and LLW. Gene Pera, W6DOT, has been named radio aide by the OCD, for city and county of San Francisco. Gene can be reached at 27 Gaviota Way, San Francisco, 'phone Del. 0821. DOT was released by the fire dept. for these new duties, and is really getting things started on our WERS for this Section. All available 2½-meter equipment is being gathered, so anyone having such gear which can be put to good use, please contact the radio aide! RBQ tells about our old friend on SFN-CCN up Sacto. way, PIV, helping to organize WERS in that city. We hear AGS is with PAA at Treasure Island. CII is holding down KRG while CIS is on leave with the Navy. RH has left KYA and is trying for the Army. ZF is back in Washington with the Air Corps, doing communication work. NIO is working in the shipyard. RAH is still with CBS here in town. EAR is operating for the Army in Alaska. NQJ still putting out fires. RBQ had unexpected visit from KB6ILT. 4HHB, ex-5BUX, and 4DAM dropped in to chat with the SCM. On Feb. 5th the following hams were guests of LV for a good rag-chew: RBQ, ZS, KJ, DOT, AWA, MZ, BUJ, SCR, NNF, ATY, CIS and Al McGurk. CVL of Salinas is pounding brass in the Army here. JMR went to San Diego with FCC. SG is a major now. GPB reports things pretty much at a standstill north of the Bay. He will try and gather some dope at their coming meeting. Leonard Collett is a RM1c, Navy 1240, Fleet Post Office, San Francisco, Calif., and would enjoy hearing from any of the old gang. He has done quite a bit of traveling, and would like to swap a letter or two with his old ham pals. HJP is a 1st lt. in the Air Corps, stationed at Chico Army Flying School, Chico, Calif. Let's hear from some of you fellows. 73. — *Ken, CIS.*

ROANOKE DIVISION

SOUTH CAROLINA — SCM, Ted Ferguson, W4BQE/ ANG — CSP is now located in Baltimore. GBY is located in a camp in California. FVF is doing civilian work at Fort Monmouth, N. J. Congrats to GEX, who now has her Class "A" and also has restricted broadcast with special endorsement. DAM has joined the Merchant Marine. HMG keeps busy with his teaching and CAP work. The last time we saw Lt. Col. McArthur, FCW, he was headed for Texas. EXJ is busy in the Navy. DQY is now in Boston with a nationally known radio manufacturer. The last time we heard of CE, he was stationed in Washington. FWO moved along with the 8th division. AZT is doing his bit as a radio instructor in Baltimore. DPN holds down the home front in Orangeburg. BPD says he is busy with service work and home defense. HTT and GEX say they miss the rag-chews on 160. What's happened to VL? Has anyone seen GKD, better known as "Short Circuit Price"? ICK is lt. and now located at Ft. Monmouth. CEL is doing civilian service work for the Signal Corps. FMZ is still turning out ops for the Navy. GB is running mail for the railway service. DTU reports that being a doctor keeps him busy these days.



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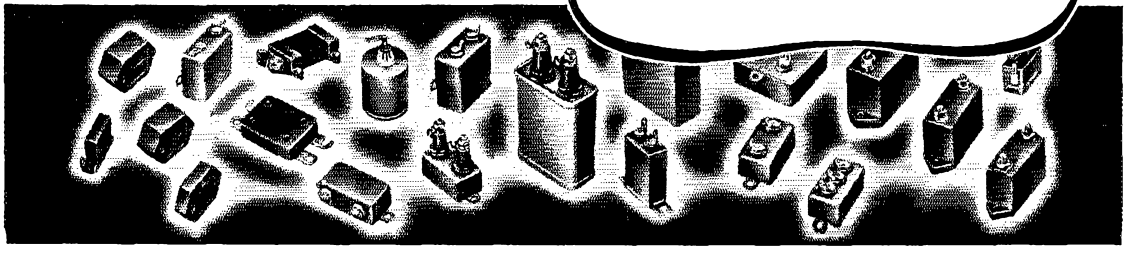


W/O C. E. Fort, 2GBY, has made it across. HEV makes the following report: "Place, Alcan Highway -- met several Canadian hams and found them to be swell fellows. Had several long rag-chews which were enjoyed. The past summer was enjoyable except for the mosquitoes, gnats and flies. The fishing was the kind that answered every fisherman's dream. The winter was cold and dry with very little snow, due to the intense cold. There is not much chance of taking the wrong road, as there is only one. Hi. Things that you missed most were the ladies, liquor, motion pictures, gin mills and the bright lights." Yours truly can be found at the same old joint, trying to aid in the great amount of traffic that the railroads are moving concerned both with men and materials. Fellow hams: It is the request of ARRL officials that this gossip be kept up in *QST*, so won't you please drop us a line and let us have some dope on your activities? We would be very glad to hear from all the fellows that hail from South Carolina. 73. — *Ted.*

VIRGINIA — SCM, W. G. Walker, W3AKN — The Peninsula Radio Club suffered last fall when the club building was turned over to the armed forces. This move not only made it necessary to store all the transmitting and receiving equipment, but also knocked the holding of code and theory classes. The members rallied to the cause by holding meetings once per month at the homes of members, in a rotational pattern. This lasted until the strict rationing of gasoline forced all meetings to be cancelled. The Peninsula is indeed in bad shape as to personal contacts between the hams, except by phone, and even that is frowned upon because of war calls having first preference. Hitler really upset a lot of well ordered routines with his crazy business. The news is meager from individual hams. NE is still on a tanker plying between West Coast ports and the far Pacific. Jonesy must have a rabbit's foot, for he has still to sight a Jap sub. II continues to be with the FCC in Washington and, according to latest dope, he will soon be one of the commissioners. Congrats to him on another promotion. I have not had any reports from the fellows in Virginia regarding WERS operations or preparations for same. What say?

SOUTHEASTERN DIVISION

GEORGIA — SCM, Ernest L. Morgan, W4FDJ — That the boys are eager for news of the Georgia gang is evidenced by the beginning of mail from everywhere. Your SCM is starting a card index of all those in the service with their addresses, as the changes come to him. This includes those in civilian capacity also. Here's what we have, so far. DYX with CAA in Puerto Rico. EZU is eng'r with WGAC in Augusta. BED is in AAC. GGW is building pipe organ in home in lieu of hamming. FGU is 1st lt. in Washington. GTX gave up sgts. rating for communications. EFB is in Navy. FDE is now BC opr. at Jax. DNY is RM1c in USN. Lewis last ham at Cordele. Keep the news coming. These boys want to know what's doing back here at home, and if you get it to me they will know. Last line on all letters: "How I miss my ham radio, and what's it going to be like when we get back?" Those of us at home will answer that to the extent that we support the ARRL. The boys in the services are doing their part for it by their work. Expect much longer column as hear from the more distant lads.

EASTERN FLORIDA — Acting SCM, Frank C. Fassett, W4BYR — GIP is in Army S.C. DWL is busy repairing and tuning a grand piano. QN is still with the Navy in Jacksonville. IBW is an ensign and located in Boston. Ex-DC, now W9THS, was home from Fort Knox recently on furlough. GJO is with the Army as comms. officer. HAD has returned to Alaska under a year's contract. Crowley reports from Clearwater that he has started a 3-night-per-week radio class for local school board. ETL reports organization of class in radio fundamentals at St. Pete high school in coöperation with University of Tampa. A. P. Perez will be chief instructor. DBA is now field engineer for Motorola in Southeastern Div. DBO has just returned from Newfoundland. JM has taken to himself an XYL. DHD is home on furlough from Navy. HPM is installing new equipment for St. Pete police dept. FHX is home on ten-day leave from Navy. FPC has just been promoted to lt. (jg) at U.S.C.G. Station. Word has just been received from FYI, who is RT2c in Navy and likes it swell. This report gets shorter by the clock due to failure of gang to report goings-on in their respective areas.

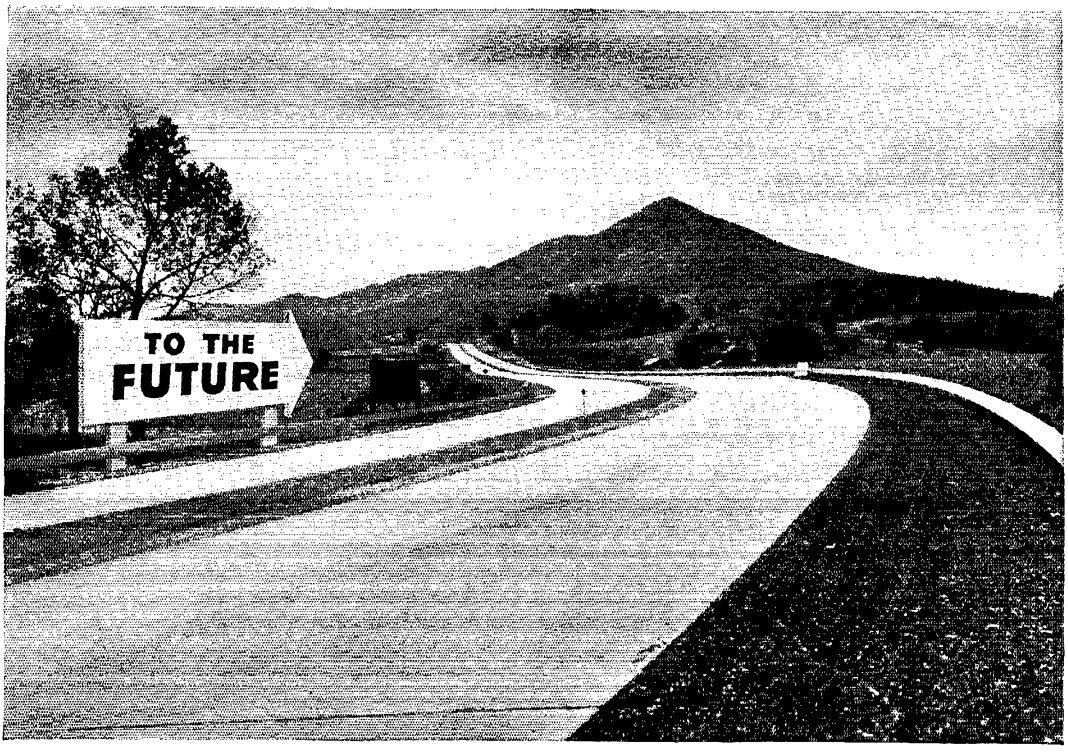
WESTERN FLORIDA — SCM, Oscar Cederstrom, W4AXP — 9CFL, Lt. Cmdr. Hodges, is at Sqdn. 3 at the Naval air stn. in Pensacola, in charge of aircraft radio training. Lt. H. D. Pickett is another old radio operator at Sqdn. 3. He was called to active duty by the Navy on April 1, 1941. C. G. Rose, aviation radioman 2/c, out at Bronson Field, is studying for his Class C ticket. Rose reports that 7IDM, RM2/c, formerly of Portland, Ore., is at Bronson Field. DAO has been doing some work on receivers for pastime. BCZ sent in a nice report from Tallahassee. He is to be the new Emergency Coördinator for Tallahassee area. This was formerly held by BOW. Credit for a goodly increase in ARRL membership in this area goes to McMasters. Phil has been teaching radio at the Signal Corps school along with 3IPD, FJV and CDY. Persons desiring preemployment training for war work and vocational education for national defense should write BCZ, Phil McMasters, and get details on course. This training includes all phases of radio work and operating technique. The training is free, but students must agree to take a job in industry when offered by U. S. Employment Service. This is a good chance to get trained to do some heavy hitting at the Axis. BCZ has built an FM transmitter which he hopes to use sometime in the near future. 3IPD is building a 20-meter rig which he hopes to use in the not too distant future. Bob Watson, an old timer in the radio game, has joined ARRL. DAO has renewed his membership after being a newsstand reader for a short while. "The Old Maestro" would like to arrange a meeting of the radio amateur fraternity in the services of the Navy, Marines, and Army in Pensacola area. Would like to hear some comments on this matter, so write or see your SCM personally. The OM hopes the day isn't far away when we can have another general hamfest in the Section for all comers. News and items about our boys in the services are especially welcome. Best 73 to all of you. — *AXP, "The Old Maestro."*

SOUTHWESTERN DIVISION

ARIZONA — SCM, Douglas Aitken, W6RWW — The Phoenix and Salt River Valley gang is happy these days, for certification of their WERS setup has just come through, along with 7 operator licenses, with more of the latter pending. Their call letters are KFRS. They are figuring on "going to town" and having the most efficient organization in the country! The Radio Club of Arizona has suspended meetings for the duration. Here's more news of some of the gang in service or just entering: PGO is now a captain and is in the overseas forces. KMM, a former Ariz. SCM, has entered the Navy, as has QJL, who goes in as RT2c; TBJ and UOG have both received their call for service, and will be in when you read this. Have had several letters this month from the scattered gang. RJN is now flight operator for a commercial air line, and reports wonderful trips over foreign soil. UKB wrote that he had been promoted to RT3c, and was continuing his schooling, and would come out with higher rank still. JHV, now signal sergeant at San Angelo, Texas, says that he's teaching code and theory to his Section, and all are figuring on a ham ticket, when the shooting is over. MLL went up to Tucson, recently, and visited the gang there. IYZ made the trip to Nogales, visited the gang, and took in some of the bright spots over in Old Mexico. Tch, tch! Note that the Tucson Short Wave Assn. is still on the Honor Roll. The gang down there deserves a lot of credit for their work. GS has just signed up a new class of 34 pupils, and TJH is teaching code and theory at the high school in evening classes. They and OZM all work at local air bases, too. CMP is busy with defense construction. Says he is now eligible for the "20 Year Club." The Navy has a primary school at Prescott now, with an initial class of 75. Let's hear from some more of you; we're all interested in your doings! Vy 73s. — *Doug.*

WEST GULF DIVISION

NEW MEXICO — SCM, J. G. Hancock, W5HJF — 8VP is now a New Mexican, and hopes to be a W5 soon as possible. 8VP was RM for Ohio for many years before joining the Navy. He is now a patient at Presbyterian Sanatorium, Albuquerque, and wants to get acquainted with the bunch in and around Albuquerque. (Ask for J. C. Nicholson.) Robert Roy is the new junior op. at KKS. JWA is somewhere at sea. Although it is not confirmed, rumor has it that a lot of fellows are angry with the SCM for not answering their letters. He sure needs a secretary, gang! HJF is kept busy servicing receivers without pay, and thinks it's a swell way to keep on the good side of the BCL while the regular servicemen are off to war. Reports are lean this month. How about it, gang? 73. — *Jake.*



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INTERNATIONAL RESISTANCE COMPANY

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Some New Thoughts on WERS

(Continued from page 25)

It is necessary, in submitting application for a CD-WERS license in which mobiles are included, that the "usual area of operation" of each mobile be given as part of a supplementary statement. This does not mean, of course, that under emergency conditions such mobiles cannot be allowed to operate in any other area. A mobile unit may operate in any part of the area covered by the station license.

Tightening of Controls

In the near future it is expected that controls over the operation of CD-WERS stations will be tightened by FCC, probably at the request of the Army. In addition, it may be expected at any time that the Army will put through a silencing order for certain areas in order to determine the dispatch with which such stations can be put off the air if it becomes necessary. If the controls are found to be lax and unreliable it is more than likely that, instead of prosecuting those who did not comply with the order, for whatever reason, the reflection will be on the entire civilian-defense WERS organization for which you and I have worked so hard. If there are violations of FCC rules, intentional or otherwise, it is possible that CD-WERS will be condemned as a nuisance and barred from the air completely, as the amateurs were last January. *It is therefore most essential that all CD-WERS licensees receive silencing orders the minute they are issued and act upon them promptly.*

FCC officers will further check on the various units of a station licensee to see that each prominently displays a photostatic copy of the station license and the call letters and unit number. If it is a fixed unit it must be located at the place designated on the license. Operators will be checked to see that each one is in possession of a WERS operator's permit. The networks will be observed in operation, and operating procedure will be noted. It is time for us to make sure our houses are in order. Make your transmissions brief and to the point; avoid use of names in directing your transmissions, make them sound curt and official. We are amateurs, but in CD-WERS we are not operating as amateurs and the old tendency to chew the rag must be avoided. In training operators this should be emphasized and a good example set by those amateurs participating.

District Licensing

When WERS was first announced by OCD and FCC, OCD recommended that licenses be granted only to cover entire warning areas and that the licensing of independent communities should be discouraged. Recognition of the fact that such a policy would retard licensing prompted FCC to begin licensing independent communities.

We now wish to renew our recommendation that licenses be applied for, if possible, in the name of the d.w.c. city to cover the entire warning area. The advantages of such a system of licensing become more and more apparent. First, receipt of possible silencing orders from the Army Information Center is facilitated and expedited;

Everywhere

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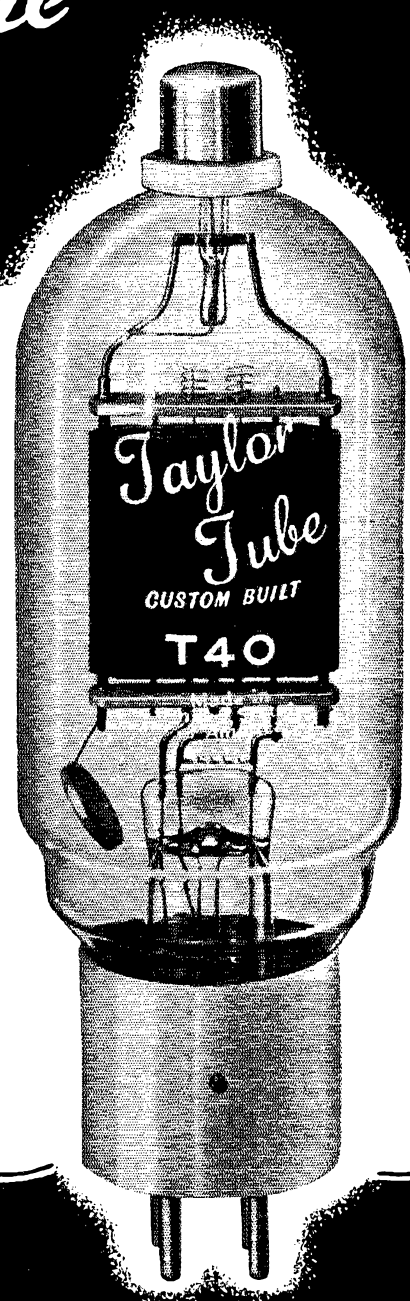

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(*Continued from page 76*)

second, holders of WERS permits have a wider area in which to operate; third, and most important, no community can expect to be self-sufficient in the event of a heavy air raid. The third advantage is the only one which hasn't previously been discussed in *QST*.

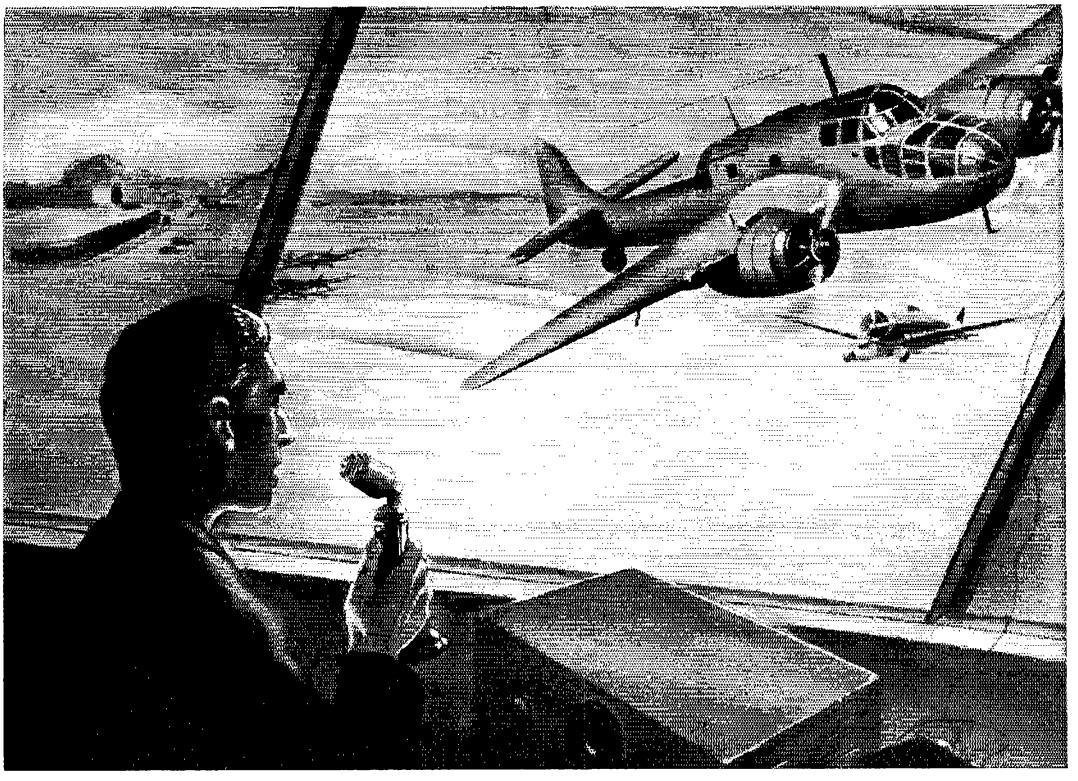
Experiences of the British have shown that bombing raids are usually concentrated in one spot, and that the amount of fire apparatus, medical attention and police service needed at that spot is tremendous. Figure it out for yourself. Most bombers can carry better than a thousand incendiary bombs, and many do. Such bombs are sprinkled liberally over the target area and are invariably accompanied by high-explosive bombs. Communication wires are blown apart, water mains are broken, gas mains are dug up and set on fire. The result is holocaust, with hundreds of fires raging in all parts of a concentrated area. The service facilities of one community are utterly incompetent, no matter how modern and well-manned, to cope with such a situation. Additional facilities from adjacent communities must be called in to help. It is the height of conceit for any one community to think that it can adequately cope with the type of bombing raid that it will get if it gets any.

Communications play a vital part. With wire facilities bombed out of existence and no radio communication with adjacent communities which have perhaps escaped damage, independently-licensed communities will be left high and dry. Help will have to be called by messenger, or by hastily improvised radio communication. Time will be lost, and with it hundreds of lives and millions of dollars worth of property.

The point we are trying to make is that *it is absolutely essential that the necessary services be dispatched to the community in distress with the least possible loss of time*, from nearby cities. This will be done by a strategy board created at some central point in the area. We must plan our supplementary radio communication accordingly; there must be coördination of all networks in a warning area. This coördination must be directed from a central point, preferably (but not necessarily) the control center of the district warning center city; in any event, near the location of the area strategy board. There must be not only communication between communities, but *coördinated* communication, to such an extent as to break down the sanctity of community boundaries and effect a communications network that will serve not only a single community but an entire area of as great extent as possible.

Most licenses at present cover more than one community, but comparatively few of the licensees are district warning center cities. Perhaps the main reason for this is that many civilian-defense regions are not yet organized into definite warning areas; but there are certain cities that have direct connection from their control center to the Army Information Center, and these are the cities from which silencing orders emanate to independently-licensed communities; these are

(*Continued on page 82*)



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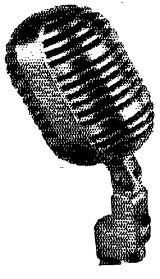

If, however, your limited quantity requirements can be met by any of our standard model microphones, with or without minor modifications, may we suggest that you contact your local radio parts distributor? He may be able to supply your immediate needs from remaining stocks. In all instances, his familiarity with our products and many of your problems will enable him to serve you well. Our distributors should prove to be vital links in expediting your smaller orders.

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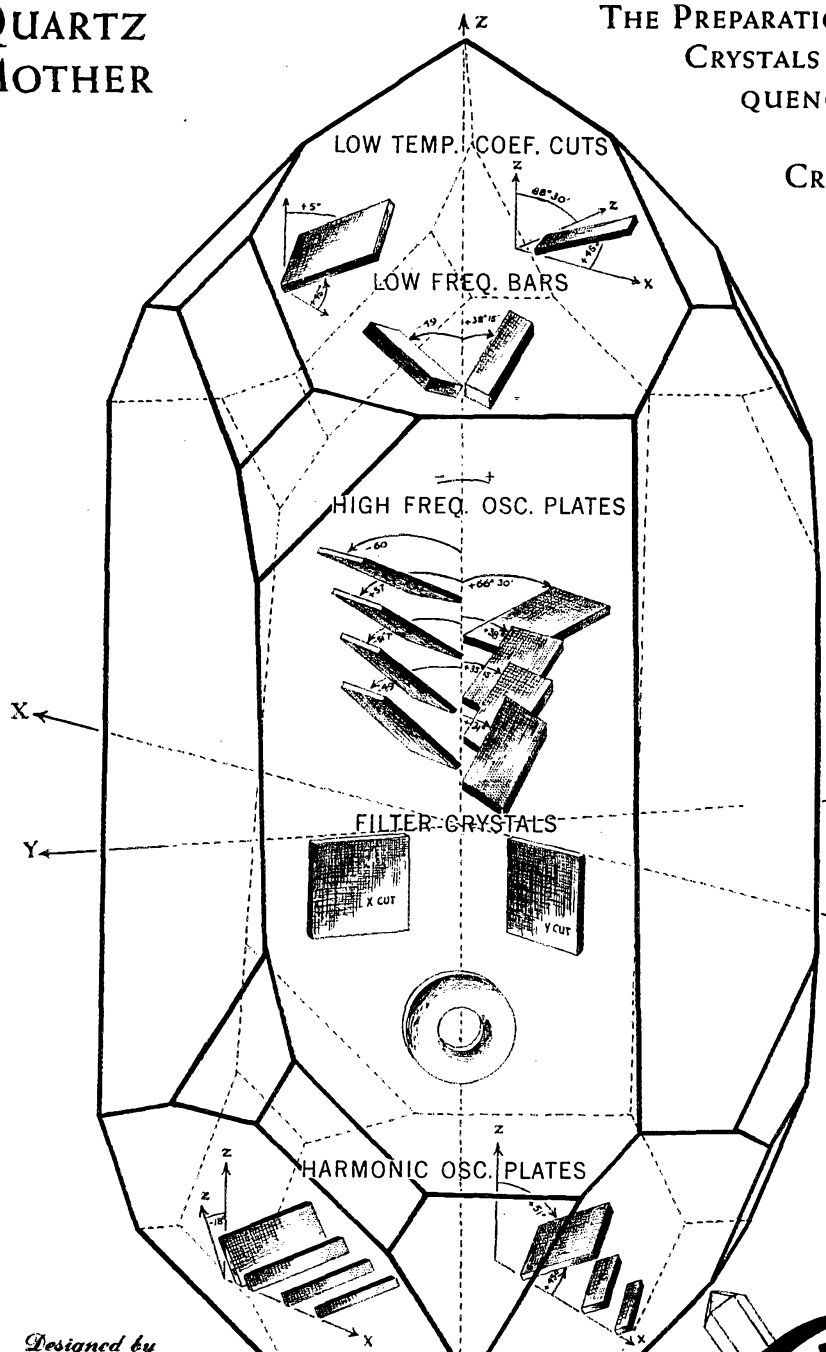
QUARTZ MOTHER

THE PREPARATION OF PRECISION CRYSTALS FOR RADIO FREQUENCY CONTROL.... AS MADE BY CRYSTAL PRODUCTS



ORIENTATION OF OSCILLATOR AND FILTER CRYSTALS WITH RESPECT TO MOTHER

FREQUENCIES IN MILITARY COMMUNICATIONS ARE ACCURATELY CONTROLLED BY CRYSTALS

Designed by
J. M. Ziegler

Crystal
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Producers of Approved Precision Crystals for Radio Frequency Control

(*Continued from page 78*)

the cities around which our CD-WERS organizations should be organized.

The trend should be toward expansion of the service to cover more and more adjacent communities and surrounding areas. Organizers of CD-WERS should lend their assistance to establishment of similar organizations in other towns which lack the personnel and facilities to do it on their own. Independently-licensed municipalities in areas in which the d.w.c. city is licensed should give up their licenses in order that they might be covered by the d.w.c. licensee, thus providing wider scope to their operation and their operators. In areas where the d.w.c. city is unlicensed, efforts should be made to assist that city in obtaining its license or, failing that, to include as many adjacent communities as possible under the existing license. It is dangerous and unwise for any community to draw itself within its own boundaries and assume that it can take care of itself in any emergency. *Expansion* and *mutual assistance* should be our watchwords from now on.

A Tape Recorder

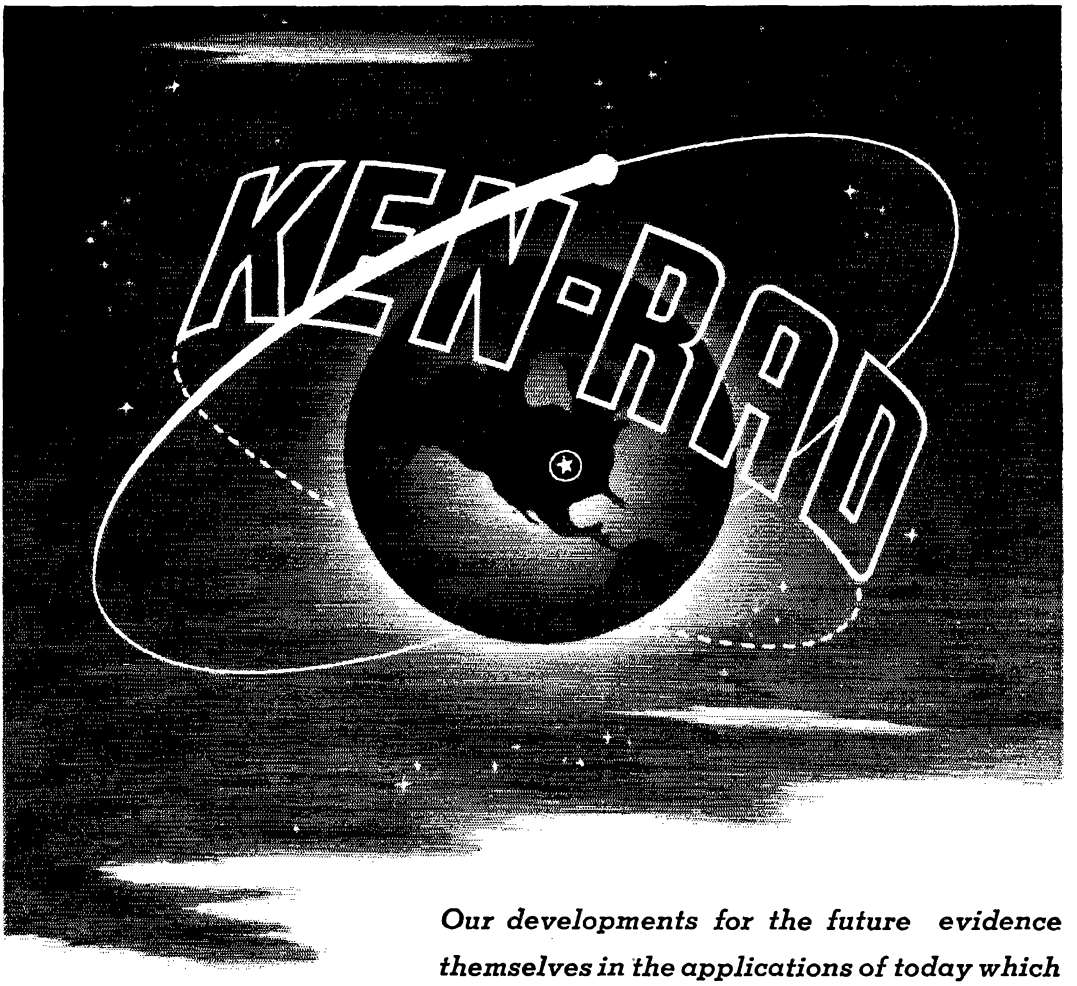
(*Continued from page 23*)

The inside depth is 7/16-inch. A 3/16-inch projection, 1/4-inch outside diameter, is turned at the bottom of the cup. A tiny hole is then drilled, with a No. 73 drill, through the center of the projection into the interior of the cup. The projection is then countersunk as deeply as possible, without enlarging the tiny aperture at the bottom of the projection, with a No. 11 drill. This finished piece is plugged into the 1/4-inch hole in the back of the tape track and soldered fast.

One more unit is required before the tape-guide assembly is complete. This consists of the lens holder (F) and mounting (H), which can be seen projecting from the front of the tape guide. The construction of the lens holder starts out with a piece of 1/16-inch brass, 1 1/2 inches by 7/8 inch, in which a 3/4-inch hole is cut to fit a 1 3/16-inch length of 1/16-inch wall brass tubing of the same outside diameter. You will notice that the 3/4-inch hole is not at the exact center of the piece, since its center must line up with the tiny aperture in the photocell mounting, which comes above the center of the tape guide. The tubing is sweat-soldered into the flat piece and the outer end of the tubing is fitted with a ring to increase its wall thickness to 1/8 inch to provide sufficient wall for the setscrews which hold the lens *holder* in place. Here again, construction and dimensions may be varied to suit the material at hand. The main point is to line up the center of the holder with the small aperture in the photocell mounting.

The lens is a small one, 1/2-inch in diameter, flat on one side and convex on the other. It has a focal length of 1/2-inch and may be cemented in the brass holder as shown in Fig. 4. The light from the exciter lamp can be focused on the aperture by moving the lens holder back and forth in the mounting and then tightening up the setscrews.

(*Continued on page 86*)



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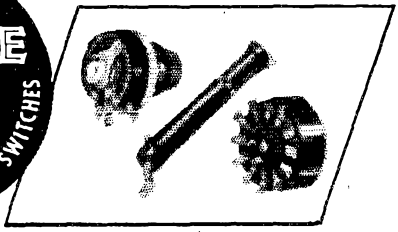


(Continued from page 82)

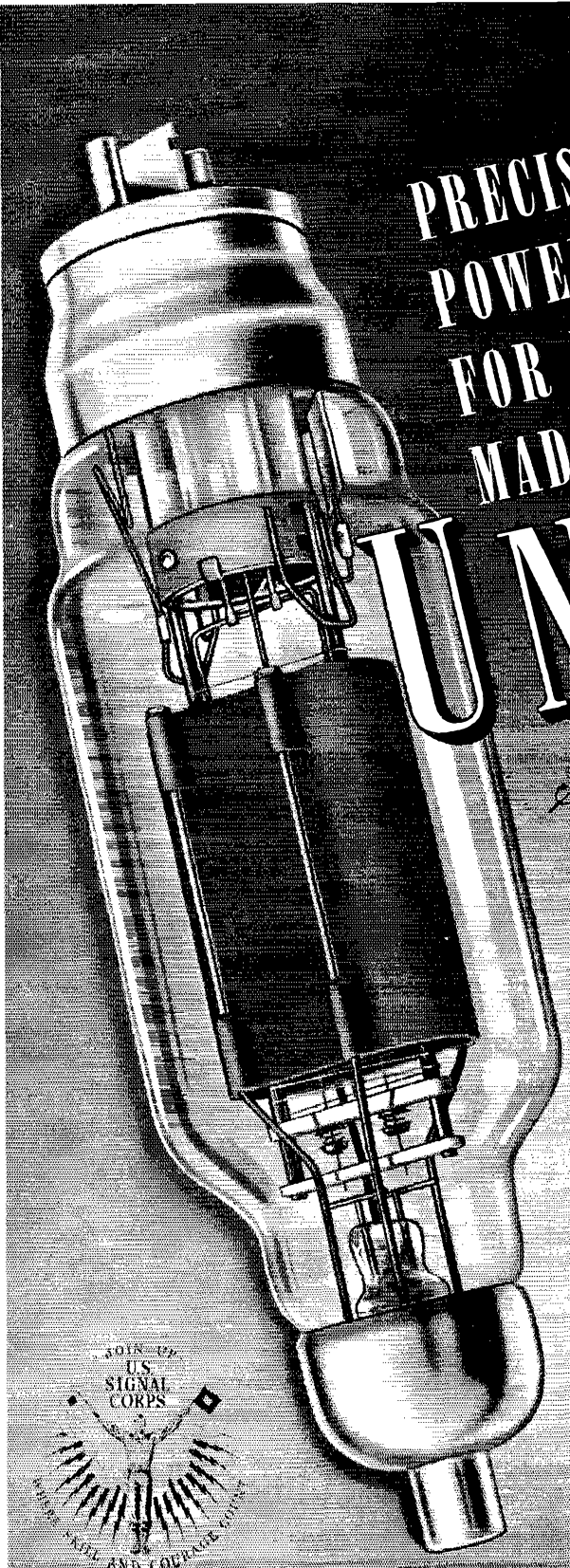
The mounting for the 50-candlepower automobile headlight exciter lamp for the play-back section is not shown in the sketches, since any arrangement will work which holds the filament of the bulb opposite the opening in the lens holder. The front-view photograph shows the lamp enclosure in place. It has an opening cut in the back side to allow the light to pass through to the lens. The pressure of the pen on the tape or accurate focusing of the light spot on the tape can be adjusted by the threaded-rod adjusting arrangement to the left of the photocell shield, which swings the left-hand end of the tape-guide assembly back or forth against the tension of the coil spring, while the assembly pivots on the hinge at its right-hand end. The adjusting screw is fitted with a small bakelite knob. The hook at the end of the guide is for fastening the coil spring.

Tape Puller

Another of the most important parts of a successful recorder is the tape puller — the mechanism which moves the tape along. The speed must be constant and easily controlled and there must be no slippage. Fig. 5 shows sketches of the essential parts of the pulling mechanism. Dimensions of the rotating parts are based on a normal motor speed of 78 r.p.m., since the motor I used was taken from an old phonograph turntable. It has a mechanical-type control by means of which the speed may be varied from about 48 r.p.m. to about 110 r.p.m. I have arranged a simple wobble wheel, consisting of a disk set at an angle on a rotating shaft, to operate the speed-control arm from a knob on the panel. Commutator-type motors are out, unless you want to fool around with filters to cut out noise in the receiver from the commutator sparking. The tape runs between a knurled pulley on the $\frac{3}{8}$-inch motor shaft and a rubber-rimmed idler wheel (A) which operates against the tape under spring pressure. The idler assembly, shown in Fig. 5, consists of a mounting stud (E), an arm cut from a piece of $\frac{1}{8}$-inch brass and fitted with a spacing collar soldered to the arm (C), a coil spring of a few turns (D) and the rubbered-rimmed wheel (A). Small anchoring holes for the spring are drilled in the mounting stud and in the arm. While the idler wheel shown was turned out in a lathe, it might be possible to make a satisfactory substitute by clamping the rubber between a pair of large washers. The rubber ring is a large grommet with an outside diameter of $1\frac{1}{2}$ inches and an inside diameter of 1 inch before it is stretched by mounting on the wheel. After mounting, the outside diameter stretches to $1\frac{7}{8}$ inches. It is best to use a very soft gum rubber for this purpose, since it will provide a more positive drive. To prevent smearing the ink record, I made a groove in the rubber, $\frac{3}{32}$ inch wide, starting $\frac{1}{16}$ inch from the upper edge.

The motor shaft is fitted with a $\frac{3}{4}$-inch pulley below the panel. This pulley drives the shaft of the take-up tape reel by means of a coil-spring belt similar to those used on home movie projectors. The pulley on the reel shaft has a groove

(Continued on page 90)



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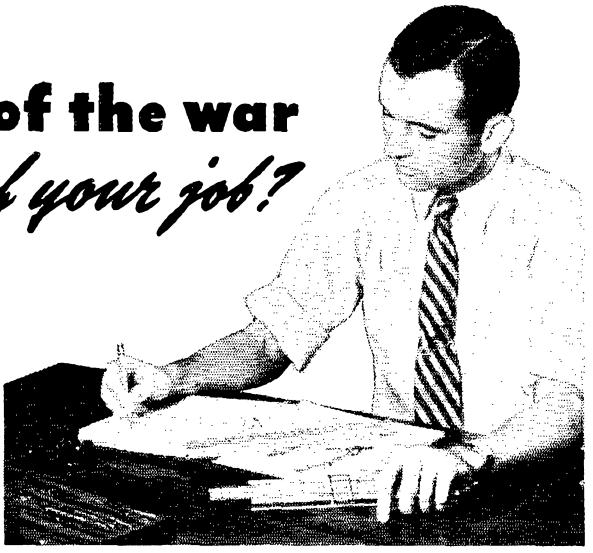

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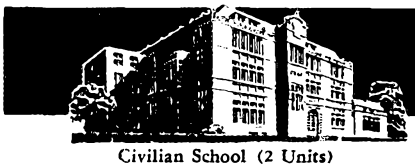

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(*Continued from page 86*)

diameter of 1¼ inches. Thus the take-up reel is "over-driven" at all times, regardless of the amount of tape on the reel. The spring belt allows slippage to compensate for the required variation in reel speed as the diameter of the tape roll on the reel increases. Also shown in Fig. 5 is a sketch of the idler pulley which may be seen to the left of the feeder reel in the photographs.

Both reels, which are 8-mm. movie reels, slip over ¼-inch shafts running through bushings fastened in the panel. Each shaft is fitted with a 1¼-inch-diameter disk above the panel. A vertical metal peg near the edge of the disk prevents the reel from turning without turning the shaft. I used large bushings, which accounts for the ¾-inch holes in the upper corners of Fig. 3. The feeding reel should turn against a slight amount of friction, to keep the tape taut at all times. When not in use, both reels may be stored in the lid which covers the top panel.

The case is made of ¼-inch plywood covered with leatherette. Its outside dimensions are 17½ inches long, 11⅝ inches deep and 12⅜ inches high. All joints are strengthened by ½-inch-square strips of wood on the inside. The control panel measures 8½ by 5½ inches and is set back of an opening in the front of the case so that the controls do not project where they may be bumped accidentally. The speaker opening in one end of the case is 4 inches in diameter and several 1-inch holes, lined with bezels, are cut in the ends and back to provide ventilation.

Signal Amplifier

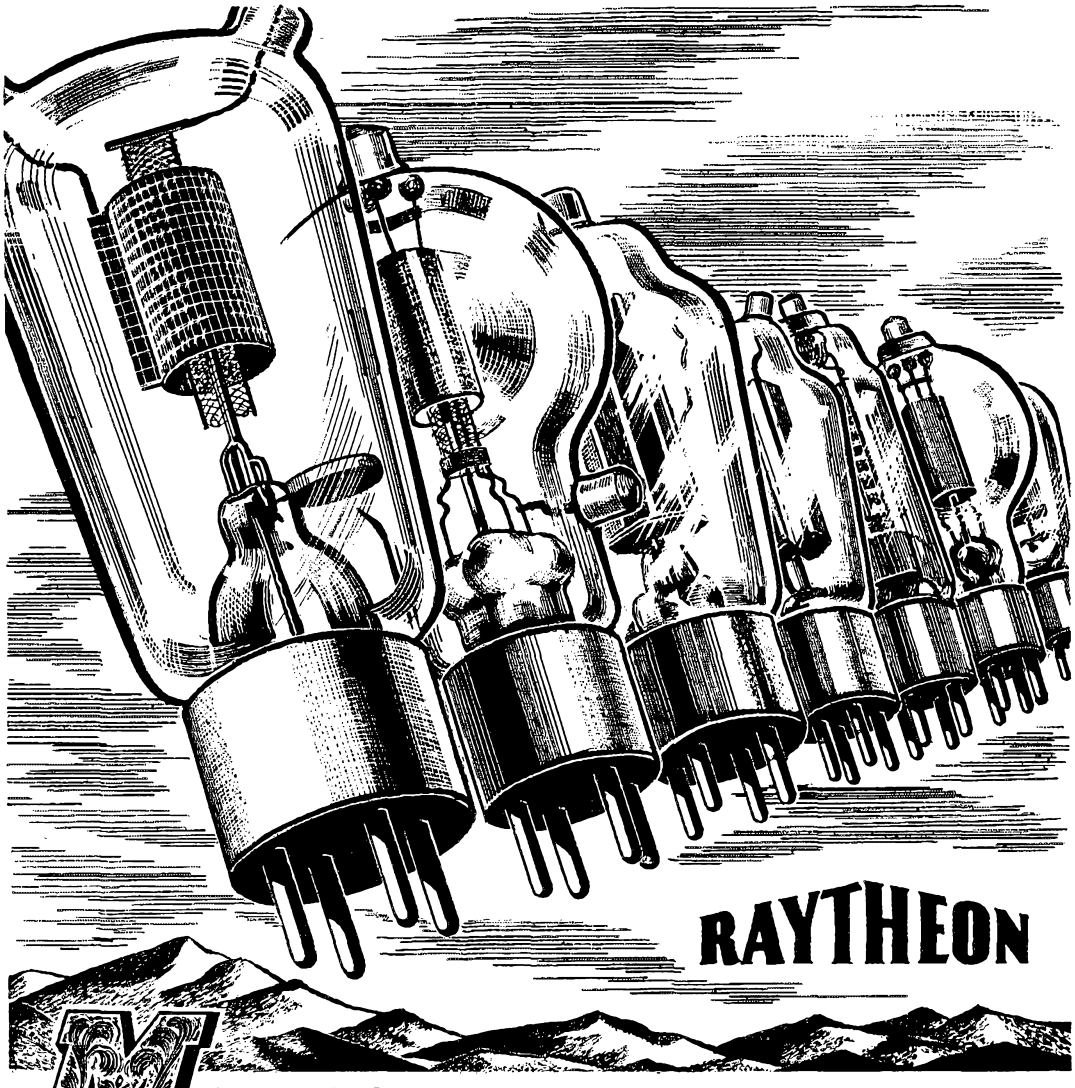
After wading through the mechanical end of the job, the electrical end should be duck soup for any amateur. The circuit diagram of the signal amplifier is shown in Fig. 6. It consists of two resistance-coupled stages with a 6J7 and a 6SJ7, followed by a 6F6 driver and Class-B 6A6 output. The 6SJ7 is operated at low plate voltage to act as a signal limiter. This feature has been found of great advantage in recording high-frequency signals, which often have a tendency to fade rapidly. Proper voltages and currents for a terminal voltage of 260 are indicated in the diagram.

The oxide rectifier used to feed the signal coil was taken from an old broadcast-receiver speaker and is rated to deliver approximately 30 volts at 40 ma. A bridge rectifier made up of three full-wave rectifier tubes, such as 80s, might also be used.

Audio Oscillator

The audio oscillator and amplifier unit is one patterned after the phase-shift oscillator described in I.R.E. *Proceedings* some time ago and also on page 52 of *QST* for November, 1941. The circuit appears in Fig. 7. It has the advantage that no inductances or transformers are required. The frequency of the oscillator may be varied from 200 to 1000 cycles by means of R_5, while R_6 controls the output level. If a dynamic speaker is used, the output transformer will replace the magnetic speaker in the diagram. The audio

(*Continued on page 92*)



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(*Continued from page 90*)

oscillator and the signal amplifier are assembled on one chassis which may be seen to the right in the interior view of the recorder.

Photocell Amplifier

The photocell amplifier is a simple affair, consisting of a single stage with a 6K6G. The circuit is shown in Fig. 8. The photocell is a Cetron CE22, Class E, manufactured by Continental Electric Co. The action might be improved, however, by using a more sensitive type such as the CE22-WB, Class C. The relay is of the sensitive type with a 5000-ohm winding. Bias for proper operation is adjustable by means of R_2. This amplifier is not shown in the interior photograph, since it was removed to prevent obstruction of the view of other parts. It is mounted on a small shelf screwed to the back of the case, immediately above the rear end of the chassis containing the signal amplifier and audio oscillator.

Power Supply

The circuit diagram of the power supply, shown in Fig. 8, is perfectly straightforward. A separate pair of terminals is provided to supply the signal-coil field winding.

Pen Adjustment

The tape used is known as "Perfection A Recorder." It is $\frac{5}{16}$-inch wide, about 0.004 inch thick and is obtainable from Paper Manufacturers Co., Inc., Philadelphia, Penna., at approximately ten rolls for $1.50. Each roll contains 1000 feet of tape. As the photograph of sample recordings shows, there is room for two recordings on each side of the tape and both sides of the tape may be used if play-back is not required.

Black India ink is used in the pen, which will have to be primed before it will draw. The primer consists of a medicine dropper in which the usual rubber nozzle is replaced by a rubber plug with a small hole in the center to fit snugly the tubing of the pen. The pen is pushed through into the ink in the dropper and when the bulb of the dropper is squeezed, ink will be forced through the pen. The pen is then replaced in the recorder with its lower end dipping into the inkwell. The position of the tape guide is then adjusted until the pen barely touches the tape. As soon as the tape is started, the ink will flow quite readily. When the recorder is not in use, the pen arm and pen should be removed and submerged in water or a piece of 0.01-inch wire slipped into the pen; otherwise you may find the pen plugged up with dry ink the next time you try to use it.

The lower pen stop should be adjusted until the pen line with no signal is approximately $\frac{1}{16}$ inch below the lower edge of the upper retaining strip. The upper pen stop should then be adjusted so that a steady signal from the audio oscillator or a b.c. station draws a line just below the lower edge of the upper retaining strip. This line should pass squarely over the light-cell aperture as the tape moves along. If a signal exerts a downward pull on the pen, instead of an upward push, the connections either to the signal coil or to the field coil

(*Continued on page 94*)

(Continued from page 92)

must be reversed. Best results are obtained with the receiver gain kept fairly low and the signal-amplifier gain high.

Monitoring

For monitoring the signal with headphones while recording, I rigged up a small box with two open-circuit jacks and a plug on a cord — all connected in parallel. The plug goes into the output jack of the receiver or audio oscillator, as the case may be, and the headphones plug into one of the jacks, while the input of the signal amplifier is plugged into the other jack.

Tape Speed

Tape speed should be adjusted according to the speed of transmission; if the speed is too fast tape will be wasted, while the characters will be bunched too closely for easy transcribing if the tape runs too slowly. A speed of five words per foot of tape is about right. With a puller diameter of 7/16-inch, a motor speed of 48 r.p.m. will give a receiving speed of about 28 w.p.m. on this basis, while a motor speed of 109 r.p.m. will give a receiving speed of 63 w.p.m. Faster speeds may be recorded with closer spacing of characters, but for high-speed recordings a motor with higher speed or a puller of larger diameter would be better. A puller diameter of 0.7 inch will give enough tape speed for 100 w.p.m. or better. After the recording has been made the tape may be run through again at any desired slow speed for transcription by eye, or, if the play-back unit is included, it can be copied by ear.

There is not much to say about the operation of the audio oscillator unit. It may be keyed by an external key or by the relay in the play-back unit. When the audio signal is fed into the signal amplifier for recording one's own fist the amplifier in the oscillator unit is not required, since the output of the oscillator alone is sufficient.

Play-Back Adjustment

In adjusting the play-back circuits, it is of first importance to see that the top line of the tape passes exactly over the small aperture in the photocell holder, otherwise the change in light may not be sufficient to give a good plate-current swing. Focussing of the light can be adjusted for best relay operation with the unit running. It will be noticed that a back-contact relay must be used, since the shadow cast by a dot or dash line on the tape will cause a decrease in amplifier plate current. Bias on the grid on the 6K6G should be adjusted, by means of R_2, until the contacts open with the light showing through an uninked space on the tape. An ink shadow should then cause the relay to close contacts. You may find this adjustment rather critical.

Although the finished job represents a lot of patience and careful work, anyone who builds a recorder such as this will find himself well rewarded. Unless you try to rush the job, the work can be very interesting and instructive. I hope that this story will help others to avoid many of the detours I had to make.

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These men who fight for America . . . we knew them as just boys a few months ago. Now they're the toughest fighting men in the world. Call it the American love of freedom and justice, if you will, that makes them fighting mad. Or let's say simply that they don't like bullies. This much you can count on—they're going to drive a hard bargain with America's enemies.

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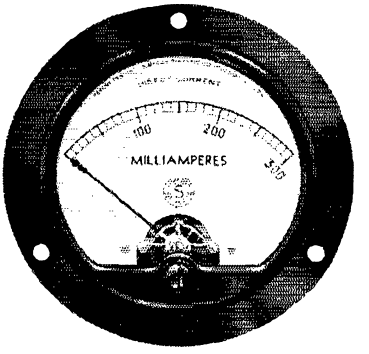

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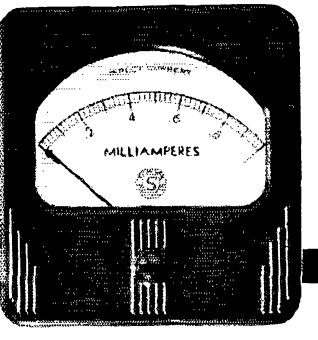

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QST Visits the Marine Corps

(Continued from page 17)

showing typical components and partial unit assemblies are used to illustrate the lectures. In addition, training films, supplied by the Signal Corps, are shown in a large projection room.

The technical part of the course is designed to give the prospective operator sufficient theoretical knowledge so that he knows what is happening when he presses the key. On the other hand, it is recognized that a radio operator need not be an engineer or even a highly skilled technician; so long as he can tune a rig correctly and make minor repairs and routine adjustments, that's all that is required.

Lecture groups for this part of the course average 60 to 70 men, the total of perhaps 130 men in an average class being divided into two shifts. Each instructor handles his own specialty.

The course is a flexible one, arranged so that changes can be made at any time to conform with information on new techniques or requirements relayed from the front lines. When an instructor arrives fresh from a battle zone he starts right in to teach the new tricks he brought back with him. Graduates of the school assist in keeping the instruction up to the minute by checking back after they've had experience in the field, pointing out deficiencies in their training or good points to be stressed.

A significant item concerning the training is that the instructors are no academicians. They are veteran non-coms, many of them newly back from active duty in the Pacific, whose records inspire the respect and admiration of their students. Several of the 48 instructors have been decorated in the present war. The Marine Corps believes in having as instructors men who learned their stuff right on the scene, from personal experience bought at the risk of their lives. These hard-bitten veterans teach the youngsters all the tricks of security and maintenance and operating cunning that can't be found in books.

It goes without saying, of course, that some of these battle-scarred campaigners are none too happy in their present seat-polishing jobs safe at home, and the official mails are filled with pleas for transfer to active service from veteran fire-eaters gnawing their hearts out for the smell of battle smoke. But as instructors they recognize that the battle of training is fundamentally as important as any they might be fighting elsewhere, and they give their best to their jobs.

A Full Schedule

So much for the work of the first eight weeks. It's an arduous schedule, but the system of letting each student progress according to his individual capabilities makes it a practical one.

The day starts with reveille at 5:45 A.M. School is called at 7:30 and continues, except for recesses, until 11:30. Following the noon meal — for which the Signal Battalion trainees assemble in two large mess halls — classes resume again at 12:45 P.M. The afternoon session lasts until 4:30,

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A WORD ABOUT DELIVERIES

Naturally deliveries are subject to necessary priority regulations. We urge prompt filing of orders for delivery as may be consistent with America's War effort.

(Continued from page 96)

after which they have evening meal and then assemble once more for an evening period from 6:00 to 7:30 P.M.

That's the schedule for the average student. Those who have difficulty keeping up receive an additional hour of "intensive instruction" — actually a thorough review gaited to fill individual lapses — in the evening.

Taps comes for all at 10:00 P.M. On Saturdays classes are limited to the period from 9:00 to 11:30 A.M. Then the students are free from Saturday noon until Monday morning reveille. Each week end half the students in each class are allowed to leave the station on liberty. The reason only half can get away is that Marine Corps regulations permit men to leave their post only every other week end; the classes are divided into starboard and port watches, therefore, and these watches alternate their week ends off.

This regulation isn't really a hardship, however. The remote location of the camp makes it a little difficult to find amusements of metropolitan calibre during week-end furlough — but it does help the recruits to keep their minds on the business at hand.

Outside the classrooms the students are grouped into two companies, with full company organization. Two captains permanently stationed at the post command these companies. All instructors and administrative workers are included in a headquarters company, which handles the functions of housing, maintenance and supply. The school is a completely self-sustaining unit, capable of being transferred bodily at any time without dependence on any other branch.

Incidentally, in contrast to most military schools, all administrative workers, clerks and so on — even the stenographers — are enlisted Marines. There's not a woman in the place!

Field Training

The final four weeks of the course in reality form a transition period between academic schooling and the more exacting demands of active service. During those weeks the locale shifts from the classroom to work in the field that closely simulates actual service conditions.

It is in this phase that the distinctive character of Marine Corps training becomes apparent. To picture it in detail, let us go out for a day with a typical field class group.

Early in the morning the class turns out, organized as a company, its members garbed in the gray-green dungaree jumpers that constitute the Marine's rough field service uniform. Fully armed and equipped, complete with pack, mess-kit and trenching tools, each man carries also a component unit of the radio equipment.

The company of perhaps 200 men falls in and marches away — down the long asphalt streets lined with barracks, beyond the recreation halls, out to the edge of the building area. There they leave the surfaced streets to tramp over rough country roads which eventually become woodland trails. On they march, deep into the densely-

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PLATE DISSIPATION: Watts	25	50	150	50	100	75	300	150	150	250	250	300	450	450	750	1000	1200	1500
AVERAGE AMPLIFICATION FACTOR	25	27	10	25	25		10	14	35	14	30	22	14	30	13.5	14.5	10	20
MAX. RATINGS: Plate Volts	2000	3000	3000	2000	4000	4000	3000	4000	4000	5000	5000	4000	6000	6000	6000	5000	3000	5000
Plate M.A.	75	150	500	200	225	150	1000	300	300	375	375	600	600	600	1000	1000	800	2000
Grid M.A.	25	30	75	40	40	25	150	60	70	60	85	100	80	110	125	250	200	500
MAX. FREQUENCY, Mc.: Power Amplifier	200	200	175	100	175	150	175	50	50	150	150	50	125	125	100	30	20	30
INTERELECTRODE CAP: C g—p u.u.f.	1.7	1.8	5	4.6	3.6	0.04	9	3.8	3.8	3.4	3.4	5.5	5	4	5	11	18	15
C g—f u.u.f.	2.5	2.1	7	4.7	3.3	13.8 In.	12	4.5	4.5	4.6	4.6	6.2	6	8	8	15.5	15	25
C p—f u.u.f.	0.4	0.5	0.4	1.0	1.0	6.7 Out.	0.8	1.1	1.1	1.4	1.4	1.6	0.5	0.5	0.8	1.2	7	2.5
FILAMENT: Volts	6.3	5.0	5-10	12.6	5.0	5.0	5-10	5	5	6	5	7.5	7.5	7.5	7.5	11	10	14
Amperes	3	5	13-6.5	2.5	7.5	7.5	13-26	10	10	11	11	15	12	12	21	17.5	22	45
PHYSICAL: Length, Inches	4½	5 1/16	7⅜	4¾	7	6¾	7¾	9	9	10	10	10⅜	12½	12½	16½	18	21¼	30¾
Diameter, Inches	1⅝	2	2½	2	2⅝	2⅝	3½	3⅜	3⅝	3¾	3¾	3¾	5	5	7	6	6	9
Weight, Oz.	1½	2½	8	4	8½	8	9	6½	6½	7	7	14	14	14	42	58	68	200
Base	Small UX	Std. UX	John-son #213	Std. UX	Std. 50 Watt	Glant 7 Pin	John-son #213	Std. 50 Watt	Std. 50 Watt	Std. 50 Watt	Std. 50 Watt	Std. 50 Watt	Std. 50 Watt	Std. 50 Watt	John-son #214	HK 258	W.E. Co.	HK 258
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*Beam Pentode.

HEINTZ AND KAUFMAN LTD. SOUTH SAN FRANCISCO CALIFORNIA U·S·A·

(*Continued from page 98*)

wooded reservation — so deep, in fact, that stragglers face a good possibility of getting lost.

Reaching the end of the made trail, the men unsheathe machetes and clear new paths. Finally the assigned position is reached. The instructor commands "Halt!" and they disperse according to plan, setting up a communications center for a theoretical division base command.

Entrenching tools are unlimbered and foxholes dug. Antennas are strung with the *whoosh* of a flying weight clipping treetops. Equipment covers are unlatched and cables connected. Hand generators commence to whine.

Almost in less time than it takes to tell it the command post is on the air. Two-man walkie-talkie teams strike out through the forest to set up outposts. Regimental field units, which had continued on when the main body halted, begin to report back. Traffic starts to hum.

Except for the probability of a treacherous Jap sniper camouflaged in a tree ahead or a malevolent Nipponese knifeman lurking murderously behind that next clump in his green paint, they're doing the same thing they might be doing on a battletorn island in the Southwest Pacific. Apart, perhaps, from the temperature in North Carolina in winter time, even the terrain and the vegetation are closely similar to those they would find were they fighting in the murky jungles of Guadalcanal. Only the sharp "pi-ying" of snipers' bullets, the rumble of distant battle and the piercing wail of bombs climaxed by thunder, are missing. But they'll come soon enough.

Meanwhile the men behave exactly as though they were actually under fire. They keep religiously under cover, sprawled beneath camouflage nets or concealed in thickets. They crawl on their bellies, snaking through the underbrush with the stealthiness of a cougar. They climb trees with the speed of a jungle denizen pursued by a lion — and without climbers. (Leg-irons are left to the telephone men; radio men don't use them.) Gain controls are turned down to the threshold of audibility lest the shrilling of a loud signal betray them to an enemy; even the faint tell-tale whine from the hand generators is muffled.

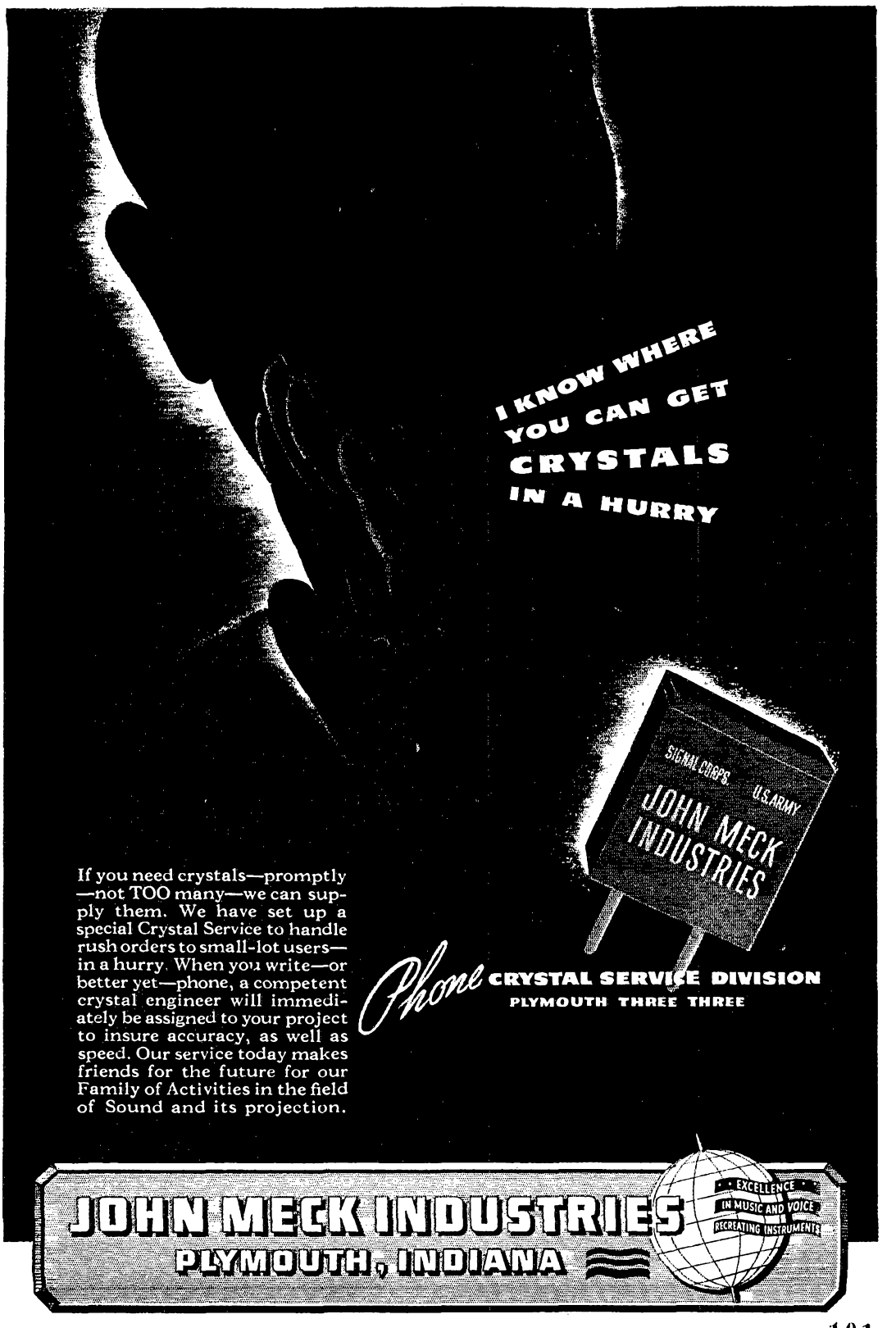
That's the way a radio operator whose job lies within range of the lurking death the Marines are accustomed to facing learns how to do that job.

Bivouac for the Night

It is tense, strenuous and yet exhilarating training. When the shadows lengthen the prospective fighting Marines know that they have learned something — that they are keener, more alert, better equipped for the coming battle for life.

If it's payday, they'll be heading back to camp when the day ends. Likely as not, however, they'll bivouac in the field that night — and perhaps the next night, too. It doesn't matter what the weather's like; be it rain or freezing cold they'll curl up in their foxholes and sleep the sleep that comes from a hard day's work.

A few won't be able to take the exposure and the tense, exhausting training, of course, but it's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(*Continued from page 100*)

better for the Marine Corps — and for them, too — to find that out in North Carolina than in Iceland or the New Hebrides. The hospital usually gets its quota after such an outing — but after all, that's what it's for, isn't it? The doctors know how to care for an exposure case so he's good as new in no time at all.

If this point of view seems harsh, bear in mind that a Marine *must* be tough. One purpose of this kind of training is to toughen him, inure him to exposure in all kinds of weather. The Marine Corps means a hard life; he must understand that before he gets in. And he must be prepared for anything that may come. To repeat, if he can't take it at home he certainly won't be able to on a foreign shore ten thousand miles away.

The men appreciate that fact, and accept the hardships as the valuable training and conditioning they are. They realize from the reports of instructors fresh from the front that only by superior stamina and proficiency can they survive against the Japs. They know, too, not to underestimate their enemy, with his sadistic cruelty, his callous disregard for life including his own, his fiendish cunning, stoical endurance and treacherous depravity.

When he comes to the end of his fourth week of this heroic regimen — his twelfth in the school — the new trainee is well on the way to becoming a sturdy, reliant, seasoned campaigner. He's ready to go right out with a combat unit — and he usually does.

Of course, there are exceptions. Those whose ability obviously lies along technical rather than operating lines may first be sent to the matériel school at Bellevue or the vocational school at San Diego. A certain percentage of the most promising men may be assigned to receive advanced training for work with secret devices.

But the bulk of the radio-operator trainees — the fellows with average code ability and the makings of a fighting man — go immediately to the battle zones. In fact, they probably go there faster than the men in any other branch. A typical student will finish his last day in the school, receive his first-class private rating (80 per cent of the graduates do), rush home to enjoy a five-day furlough — and a week later be fighting Japs.

Joining the Marines

How does a bright young lad with a liking for radio and a yearning for adventure get into the Marines? These days, of course, voluntary enlistments in the Corps can no longer be made. In common with all the services, the future leathernecks are being taken from the selective service lists. In other words, now you've got to be drafted to join.

But that doesn't mean your choice in the matter is ended. You can still get into the Marines, if you want to — and into radio, too. All you have to do is say so. When your number comes up, specify that that's the kind of duty you prefer — and make it plenty strong. The chances are excellent that you'll land in the berth you want.

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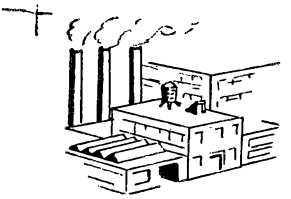

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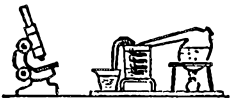

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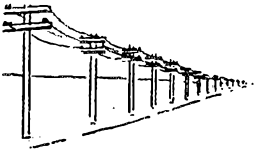

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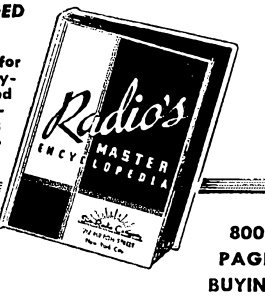

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(*Continued from page 102*)

Of course, you must have the qualities the Marine Corps wants, first. You must have a fighting heart, a strong constitution and the ability to take punishment. And you must have a natural aptitude for radio work as well.

The kind of men the Marine Corps wants for radio work fall into two classifications. One is the older trained man, professional or amateur, with experience either as operator or technician — more probably the latter. In the second (and, of course, the largest) category is the younger fellow, the lad with little or no actual experience but with a flair for operating as demonstrated by his classification tests, who goes through the school from scratch and ends up a fighting Marine as well as a qualified radio operator.

For this second group the Marines likes 'em "young and fresh." Fellows of 19 or 20 make the most likely trainees, particularly when it comes to learning code, they find. The requirements aren't difficult — a year of high school, with credits in algebra and physics and preferably also in geometry and trigonometry, and a satisfactory showing on the mechanical and radio aptitude tests given upon induction. Anyone with an operator's license, either amateur or commercial, as well as engineers and professional servicemen will qualify immediately.

A lad who qualifies has the world at his feet. He gets top-notch schooling, is turned into a qualified specialist (with a civilian profession assured) in the quickest possible time. He can count on a probable increase in rank before ever he goes on active duty, and if he has the stuff his opportunities for advancement thereafter are splendid, for the older non-coms are constantly coming back from the front lines while the newer men move up to take their places.

Radio operators are considered highly important people in the Marine Corps. Apart from the importance of their duties and the urgent need for operators, the required training is as difficult and rigorous as any that is given. Even those who flunk out of radio are retained in some branch of communications, since only the highest type of recruit is assigned to radio in the first place and the communications branch wants to hang onto them.

"*For Right and Freedom*"

By the time these lines are read many of the lads we saw training at Camp Lejeune will be fighting under the flag of that valiant Corps which, according to its famous hymn, is always "First to fight for right and freedom" — the Corps which, in more than 167 years of fighting for America, has never known defeat.

Even now, we can see the story as history will record it. This is the way it will go:

"*The Marines have landed . . .*

"The radio operators from Camp Lejeune were among the first off the transports, daring the enemy fire, setting up communications and transmitting vital information with the one hand while counter-fighting with the other.

"*. . . and the situation is well in hand.*"

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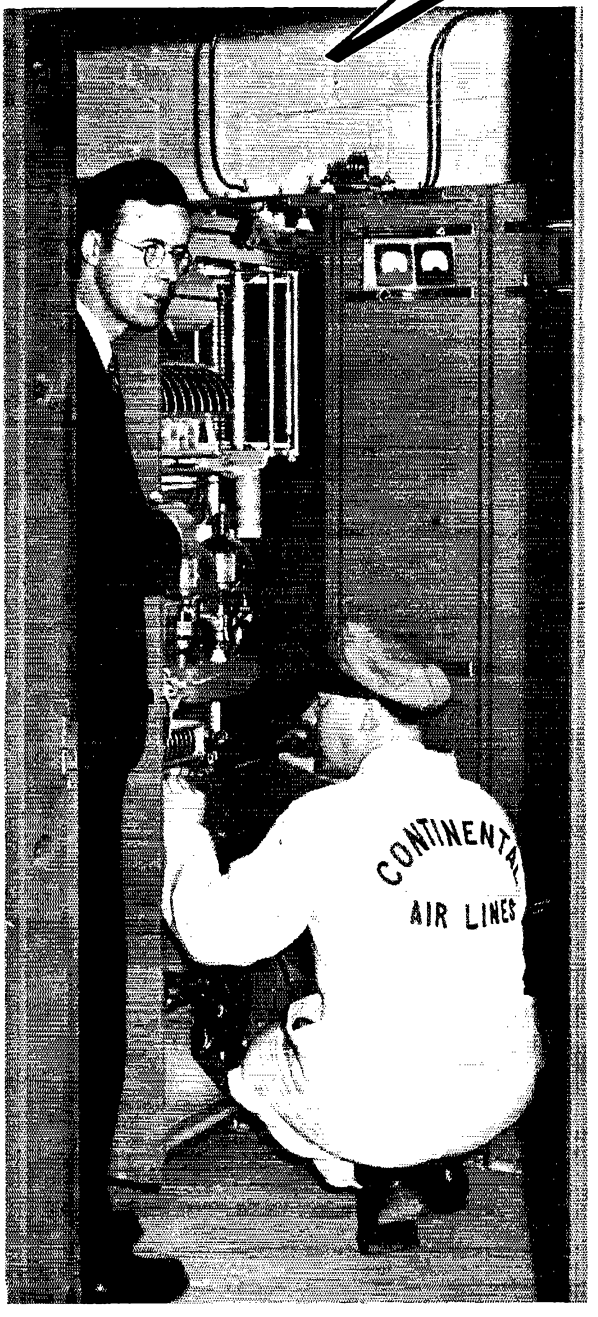

says E. H. Forsman,
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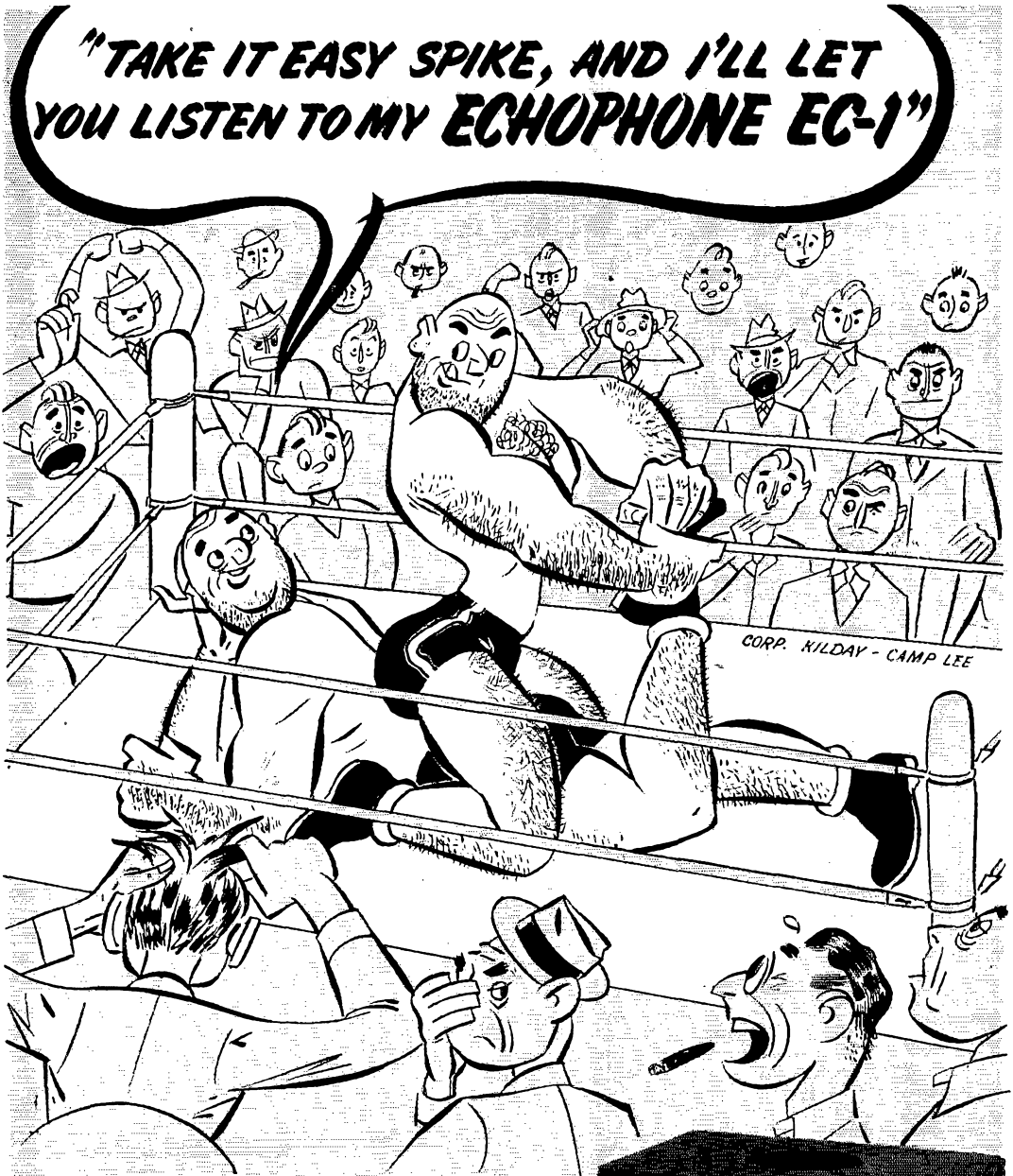

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ELECTRONICS ENGINEERS. Electrical engineer to design electronic devices as applied to Industrial control, welding and similar applications. Also an electrical engineer with knowledge of electronics for application work. Write Westinghouse Electric & Manufacturing Co., Room 1415, Union Bank Building, Pittsburgh, Pennsylvania, for application blank.

WANTED — Operator with first class ticket. If considering changing employers — this progressive station and congenial staff offers opportunity worth investigating. write, Wire, or phone — stating when available, starting salary expected. KTSM — 1000 Watts — NBC, Karl O. Wyler, Gen. Mgr., El Paso, Texas.

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WANTED — Cooke radio slide rule. R. Arrowsmith, 219 E. Carroll St., Macomb, Ill.

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SELL HRO grey relay rack type with coils and power supply. Wanted: NC-200, SX28, SX32, SX25, SX24, SX17, SW-3U. Also RCA 815, Hytron 67. Joseph Whiting, Taylorcraft, Alliance, Ohio.

WANTED — In excellent condition, SX17, SX28, SX32 or NC-200; also radio servicing test instruments. Will pay up to full price. Raymond Spefna, 351 Holford Street, River Rouge, Michigan.

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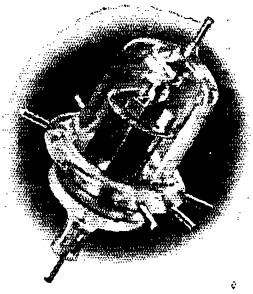

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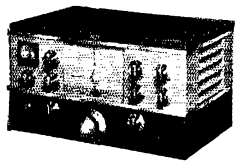

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