In This Issue:
The Radio Ship Apache
How Microphones Work
Mapping U. H. F. Contours
One-Tube Transmitter-Receiver
The Signal Corps Radio Relay Link
WHAT ARE YOUR
TRANSFORMER PROBLEMS?

IS IT QUANTITY?

IS IT QUALITY?

IS IT DESIGN?

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Thousands of testimonials are in the files at Hallicrafters. They are from members of the armed services all over the world. They tell how Hallicrafters-built communications equipment has performed dependably and brilliantly on all the battle fronts of the world. Many of these letters are signed by licensed amateurs who include their call letters with their signatures. A high percentage of the letters conclude with sentiments like these—we quote: "If a rig can take it like the HT-9 took it in the Australian jungles, it's the rig for my shack after the war"... "When I buy my communications equipment it will be Hallicrafters"... "After we have won this war and I can get a ham ticket these will not be the slightest doubt as to the equipment I will use... It will be Hallicrafters"... "Meeting Hallicrafters gear in the service was like seeing someone from home... I used to have one of your receivers at W7FN... hope to have more after the war"... "being an old ham myself I know what went into the 299..." This does the voice of the amateur come pouring into Hallicrafters headquarters, providing information, guidance and further inspiration to Hallicrafters engineers. Amateurs will find in Hallicrafters peacetime output just the equipment they need—refined and developed in the fire of war and continuing to live up to the well earned reputation as "the radio man's radio."

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HOMECOMING...

There's a homecoming in sight. With the achievement of total victory, millions of vets will eagerly await the time of coming home. Hallicrafters will be able to have a homecoming of its own.

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When Hallicrafters resumes its place as a leader in the development of receivers and transmitters for the amateur it will be a true homecoming. The HT-4 and a long line of other battle proved Hallicrafters communications equipment will soon be ready to operate in the ham shacks of tomorrow.

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Radio equipment? Right. And one thing more a common need to make sure the transmitter is on the correct frequency.

This means that, postwar, most transmitters will also have in common the proud ownership of a very special piece of equipment. For there is only one piece of equipment which, at a modest price, accurately and quickly checks the frequency of any transmitter and is especially designed for mobile services. That is the Browning Frequency Meter.

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The establishment of radio ground stations on every continent and in fifty-two different countries...overcoming the widest extremes in operating and climatic conditions (from 40 degrees below zero to 140 degrees above)...stations in jungles...in deserts...in mountains and towns...and to have these stations constantly operating at near peak levels is a tribute to the equipment employed. On this page are shown three AACS Stations located at widely separated spots on the globe.

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

Reports Invited. All amateurs, especially League members, are invited to report communications activities, training plans, and progress made toward building or planning each mid-month (15th of the month for the last 30 days) direct to the SCM. The administrative official in each Section whose address is given below, Radio Club reports and Emergency Coordinator reports representing community organized work and plans and activities are especially desired by SCMs for inclusion in QST. ARRL Field for inclusion in Emergency Corps plans, with the exception named, will be made. This is to permit full efforts of all in Emergency Corps plans.

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Official appointments are to act temporarily in the absence of a regular official.
Make Variable Bandwidth Crystal with uniform gain a MUST in your postwar receiver. Then YOU will be "RIGHT... from the start." All Hammarlund receivers have that feature.
is a noncommercial association of radio amateurs, bonded for the promotion of interest in amateur radio communication and experimentation, for the relaying of messages by radio, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternity and a high standard of conduct.

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

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

Inquiries regarding membership are solicited. A bona fide interest in amateur radio is the only essential qualification; ownership of a transmitting station and knowledge of the code are not prerequisite, although full voting membership is granted only to licensed amateurs.

All general correspondence should be addressed to the Secretary at the administrative headquarters at West Hartford, Connecticut.
"IT SEEMS TO US—"

THE NEWCOMERS

The final ending of war, almost certainly a matter of days if not hours away as we write this, suddenly brings into sharp, close-up focus many a question about which we've been pondering these past months. Now, almost overnight, they become perplexities requiring immediate solution rather than conjecturing in terms of futures. There's one problem in particular that concerns us just at this time.

Here's the problem: what are we going to do to get the radio-trained veterans of the armed forces into amateur radio? Mechanically and physically, how are we to go about doing it? It is variously reported that somewhere between a half and three-quarters of a million young men and women in uniform have received some degree of radio training and experience during the war, and a certain percentage of them will be admirable candidates for amateur radio. We want them in the game. We need them.

We might as well pause right here to discuss that question of needing them, for there are always some amateurs who think that we are so crowded that it is poor policy to encourage any new people to enter. That is a very shortsighted view and overlooks several fundamental facts. While we all know numerous amateurs who have been in the game twenty years, or even thirty, it is true that we have always had a pretty good rate of turnover in amateur radio, just because it is only an avocation in a land that is primarily business-minded. College attendance and courtships have always heavily decimated our ranks but the real grim reaper has been "business," the dawn of a business opportunity, something that makes the amateur "too busy" to carry on. Nearly always, therefore, it is the amateur of some little experience and skill who has to quit — we die off at the top. We always have new fellows coming along, of course, for we have shown constant small growth in our total, year after year until the war. But the war has been going on for years and the new blood hasn't been coming in. Allowing both for our usual rate of turnover and our normal growth, we figure the war has prevented the entry into amateur radio of at least fifty thousand new people who would have become experienced hams by now. We are behind that much, because these thousands of young men and women are now in the armed forces. Meanwhile the prewar list of licensees contains more and more who will not resume. Many will not be able to, for they lie buried in foreign lands and seas. Many will be prevented from resuming by the changed pressure of affairs, both business and family; and some will have lost their interest. We really doubt that much more than a third or perhaps a half of the Pearl Harbor ham list will return to the postwar air. We do need new blood; to give us the strength of numbers, to introduce to our activity the knowledge of new techniques these men possess, and to fulfill our destiny as the great training school for America's radio needs.

The new men of whom we speak have had no experience of amateur radio; they're "too young." That was driven home to us just recently when a Government agency telephoned us to ask if we could locate for them a number of prewar amateurs of good code ability between the ages of 17 and 18, so that arrangements could be made to take them on when they were drafted. We had to point out that such lads were under the age of 14 at Pearl Harbor and that there weren't many such in all amateur radio. The new crop of young men and women will be starting fresh.

As we all know, a goodly number of them have heard about amateur radio, chiefly by contact with amateurs encountered in the services and through the study of ARRL publications, and are already intended to qualify as amateurs after the war. But doubtless many of them don't even know that there is such a thing as amateur radio, where you can build your own station and communicate all over the world to your heart's content; or, if they do know, that they have any true appreciation of its endless possibilities and what it can mean to them. Yet here they are, possessing already the basic knowledge of code and theory, waiting only to be sparked into the realization that they ought to become amateurs. What shall we do about it as they come home?

A couple of years ago we planned to write a booklet which, with the collaboration of the armed services, would be distributed to radio students at the service schools. We were going to print hundreds of thousands of copies. We were going to tell these students about amateur radio and what it could mean to them after the war. It was in our mind that this vision of what could be done with radio knowl-
edge after the war would give the students an added incentive to study hard and really learn. About that time the manpower shortage caught up with us and we never succeeded in producing the booklet. We doubt if we lost too much by that failure, though, as not too many men would be likely to carry the remembrance of our little booklet close to their hearts all these years; and even if we had their prewar addresses as a mailing list for memory-joggers, what good are prewar addresses now?

No, there is no way we can reach any appreciable percentage of these men while they are still in the services. The thing that will happen now is that they will receive their individual discharges and settle down somewhere, one by one, as civilians. They possess this excellent background knowledge of radio and we have no way of getting hold of them as a group to tell them that they are qualified for ham radio and that it can possess boundless fascinations and delights for them. Left alone, most of them are likely to do nothing at all about it, because they don't know of us and the fun we have. Some of them will find out about amateur radio by accident but most of them may never learn of it — unless we develop a plan. That is our problem.

Have you any ideas for a plan? The League has the means to carry out any good plan as soon as it can replenish its now sadly-depleted headquarters staff. What we want now is the best possible scheme for action, and we think that many ARRL members may have helpful ideas. We'd like to hear from you. We know, too, that QST is reaching a goodly number of the very kind of people we are talking about — with service-acquired radio training, amateur ambitions, and no actual amateur experience. Such chaps could be of particular aid to us, for they see things through service-men's eyes, and their suggestions would be particularly welcome.

The way it seems to us, this is going to be a local job. Joe and Mac are going to be back home — or home will be back home — before we can reach them effectively, we think. This is very likely to mean that the story of amateur radio must be told to them by existing local amateurs. And so we are led straightforward to the thought that this whole undertaking really belongs to the local clubs. We have some seasoned amateurs in almost every community and many hundreds of good amateur clubs. How would it be for a solution if ARRL created some attractive literature on the nature and possibilities of amateur radio and made it widely available to the clubs to distribute? The clubs could hold special meetings to which they invite the returned service men who would like to learn about ham radio, and the newspapers would be glad to help with local publicity. Don't you think this would work?

We foresee great days for local clubs after the war. We think they will experience enormous growth in membership, interest and usefulness. In fact, we have been thinking that it may be desirable for the League to extend its organization to the extent of forming an ARRL Club of the local members in every town in the nation, operating under substantially uniform constitutions and under the general supervision of some ARRL field official, such as the SCM. Our thinking goes in this direction because the task before us is much greater than simply that of getting new men and women to make a start in amateur radio. Regardless of their technical skill and code ability they'll still be without practical knowledge of amateur radio and its particular ways of doing things. If you who are experienced amateurs will pause and reflect a moment you'll realize that amateur radio is a peculiarly complex society and that it has taken us years and years to learn and understand as much as we do about the reasons we do things a particular way, the things we don't do and why not, all the intricacies of our traffic handling and our contests, the way we govern our affairs, and so on. All these things will have to be taught the newcomer. He will not automatically be a good amateur just because he was a good military operator. We have a vast body of tradition, we have a long and honorable history as an American institution, we have codes of ethics, and in particular we have an institutional sense of social responsibility and the realization of certain responsibilities to our nation, our community and each other.

These are the very things that set apart the experienced amateur from the newcomer, and it is essential that an adequate comprehension of them be imparted to the new men. It is going to be a job of very big dimensions, for the number of prewar amateurs who remain active is likely to be much less than that of the service-trained newcomers, and if we wish to be sure that amateur radio remains a wholesome and well-regarded and useful avocation it seems to us that we'll all have to pitch in and work like crazy to teach the new men how to go about things the right way. Once these new amateurs are in the ARRL fold, articles in QST of course can help a lot, but our current impression is that this is essentially a job that can be accomplished only in local meetings, and that is why we are expecting that postwar local organization will be of higher importance than ever before. To thoughtful old-time amateurs in particular we commend the possibilities of making an exceedingly valuable contribution to the future of amateur radio by preparing to pitch in and help to tell the story of amateur radio to the new postwar gang and to lead them in the directions that make for a sound and enduring structure.

It only takes four people five hours a day to open the mail received at ARRL Hq.! We can stand some more. Have you any ideas on this big subject?

K. B. W.
Signal Corps Radio Relay in North Africa

The First Application of a V.H.F. Radio Relay System to Military Operation

BY CAPT. O. D. PERKINS,* SC, EX-W7MH, AND A. DAVID MIDDLETON,** W20EN

About eleven o'clock on the night of April 19, 1943, a three-quarter-ton weapons carrier towing a small trailer crept cautiously through a Tunisian olive grove into a blacked-out command post, threading its way past foxholes and pup tents, guided only by the ghostly white-gloved hand of an MP. The darkness was punctured at intervals by flashes of artillery fire. The soft swishing of shells in flight could be heard overhead. Off in the distance, streamers of fire reached into the sky and exploded in sharp bursts as they searched out a flight of German bombers.

The truck stopped under a spreading olive tree. The silence of the night suddenly exploded with the putt-putt of a small gasoline engine power unit. A faint glow of radio tubes emanated from beneath the cover of the truck body. Quickly drawing a tarpaulin over the offending light, three men climbed into the weapons carrier. Installed in these cramped quarters were a 50-watt Motorola v.h.f. f.m. police radio set, a British teletypewriter and some unusual-appearing equipment labelled "Apparatus, Telegraph MKII."

Capt. Perkins, ex-W7MH, pressed the button on a telephone handset and spoke — "X-ray to Able — over." From the loudspeaker came the reply "Able to X-ray. Roger." Perkins spoke again. "X-ray to Able. Stand by for A2," and he flipped a switch. One of the men began to type out a message on the teleprinter. After a moment's pause a reply appeared on the machine in front of the three men jammed into that truck body. Thus was history made. V.h.f. radio had spanned a distance of over 350 miles from the battlefield of Tunisia to Allied Force Hq. in Algiers with solid communication on both voice and teletype. The secret? Radio relay. This was the first application of radio relay and v.h.f. radio-teletype in tactical operations by Allied forces.

The tremendous amount of work and preparation preceding this historical moment began in December, 1942, when Colonel Dan C. Gilmer, secretary of General Eisenhower's AFIHQ General Staff, visited the Chief Signal Officer in Washington as General Eisenhower's personal representative to present requirements for additional communication equipment in the North African Theater of operations. During the discussions that followed, an urgent requirement became apparent. A trunk line communication system was needed to extend eastward from AFIHQ Algiers to the combat forces in Tunisia, particularly for the use of General Eisenhower during his frequent trips from Headquarters. Colonel J. D. O'Connell and personnel of the Signal Corps Engineering Laboratories had long visualized and now proposed the use of a radio relay based on a system with which the Laboratory had experimented in the 1941 Carolina maneuvers, when the "Blue Army" had used a number of police radio f.m. sets, in what was known as the Combat Zone Warning System. This network employed voice operation between two or more headquarters and between moving vehicles. The system successfully furnished the "Blue Army" advanced information about movements of the "Red Army" as "Blue" observation reports were sent back to the nearest radio station of the Warning System. From there the information was relayed on voice through one or more stations to the headquarters.

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**Assistant Editor, QST.
After successful demonstration of this system under simulated battle conditions, the boys at the Laboratories were convinced that they could extend the system and make the relaying automatic instead of manual.

Colonel Gilmer was quite impressed with the details of this relay system formulated and tested under the supervision of Colonel O'Connell; Lt. Col. Wm. S. Marks jr.; Lt. Col. V. A. Kamin, W9US, Capt. Perkins, ex-W7MII, and Julius Kravetz, W20EF. It was agreed that the required equipment and necessary personnel must be assembled by January 1, 1943, so that it could be employed in the Tunisian campaign.

On December 7, 1942, the Laboratories were directed by the Chief Signal Officer to procure and assemble all available equipment for shipment at the earliest practicable date. This task, an enormous one in normal times and a truly staggering job with such short notice, was turned over to Lt. Col. Marks, Captain Perkins and Kravetz. These men had a reputation of accomplishing the seemingly impossible almost immediately. Through the cooperation of Paul Galvin, Daniel E. Noble and Floyd McCall of the Galvin Mfg. Corp., and Fred M. Link and Fred Budelman of Link Radio, W20EF and his civilian associates assembled a total of 21,142 articles and delivered them to the New York Port of Embarkation by December 26th. Just 19 days had elapsed since the receipt of the directive from Washington!

To accompany the shipment and install this radio system in the African Theater, Capt. Perkins was designated officer-in-charge, with Kravetz (civilian-in-charge); Russell A. Berg, W1CIW; J. H. Durrer; V. H. Colagouri, W2GUM; F. W. Neidt of Coles Signal Laboratory, and J. J. Kelleher, W2DSY, of OCSigO, as civilian engineers. At the last minute higher authority decided to retain W20EF at the Laboratory to organize subsequent operational phases and to assemble additional components. Kravetz had a wealth of information on radio relay as a result of his work in developing the original Combat Zone Warning Net during the Carolina maneuvers.

After a terrific “hurry-up” job of preparation, Capt. Perkins and the civilian engineers set forth on January 9, 1943, to make radio history.

Upon debarking at Oran, local Signal Corps Depot personnel promptly pounced upon the large shipment of equipment with a cannibalistic gleam in their eyes. What a mass of spare parts for their depot and repair stocks! And what a sad awakening they had when, after a frantic search, “Perkins and Co.” caught up with them and sounded warnings of the consequences should any piece of their precious relay gear be touched.

After arrangements had been completed for transshipment of the equipment to Algiers, the group proceeded there by air arriving January 31, 1943. They immediately set to work unpack-
ing, requisitioning additional supplies, and preparing for the arrival of Company D, 289th Signal Service Battalion, commanded by Lt. Lotus B. Blackwell, W5E2D. This organization had received training at Fort Monmouth and preliminary technical instruction at Coles Signal Laboratory from W2E0F. They arrived in Algiers a few weeks after the party from Coles.

**Preliminaries**

Preoccupied with the complex workings of a major invasion force, the Signal Corps personnel of AFHQ found it necessary to become familiar with the scope and objective of the projected communication system. Quite naturally and forgivably the authorities were reluctant to go all-out in accepting an untried non-standard system employing such a radically different technique. There was also the possible interference with normal routine of existing communication facilities. Furthermore, from the standpoint of possible violation of security, uncoded voice transmission over any radio circuit was absolutely out of the question.

It was discovered that some of the signal officers questioned the idea of providing even General Eisenhower with a personal radio circuit, especially one that would be voice-operated and thus lacking in the necessary element of security. They didn't want "Ike" or anybody else using voice radio while at the front because of the risk of interception.

However, due consideration was given to the proposed system during which Capt. Perkins argued loud and long, with the result that Brig. Gen. J. V. Matejka, Chief Signal Officer, AFHQ, approved the initiation of tests. To provide security, Lt. Col. Henn-Collins, Royal Corps of Signals, who headed up the Radio Division of AFHQ, arranged for the provision of British 7B teletypewriters and associated two-tone telegraph apparatus with which encrypted traffic could be handled rapidly. The only two-tone sets available were development models which had been tested over wire teletype circuits and discarded as being unsuited for the required operational use. These two-tone telegraph units performed admirably over the f.m. radio links, however, and the entire African Theater was searched, with the result that a total of six teletype equipment were eventually obtained.

With the preliminary tests a marked success, Capt. Perkins soon convinced Gen. Matejka and his staff that the proposed new communication system could play a vitally important rôle by extending teletype service into combat areas more quickly and easily by v.h.f. radio than by installing wire lines, subject to sabotage and the other normal hazards of combat operations. However, the mere authority to take the equipment into combat zone was far from the solution of the many problems still confronting the boys.

There were many obstacles to overcome. This group of Signal Corps engineers and their GI companions were the first Allied military unit ever organized for the specific task of providing a tactical radio relay communication system. They faced overwhelming problems of supply and administration of widely separated detachments operating on isolated and almost inaccessible mountain peaks. There was also the immediate and vital work to modify the police radio equipment to meet the specific tasks, and to supplement the previous training of the GI personnel for the new tasks as they became evident.

Not the least of their worries was the lack of qualified teletype operators. W2DSY, however, had been a high-speed c.w. operator with the Signal Corps and RCA in previous years and was a "whiz" on a teletypewriter. On him fell the job of selecting and training a group of teletype operators. The company clerk became the first "draftee" for this assignment. Anyone who could recognize a typewriter when he saw one was drafted instantly. Vehicles, ordnance, quartermaster and engineer supplies and equipment had to be obtained far in excess of quantities authorized for the original company organization. This task was, perhaps, the most difficult of all since, at the time, every item was in short supply and vitally needed either at the front or for early replacement of battle-destroyed equipment. The unconventional means resorted to in obtaining many of these supplies are considered by Capt. Perkins to constitute a military secret to be forever closely guarded.

Early in the planning for eventual operations, it became evident that additional military per-

![Fig. 2 - Block diagram of the duplex radio relay system installed between Tunisia and Malta.](image-url)
A radio relay receiving station at Pantelleria.

sonnel augmenting the original Company D and that reorganization into an independent signal company operating directly under AFHQ would be required. Accordingly, Capt. Perkins executed a series of concerted attacks upon the personnel office of Lt. Col. Kirk Buchak, Assistant to the Chief Signal Officer, AFHQ. Perkins soon achieved the distinctive title of "The Terror of Buchak's Office," but his efforts were rewarded eventually by the establishment of the provisional 2650th Signal Radio Relay Station Co. and the assignment of the necessary additional personnel.

**Hunting That "Perfect Location"**

After overcoming some of these obstacles to the extent that operation could be initiated, the boys began the reconnaissance of sites for the relay chain eastward from Algiers. Perkins, Colagouri, and Durrer started out into the Atlas mountains of Eastern Algeria, a rugged country of high peaks and deep valleys thick with Arab villages bearing unpronounceable names. The first selection from a map, Djebel Toukra was a dream location, 4500 feet high, and within line-of-sight of Algiers, 86 miles away and accessible by road. The first test with a 25-watt police set in a jeep, before reaching the peak, was an instant success with perfect communication. The party bivouacked for the night. At that time of year, early spring, the peaks were covered with snow, and snow and sleet-storms were frequent. Brutally cold, the boys reported a rugged night, sleeping on the steel floor of a GI truck. The accepted night dress was all available GI clothing, including helmets. To add to the discomfort, tribes of monkeys and baboons prowled about the camp site, keeping the men awake with their chattering.

The next morning the party reached the top of Djebel Toukra and selected two promontories one on either side of a "saddle," for the receiver and transmitter sites, respectively. In their impatience to set up the 250-watt relay station for final tests, the boys were caught in a downpour of sleet and rain, drenching the transmitter and causing all sorts of fireworks when the power was applied. There was nothing to do but return to Algiers, dry out the set and repair the damage, which fortunately proved to be minor.

Returning in a few days with an operating detachment and complete camping equipment, they set up a permanent site and put the first radio relay station on the air. Meanwhile the rest of the party were busily establishing themselves in a permanent company headquarters in Algiers installing the AFHQ radio terminal and assembling a mobile radioteletype terminal. The latter was dispatched to the town of Bougie, on the Mediterranean coast, some 40 miles from Djebel Toukra, where it was placed at the disposal of a British Supply Headquarters for its first trials in handling bona-fide traffic. These trials were successful and highly instrumental in further convincing the signal personnel at AFHQ that the boys had developed a really useful communication system.

The blessings of AFHQ lent new zeal to the efforts in extending the system toward the battle area of Tunisia. Durrer and W2GUM set forth in the radio-equipped jeep to spot the next site.

As the relay expedition continued east they were constantly amazed at the distances they achieved from the original relay station at Djebel Toukra, and 206 miles from AFHQ, when they called in with the radio-jeep giving the location, they were able to relay through without difficulty. Up to this time no one had dared to suggest that such distances could be spanned over that mountainous country.

While preparations were under way to set up the relay station at Djebel Ouasch and move the mobile terminal there from Bougie, Joe Durrer and W2GUM proceeded eastward with high hopes. They lost contact with AFHQ, and Perkins spent several anxious days awaiting word as the boys had entered territory known to contain scattered parties of German troops. However, the party returned without mishap but somewhat discouraged by the results of their efforts. They had traveled through the most rugged terrain yet encountered without finding an accessible site. They had literally cleared their own road for miles over a mountain trail apparently leading to the only promising location in the area to suddenly find
their way completely blocked by mountains. They even told of a family of French settlers who had run away in fright, screaming "Avion! Avion!"—believing them to be Germans dropped by parachutes, as they could not conceive of any vehicle possibly traversing the route over which the party just passed.

With the installation at Djebel Oussach in operation, however, prospects for extending the system were more promising and once again the reconnaissance party started out, this time with Djebel Rorra, selected from a map, as the objective. They were soon blocked again, however, shortly after leaving the main highway by a rather formidable river. Despite the obvious risk, the boys started across. About six feet from the opposite bank—their jeep went down! The boys managed to haul it ashore and after drying out the ignition system they drove on up the mountain along a nearly impassable trail. With much heaving and pushing they reached a promontory which gave them communication back to AFHQ. Trouble developed with the radio set due to the ducking it had received in the river, and all they could hear was something about "a big change in plans." This was extremely confusing, but they returned to the highway after spending several hours tossing boulders into the river to provide a rough but more reliable ford.

They returned the next day, followed by the truck with the relay station and its operating detachment, with Perkins in the mobile terminal vehicle butting his way through trees and underbrush and nosing boulders out of the trail. Upon reaching the top of Djebel Rorra they saw a fine dirt road winding away before them, unmarked on the maps, but which met the main highway a few miles from the trail junction!

**Searching for the II Corps Hq.**

When a circuit was established to AFHQ, they learned of the altered plans. The American II Corps was moving secretly from Southern Tunisia to make a surprise attack upon the German forces near Beja. The whereabouts of the American headquarters was unknown, and no communications facilities directly to AFHQ were to be available for some time. Capt. Perkins was directed to report to the Corps headquarters near Souk-el-Khemis. For the rest of that day and the day following he searched to no avail. Finally word came to the mobile teletype station that II Corps had located its CP near Beja.

Perkins eventually found II Corps Headquarters. The necessary password, however, was lacking. That the ensuing pleas were persuasive, however, is evidenced by the fact that the sentry himself gave Perkins the password. He repeated it, the sentry gave the countersign—and the truck passed into Corps Headquarters. There

On the peak of Djebel Rorra. The receivers and associated equipment, concealed and camouflaged, are shown about two hundred yards from the transmitter.

Perkins reported to Colonel T. J. Tully, Signal Officer, and agreeably surprised him with the information that a radio teletype circuit was in operation to AFHQ!

Operations began the morning of April 20th. Since II Corps had no wire circuits available, the radiotelegraphic circuit to Algiers carried all Corps traffic which otherwise would have been routed over wire lines. II Corps at that time was operating directly under AFHQ and, consequently, independently from the British Armies and the 18th Army Group. It was therefore a vital necessity that traffic for AFHQ be handled as directly and expeditiously as possible.

In the meantime WICIW, Durrer and Ferd Niedt were rushing to completion a fourth relay station intended to cover the northwestern part of Tunisia. This station was merrily on its way to a likely looking mountain top when the detachment was pulled up short by a motorcycle MP.

"Where do you think you're going?" he snapped. Without waiting for explanations, the MP continued: "This is still enemy territory. Get the hell out of here!" The crew backtracked. Standing by for a few days, they had the opportunity to view at close range the terrific artillery assault upon famed Hill 609. After the fireworks cooled down they set up the relay on a hill a quarter of a mile south of Hill 609. W2GUM tuned to the station on Djebel Rorra while the II Corps terminal leap-frogged from Beja to Sidi Neir, continuing operation to AFHQ through the additional link with scarcely a moment's lost time. Hour after hour, day after day, the distinctive two-toned signal from the hidden CPs in the valleys of Tunisia leaped from peak to peak along

(Continued on page 88)
Choosing U.H.F. Sites

Using Contour Strips to Predict Circuit Performance

BY PHILIP S. RAND,† W1DBM

In looking over the new frequency allocations one is intrigued by the many new u.h.f. amateur bands. With all the new tubes and circuits developed for war use and with antennas only a few inches long, what will we hams do with them? What sort of DX will be possible when transmitting on several hundred or several thousand megacycles? There is one thing of which we can rest assured—that the ones with the best locations will get out the best. As the frequency goes up and up, a line-of-sight path between the transmitter and receiver becomes more and more important. Undoubtedly there will be plenty of new effects observed with signals bouncing off near-by hills, buildings and even airplanes. Many of these characteristics have been observed on 112 Mc., 56 Mc. and even 28 Mc. Did you ever notice that rapid flutter as a plane flew over?

After V-J Day when the new amateur bands are open and the thousands of hams return from the battlefronts and the war factories, many will be looking around for a new home to buy or build with those war bonds and naturally they will want to locate in a spot as favorable as possible for the new u.h.f. bands. To find a good QTH most hams will not have to do as the writer once did in New Jersey when he drove all over the countryside with an altimeter in the car and when that read the highest level he started looking for a near-by house to rent. Here at WKNQ in Middletown, Conn., we have been able to predict with pretty fair accuracy whether or not communication will be possible and, if so, how good it will be, simply by purchasing a set of geodetic survey maps at 10 cents apiece. These maps are calibrated in twenty-foot contours, and a set of six or eight will pretty well cover any practical range.

Most large book stores or map-supply houses carry these maps or they may be obtained by addressing the Director of the United States Geological Survey, U. S. Dept. of the Interior, Washington, D. C. An index of maps available for any state will be supplied free, from which the titles of the maps desired may be selected. Applications for maps must be accompanied by cash, draft, or money order (no postage stamps!).

The scale is 1 to 62,500, or approximately one inch to a mile, so that airline distances may be measured very quickly with a ruler. Of course, to predict the chances of working another station from a given location it is necessary first to construct an outline of the intervening ground by contours, which takes about ten minutes. This is a lot quicker and easier than waiting till next Sunday between five and seven when you can drive from hill to hill with a WERS mobile, and furthermore it does not use any gas!

The use of this system has been very helpful to us in WERS at WKNQ since we are located in the hilly central part of Connecticut. It was only by this method that we were able to find a location from which a mobile transmitter could establish direct contact with both New Haven and Hartford as well as one from which all our outlying towns could be worked. In the past it has been necessary to drive several miles away to work New Haven. A third hill was necessary to work Haddam and a fourth for Durham.

Hams who are fortunate enough to be at home and connected with a WERS outfit not only can find a good QTH on the map but also can take a portable or mobile rig operating on 112 Mc. to the location to try it out. By drawing contour maps or strips of various known v.h.f. paths and comparing them with known results, it soon becomes easy to predict results over unknown paths. These results can then be converted for u.h.f. use by taking into consideration known modifying u.h.f. propagation data, such as less bending, more bounce and scattering off hills, and greater

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Fig. 1—Typical contour outline strip laid out along a proposed high-frequency path.
shadow effects from intervening hills as the frequency is increased. In other words, if you find you have a line-of-sight path or practically so, u.h.f. should be as good as v.h.f., especially since beam antennas will undoubtedly be used to a greater extent because of their small size. However, if you find a hill in between which casts a bad shadow at 112 Mc. it will be much worse at u.h.f., especially if the hill is near one end or the other of the circuit.

**Making the Contour Strip**

The first thing in making a contour strip of any given path, of course, is to purchase the necessary maps. These maps should have the borders shadow effects from intervening hills as the frequency is increased. In other words, if you find you have a line-of-sight path or practically so, u.h.f. should be as good as v.h.f., especially since beam antennas will undoubtedly be used to a greater extent because of their small size. However, if you find a hill in between which casts a bad shadow at 112 Mc. it will be much worse at u.h.f., especially if the hill is near one end or the other of the circuit.

**Making the Contour Strip**

The first thing in making a contour strip of any given path, of course, is to purchase the necessary maps. These maps should have the borders trimmed off so that they will but with one another to form one large map. After trimming, the various sections preferably should be pasted down on a large sheet of beaverboard with wallpaper paste so that the various sections will not skid around while working on them. After the map has dried and can be handled, the first thing to do is to take a red pencil and shade or color the highest points in your locality. Here at WKNQ we shaded the 700-, 800-, and 900-foot contours red since they are the highest. The 500- and 600-foot contours were shaded yellow. In this way, it is possible to tell at a glance where all the high spots are. You will notice many high places which you did not realize were there; also you will see that there are roads leading to some of them, although some may be unimproved woods roads.

Now that the map is colored you may see that your favorite mobile spot (shaded yellow) is blocked to the southwest by some hills which are shaded red. No wonder you never got out very well in that direction. However, you also see farther north another hill shaded yellow with a road leading to the top. This hill is farther away from the station you want to work but at the same time it puts the offending “red” hill, which is casting the shadow, farther away from you so that more signal will bend over and reach you.

Now make a contour strip of both paths and if luck is with you the signal from the new hill may cross the offending red hill at a lower elevation which will mean stronger signals both ways. Make a dot on the map with a pencil to locate the position of the transmitters at both ends of the path and then draw a connecting line between the two dots. Lay a piece of paper about two inches wide and long enough to overlap slightly both locations on the map with one edge on the line. See Fig. 1. Mark in pencil the elevation in feet of each end as well as that of each contour on the strip. Now remove the strip of paper and with a ruler draw a series of parallel lines the length of the paper about ¼ inch apart. The spacing of the parallel lines really should be 1/52 inch to be to scale; however, this would so compress the hills that the strips would be hard to read, therefore ¼ inch is selected for their spacing.

Label the bottom line “zero” or “sea level,” the next “100 feet,” “200 feet,” etc., until you have enough lines to take care of your maximum elevation. Now, from each of your contour lines drop a vertical line to intersect with the parallel elevation lines and put a dot where they intersect at the elevation marked on the edge of the strip. Connect all the dots with a smooth line, as in making a graph, and there is your first contour.

Repeat the above process for the other location and then compare the two strips. The two may be plotted on the same strip or the two strips may be held up to the light while superimposed for study. Dotted lines may be drawn from the antenna at each end towards the center just missing the top of all hills. The heights of the two antennas also should be taken into account. This will be the approximate line-of-sight path, not considering the curvature of the earth, which is not necessary for the average short 112-Mc. path. However, for longer distances it would be wise to do it. The formula is

\[ H = \frac{D}{1.51} \]

where \( H \) is the height in feet and \( D \) is the distance in miles for an optical path. When both transmitters are elevated, the maximum line-of-sight distance to ground level as given by the above formula can be determined separately for each end of the circuit. Adding these will give the maximum optical path, providing the intervening ground is at sea level. See Fig. 2.

**Fig. 3** — Chart plotted from formulas of Fig. 2. The solid line shows distances taking refraction into account, while the dashed line is for the optical path.
Fig. 1 — Contours showing terrain over various communication paths discussed in the text.
It will be seen from the chart of Fig. 3 that 100 feet of antenna height should be provided for each 12 miles. This is the equivalent of an antenna height of 50 feet at each end of the path. It will be noticed also that the effective range in practice is slightly longer (about 15 miles) when the effects of refraction are taken into account. In our particular case in Middletown we did not bother with the earth's curvature since practically none of our paths were within line of sight and it complicated making the contour strips; also most of the distances were rather short.

In selecting a new QTH for v.h.f. or u.h.f., contour strips should be made from each new location under consideration to all of the surrounding towns and cities with which communication is desired. Also strips should be made to the transmitters of various f.m. and television stations from which you may wish to receive entertainment. In this way you will get a pretty good idea of just what to expect after you have purchased or built your new home, and you won't be disappointed when you find that Bill over on Jones Hill works all DX and gets good f.m. and television reception while you do not, despite the fact that your location is just as high.

Interpreting Contour Strips

Referring to Fig. 4, you will see contour strips of the paths between several of the WKNQ stations. That of (A) between Unit 1 in Middletown and Unit 12 in Portland is the best. It is a line-of-sight path less than 2 miles in length. Signals are S9 plus both ways. (B) is another very good circuit, also a line-of-sight path, between Middletown and Unit 3 in Cromwell, also with S9 signals. (C) is a portable-mobile shot at Unit 4 in Durham from WKNQ-25 on a 400-foot hill in Middletown. It is a very good location but only for Durham and Hartford with S8 signals. (D) shows the tough radio path between Unit 5 in Haddam and Middletown Master Control, WKNQ-1. This path is poor because of the hills which are low but close to each station. Signals average only around S6 despite the comparatively short distance. The rising ground in front of each station seems to attenuate the signals severely.

(E) is another good shot at Durham from a different part of Middletown. Notice that in this case the ground directly in front of the two stations falls away sharply for some distance allowing the radio signals to "get started." Signal strengths here are S8 to S9. Compare it with (F) which is a very difficult circuit. Signals over this path are S6, and yet the two Middletown points are only about 1½ miles apart. This shows the entirely different type of path made possible by selecting a location only a short distance away.

In (G) the signal gets a good start from the Middletown end but the last hill in Haddam casts a bad shadow and communication is difficult. (H) shows the best circuit to New Haven to the southwest. However our mobile unit has to drive 10 miles due west to Meriden to do it although Meriden is very little closer to New Haven. Incidentally, signals are stronger from this 465-foot hill (S9) than they are from the top of Meriden Mountains, 1000 feet high (S8) only about 3 miles farther west, because of the shadow from a hill very close to New Haven. (I) shows the path between WKNQ-4 and -5. These two stations never have heard each other because of the impossible terrain in between. Here are seen severe shadows at both ends, plus very high hills in the middle. The worst conditions exist at the Haddam end. In plotting this strip to try to find out why communication could not be completed over this 8-mile circuit we discovered a woods road leading right to the top of the highest hill. As soon as this becomes passable we plan some mobile tests from that location.

(J) shows another of those impossible paths with rising ground directly in front of both stations and high ground in the middle of a considerably longer path. Once in a while WJLH-1 hears WKNQ-1 but never vice-versa. Apparently some of the WKNQ-1 signal bends over the top of the Three Notches and scatters into New Haven over the top of East Rock; however, East Rock blocks the major part of the WJLH-1 signal so not much is left to reach WKNQ-1. (L) shows Great Hill, the location mentioned earlier, whose possibilities were discovered by the contour-strip method. Although it is not quite a line-of-sight path the signals to New Haven are very good — S8 to S9. Compare this with (J) and notice the difference. Great Hill is only about 1 mile out of line with Middletown and is several miles farther away.

(K) shows a fair path between Middletown and West Hartford with signal strengths of about S8. The 300-foot hill is about midway along the path and the signals bend over it without too much trouble. (M) shows a path to New London which is rather spotty. The trouble is caused by the 400-foot hill between WKNQ-1 and the Connecticut River. (N) shows the almost-visual path to West Hartford from Great Hill. S8 to S9 signals were predicted and when the circuit was tested, that's what they were.

(O) is the contour over an S9 circuit between Columbia and Prospect, Conn. Despite its 36 miles, signals are stronger than on many of the other circuits because of its almost visual path. Compare strip (P) with the combined strips (P) and (Q). The direct path (O) crosses Middletown only about three miles north of WKNQ-1 and yet misses the top of Great Hill and also misses Mt. Highby. WKWG-70 in Prospect can be worked easily from Middletown but Mt. Highby knocks the punch out of his signal. As mentioned earlier, a hill close to the transmitter bothers more than one at a distance, hence the signal from WKNQ-1 shoots up to clear Mt. Highby and therefore is weaker at WKWG-70 than WJLH-1. Referring to strip (Q) WKNQ-1 is pretty well blocked by Great Hill so far as Columbia is concerned. However, they can be worked satisfactorily from both Marlboro and Columbia although WKWG-70 is stronger at Columbia.

(R) This shows the path between WKNQ-70 and WJLH-1 and is of interest because it is the

(Continued on page 80)
More About Postwar Station Calls

Revision of Proposed Call Areas Adopted by Board and Sent to FCC

BY CHARLES A. SERVICE, JR.,* W4IE

In our July issue we presented a plan for proposed changes in postwar call areas and station calls, adopted at the May meeting of the ARRL Board of Directors and transmitted to FCC for consideration. “Happenings of the Month” for August intimated an amendment was in the works which, if approved by the directors, would result in fewer changes in existing calls. This revision was approved and is now before the Commission for study and, we hope, acceptance.

The revision involves a change in call areas and does not affect the original plan, insofar as that provides for a new system of calls in the event the present series proves insufficient for future needs. It has reduced the number of prewar calls which would have to be changed from 19 per cent under the original plan to 11 per cent under the amendment. If changes in split-state areas, which are to be eliminated by FCC in any event, are disregarded, the total loss of prewar calls in the rest of the United States amounts to only 3 per cent.

To understand the basis for this revision let us refer back to the original plan for a moment. It was first proposed to move the W2 part of New Jersey into W3, so that the entire state of New York would comprise the new W2 area, and W3 would then consist of the states of New Jersey and Pennsylvania. Because of the large number of amateurs in the W2 portion of New Jersey as contrasted with the W3 portion, it was later proposed that our plan would be a better one if all of New Jersey were placed in W2, thus making it the states of New Jersey and New York.

This was found possible under the expected growth figures for the W2 area, and the removal of New Jersey from W3 to W2 in turn made possible the restoration of Delaware, Maryland and the District of Columbia to W3 without unduly increasing the amateur population of that area. Similarly it was found possible to return West Virginia to W3, without unduly adding to the latter’s size or impairing the future workings of the plan. W4 then being reduced by the loss of these three states and the District to an abnormally low figure, it was both necessary and desirable to build it up by the restoration of Alabama and Tennessee to that area from W5. The return of Alabama and Tennessee from W5 to W4 then made possible the shift of New Mexico back to W5 from its placement in W7, proposed in the first plan.

In the final analysis, then, W1 and W5 remain unchanged from prewar practice; the split-state areas of W2, W3, W8 and W9 (peninsular Michigan) are eliminated with the least possible change in prewar calls; W9 is brought into line with other areas by splitting off its western states into a new WØ area and transferring Kentucky and upper Michigan to W4 and W8, respectively; W4 is built up by the addition of Kentucky and Virginia; and the abnormally large W8 is reduced by transferring Arizona, Nevada and Utah to W7, which needed upbuilding.

Under the revised plan, therefore, the set-up of future call areas as proposed to FCC looks like this:

<table>
<thead>
<tr>
<th>Area Territory Embraced</th>
<th>Changes from Preswar Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 New England States</td>
<td>None</td>
</tr>
<tr>
<td>2 New York, New Jersey</td>
<td>Transfer W8 portion of New York and W3 portion of New Jersey to W2, eliminating splitting of states.</td>
</tr>
<tr>
<td>3 Delaware, District of Columbia, Maryland, Pennsylvania</td>
<td>Transfer W8 portion of Pennsylvania to W3, eliminating splitting a state. Subtract W3 portion of New Jersey, transferred to W2, Subtract Virginia, transferred to W4.</td>
</tr>
<tr>
<td>4 Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, U.S. Possessions in the Caribbean</td>
<td>Add Kentucky from W9 and Virginia from W3.</td>
</tr>
<tr>
<td>5 Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma, Texas</td>
<td>None</td>
</tr>
<tr>
<td>6 California, U.S. Possessions in Pacific</td>
<td>Subtract Arizona, Nevada and Utah, transferred to W7.</td>
</tr>
<tr>
<td>8 Michigan, Ohio, West Virginia</td>
<td>Add W9 part of upper Michigan, eliminating splitting a state. Subtract W8 part of New York, transferred to W2; and W9 part of Pennsylvania, transferred to W3.</td>
</tr>
<tr>
<td>9 Illinois, Indiana, Wisconsin</td>
<td>Subtract W9 part of upper Michigan, transferred to W9, and Kentucky, transferred to W4. Subtract Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota to form new 9 area.</td>
</tr>
<tr>
<td>0 Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota</td>
<td>Proposed new call area to be formed by transferring these eight states from W9.</td>
</tr>
</tbody>
</table>

*Assistant Secretary, ARRL.
ALLOCATION NEWS

There isn't any. Last month we thought that the final FCC announcement of its decisions respecting frequencies below 25 Mc. would be available for this issue but the Commission staff, and others concerned, have been so heavily occupied with other matters that nothing has been done about this job, it not involving as much urgency to permit postwar manufacturing planning as did the frequencies above 25. The present expectation is that the announcement will come along about the time of the Rio conference.

The Rio conference, opening September 3rd, is one of the inter-American region, a conference of governments, with private agencies represented by nonparticipating observers who may speak only through the intercession of their government's delegation. The conference works within the framework of the Madrid Convention and the Cairo Regulations. ARRL is to be represented at this conference by Lt. Comdr. Arthur L. Budlong, USCGR, WlJFN, in civilian status on temporary leave-of-absence from the Coast Guard for that purpose. He goes as senior assistant secretary of ARRL, from which position he is now on leave-of-absence and in which status he was our representative at the preceding regional conference at Santiago de Chile. Later this year we shall expect to have a QST article from him on the results of the conference.

ELECTION NOTICE

To all Full Members of the American Radio Relay League residing in the Atlantic, Dakota, Delta, Midwest, Pacific and Southeastern Divisions:

You are hereby notified that, in accordance with the constitution, an election is about to be held in each of the above mentioned divisions to elect both a member of the ARRL Board of Directors and an alternate thereto for the 1946-1947 term. Your attention is invited to Sec. 1 of Article IV of the constitution, providing for the government of ARRL by a board of directors; Sec. 2 of Article IV, and By-Laws 12, defining their eligibility; and By-Laws 13 to 24, providing for the nomination and election of division directors and their alternates. Copy of the Constitution & By-Laws will be mailed to any member upon request.

All steps in the election process now occur one month earlier than heretofore. Voting will take place between October 1st and November 20, 1945, on ballots that will be mailed from the headquarters office in the first week of October. The ballots for each election will list, in one column, the names of all eligible candidates nominated for the office of director by Full Members of ARRL residing in that division; and, in another column, all those similarly named for the office of alternate. Each Full Member will indicate his choice for each office.

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

Executive Committee

The American Radio Relay League
West Hartford, Conn.

We, the undersigned Full Members of the ARRL residing in the Division, hereby nominate

(a) ........................................ as a candidate for DIRECTOR; and we also nominate
(b) ........................................ as a candidate for ALTERNATE DIRECTOR; from this division for the 1946-1947 term.

(Signatures and addresses)

The signers must be Full Members in good standing. The nomination must be a Full Member and must have been both a member of the League and a licensed radio amateur operator for a continuous term of at least four years immediately preceding receipt by the Secretary of his petition of nomination, except that a lapse of not to exceed ninety days in the renewal of the operator’s license and a lapse of not to exceed

Get Set!

We have just time (and space) for a few words as one of the momentous periods of history ends — marked by the first use of atomic bombs, Russia's entry into the Pacific war, and the Japanese capitulation. The rapid culmination of these breath-taking events means that we should be back on the air months sooner than was visualized even a week ago.

ARRL has already moved for the reactivation of amateur radio. We have asked first for release of the 2½-meter band and the cancellation of WERS, so that amateurs may resume their traditional preparedness to furnish emergency-communication service. That band, and the gear for it, are available for the job. It is probable that the next bands to be released to us will be the higher-frequency ones, above 200 Mc. The DX frequencies will come slower; the armed services will need many of them a while longer.

But they're coming, OM, and we're on our way to great things — the greatest boom in the history of amateur radio! FCC is eager to resume the licensing of amateur stations as soon as BWC will permit, to get on with the job before the great rush starts. Stand by for ARRL bulletins to directors, SCM's, clubs and radio stores the instant there is good news to report. And expect in QST, as soon as secrecy goes off, the most interesting radio dope you've ever read.

The days we have been living for seem close at hand: our beloved amateur radio is about to come into its own once more! Get set!
AMATEUR WAR SERVICE RECORD

Name

Present mailing address

Rank or rating

Branch or bureau: Signal Corps, AAF, BuShips, W.I.V.E.S, etc. If civilian industry, give title and company.

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

SERVICE

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

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SERVICES

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

thirty days in the renewal of membership in the League, at any expiration of either during the four-year period, will not disqualify the candidate; provided that if a candidate's membership has been interrupted by reason of service in the armed forces of the United States, he shall not be deemed to be disqualified so far as concerns continuity of membership if he has, since May 7, 1943, renewed his ARRL membership within ninety days of discharge from the military service. He must be without commercial radio connections; he may not be commercially engaged in the manufacture, selling or renting of radio apparatus normally capable of being used in radio communication or experimentation, nor commercially engaged in the publication of radio literature intended, in whole or part, for consumption by licensed radio amateurs. Further details concerning eligibility are given in By-Law 12. His complete name and address should be stated. The same requirements obtain for alternate as for director. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon EWT of the 20th day of September, 1945. There is no limit to the number of petitions that may be filed on behalf of a given candidate but no member shall append his signature to more than one petition for the office of director and one petition for the office of alternate. To be valid, a petition must have the signature of at least ten Full Members in good standing; that is to say, ten or more Full Members must join in executing a single document; a candidate is not nominated by one petition bearing six signatures and another bearing four. Petitioners are urged to have an ample number of signatures, since nominators are frequently found not to be Full Members in good standing. It is not necessary that a petition name candidates both for director and for alternate but members are urged to interest themselves equally in the two offices. League members are classified as Full Members and Associate Members. Only those possessing certificates of Full Membership may nominate candidates, or stand as candidates; members holding certificates of Associate Membership are not eligible to either function. Present directors and alternates for these divisions are as follows: Atlantic Division: director, Tom E. Davis, W9VVA; alternate, Aaron E. Swanberg, W9HY. Delta Division: director, E. Ray Arledge, W8AT; alternate, Samuel H. Dowell, W5ERV. Midwest Division: director, Floyd E. Norwine, jr., W9EFC; alternate, C. A. Colvin, W9VHR. Pacific Division: director, J. L. McCargar, W6GY; alternate, Elbert J. Amarantes, W6FBW. Southeastern Division: director, Wm. C. Shelton, W4ASR; alternate, Wm. P. Sidoo, W4AUP.

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

For the Board of Directors:

K. B. WARNER, Secretary

NOTICES TO MEMBERS DISCHARGED FROM THE MILITARY SERVICES

The requirement of continuous membership in the League for eligibility to ARRL offices has been waived for members serving in the uniform of the United States. See particulars on page 39 of QST for July last. Those desirous of taking advantage of this arrangement are asked to claim the right when renewing membership, stating the beginning and ending dates for their military service.

YOUR WAR RECORD?

The little coupon on the top of this page has brought thousands upon thousands of reports to ARRL headquarters at West Hartford where the League is compiling a card record of every known case where an amateur or former amateur of either the United States or Canada has employed his ham know-how in war work — whether in the armed forces, the Maritime Service or merchant marine, the Civil Service or other government service, the contract laboratories, or in industry 100 per cent devoted to war manufacturing.

Are you on our records? If not, we want you — and any of your buddies on whom you can supply dope. It will only take a moment to clip and fill out this form, or to reproduce its essentials on a post card if you prefer. Thanks very — it will help!
Matching the Antenna for Two-Band Operation

Flat Lines with Fundamental and Second Harmonic

BY JOHN G. MARSHALL, W9ARL

Often a fellow thinks of his future station with the ultimate in multiband and rapid QSY operation. One of the oldest problems in this respect is the operation of the station's single antenna on more than one band without readjustment or retuning. Even by retuning usually there are large standing waves on the feed line. In some cases, a trip out of doors is made to change matching stubs. Some are more fortunate in having a system of relays to do the outside work.

An impedance-matching network may be designed and constructed to provide matching of the antenna to the feed line on two bands, whether it is a simple half-wave or an elaborate multi-element array. When properly constructed and adjusted, no retuning or mechanical readjustments of any kind are necessary for two-band operation with a flat line.

Fig. 1 — Foundation circuits.

To clarify the points concerned here, a review of the basic principles involved in impedance matching is in order. A knowledge of vector algebra will help greatly and for those not familiar with it, a good understanding of the article "Meet Mr. j," appearing in an earlier issue,1 or an evening with a good textbook should suffice. Use of the slide rule also will help and its accuracy, to three significant figures, is generally sufficient. Special care should be exercised in reading the scales. Use of the slide rule also will help greatly and for those not familiar with it, a good understanding of the article "Meet Mr. j," appearing in an earlier issue,1 or an evening with a good textbook should suffice. Use of the slide rule also will help and its accuracy, to three significant figures, is generally sufficient.

The primary purpose of impedance matching is to deliver the greatest possible power to the load. To do this, the load impedance, $Z_L$, must equal the internal impedance, $Z_A$, of the source of power. In the case involving only pure resistances, such as in Fig. 1-A, it is assumed that the generator supplies 10 volts and has an internal resistance, $R_A$, of 20 ohms. If $R_L = R_A$, the total $R$ in the circuit is 40 ohms and with 10 volts applied, the current is $E/R = 10/40 = 0.25$ amperes. The power in $R_L$ is $PR = (0.25)^2(20) = 1.25$ watts. If $R_L$ is less than $R_A$, for example 10 ohms, the total $R$ is 30 ohms, the current is 0.33 amperes, and the power in $R_L$ is only 1.11 watts. If $R_L$ is greater than $R_A$, for example 30 ohms, the total $R$ is 50 ohms and the power in $R_L$ is only 1.2 watts. Therefore when $R_L = R_A$ the greatest possible power is delivered to the load, $R_L$.

In the circuit of Fig. 1-B, where the generator has an internal impedance containing both resistance and reactance, there is another condition to satisfy in addition to having $R_L = R_A$. As before, with no reactance present, Ohm's Law shows that $R_L$ would receive 1.25 watts. However, there is reactance present and the total circuit, as seen by the generator, is composed of 40 ohms $R$ and 30 ohms $X_L$ in series. This results in an impedance $Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{40^2 + 30^2} = 50$ ohms. The current $I = E/Z = 10/50 = 0.2$ amperes and the power in $R_L$ is $PR = (0.2)^2(20) = 0.8$ watt. As shown in Fig. 1-C, adding a capacitive reactance of 30 ohms to the load to balance out the 30-ohm $X_L$ results in an impedance $Z = \sqrt{40^2 + (30-30)^2} = 40$ ohms. The current is now 0.25 amperes and the power in $R_L = (0.25)^2(20) = 1.25$ watt, the same as with no reactance. Then, it is evident, to supply the load with the greatest possible power, $R_L$ must equal $R_A$, and the net reactance must be zero. When these two conditions are met, impedances are matched. Note that when $X_L = X_C$ the net reactance is zero and this is also the condition for series resonance.

In Fig. 2-A, $R_L$ is necessarily 4 ohms which is greater than $R_A$. If $R_L$ is made to appear as 2 ohms to the source, although actually 4 ohms, an impedance match can be accomplished and $R_L$ will be supplied the greatest possible power. $R_L$

One of the objections to amateur use of "flat" or untuned lines for feeding amateur antennas is that normally the antenna system may be operated without standing waves on only one band without encountering the practical complications of remote switching or some equivalent device. Especially those who have two- or three-element rotatable arrays will find unusual interest in this article, which describes the design of networks which provide "flat-line" operation of a single antenna system on two bands without switching of any kind.

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* 723 Paseo, Kansas City 6, Mo.

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can be made to look like 2 ohms to the source by placing in parallel with it, a reactance of 4 ohms. By the admittance method, \( Y = G + B \), \( Z = 1/Y \), \( G = 1/R \) and \( B = 1/jX \) where the conductance, \( G \), the susceptance, \( B \), and the admittance, \( Y \), are in mhos and the resistance, \( R \), the reactance, \( X \), and the impedance, \( Z \), are in ohms. Solving the \( Z \) in this parallel combination, 

\[
Y = G + B = 1/R + 1/jX = 1/4 + 1/-j4 = 0.25 + j0.25 \text{ mho.}
\]

\[
Z = 1/Y = \frac{1}{0.25 + j0.25} = \left( \frac{0.25 - j0.25}{0.25 - j0.25} \right) = \frac{0.25 - j0.25}{0.125} = 2 - j2 \text{ ohms.}
\]

Here \( Z \) is expressed in its rectangular form which means that \( Z \) in this parallel combination equals the impedance produced by 2 ohms \( R \) in series with 2 ohms \( Xe \). Then, 2 ohms \( R \) in series with 2 ohms \( Xe \) is the electrical equivalent series circuit of 4 ohms \( R \) in parallel with 4 ohms \( Xe \), since both are equal to the same impedance. So far as points \( A \) and \( B \) in Fig. 2 are concerned, one circuit may be substituted for the other.

Fig. 2-A shows this equivalent series circuit substituted for the parallel combination and with 2 ohms \( XL \) added to produce a net reactance of zero. Now \( RL = Ra \) and the reactance is zero, so \( RL \) receives the maximum possible power. Fig. 2-C shows the equivalent parallel circuit between points \( A \) and \( B \), thus providing a perfect impedance match for the 4-ohm load to the 2-ohm source. If the \( RL \) necessarily is smaller than \( Ra \), the same method may be used by paralleling \( Ra \) with a reactance of such value as to make \( Ra \) appear the same value as \( RL \) and adding a reactance, of opposite sign, in series to balance out the series equivalent of the parallel reactance. These same principles will be used in matching the antenna to the feed line.

**Application to Antennas**

Everyone is familiar with the half-wave antenna and, since it performs well for two-band operation, it is used here as the "example in detail." Selecting the popular 7- and 14-Mc. bands, the center-fed antenna will operate as a simple half-wave on 7-Mc. and as two half-waves in phase, colinear, at 14 Mc. With self-resonance assumed on both bands, the popular 600-ohm line must be matched to a 73-ohm pure-resistance load on 7 Mc. and about a 1200-ohm pure-resistance load at 14 Mc. The center of a half-wave antenna varies from 57 to 96 ohms for heights above \( \lambda/4 \), with 73 ohms being the average. Even though there seems to be several opinions concerning the impedance of the colinear arrangement, 1200 ohms is representative and is used here to illustrate the network.

The antenna impedance, being a pure resistance load, may be represented by \( R_L \). When terminated by an impedance, \( Z_L \), equal to its characteristic impedance, \( Z_0 \), which is necessary to prevent standing waves, a line may be represented by a generator having an internal impedance \( Z_0 = Z_L \). Since \( Z_L \) is independent of frequency, \( Z_0 \) may be considered to be a pure resistance, \( R_0 \), equal to \( Z_0 \), which in this case is 600 ohms.

On 7 Mc. the 600-ohm \( R_0 \) must be shunted by a reactance of such value as to produce an equivalent series circuit containing a resistance component equal to the 73-ohm \( R_L \). The use of \( XL \) is preferable to \( Xe \) here because when the frequency is changed to 14 Mc. the value of \( XL \) will double and will produce an equivalent series circuit containing a resistance component much closer to the value of the 1200-ohm \( R_L \) than if \( Xe \) were used. This is especially desirable because the required value of reactance across the 1200-ohm \( R_L \) will then be much greater and will cause a smaller upset in the 7-Mc. calculations, which are to be made without any reactance across the 73-ohm \( R_L \).

At 14 Mc. \( R_L \) is greater than \( R_0 \) so it must be shunted by a reactance of such value as to produce an equivalent series circuit containing a resistance component equal to the resistance component produced by \( X_L \) in parallel with \( R_0 \). The use of \( Xe \) is preferable to \( X_L \) across this 1200-ohm \( R_L \) because, when looking back to 7 Mc., the value of \( Xe \) doubles and upsets the 7-Mc. calculations much less than if \( X_L \) were used.

**7-Mc. Network**

On 7 Mc., the value of \( X_L \) in parallel with the line \( R_0 \) to produce an equivalent series circuit containing a resistance component of 73 ohms may be found from the formulas

\[
B_p = \sqrt{\frac{G_p}{R_L} - G_p^2} \text{ and } X_p = \frac{1}{B_p},
\]

where \( B_p \) is the value of the parallel reactance, \( X_p \) is the susceptance of this parallel reactance which equals \( 1/X_p \), \( G_p \) is the conductance of the resistance representing the line which equals \( 1/R_0 \), and \( R_0 \) is the value of the resistance component of the equivalent series circuit, all in basic units. Solving for \( X_p \),

\[
B_p = \sqrt{\frac{G_p}{R_L} - G_p^2} = \sqrt{\frac{0.00167}{73} - (0.00167)^2} = \sqrt{0.00002} = 0.004475 \text{ mho.}
\]

\[
X_p = \frac{1}{B_p} = \frac{1}{0.004475} = 223 \text{ ohms}
\]

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The reactance component of the equivalent series circuit may be found from the formula

$$X_r = \frac{B_p}{G_p^2 + B_p^2}$$

where $X_r$ is the reactance component of the equivalent series circuit. Solving for $X_r$,

$$X_r = \frac{B_p}{G_p^2 + B_p^2} = \frac{0.004175}{(0.004175)^2 + (0.00167)^2} = 196 \text{ ohms}$$

Then the 223-ohm $X_L$ in parallel with the 600-ohm source, $R_L$, produces an equivalent series circuit of 73 ohms $R$ in series with 196 ohms $X_L$. Fig. 3-A shows this equivalent series circuit representing the actual circuit, with 196 ohms $X_C$ as a balancing reactance added to produce a net reactance of zero. Since $R_L = R_G$ and the net reactance is zero, the maximum possible power is supplied to $R_L$.

Fig. 3-B employs the actual parallel circuit and shows the 600-ohm line matched to the 73-ohm antenna. The 196-ohm $X_C$ is divided between the two legs to maintain symmetry. This is all there is to the design of the 7-Mc. impedance-matching transformer. Easy, wasn’t it?

Adding 14 Mc.

On 14 Mc. the $X_L$ across the line becomes 446 ohms and the line, of course, remains at 600 ohms since it is independent of frequency. Solving for $Z$ in this parallel combination,

$$Y = G + B = 1/R + 1/jX = 1/600 + 1/j446 = 0.00167 - j0.00224 \text{ mho}.$$  

$$Z = 1/Y = \frac{1}{0.00167 - j0.00224} = \frac{1}{0.00167} + j\frac{0.0009}{0.00167} = 600 \text{ ohms}$$

As mentioned previously, $Z$ is expressed in its rectangular form which is actually the equivalent series circuit. Then on 14 Mc., the $X_L$ in parallel with the line produces an equivalent series circuit of 214 ohms $R$ in series with 288 ohms $X_L$. The 1200-ohm $R_L$ now must be paralleled with a reactance of such a value as to produce an equivalent series circuit containing a resistance component of 214 ohms. $X_C$ is preferable in this position because, when looking back to 7 Mc., its value will be twice and will have much less effect upon the 73-ohm $R_L$. Using the same formulas as before,

$$B_p = \sqrt{\frac{G_p - G_p^3}{R_p}} = \sqrt{\frac{0.000033}{214} - (0.000033)^2} = 0.00179 \text{ mho}.$$  

$$X_F = \frac{1}{B_p} = \frac{1}{0.00179} = 559 \text{ ohms}$$

$$X_L = \frac{B_p}{G_p^2 + B_p^2} = \frac{0.00179}{(0.000033)^2 + (0.00179)^2} = 459 \text{ ohms}.$$  

Thus an $X_C$ of 559 ohms in parallel with the 1200-ohm $R_L$ will produce an equivalent series circuit of 214 ohms $R$ in series with 459 ohms $X_C$.

Fig. 4-A shows the two equivalent series circuits representing the actual parallel circuits, with 171 ohms $X_L$ as a balancing reactance added to produce a net reactance of zero. Since $R_L = R_G$ and the net reactance is zero, the maximum possible power is supplied to $R_L$.

Fig. 4-B employs the actual parallel circuits and shows the 600-ohm line matched to the 1200-ohm antenna. The 171-ohm $X_L$ is divided between the two legs to maintain symmetry.

Since making the 7-Mc. calculations, the load, $R_L$, has been shunted by $X_C$ which becomes 1118 ohms on 7 Mc. This will alter the 7-Mc. calculations only slightly. Solving,

$$Y = G + B = 1/R + 1/jX = \frac{1}{73} + \frac{1}{-j1118} = 0.0137 + j0.0009 \text{ mho}.$$  

$$Z = 1/Y = \frac{1}{0.0137 + j0.0009} = 0.0137 - j0.0009$$

This 1118-ohm $X_C$ across the 73-ohm $R_L$ produces an equivalent series circuit of 72.8 ohms $R$ in series with 4.78 ohms $X_C$. For all practical purposes, the 73-ohm $R_L$ is unchanged but there has been added about 5 ohms $X_C$ in the circuit which can be compensated for by reducing the value of the balancing reactances. Fig. 3-C shows this reduction. If the $X_C$ across the load upsets the 7-Mc. calculations too much, the entire problem should be reworked, using a lower value of $X_L$ across the line $R_L$. Figs. 3-C and 4-B show correct matching for 7 and 14 Mc. respectively.

**Fig. 3** — Development of 7-Mc. network. (A) — Electrical equivalent series circuit. (B) — 600-ohm source matched to 73-ohm load. (C) — Same as (B) but corrected after 14 Mc. has been added.

**Fig. 4** — Development of network for the addition of 14 Mc. (A) — Electrical equivalent series circuit. (B) — 600-ohm source matched to 1200-ohm load.

Inspection of Figs. 3-C and 4-B will show that to change from one band to the other, the only change necessary is the balancing of reactances, all other components changing value automatically. If each balancing reactance is made up of both $X_L$ and $X_C$, a certain combination will have a value of 95.5 ohms $X_C$ at 7 Mc. and at the same time have 85.5 ohms $X_L$ at 14 Mc. This combination may be found from a few attempts using the "cut and try" method or directly from a pair of
simple simultaneous equations. At 7 Mc., the 
$X_L$ and $X_C$ must add up to 95.5 ohms $X_L$. With 
these same reactors on 14 Mc., the $X_L$ is doubled 
and the $X_C$ is halved and must add up to 85.5 
ohms $X_L$. Since $X_L$ is positive and $X_C$ is negative 
the two equations are 
\begin{align*}
1) & \quad X_L = X_C = -95.5 \\
2) & \quad 2X_L - 0.5X_C = 85.5
\end{align*}
Solving (1) for $X_C$ and the 
in (2), 
\begin{align*}
2(X_C - 95.5) & = 0.5X_C = 85.5 \\
2/X_C & = 191 - 0.5X_C = 85.5 \\
X_C & = 184.3 \text{ ohms}
\end{align*}
Substituting this in (1), 
\begin{align*}
X_L & = 184.3 = 95.5 \\
X_L & = 88.8 \text{ ohms}
\end{align*}
These values of $X_L$ and $X_C$ are used as the balancing 
reactances in Figs. 5-A and 5-B which illustrate, in ohmic values, the complete networks for 
7 and 14 Mc. respectively.

![Diagram of two-band network](image)

These networks may be determined. In the finished network of 
Fig. 5-C, the 20-µµfd. capacity and the antenna 
resistance have the same voltage across them. 
Since the power in the antenna resistance is 4 kw. for both a 73-ohm and a 1200-ohm antenna, 
the voltage will be greatest across the 1200-ohm 
resistance. This voltage is 
\[
E = \sqrt{PR} = \sqrt{4000 \times 1200} = 2190 \text{ volts},
\]
which has a peak value of 
\[
E_{\text{max}} = 1.41E = (1.41)(2190) = 3090 \text{ volts}.
\]
A 50-µµfd., 5000-volt condenser will be satisfactory in this position.

The voltage across the 122-µµfd. capacities may be found when the current through them is known. This is the same current which flows 
through the antenna resistance and 20-µµfd. capacity in parallel. The current through this 
parallel combination has the same value as the current which would flow through its equivalent 
series circuit because one circuit may be substituted 
for the other. Also, the power in the resistance component of the equivalent series circuit 
will be of the same value as the power in the antenna 
resistance. Figs. 3-A and 4-A show that the 
current will be greatest at 7 Mc. because on this 
frequency the resistance component of the equivalent 
series circuit has the lower value, 73 ohms, 
as compared to 214 ohms. The current through 
this resistance component is 
\[
I = \frac{P}{R} = \frac{4000}{73} = 74 \text{ amperes.}
\]
With this same current flowing 
through the 122-µµfd. capacities, the voltage 
across them is 
\[
E = IX = (7.4) (184.3) = 1290 \text{ volts},
\]
which has a peak value of 1820 volts. Two 
250-µµfd., 3000-volt condensers should be satisfactory in these positions.

The coils may be made from the coil charts 
found in the Handbook. Accuracy is stressed, 
especially with coils of small inductance. The 
greater the accuracy the less the magnitude of standing waves after the network is "tuned up."
Adjustment

7-Mc. adjustment is accomplished when acquiring resonance by the simultaneous adjustment of the condensers of the balancing reactances. 14-Mc. adjustment is accomplished when acquiring resonance by adjustment of the condenser across the antenna. Tuning on one band will affect the other slightly, but going from one to the other a few times should put the network "on the nose" for both bands. These adjustments may be closely approximated in the station by substituting carbon resistors for the antenna and feed line, and loosely coupling the unit to the transmitter. These odd values can be made by filing down lower values, checking against an ohmmeter.

Those of us who will receive the most benefit from the network described here are those having a small space who must be satisfied with only one antenna. Many, having limited space, have installed a two- or three-element rotatable. Ordinary operation of these is confined to a single band. The accompanying chart shows the values of the components for the two-band network which should be placed between the feed line and the driven element of 2- and 3-element rotatables operating fundamentally at 14 Mc. and as 4- and 6-element systems at 28 Mc. The foregoing procedure was used in making up this chart.

Parasitic Elements

With these "rotary beams" operating fundamentally at 14 Mc., the driven element itself will operate also at 28 Mc., as two-half waves in phase, colinear, simply because it is center-fed. The 14-Mc. parasitic elements will function at 28 Mc. if opened in the center. Then a system of opening the center for 28 Mc. and closing the center for 14 Mc. will make possible two-band operation of the parasitic elements. A series-resonant circuit having low r.f. resistance, resonating at 14 Mc., placed in the center of the element, will effectively close the circuit for 14-Mc. operation. A parallel-resonant circuit, having a high Q under operating conditions and resonating at 28 Mc., will effectively open the circuit for 28-Mc. operation. A combination circuit can be made to perform both functions. When operating at 14 Mc., the 28 Mc. parallel-resonant circuit will have a net inductive reactance. A pair of variable capacities may be placed in series at the element to balance out this reactance. Variable condensers placed in series will affect the 28-Mc. adjustment only slightly. This can be corrected by a slight readjustment of the parallel condenser. Thus, the center of the element is effectively closed for 14-Mc. operation and open for 28-Mc. operation, automatically with the change in frequency.

Another method providing two-band operation of the parasitic element, which is simpler and probably superior, was mentioned in QST in a discussion of antennas of the DX men by Goodman, W1JPE.3 In that article, W9TB used a quarter-wave open stub in the center of the element, as in Fig. 6-A. As applied here, a quarter-wave stub having negligible losses, open at the receiving end, may be considered to present zero impedance at the sending end. At 28 Mc. this stub becomes a half-wave long and when open at the receiving end will, when its losses are zero, offer an infinite impedance at the sending end. Thus such a stub effectively will open the element for 28 Mc. and effectively close it for 14-Mc. operation automatically with the change in frequency.

The latter method may be improved upon by the proper placement of two identical variable condensers. These condensers will make possible exact adjustment on both bands. First, it must be determined which frequency of operation requires the shorter over-all physical length of stub plus element. This can be done by a careful consideration of the element spacing, element function (reflector or director) and the relationship of the two frequencies of operation. A more positive method would be the physical comparison of separately-adjusted stubs for each of the two frequencies. If the over-all physical length at 28 Mc. is shorter, adjustment of the stub length will provide 14-Mc. adjustment, and two identical variable condensers placed in the center of the stub will provide 28-Mc. adjustment, as shown in Fig. 6-B. If the over-all physical length at 14 Mc. is shorter, adjustment of the stub length will provide 28-Mc. adjustment, and two identical condensers placed in series with the junctions of stub and element will provide 14-Mc. adjustment, as shown in Fig. 6-C. Adjustment on one band will affect the other, particularly so with the arrangement of Fig. 6-B, so care should be exercised when cutting the stub to prevent cutting it too short.

The approximate value of these capacities and the approximate stub length may be determined for each individual case by preliminary adjustment of the array, when within reach from the ground, using any available condensers with low-power input. When the stub lengths and condensers of the parasitic elements are adjusted for maximum field strength on both bands, the approximate working capacity of each condenser may be determined by visual inspection and the voltage across each can be calculated after measuring the current through it. This voltage will have a peak value of $E_{max} = 1.411 X_C$. At full power

---

### Type of Array | Type of Line | \( X_L \) (ohms) | \( X_L \) (ohms) | \( X_C \) (ohms) | \( X_C \) (ohms)
---|---|---|---|---|---
2-element antenna-director type at 14 Mc. (13-ohm load) and 4-element antenna-reflector type at 28 Mc. (2200-ohm load) | 73-ohm Line | 34.0 | 68.0 | 0.38 | 82.7 | 165 | 0.925 | 550 | 275 | 20.5 | 96.6 | 48.3 | 115
---|---|---|---|---|---|---|---|---|---|---|---|---|---
3-element at 14 Mc. (8-ohm load) and 6-element at 28 Mc. (3800-ohm load) | 600-ohm Line | 25.6 | 51.2 | 0.28 | 92.0 | 185 | 0.103 | 695 | 301 | 18.5 | 104 | 52.0 | 108

---

*Fig. 7—Chart showing values of components making up the two-band impedance matching transformer for the popular two- and four-element arrays. With 0.1\( \alpha \) element spacing, antenna-director type is superior and with 0.2\( \alpha \) element spacing, antenna-reflector type is superior. Therefore, this chart treats the two-element as antenna-director at 14 Mc. and as a four-element antenna-reflector type at 28 Mc. All adjustments must be made for maximum gain in the desired direction.*

---

this voltage has a peak value of \( E_2 = E_1 \sqrt{\frac{P_2}{P_1}} \),

where \( E_2 \) and \( P_2 \) are full-power values and \( E_1 \) and \( P_1 \) are values at the reduced power used during adjustment.

When the permanent condensers are selected and placed in a weather-proof box, with adjusting rods extended to within reach from the tower to facilitate adjustment in the air, the parasitic elements are ready for final adjustment.

**Conclusion**

By knowing the load impedance represented by the antenna on each of the two frequency bands selected, the network described here may be applied to any antenna providing it is fed at a point considered to be substantially a pure resistance, with a feed line selected to have a value of characteristic impedance falling between the two values of antenna impedance. Any of the common feed lines will fall between these two values with any of the common antennas except some of the long-wire types. The long-wire types in general have an impedance, at the current loops, above 100 ohms, which eliminates the use of the popular 72-ohm line when a minimum of standing waves is desired. This same feed point, when operated at the higher frequency, has an impedance much greater than any of our feed lines. Then the logical choice of feed line for the long-wire systems is the 600-ohm open line.

It is regretted that concrete information concerning the impedances of the various popular antenna systems operating on frequencies other than the fundamental, isn't available at this time, so that more accurate values of components which make up the impedance-matching network, together with more examples, could be included in the accompanying chart. When postwar operation begins, these load impedances may be measured, while on the air, by one of several methods, such as the standing-wave ratio or the resistance-substitution method. However, it is believed the values shown are workable and should not produce standing waves having too great a magnitude.

A word of caution is in order concerning harmonic radiation. Since the antenna system is simultaneously operative on two bands with magnetic coupling to the transmitter, operation on the lower-frequency band will cause a very strong radiation at the higher frequency if some means to minimize the generation of harmonics isn't employed. Obviously, a Farady screen will be effective only at frequencies other than the two for which the network is designed. Push-pull operation with plenty of capacity in the tank circuit (high \( Q \)) and matched tubes with equal grid drive will greatly reduce the generation of harmonics. This may be a sufficient precaution.

An antenna system designed along the lines described here seems to be quite involved but the results and convenience of the finished product should be very encouraging and well worth the trouble.

---

**Silent Keys**

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

- W9GREX, Pvt. David R. Lebeson, Winnetka, Ill.

---

**Strays**

C. J. Harpold of Chicago, Illinois, reported "better than usual reception of signals between 23 and 30 megacycles" during the eclipse of the sun on July 10, 1945.
"Bismarck"

The Tale of the Electronic Dog

BY CPL. D. M. CRAFT, W8CDX

Scene: A bar. The character jostling my elbow speaks:

"Did I ever tell you about my dog, Bismarck?"

"No," I answered. "Have another beer?"

"Thanks," he said.

"Now, what were you saying about a dog?"

"A dog? Oh, yes — my dog, Bismarck."

"Didn't you mention a dog before?"

"Yes, but we got off on another story."

"I remember now," I said. "It was something about herding cattle with a jeep down in a Mexican shack with a blonde on your knee and a Boston aristocrat from Chicago and his daughter saving the jewelry from train robbers. Now proceed."

"Bismarck," he said, "was an electronic dog conceived by me and another dope at Brookley Field. That's in Alabama."

"What's in Alabama — the dog?" I asked.

"No," he said. "Brookley Field. Anyway, we accidentally created this dog while we were designing an electronic 'still' to take on the ship."

"What ship?" I asked.

"This ship we were going on," he said.

"What kind of drinks were you going to get from this still?" I asked.

"Electronic drinks. You know — give me a shot of electrons and a double proton chaser, old boy."

I laughed at this, so we had another beer. Things began to look better.

"What did this dog do?" I asked.

"I'll tell you. At first we couldn't keep track of him. Once I ran into him and I fell right in the middle of the shop. Another time this buddy of mine stepped on his tail. He still has an r.f. burn from the bite."

"Who — the dog?" I asked.

"No, my buddy. One day a young girl who was working near us spilled some yellow paint. She started to clean it up when Bismarck walked through it. Of course you couldn't see him, but his tracks went right through the paint and on across the floor."

"What happened?" I asked.

"The girl fainted. Later she said she got the shock of her life. After that we put a bulb on his tail so we could see him. He stayed lit up like my brother, Neon. We finally got him in an r.f. can, and when we left on the ship we stored him in the radio shop."

"Who — your brother?"

"No, Neon — I mean Bismarck, the dog. After we got things working okay in the shop we let Bismarck out and put the 'scope on him to see how he was doing. When he had warmed up and the 'scope had warmed up, we got the shock that was heard 'round the world."

"Huh?"

"I looked at the 'scope and turned pale. My buddy looked at the 'scope and turned pale. The beer looked at the 'scope and went flat. Where was I, anyway?"

"You were drinking pale beer and went flat," I said.

"Oh, yes. The miracle had happened. Bismarck was no longer a Mr. He was a Mrs. — and about to have sixteen little Bismarcks. Things were happening fast."

"I'll say! How do you account for the change?"

"Well, this r.f. can must have become grounded to the ship and Bismarck got an overdose of protons. I always said that if diode would have told what anode and cathode did, Bismarck's bleeder resistor would not have ceased to bleed. I think triode messed us up somewhere, too."

"What did you do?" I asked.

"When?" he said.

"When all this happened to your dog."

"We called the rubber repair department," he continued, "and put in an order for eight little foot pads. We didn't want the pups to ground themselves out. They informed us we would have to go through channels. I called all departments including the chaplain. In ten minutes the sides of the ship were bulging because there were so many people in the shop. R.f. was arcing everywhere. I had a gold ring on my finger that just faded away. One of the ship's crew opened his mouth to say something and lost six teeth. A brass hat started to sit down and lost his hat. A submarine twenty miles away flashed us a message that the hull of the ship was glowing at a sixty-cycle rate. We were watching the 'scope. The big event was about to happen. We were ready, the medics were ready, and then—"

"Then what?"

"The lights went out and there was a deadly silence. Then the lights came on. All that was (Continued on page 83)
**IN THE SERVICES**

Thanks to you fellows in Civil Service and 100% industry status for waiting so patiently for your names to appear in this column. We have given preference to men in the armed forces while many hundreds of non-military amateur listings waited in file till space permitted their being used. New registrations in all classifications still arrive daily but in decreasing amounts and the reserve supply now can be tapped to keep this column up to its usual size for months to come.

If you have registered, you can be certain your name will be used. If this is your first notice of the In The Services roster, be sure and send us the blank on page 22.

### ARMY — AACs

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### COAST GUARD

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<td>3QDF</td>
<td>DuBord, CRM, foreign duty</td>
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Hamming for the U. S. Coast Guard, CRT Nila Segerdahl, W2UX, left, and RT2c Ernest Jerome, W2AOM, were stationed at the U. S. C. G. Radio Engineering and Maintenance School, Croton, Conn., when this photo was taken.


NAVY — GENERAL

1ACS, Quinn, Ens., Cambridge, Mass.
1AN, Dreyer, Lt., New York, N.Y.
1AT, Coolikoff, Lt., Washington, D.C.
2AB, Phoenix, Lt., Washington, D.C.
2AM, Whittemore, Rf, Hingham, Mass.
2CHB, Hall, Capt., Washington, D.C.
2CM, McLean, Lt. Comdr., Mare Island, Calif.

1BF, Levinson, Lt. (jg), foreign duty
2J, Van Dyke, Comdr., address unknown
3GSB, Sunderland, RE, foreign duty
3DG, MacLean, Lt. Comdr., Mare Island, Calif.
3NKB, Pitman, Lt., Washington, D.C.
3MUV, Geyer, Lt., Washington, D.C.

NAVY — SPECIAL DUTY

ex-1MLU, Woodhouse, CRT, foreign duty
1HJF, Young, Stc, Chicago, III.
1HGP, Rose, Palm Beach, Fla.
1HLL, Alley, CRT, foreign duty
21B, Tumulty, CRT, address unknown
22A, Specker, CRT, foreign duty
22G, Goldman, CRT, foreign duty
22X, Smith, CRT, foreign duty
30AB, Dayhoff, EM, foreign duty
30H, Merriman, CRT, Chicago, Ill.
ex-1AKT, Higgins, CRT, foreign duty
4EX, Barker, CRT, Chicago, Ill.
4PEZ, McGuire, CRT, Mechanicsburg, Pa.
4HFL, Lane, CRT, foreign duty
5CC, Stipp, CRT, Chicago, Ill.
5ETF, Weidman, CRT, foreign duty
5AA, Graham, CRT, Pittsburgh, Pa.
5L3E, Durham, CRT, Chicago, Ill.

ARMY — SIGNAL CORPS

ex-1ABS, Beard, Pvt., Camp Crowder, Mo.
1L4W, Dafour, M/Sgt., foreign duty
1NLA, McKown, Cpl., foreign duty
1NKB, Pitman, Lt., Washington, D.C.
1MUV, Geyer, Lt., Washington, D.C.

ARMY — GENERAL

2CMX, Meyer, T/4, Atlantic City, N.J.
2CMZ, Christiansen, Pvt., Ft. Leonard Wood, Mo.
2NUU, Nash, Pvt., foreign duty
3LQ, Bash, Pvt., foreign duty
3LRA, Ballou, CRT, foreign duty
5JEU, Meriwether, CRT, Chicago, Ill.
5ICC, Higgins, CRT, foreign duty
78H, Nock, Pvt., foreign duty
78N, Tumulty, CRT, address unknown
78P, Alley, CRT, foreign duty

OPERATOR’S LICENSE

By permission only:

Barnes, Pvt., foreign duty
Huber, Pvt., Camp Lee, Va.
Huber, Pvt., foreign duty

September 1945

Amateurs stationed with the 9402 Technical Service Unit, Signal Corps, Army Experimental Station, Pine Camp, N.Y., send greetings to fellow amateurs in and out of the service. Left to right, standing: Pfc. Biefer, W2CR; Sgt. Kohler, W9JHC; T/4 Becker, W1NDJ; 2nd Lt. Wiggin, W1GEW; Pfc. Payer, W8VUC; T/5 Hook, W1EKU; Sgt. Lavetaky (operator’s license). Kneeling: Pfc. Schraut, W9DDG; T/5 Wing, W1FSA; T/4 Bodwell, W9TML, and T/5 Skinner, W8L9Q.
Colonel Fred J. Elser, SC, W6ANM, started his radio career in Manila as a PTZ about 1921, later becoming better known in DX circles as KA3AA before moving to the States. His Army career included twenty-eight months overseas, most of the time as signal officer for the Mediterranean Service Depart-
September 1945

In spite of our earnest requests over past months for more listings of Canadian amateurs, our file shows five new names only since the Canadian section appeared in this column in July. That is too small a number—sued at the beginning of the war and too late for a station ticket. We give you L/W Tel. Ramsay, WRCNS to hold a ham license. We hold amateur operator license, is-stationed in July. That is too small a number—sued at the beginning of the war and too late for a station ticket. We give you L/W Tel. Ramsay, WRCNS to hold a ham license. We hold amateur operator license, is-stationed in July. That is too small a number—sued at the beginning of the war and too late for a station ticket. We give you L/W Tel. Ramsay, WRCNS to hold a ham license. We hold amateur operator license, is-stationed in July. That is too small a number—sued at the beginning of the war and too late for a station ticket. We give you L/W Tel. Ramsay, WRCNS to hold a ham license. 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How Microphones Work

A Discussion of Various Types of Voice Pick-Ups

BY ALBERT KAHN, W9KYM

IN OPERATING practice, c.w. and 'phone have a lot in common. In both, signals must be easy and pleasant to listen to; they must get through QRM and QRN; and they should convey not only words but the personality of the operator. In the same manner that an x.p.d.c note with well-spaced characters and a rhythmic swing makes a c.w. station "the one you'd like to sked," a pleasant, well-modulated voice gives a 'phone station that something which makes it stand out from the others on the band as desirable to work. These qualities will, in the final analysis, give a 'ham a "they-want-to-work-you" signal.

Aside from more answers to a CQ, the QSOs will have a better chance of developing into real friendships as a result of putting more personality on the carrier.

Fidelity

It has been said that there is no need for "high fidelity" in an amateur transmitter. "After all, what we need is speech, not music!" Such thinking ignores some pretty important factors. Quality is important. Speech is a very complex collection of sounds, and intelligibility may be greatly impaired by loss or over-emphasis or other distortion of some of those sounds. For instance, "harmonic distortion," such as frequently appears in common carbon microphones in the form of strong harmonics generated within the microphone itself, produces one of the most unpleasant varieties of distortion. Also, of course, such harmonics are serious wasters of valuable r.f. energy and creators of aggravated sideband interference. The desired objective of an amateur 'phone transmitter is not to put maximum signal strength into a distant receiver but to put in a maximum of intelligibility, in a pleasant-to-listen-to voice. Many a low-power 'phone has proved astonishingly effective because its speech quality was extraordinarily good. High intelligibility and a "pleasant" voice often may accomplish more than would a boost in power and this can be achieved only with the aid of a microphone which does a good job on its initial end of the circuit.

Unlike brass pounding, where an operator pounds or wiggles a key, the 'phone ham actually does nothing to the microphone. He talks to the air and the air, in turn, actuates the microphone. Accordingly, in any discussion of sound pick-up practice, we must consider the action of a sound wave on the microphone.

Fig. 1 is a picture of the coupling between the sound source, $P$ (the ham's mouth), and the microphone, $M$, located at a distance away, $R$. Although the radiated sound is hemispherical, we are concerned only with the segment of sound shown in Fig. 2. The rest is radiated into space or reflected. (If the amount reflected is too great it messes up the calculations as well as the signal on the air.)

Emitted sound expands equally in all directions, decreasing in intensity by the square of
the high frequencies travel in a beam and are accordingly deflected. An ideal diaphragm is one which follows perfectly, in physical movement, the sound pressure applied and thereby provides an accurate voltage image, as shown in Fig. 5-A. Fig. 5-B illustrates a badly overloaded diaphragm of a moving-coil microphone which reaches its elastic limit before the sound pressure has reached maximum amplitude. Pressure and diaphragm movement start at normal and expand to the elastic limit of the diaphragm. At this point the pressure continues to increase but the diaphragm comes slowly to rest in its displaced position until the sound wave is on the decay side of the cycle and then it returns in phase with it. The electrical output, meanwhile, follows the velocity of the diaphragm or voice coil, and while

Pressure Microphones

The pressure type of microphone has the widest use. By definition, it is one which produces voltage directly proportional to the sound pressure applied. The back of the microphone is always closed to prevent the sound from striking the back of the diaphragm in improper phase relationship. Fig. 3-A shows a single-frequency sound wave, with the pressure component leading, striking the diaphragm. This pressure displaces the diaphragm from its normal position to that indicated by the dotted line and this movement is transmitted to a moving coil, crystal, carbon granules, or a condenser plate. At the next half cycle, the diaphragm position is shown by Fig. 3-B. At this instant, the wave has passed on and there is a rarity of pressure in front and the diaphragm springs back, through equilibrium, in the outward position. At the conclusion of the cycle it returns to rest in its normal position.

Since the pressure of a sound wave is equal in all directions, a sound wave from any direction will actuate the diaphragm. Fig. 4-A shows sound originating from the side and exerting side pressure on the diaphragm. Whenever the wavelength of sound from an angle is short compared to the diaphragm width, there are several points of pressure and of rarefaction which cause irregular movement of the diaphragm. For highest-fidelity angular pick-up, the diaphragm therefore should be kept small. However, in actual practice too small a diaphragm lowers the output and usually a compromise is made. Fig. 4-B illustrates sound striking the microphone from the rear and energizing the diaphragm. This is true only, however, at the low and middle frequencies;
few if any can be used for both close and distant pick-up with satisfactory results.

Pressure microphones are the closest approach to an all-around instrument. They maintain their inherent frequency response at various distances from the sound source and they can be built as a dynamic, condenser, crystal, carbon, or a ribbon with a closed back. Since the diaphragm can be made stiff, they are not, as a rule, too susceptible to breath or wind noise. They are semi-non-directional and can be used for group pick-up when room reverberation permits. Relatively high efficiency and excellent frequency characteristics can be secured with correct design.

**Velocity Microphones**

The velocity microphone is of the type which is responsive to the pressure gradient or the difference between the instantaneous sound pressure on the front and back of the ribbon or diaphragm. Fig. 6-A illustrates a conventional velocity microphone looking directly at the interior assembly. The ribbon is loosely suspended between the pole pieces which also serve as baffles. Variations in sound pressure move it through the magnetic field set up by a permanent magnet attached to the pole pieces, inducing a voltage in the ribbon. Fig. 6-B is a bird’s-eye view of the same assembly showing the ribbon, pole pieces, and the magnetic lines.

Fig. 7-A is a picture of the ribbon being actuated by a single sound wave at the top half of the cycle, with the pressure component leading. For simplicity, it has a wavelength of less than one-fourth the distance around the pole pieces. For lower frequencies, actually there is a pressure on both sides of the ribbon and the microphone responds to the difference in pressures, the pressure gradient.

The ribbon moves through the magnetic field, cuts the lines of force, and a voltage is induced in the ribbon which is the electrical image of the sound wave. As the wave progresses a half cycle it passes around the pole pieces and at the instant of passing (Fig. 7-B) there is pressure from the rear and a rarity of air at the front. Since the ribbon is loosely suspended without any inherent spring and resonating below audibility, it floats back, following the difference in pressure between the front and the back — just as simple as that.

**Fig. 7 — Movement of velocity-microphone ribbon in respect to wave direction.**

In the design, it is necessary to determine the desired upper-frequency response and make the pole pieces, or baffles, the correct width. There is a direct relationship between baffle width and upper frequency cut-off, since the high frequencies which are physically close together do not have time to get around a wide pole piece before the next one is on its heels. Narrow poles require higher magnetic energization for a given level since there is less collection of sound and therefore less movement of the ribbon. The baffles should be slightly less than one-half wavelength at the highest frequency to be reproduced. Thus you can measure the frequency response of a velocity microphone with a ruler, assuming no introduced distortion by the ribbon, coupling transformer, or sound reflection within the case.

The velocity microphone, it is seen, is bidirectional because if sound enters at the side, there is equal pressure on both sides of the ribbon and therefore no movement can result. Fig. 8 is a picture of the directional characteristics of a velocity microphone. The sound entering directly into the front or back gives maximum output, sound from the side producing zero output. As the sound strikes it from an angle, there is a corresponding decrease in level which may be represented by drawing a line (dotted) from angular to direct sound. If the angle adjoining the top of the angular sound angle is kept a right angle, the output will be graphically represented by the length of the lines, or, if you remember your trig, the output will vary as the cosine of the formed angle. The frequency response for all practical purposes will remain constant at all angles of sound incidence — there will be just a drop in level.

This bidirectivity can be put to work to reduce reverberation since the attenuation at the sides decreases random sound pick-up by 6 db. It can be oriented so that the sides face objectional noise (XXL and jr. ops?). It can be used between two persons and “worked to” from front and back with equal pick-up. As the ribbon in the conventional type is loosely suspended it will follow even extreme sound pressures without blasting and without the harmonic generation shown in Fig. 5.

The velocity microphone must not be worked too close to the sound source since there is a shift in phase between particle velocity and sound pressure at close distance which causes a substantial rise in the low-frequency response. Popular-priced velocity microphones are lower in output than their pressure counterparts and require higher-gain speech amplifiers and better input shielding.
The Differential Microphone

The third type of microphone, the differential, was covered completely in the December, 1943, issue of *QST*. This has proved to be extremely useful for overcoming high ambient noise in nearly all military applications. Already it has been used widely for all types of communication in the aircraft, railroad, industrial, and emergency service fields.

Unidirectional microphones are a fourth type but in reality they are combinations of pressure and velocity elements which are operated together in such phase relationship that sound pressure adds from the front and cancels from the back. This has been done successfully in both dual- and single-head instruments. These provide a 5 db. reduction in random noise and are highly desirable in "live" rooms, especially where the undesired sound strikes the microphone from the rear.

Research has provided a wide choice of microphones and intelligence in selection and use is therefore more necessary than ever. The carbon microphone (pressure or differential type) has been widely used for military application and does provide high articulation. In addition, the modern version is durable and has high output. The chief disadvantage is high harmonic distortion, especially in the single-button variety.

Laboratory articulation tests have proven quite conclusively that a flat response curve between 200 and 4000 c.p.s. is ideal for communication service. Peaks in the frequency response lower the effective intelligibility at the receiving end as indicated by Fig. 9. In this instance the energy in the peak does not represent intelligibility but limits the receiver volume to the point of overload caused by the peak, yet if the peak is removed, the entire spectrum can be substantially raised. This same reasoning also can be applied to the rest of the transmitting and receiving equipment.

There will be a wide variety of microphones waiting for the radio amateur after the war. Wise choice of the appropriate type and correct use will put new sparkle in the QSO of Tomorrow.

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Gold Stars

SGT. FRANK ROGOWIN, WSHFW, was killed at Donauworth, Germany, April 25, 1945, when the tank in which he was serving as radio operator ran over a mine.

Frank had graduated from a school of dentistry shortly before entering service, but his radio knowledge was more valuable to the Army. After receiving training in tank radio maintenance he became an instructor, serving at Fort Knox, Camp Chaffee and Camp Campbell before going overseas. WSHFW held Class A, radio-telephone and telegraph second-class licenses and was a member of the Mike and Key Club of Lorain, Ohio.

SGT. WINSTON V. BRADBURY, W5CIQ, was killed in action in Germany, December 18, 1944. At the time he was serving as a radio operator with a field artillery battalion.

W5CIQ was a member of the New Orleans Radio Club and the Rag Chews Club, and held radio-telephone first-class and telegraph second-class licenses. Prior to entering service in December, 1940, he had been an operator with the Mississippi Shipping Co., the Texas Oil Co. and had been employed at station WNOE, New Orleans. Before going overseas he was a radio instructor at Fort Bragg, N. C.

PT. HENRY FRITSCH, W1NKV, was killed in action in Germany, December 3, 1944, while serving in the infantry.

A member of the Rag Chews Club, W1NKV operated chiefly on 7 and 14 Mc. Up to the time of being inducted in June, 1944, he was employed by the Van Brode Milling Co., Clinton, Mass., as an electrical engineer. He received basic training at Camp Wheeler and went overseas early in November, 1944.
President Hiram Percy Maxim has visited the San Francisco Radio Club, the first time a League official has been on the West Coast, and, we read in QST for September, 1920, has told them the story of ARRL from the beginning to the present. Reports from the coast indicate that much good was done by the get-together. IIPM was much impressed by the SFRC, which not only maintains a large meeting room but has an operating room and a Board room and sustains its activities the year around. While in that city he was also able, through the facilities of Lee deForest, Inc., to address the wireless world of the western United States over the 1-kw. radiophone at the California Theater, extending compliments to the amateurs of California and hoping that it would not be long before amateurs on our two coasts were in direct communication. . . . Mr. Maxim also has an article in this issue of QST, "Our Less Experienced Brothers," dealing with the danger that confronts our organization in the tendency of more advanced amateurs to draw apart from the beginners.

Transmitting tubes are soon to be available. Our leading technical article presents "A Few Ideas for Amateur C.W." The article describes and gives some circuits from NSF and 8XK, leading c.w. stations. New ideas presented in QST for the first time include the master-oscillator power-amplifier circuit, the a.c. heating of transmitter filaments, and the use of a spark-coil supply for i.c.w. 8XK, the station of Frank Conrad in Pittsburgh, is the subject of the cover illustration and of the station description of the month. He has spark, i.c.w. and 'phone, generally on a wavelength of about 250 meters, and has been one of the best stations in the BuStands-ARRL Fading Tests. . . . S. Kruse, assistant electrical engineer at the Bureau, makes a preliminary report of "Station Performance During the BuStands-ARRL QSS Tests of June-July, 1920," comparing the performance of the various transmitters and receivers which engaged in the work. Fifty of the fifty-one observers used Paragon-type receivers. . . . League and Bureau officials have conferred and arranged further tests which are to be held in October, January and April.

"The Construction of a Two-Step Amplifier" is described by McMurdo Silver in his first QST article. "How to Tune the Honeycombs" offers practical-experience instructions on how to get results, by that maestro of the honeycombs, A. L. Groves. "QRU" is the pen name of an unknown contributor who authors "The First Epistle from The Young Squirt to The Old Man," the first of a series of lively exchanges which is to delight amateur radio for years.

KBW, the editor, takes inventory of our progress of the past year since our reopening: "Technically, our stations have improved in ability beyond anything that the most optimistic of us would have imagined possible a short time ago. All during the past summer it has been an ordinary thing to hear Pittsburgh, Washington, Chicago, New York and Hartford working each other, not to speak of many other equally distant points. And all of this has been done on wavelengths below 250 meters. Continuous wave transmission, both straight and modulated by buzzer, is in nightly use, and it is a rare evening that the human voice and the strains of music do not come in over the air. Messages by the thousands are dispatched every night, and reliable communication over long distances by the ordinary citizen without the assistance of any public equipment or organization is an accomplished fact. This is CITIZEN RADIO as some of us dreamed it years ago. We call it 'amateur' radio, but it is more than that. It really is the first instance of an independent, countrywide, citizen-owned-and-operated utility. Fellows, honestly, it is going some.

"Before the year rolls around we expect to see tremendous improvement in reliability, in distance covered, and in the breadth of our field. We shall see transcontinental messages as common as inter-district messages now are, we shall hear the voice used up to a thousand miles, and we shall see five radio stations where now stands one. It's a great game we are in, fellows. Let's stick and watch ourselves grow."

Strays

A 1915 issue of the New York Times carried these headlines: "DeFOREST TO AID AGAINST ZEPPELINS. Will Place His Electric Detector at the Service of the Allies. It Is Expected to Record Airship Propeller's Vibrations and Disclose Their Location." The news item continued: "A middle-aged American inventor [Dr. Lee deForest] with an electric bulb will arrive in London this morning on a hurry-up call from the British Government to show Sir Percy Scott how the British capital may avert danger from Zeppelins. And when the American inventor has done his work in London he will cross the Channel to devise a system of protection from air attack for the treasures and the lives of Paris." Shades of radar!

We were told recently of a newly announced naval craft: LSC (Large Swivel Chair).
Those Singing Masts
The Story of a Sea-Going Radio Broadcasting Station

BY LT. ANTHONY W. BORGIA, W6EOU

In the past few months feature articles have appeared in such magazines as Newsweek, The Saturday Evening Post and Broadcasting concerning the radio broadcast ship Apache. This U.S. Army Signal Corps mobile signal installation has played an important part in the dissemination to the press and radio networks, not only in the United States but in Australia as well, of news of the invasion by U. S. and other Allied forces in the Philippine Islands.

The Apache is one of several ships which were released to the U. S. Army Signal Corps for the installation of mobile radio facilities. It is of particular interest since it is the only ship equipped with complete modern broadcast station facilities, and the only one capable of joining moving sea-borne assault forces and providing on-the-spot press and radio news coverage to the millions of radio listeners throughout the world, on both standard broadcast and short-wave frequencies.

In the summer of 1944 the public relations department of the SWPA theater decided that a radio ship was required which could accompany invasion fleets and broadcast on-the-spot news items of general interest to the public, and certain propaganda to the enemy-held islands. The Apache, a 500-ton 180-foot former Coast Guard vessel, was the nearest reasonable approach to what was desired from several ships which were available at the time. This good old ship, now over 55 years old, has weathered two battle campaigns, having participated in both the original invasions of Leyte and Luzon.

But these operations were not without incident. On one occasion while we were in convoy and headed for Luzon, salt water somehow managed to get into the ship's fuel supply with the result that the Apache fell far behind its convoy position. We knew the deal was going to be a hot one and some of us began to have visions of being left behind. The islands which we were passing at the time were within easy sight and were most definitely occupied by the Japs. We had no desire to be left behind. Thanks to our bosom buddies, the U. S. Navy, a tug was sent back to give us a tow and remained with us for nearly two days until the trouble was remedied.

Converting the Apache

To fit it for its purpose the Apache had to be radio-equipped. Accordingly, it was sent to Sydney, Australia, to be converted according to a specific plan of alterations. The equipment was to consist of two broadcast-type transmitters, of ten kw. output rating each, a soundproof studio with its associated control room, and two self-contained generators capable of developing 100 kw. of electric power to operate these facilities. A v.h.f. radio installation also was supplied to provide a link to ground positions so as to permit facilities for remote pick-ups, shore communication and teletype service.

Transmitters and generator equipment had to be installed in the number two hold. Since this equipment was quite massive in weight and dimensions, special planning and arrangements were necessary. After the two 50-kw. diesel-engine power units were lowered into the hold, they were slid aft and a steel wall was built across the entire width of the hold, so as to actually divide it into two portions which became the transmitter and generator rooms. These walls had to be soundproofed to obtain minimum noise disturbance from the generator room. After the flooring, walls and interior electrical wiring were partially completed, the transmitter cabinets were moved into their respective positions. Then followed the heavy oil-filled three-phase power

Among the hams serving aboard the broadcast ship Apache are, left to right: 1st Lt. L. A. Pierce, W9CII0, operations officer, OIC; 2nd Lt. Paul Juengel, W8TED, studio officer; 1st Lt. A. W. Borgia, W6EOU, transmitter officer; Sgt. Vert Mandelstamm, W8VJD, studio NCOIC. Official U. S. Army Signal Corps photographs.
transformers and modulation choke and transformers which comprised the power and Class-B modulation system. Completion of various tasks such as welding and bolting of cabinets, electrical wiring, and carpentry jobs was continued. Simultaneously, the construction of the studio was commenced, and it was placed directly above the hold in which the transmitter equipment was located.

The studio and control rooms were constructed so that in reality they became a floating, rubber-cushioned unit, suspended within the steel-fabricated bulkheads. The studio is completely soundproofed with a special perforated material known as Acoustax. The control room is so designed that the operator views the commentator in the studio through an especially designed window consisting of three individually paralleled lengths of plate glass, with dead air space between each section. Both the transmitter and studio rooms as well as the generator rooms are air cooled by a number of blower and exhaust fans.

After the building and fabrication of the control room and studio had been completed, a six-channel console, two Presto 18-inch turntables, recording equipment, two all-wave receivers, plus an equipment rack which accommodates various amplifiers and power supplies, and a patch panel were installed. This equipment was principally of Australian manufacture. The receivers were especially contracted for in Australia and designed to Signal Corps specifications. They somewhat resemble the old favorite HRO and are used primarily for program cueing and remote pick-up purposes. In view of the fact that the receiving antennas were mounted within fifty feet of the transmitting antennas, reception and service has been remarkably satisfactory under the conditions to which these receivers were subjected.

A suitable location for the antenna installation was required and the ship's two masts presented the most logical answer to this problem. Each mast was extended to a height of 54 feet above the main deck, with yard-arms of 5-inch steel pipe firmly secured in place at the top of each. Between these yard-arms were rigged two center-fed Zepp-type antennas for use with the short-wave transmitter, and a quarter-wave Marconi for the medium-wave rig. Since the operating frequencies which had been assigned were not harmonically related, center-fed Zepp antenna systems were decided upon since they could be readily tuned over a wide range of frequencies. Directional systems were out of the question, prevailing tides and winds in the bay usually being such that the azimuthal position of the ship could be controlled only to a limited degree.

A broadcast antennas tuning box was mounted on the foredeck. This was heavily constructed of steel plate, and waterproofed as protection against heavy rains or deck spray. A coaxial-line trunkway provides the necessary lead to the output terminals of the medium-frequency transmitter. An especially designed steel trunkway approximately 30 feet in length was constructed to bring the two 600-ohm open-wire lines leading to the high-frequency antennas directly over the output bowls of the short-wave transmitter.

Four-channel V.H.F. carrier equipment was installed to permit ship-to-shore or ship-to-ship telephone service, remote program pick-ups, and to provide teletype channels. During the entire operations this equipment was in constant use. It proved itself invaluable, since at times noise levels were so high on the regular short-wave receivers that satisfactory transmission of remote broadcasts could be made only by using the V.H.F. system. Unfortunately, security regulations do not permit further discussion of this equipment.

Installation of the equipment had to be completed while the Apache was en route from Sydney to New Guinea as insufficient time had been allotted to complete the wiring of the studios and transmitter. It therefore had to be done en route if the Apache was to pick up the large staff of war correspondents assigned to it and reach a secret rendezvous in sufficient time to join a waiting convoy.

Truly the Apache was a seaworthy ship, but during rough water she rolled so heavily that installation work in the transmitter compartment could be carried on only for short intervals.
Only twenty-four hours were available for final tests after the Apache reached its New Guinea base. A civilian Australian engineer, who was connected with the firm which constructed the custom-built medium-frequency transmitter, was flown from Sydney to meet the Apache for final tests. During this period voice communication with Brisbane, Australia, was established, and a report that we were being heard direct in California was joyous news to our ears.

**On to Leyte**

After these brief preliminary tests the Apache was ordered to take convoy position. It was not many hours later that she was part of a glorious spectacle of hundreds of troop-laden warships headed for the Jap-infested island of Leyte in the Philippines, which at the time only a few knew to be the actual point of destination.

The morning of A-day, October 20, 1944, saw us looking at land for the first time in about a week. It was a beautiful clear day. Shortly after sunrise, which we awaited tensely, we had our first taste of Jap bombers and the suicide planes of the Kamikaze Corps. Our ack-ack fire and our own carrier-based fighters were superb. They kept those sons of heaven out of our hair, while wave after wave of troop-carrying vessels were unloaded and beachheads established. Indeed, we saw the Nips catch hell, but as a reminder — and should any of us forget — we also saw some of our ships and lads go down valiantly as well.

Radio silence had been lifted. Navy warships were tossing heavy caliber shells directly over the Apache — and we were on the air. Sound effects were plenty and varied, but certainly not imitated; this was the real stuff! Fortunately our studios and control rooms were effectively soundproofed, so the noises encountered were not loud enough to drown out the commentator's voice. Transmission of on-the-spot news and commentaries continued directly to RCA at San Francisco, whose facilities were the feed-point for radio networks in the U.S.A.

The description of General MacArthur's forces landing on the island of Leyte was rebroadcast on the v.h.f. equipment. In the Luzon operation the v.h.f. equipment was used to handle programs originating at distances of approximately 100 miles. These remote pick-ups were necessarily relayed through intermediate stations at specific points and also over telephone wire circuits during certain portions of the span. All of this was necessary to feed spot news to various radio networks in the U.S.A.

It was at this time that resumption of the previously silenced "voice of freedom" broadcasts were again commenced. Using a frequency of 7795 kc., daily broadcasts were made to all friendly guerrilla and civilian forces summoning them to take up arms against the common enemy. Our coverage of the Philippines was excellent on this frequency. Obviously the Japs were hearing our programs, but it is doubted that they particularly enjoyed hearing them; for one thing, we rather imagined they considered them a bit too close.

Through grapevine channels information reached us that Americans and Allies held as prisoners of war in Japanese internment camps also were picking up our broadcasts on concealed receivers. Of course the Japs did not permit internees to have receiving equipment of any kind, so someone would mysteriously convert the camp theater sound system into a receiver long enough to pick up the Allied news broadcasts. Just how they did it I have never been told, but we do know that the ingenuity and cunningness of these men managed to solve the impossible. News usually was passed around by word of mouth, but in at least one case a single sheet of news copy was secretly typed and circulated. Even the civilian population was closely watched. No short-wave receivers were permitted, and those receivers containing more than the standard b.c. band had all the short-wave coils removed. This of course limited radio reception to two or three local broadcast stations which were under Jap control. So far as the average Filipino radio fan was concerned, these Jap news broadcasts indicated only how favorably the war against the Americans was being waged and how badly our troops were being annihilated, even to the day that we actually landed on the island of Luzon.

Our equipment permitted operation on either the short-wave or standard b.c. frequency transmitter but both could not be operated at the same time. Due to our position in the Leyte Gulf some 350 miles south of Luzon, it was determined that best coverage would be possible on our 7-Me. channel. It was not until the Apache reached the

(Continued on page 84)
THE CRYSTAL BALL

CONDUCTED BY A. DAVID MIDDLETON,* W20EN

This department gets under way with some lively and interesting discussions on postwar amateur station equipment design, construction and layout. Soon after the announcement appeared in July QST, material began to arrive from you boys with the hot ideas! The quality and quantity of the brain storms received shows that much thought and considerable planning has already been devoted to the equipment and layout for those all-important stations to be installed and operated, come VJ + X.

We are pleased to present the following "pre­views" from the logs of some of the best "crystal gazers" in the business.

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TWO-STAGE TRANSMITTERS

HERBERT S. BRIER, W9EGQ, Indiana's SCM, wants c.w. and 'phone transmitters with at least 200 watts input, using not more than two stages in either the r.f. or a.f. circuits. W9EGQ wants the whole rig to be fed from one power supply. He writes as follows: "An 813 at 1500 volts will permit an input of 225 watts on frequencies up to 30 Mc. The 813's grid-drive requirements (less than half a watt) allow it to be coupled lightly to an 807 oscillator, so that amplifier variations will not affect the frequency. Fundamental crystal operation with low-drift crystals up to 14 Mc. and tripling from a 7-Mc. crystal to 21 Mc. will be easy. For 28-Mc. operation a 14-Mc. crystal will be required, doubling in the oscillator. With crystals as plentiful and cheap as they are expected to be after the war, multifrequency operation can be obtained at low cost. With such simple r.f. gear, separate units may be used for each band.

"A pair of 828s at 1700 volts will produce 300 watts of audio without the grids drawing power. They will loaf along at 100 watts. A single transformer-coupled triode stage between the 828s and a good single-button carbon mike will suffice.

*Assistant Editor, QST.

"It would be even simpler if there existed a series of tubes for modulators designed to run at the same voltage as the companion r.f. tubes. Such a twin beam tube could be built into one envelope. Designed for a.f. work only, no compromise would be necessary for r.f. use.

"There's my dream transmitter — 225 watts input, 100 per cent modulated, with a single-unit power supply."

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MODERN FEATURES FOR POSTWAR W3JOP

T/Sgt. GLENN W. SMITH, W3JOP, plans the following postwar features for his station:

"Panoramic reception — Its advantages are numerous and amateurs are sure to make the fullest use of it.

"Modulation oscilloscope — Built into the transmitter rack or cabinet, full information on the percentage of modulation, c.w. characteristics, and harmonics would be available continuously. Not now, but a postwar necessity.

"Electronic keyer — I want an electronic keyer that automatically makes dots and dashes depending on the key-arm movement. Contacts would be speeded up, especially with break-in operation.

"Band-edger" — For the v.f.o. controlled transmitter, a visual 'band-edger' indicator (to keep the operator from running out of the band when hunting that open spot) would be a great asset. It requires time to set up the conventional frequency meter for each change in frequency. With a 'band-edger' indicator, set to the edge frequencies, the operator would have no fear of stepping on 'forbidden freqs.' Indications could be by tuning-eye, relays, cut-offs, or lamps. The system I have in mind has twin r.f. circuits coupled to a conventional frequency meter with one circuit tuned to the high end and the other to the low end of the band, and with proper tolerances taken into account. Any r.f. passed by the r.f. 'selector' circuit would be automatically meas-

September Prize Winners

Contributors to the Crystal Ball Department are awarded monthly prizes consisting of a $25 War Bond as first prize; $10 in War Stamps as second prize, and $5 in War Stamps as third prize. One dollar in War Savings Stamps is awarded the writer of each additional published letter not receiving a major prize.

The most interesting letters are selected by two members of the Headquarters staff: the conductor of this department and a "guest judge." This month's winners, chosen by F. Cheyney Beckley, W1G[S](QST's Advertising Manager) and W20EN, are: Francis K. Campbell, W5IGJ, first prize; T/Sgt. Glenn W. Smith, W3JOP, second prize; Lt. J. C. Phipps, USNR, W8SMH, third prize; Herbert S. Brier, W9EGQ; Henry B. O. Davis, W4HZI; B. F. Davidson, W6RWO; Warren A. Lanfer, Buffalo, N. Y.
saw a pile of quartz crystals being gradually mounted rigidly on the rack or cabinet body, making it unnecessary to disconnect any wires to remove a section. All inter-section wiring would be mounted permanently in the rack or cabinet. This would quicken tube changes, wiring, checking, cleaning, neutralizing and coil changes.

"Visitor" indicator — "You've ever been interrupted during a good QSO by the doorbell or telephone bell? Why not mount visual indicators (small colored lamps) on the operating table to indicate the presence of a caller rather than allow the bells to be relayed on the air. A switch on the operating table, used to flash on "One moment, please," outside the front and/or rear door, would give the op time to finish his transmission or reception. A telephone extension should be located near the operating table.

"Dummy antenna" — A dummy antenna should be built right into the antenna tuner.

FREQUENCY INDICATORS ON A V.F.O.

While gazing into my Crystal Ball I first saw a pile of quartz crystals being gradually pushed across the table towards the junk box by a really stable v.f.o. unit.

This v.f.o. had a number of little neon bulbs around the edge of the dial. When the dial reading was 7000 kc. the first bulb lit, and, as the dial was rotated across the band the bulbs would glow one after the other until the last bulb was lit. The dial then read 7800 kc. One of the bulbs indicated the frequency (7185 kc.) of a schedule to which the op time to finish his transmission or reception. The alarm amplifier output could be used for relays, lamps, or any other indicator.

"Plug-in equipment sections" — I'll build my transmitter in a 'rack and panel' or cabinet, with each section or panel removable by just loosening a screw or two and sliding the unit out. All outside connections to the unit will be made through banana-plugs and jacks or similar connectors. The power-pot, the speaker, and condensers used limits also was very helpful.

"Yisitor" indicator — "You've ever been interrupted during a good QSO by the doorbell or telephone bell? Why not mount visual indicators (small colored lamps) on the operating table to indicate the presence of a caller rather than allow the bells to be relayed on the air. A switch on the operating table, used to flash on 'One moment, please' sign, outside the front and/or rear door, would give the op time to finish his transmission or reception. A telephone extension should be located near the operating table.

"Dummy antenna" — A dummy antenna should be built right into the antenna tuner.

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A HAM BUYS A RECEIVER IN '43 ± 1

The year is 19VJ ± 1 and Joe Blow, a ham who patriotically sold his gear to the armed services in 1942, enters Honest Harry's radio store. The clerk approaches and, upon ascertaining that Joe wants an all-wave receiver but only has fifty bucks to spend "right now," leads him over to the counter and points to a neat job that has controls labeled "Crystal Filter," "Noise Silencer," "I.F. Band-Width," "C.W. - Phone," "Band Change," "Bandspread Tuning," and "A.M.- F.M."

Brother Joe lets out a whoop of joy, but is immediately silenced by the thought that he has but fifty bucks.

"Don't let that worry you," says Honest Harry. "Look inside." The lid is opened and there are all the fixings crowded neatly into the cabinet.

Still the fifty looks very small, but now Honest Harry is pulling out — yes, pulling out — most of the gear. When he is finished there remains the front panel with its controls and tuning condensers and band-change switches, the chassis deck filled with tube sockets, and a power transformer. The speaker is separate.

"Now, we begin by plugging in the rectifier tube, the filter condensers and the filter choke into their sockets, one for each item," he announces. The power-output tube goes into its socket, and another square box into an adjacent tube socket. This, the clerk explains, contains all the resistors and condensers used in the power-tube circuits. To service the unit all one does is to remove the box from its socket, remove the cover from the box, and replace the defective part. Indeed, the entire box is available in the store, both on an exchange basis or as an outright purchase.

Next the combination second detector, first audio and a.v.c. tube is plugged in, with its associated little black box, an i.f. transformer, and a jumper box. This permits use of the set without a noise-silencer circuit.

The i.f. stage tube, transformer, etc., are plugged in, and so on until with proper equipment a good receiver is available.

So Joe Blow buys exactly fifty dollars worth of receiver, giving him one stage of r.f., mixer, one i.f., plus detector and a.f. — meanwhile mentally planning on getting a noise silencer as soon as his funds permit. He lets the speaker slide this trip.

It is now 19V3 ± 3. The same set purchased two years previously is working. Joe turns off the f.m. broadcast and tunes in 80-meter c.w. The amplifier coupled to the oscillator. As the resonant frequency of each crystal was reached in tuning the oscillator, the little 1/25-watt neon bulb for that crystal would glow.

The arrangement appeared very convenient. Besides having v.f.o. operation I had visual indication of where I was located in the band. If the v.f.o. changed calibration for any reason it was immediately apparent. The indication of band limits was also very helpful.

— Henry B. O. Davis, W4HZI

Fig. 1 — Application of crystals (devices formerly used to control transmitter frequency!) as indicators in a v.f.o. When the v.f.o. is tuned to the frequency of one of the crystals the associated neon bulb lights, indicating the location of the variable oscillator. The unit is shown set up for a spot frequency schedule of 7185 kc.
noise silencer is on, the i.f. band-width “sharp,” crystal filter in, and two stages of r.f. and i.f. give all the soup needed. Joe’s fifty-dollar basic set is now grown up and doing a real job. And Joe has not lost on his investment at any stage of the game.

—Lt. J. C. Phipps, USNR, W8SMH

ADVANCED THOUGHTS ON EQUIPMENT PLACEMENT

Francis K. Campbell, W5IGJ, of Houston, Texas, did some serious and intense gazing into his Crystal Ball, and recorded his findings in an epistle from which we quote:

“How fortunate he is whose XYL selected such a beautiful residence—a two-story job on a hill in a diathermy-free region with a master bedroom and clothes closet directly above the combination den, hamshack and closet. An enterprising ham could easily drill a water well through the floor of the shack closet wherein to ground everything. What a set-up the stacked closets offer! An 80-, 40-, 20- and 15-meter band-switching, c.w. and ‘phone, 1-kw. rig mounted on an aluminum door with supporting rollers, replacing the regular door. A similar installation directly above, covering the higher bands, all remotely controlled from the operating position. (See Fig. 2.)

“The blessing of my neighbors in general, and my XYL in particular, will be lavished upon my head for eliminating power-line feed-back and unsightly exterior wiring by simply placing the three-wire r.f.-choked 115-volt line underground. These blessings may be withdrawn as soon as the necessary antenna array for all the bands appear above our domicile. But what is that I see sprouting from my roof-top? I wonder if I could sell my XYL on the idea that such a beautiful residence should be protected from lightning. I could cer-
[Just how OM Campbell proposes to feed all those gadgets on the pipe mast — and how well they will work — he sayeth not! But we suppose he will have another vision in his Crystal Ball by the time he gets all that stuff erected. — EDITOR.]

A SIMPLIFIED, LOW-COST TRANSMITTER

The postwar transmitter design submitted by Warren A. Lanfer, of Buffalo, N. Y., includes several interesting and versatile features:

1) A three-tube r.f. circuit, using 807s, requiring only one 750-volt power supply with suitable taps.

2) Complete front panel band- and frequency-shift, including the antenna tuner.

3) A 50-watt r.f. output on all bands from 3.5 to 28 Mc.

He plans to use low-frequency variable crystals in a Tri-tet giving doubling and quadrupling output to feed the final tube, which is always an amplifier. A third tube will be switched in between the oscillator and the amplifier to furnish additional flexibility for output on 21 and 28 Mc. The transmitter will include a pi-section antenna coupler to which will be connected a 130-foot end-fed antenna.

Variable frequency crystals will give a wide range of output frequencies with a relatively limited number of crystals. High voltages will be eliminated from the coils and tuning condensers through the use of shunt feed.

A few of the possible combinations are as follows:

<table>
<thead>
<tr>
<th>Tri-tet Oscillator</th>
<th>Doubler</th>
<th>Output Amplifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5-3.5 Mc.</td>
<td>Not used</td>
<td>3.5 Mc.</td>
</tr>
<tr>
<td>3.5-7.0</td>
<td>Not used</td>
<td>7.0</td>
</tr>
<tr>
<td>3.5-7.0</td>
<td>7-14.0</td>
<td>14.0</td>
</tr>
<tr>
<td>3.5-10.5</td>
<td>10.5-21.0</td>
<td>21.0</td>
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<tr>
<td>3.5-14</td>
<td>14-28.0</td>
<td>28.0</td>
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</tbody>
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Lanfer plans to build his transmitter and its power supply into a single cabinet to be located right on the operating table, thus providing flexibility and operating convenience.

SPACE-SAVING TECHNIQUE FOR MOBILE GEAR

B. F. DAVIDSON, W6RWO, of Sacramento, Calif., has given considerable thought to postwar mobile and portable equipment design. He suggests:

"Let's build our portable-mobile equipment as compact as possible. Take a look at your automobile and notice the unused space behind and under the front seat. In some cars there is space under the dash and in the corners of the luggage compartment. Suppose you find an odd-shaped space, say three inches high and eight or ten inches wide and deep. Take a 2 x 8 x 10 inch chassis and place subchassis in it for tubes and other components. The tubes can be mounted parallel with the normal top of the chassis. This arrangement will permit the unit to be mounted on the back of the front seat, as in Fig. 4-A, or even under the seat in some installations. With modern components and miniature tubes, proper equipment design will permit strange but efficient form factors. See Fig. 4-B for a sample chassis layout.

"Maybe you don't have space for one unit containing all the necessary elements. Make up two, three, or even four units, each containing a portion of the gear and mount them where it is convenient and efficient. This has the advantage of placing the r.f. unit as close to the antenna as possible and places the power pack near the battery source, thus shortening the primary leads.

"Just a note on efficiency. Watch your filament load. Why use tubes with 0.3- or 0.7-ampere filaments when 150- to 400-ma. tubes are available. Let's utilize a tube at its maximum efficiency and pick each tube for the job it has to do. Quick-heating tubes in transmitters will save lots of battery current!"

HOW'S YOUR CRYSTAL BALL WORKING, OM?

The Crystal Ball Department solicits letters and sketches describing your postwar plans for that super ham station you have dreamed about for these many long years. Send in your ideas and rough sketches of your plans. We'll pick out the items of most general interest and maybe Harry Hick or Phil Gildersleeve will fix up a drawing or a cartoon from your sketches.

Now is your chance to get your ideas on paper. Maybe you'll win a useful prize that will help pay for that new equipment!

Address your contributions to:
The Crystal Ball Department,
American Radio Relay League,
38 LaSalle Road, West Hartford 7, Conn.
I was stationed in Dover late in May, 1940, carrying out wireless maintenance work on a fleet of minesweepers and patrol ships. Although only a humble telegraphist I had been in radio work during peacetime as well as being an old-time ham, so it was not too remarkable that I should have been given the job.

I had completed the retuning of a converted minesweeper and was about to walk down the gangway when I was met by the chief telegraphist. "Hello, young fellow-me-lad," he greeted me. "I've got some news for you."

"I hope it's good news," I replied.

His head went down. "Um—er—well—you've caught up with a draft!"

Now a draft in the Royal Navy means either a move or a new ship. Naturally, my spirits dropped; I liked my present job. However, the CT went on to explain that this was a special draft which would last only a few days. He ended by telling me to report to the flag officer the following morning for instructions.

On the dot of 0900 this apprehensive telegraphist presented himself to the designated officer. A flag officer is an imposing spectacle, even nowadays, for he is entitled to wear an aiguillette (a twisted gold cord bent around the left shoulder, terminating in two large gold tassels). Never before had I seen splendor from such close range.

My activity commenced with: "Sparks, here is your first message. Get it off as quickly as possible!"

Naturally, I was impressed—decidedly impressed.

Apparently I was expected. As soon as I had knocked, entered and removed my hat, he greeted me kindly with: "Come in. Sit down and have a cigarette." I had never before been treated in this manner by an officer. Always it had been: "Stand at attention when you speak to an officer—take that grin off your face—put your cap on straight."

I was told that I was to proceed aboard HM Yacht Censored, first obtaining all spares, tools and gear that could possibly be required to keep the apparatus going continuously for three or four days. On no account must the apparatus go off the air. I was to keep continuous watch, taking down everything that came in. This seemed like a tall order to one with only ham experience behind him but I had done continuous operating during contests, so why back out now?

The yacht was small, only about 200 tons, with twin diesel engines and a maximum speed of about 14 knots. Her armament consisted of one dummy three-pounder forward and a machine gun amidships.

We sailed from Dover that afternoon under sealed orders—destination unknown, mission unknown. When a certain position was reached, the orders were opened. "Proceed to Calais and contact the sea transport officer." This did not sound very serious. Perhaps it wasn't going to be so much after all.
We slid into Calais harbor a couple of hours later. All was quiet — no guns, no sirens, no planes. In fact, except for the large troop ships unloading tanks, all the world might have been at peace.

After an hour of anxious waiting our commanding officer, who had gone ashore some time earlier, returned with a naval commander and an army colonel. They came straight to the wireless cabin and we heard their story. Fifth column activity had disorganized the French lines and the nation was collapsing rapidly. Our forces could hold out for only a few days, in which time we were to evacuate as many men in uniform as possible.

Speed was essential. Our yacht was the only means of communication with England. On no account were we to go off the air!

My activity commenced with: "Sparks, here is your first message. Get it off as quickly as possible!" It was a 200-word message explaining the whole desperate situation to the War Office — at the same time requesting reinforcements, adequate air cover by day, together with transport facilities.

From then on things really began to move! Darkness was falling fast, and with it came the sound of planes and the French sirens. I was about to experience my first air raid - and I had not yet seen a take off. My hand went to the switch. I pressed the key with an anxious eye on a 200-word message to send! My hand went to the key. (I learned later that this was my introduction to the famous screaming bomb — Hitler's Secret Weapon No: 1.) Something hard hit the deck forward. I looked out — the whole of the fo’c’s’le was illuminated as if a fireworks display was in progress. I heard a shout from the bridge. "Boys, get that fire out!" Just then the yacht gave a lurch to port from another near miss and the ball of fire rolled off the deck into the water. A near shave!

My stomach was turning all ways. Now I really was scared! But this feeling didn't last long, because just at that moment Dover started calling us — and he letting it rip! This was no ordinary fist; this bloke was using a bug. Bug keys are forbidden in the service, so naturally I was a little suspicious. I passed the headphones to the chief, saying: "I don't recognize that fist, do you?"

"Here! Get cracking, lad! That's the warrant officer himself," was his curt reply. I did not like this at all, what with bombs dropping all around us and a bloke calling me up on a bug at 25 w.p.m. Surely this was worse than hell itself! How I managed to take that message with only one repeat I know not to this day. My hand was shaking with excitement, or panic, or whatever you call it. My stomach was turning somersaults and at the best of times I'd always had a job writing at 25 w.p.m.

Next followed the decoding. That wasn't easy, either, although the chief did most of it, I don't remember the exact words, but the gist of it was that we were to proceed with the evacuation of troops with all speed. Air cover would be supplied by day, for three days only, after which we would have to get along the best way we could.

The remainder of the night was uneventful. The raid continued into the small hours of the morning, by which time it seemed as if the whole of Calais were on fire. Lights were unnecessary in the cabin for with the door open one could easily read by the light from the fires. Several ships in the harbor were ablaze, as well as storage houses on the quayside.

Soon after dawn broke two Hurricanes came over. They made short work of the enemy. I saw one tackle three Jerries at once. By now messages were coming in thick and fast — so fast, in fact, that some of the crew had to be called in to assist the chief with the decoding. The day wore on. I was beginning to feel the strain of little food and no sleep. Finally, around 4 p.m., the traffic slackened off. The chief took the cans off my head, saying that he would take a turn. What a relief!

I took a stroll ashore. The place was a heap of burning rubble. I walked _ into what had been a hotel. Everything was deserted except for

(Continued on page 78)

U. S. War Bonds for Stories of War Service

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

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

A Combination Single-Tube Transmitter-Receiver Complete with Power Supply

BY PAUL J. PALMER, W8UGR

"Hi, dere, fellers," said Tuffy 6L6G. "At last dis guy SUGR gimme a rest wid dis cominashun oscillater 'n' reception committee. Boy, shur'sa relief from vol Fred Sutter 'n' sum o' youse guys had me doin'. Dat SQBW sure boined me up more'n once wid his gestoppo taskicks. Dese lil 79s er 6Y7Gs 'r' sure swell pals — 'n' cheap too. Day kin woik bole en's agin de mittle widout lettin' ya down. Youse kin use dis lil peewee fer dat State Guard 5-watt eighty meter ban, too, widout no trouble as well as bein' swell fer de emojicity woik when we gits bak on. Well, gang, 'long 'n' 73. BCNU, I hope."

**Tom Thumb** is a small, compact, complete little c.w. rig just a mite bigger than the QSL-type rigs. Both transmitter and receiver are mounted on a single chassis, primarily designed for QRP work and AEC emergency service.

The rig is designed primarily for the 40- and 80-meter bands, and while not of high power — around 6 or 7 watts output — it can serve very readily in local emergency service. In fact, it would be very suitable for the recently authorized 3.5-Mc. band State Guard WERS service.

**The Circuit**

The circuit for "Tom Thumb," shown in Fig. 1, really comprises two separate units. The 79 (or its octal-base counterpart, the 6Y7G) is a twin triode with the grid of one section connected to a cap at the top of the tube. This latter section is used as a detector in a single-tube regenerative circuit, while the other triode section is used as a simple tetrode crystal oscillator.

![Circuit diagram of "Tom Thumb."]

Several novel features are provided, being the use of a dual ceramic band-set condenser to tune the tank circuit of the transmitter and the tuning circuit of the receiver. This makes it possible to set the transmitter and receiver at the best possible position for the crystal; once adjusted, it is not likely to be jarred off tune by handling. It is possible also to tune very close to the desired frequency for the receiver and then simply use the bandspread condenser for slight variations caused by the antenna or other detuning effects. The dual ceramic condenser has a capacity of 140 µfd. per section. It is adjusted through small holes in the chassis. This system was adopted to eliminate as many controls as possible, after the style of police and other equipment designed for emergency use.

In lieu of the dual ceramic condenser, small air trimmers could be mounted in the coil forms for band-setting controls. This would simplify considerably the wiring of the coil sockets, and give more flexible control for quick crystal change-over.

Top view of the "Tom Thumb" transmitter-receiver. The 79 tube is in the rear and the 6X6GT in front. Along the front edge are the screwdriver-tuning openings, the regeneration control knob, and the audio-output socket for making connections to an external audio amplifier.
Since, in the sort of service in which the rig is designed, long-range reception is not needed, the single-tube regenerative receiver is all that is required. If greater output is wanted for loudspeaker operation, a simple single-tube amplifier, such as the circuit in Fig. 2, should prove adequate. This stage could be built into a small speaker case with filament and plate power supplied from the main rig.

Regeneration for the receiver is controlled by means of the shunt variable-resistor and fixed-condenser method which is very quiet in operation and has a minimum detuning effect.

The grid-leak resistor and condenser for the receiver grid circuit are mounted on the top of the cell with the antenna lead attached through a small 3-30-µfd. mica trimmer condenser for proper adjustment and elimination of “dead” spots in the tuning range. The transmitting coil also has its antenna connections at the top of the form, thereby avoiding the necessity for feed-through insulators in the chassis.

Because the 79 or 6Y7G tube has a single cathode terminal, a change-over switch is necessary to provide proper operation of either the transmitting or receiving portion of the rig. In the event that 6P8G or 6CSG tubes are used, only a single-pole single-throw switch is necessary instead of the double-throw single-pole type, since in the latter case only a stand-by switch is needed to cut off the plate supply from the receiver when transmitting.

Bottom view of the “Tom Thumb” transmitter-receiver. The filter chokes are fastened outside the right-hand end of the chassis, the filter condensers being mounted inside. The bandspread tuning condenser for the receiver may be seen to the left.

The 6X5 rectifier was selected because of its small size, but an 80 could be used since a 5-volt filament winding is available.

Power for the transmitter is taken off after the first filter condenser, to obtain as high voltage and therefore power input as possible. The writer has found that in c.w. operation such simple filters are ample for a clear signal. This connection also eliminates voltage drop through the filter chokes.

Construction

The chassis is of the QSL type but it is one-half inch longer in order to accommodate the power transformer, the two tubes and the two coil sockets. It is a simple affair bent-up from sheet aluminum in a manner similar to that used in the other recent rigs described by the writer. The template sketch given in Fig. 3 shows the disposition of the various units.

The crystal socket may be of the 5-prong wafer type, mounted on the inside of the left panel with holes drilled ¾-inch apart and of sufficient diameter to clear the crystal plug-in pins. The ceramic condenser is mounted on the right side with a small spacer to insure ample clearance from the

Power Supply

The power supply is of the condenser-input type, with two chassis and three filter condensers to provide sufficient filtering to insure hum-free receiver operation. With the power transformer specified, around 8 watts input power can be had; if the slightly larger Thordarson T-13R11 transformer is used, about twenty-five per cent more input power can be obtained. This latter transformer would take up no more chassis room.

The template sketch given in Fig. 3 shows the disposition of the various units.
panel. Holes are drilled in proper position for screwdriver adjustment.

The lay-out is such that the right end is really the front of the rig, with the stand-by switch at the left, the regeneration control at the right, and the headphone and key terminals at the left and right of this "front" face, respectively. The receiver bandspread-condenser control also is on this edge. The tubes are mounted nearest the transformer, with the coil sockets at the opposite end from the power transformer.

In the event an amplifier is wanted, the power take-off socket can be mounted as indicated, with suitable connections. A small light could also be furnished for night operation in the field. All other component placing is clearly indicated, and no difficulty should be had in building up "Tom Thumb."

Adjustment

In first adjusting this little outfit, the regeneration control should be manipulated so that the regeneration noise is just starting, since this point is the most sensitive one for c.w. reception. The tuning condenser then is set with the screwdriver adjustment until the desired frequency is found, then the bandspread condenser is adjusted to give the best pitch for clearest copy.

The bleeder-resistor tap should be adjusted so as to give smoothest control of regeneration. Different tubes may require a change in this setting. Experimentation for the proper value of resistor, $R_4$, for most efficient detector operation may be needed.

In adjusting the transmitter, the plate current at resonance should light the 60-ma. bulb to around medium brightness, since the 79 or 67YG tube draws around 35 ma. However, for short periods and intermittent operation, a higher plate current may be drawn from the transformer without danger of overheating. As previously mentioned, the plate-voltage tap for the transmitter is taken off at the first input condenser of the filter circuit. In the event of a rough signal, this tap may be moved to the second condenser which would then give better filtering, but with a slight reduction in voltage.

It is the hope of the writer that this little outfit will prove to be a useful type for AEC work, since large numbers could be built and tuned to a given net frequency.

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<td>Band</td>
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$L_4$ Number of turns to be determined experimentally to give proper plate current readings when tuning at crystal frequency.

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to a pair of '10s in a self-excited rig. Hold Expedition at Little America - using 35 watts...

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... Albert Kahn, W9KYM, not only is an authority on microphones — he's the founder and back some 23 years (Al was first licensed in 1922 as WBB1), but microphones a mere 17. Al, like a lot of others, started with a Ford spark coil, ½-kw. spark, 1-kw. spark, "five-watt," "fifty-watt," et cetera. He has enjoyed all phases of ham activity — traffic, rag-chewing, DX, mobile, an...
Writing from somewhere in the Pacific, W8MXC recently requested technical dope on a captured Japanese transmitting tube. In closing he remarked: “I’d write the manufacturer but I can’t read the language, and anyway I suspect there would be a slight delay in delivery.

According to information from a Central Pacific base, a small lightweight soldering iron for use in instrument repair work of a delicate nature has been developed. The iron can be brought up to effective temperature in 45 seconds.

The heater assembly consists of a transformer having an output of 6 to 12 volts, with a current capacity of 10 to 30 amperes. Two carbon electrodes from a BA-30 flashlight cell are used, the soldering iron tip being inserted between these two rods. At the point of contact between the iron tip and the carbon rods a high resistance contact results, forming a small electric arc. The heat developed at these points of contact heats the iron.

P. R. Mallory and Co. have announced the development of a successful radio-frequency ignition system for aircraft which it is claimed has many advantages over conventional methods. Low voltage is generated by a magneto and distributed through shielded leads to the spark plugs. At the manifold ring the low-frequency energy delivered by the magneto is converted to a radio frequency of 2 to 3 Mc.

Streamlined antennas for vehicular radio installations, developed by the U. S. Army Signal Corps, are not only smaller and lighter than the old type but do not shake and whip when the vehicle traverses rough ground. Nor do they drip water over the mast base onto the radio set.

The spring of the new mast bases consists of a bundle of piano wires enclosed in a flexible metal sheath. These wires are fastened at one end, the other ends being held in a brace which allows free linear movement when the mast is deflected.

Mast sections to go with the new bases are each three feet long (though of different diameters) and are made of lightweight tapered steel tubing, copper plated for surface conductivity and painted for weather resistance. There are two sizes of mast base, the smaller one being used with 6- and 9-foot antennas and the larger with 15-foot antennas.

According to Dr. Joseph Needham, head of the British Scientific Mission in China, Chinese scientists, working with meager apparatus and under almost unbelievable handicaps, have developed a new type of quartz crystal which is now being used to stabilize radio transmissions.

Foresight? In 1911 the chief engineer of one of the leading American radio companies resigned his position and accepted an executive position with a manufacturer of sewing machines at a reduced salary. In explanation he made the statement which follows:

“Wireless communication has about reached its peak and only a few minor improvements are possible. On the other hand, the sewing machine industry is growing rapidly and within twenty years every household in the world will own its sewing machine.”

— Break-In (NZART).

A four-page pamphlet titled “Television as a Career,” containing a bibliography of recent literature on television and illustrated with pictures taken at Station WRGB, has been prepared by the transmitter division of the General Electric Company. It is available free on request to the Publicity Section, G. E. Electronics Department, Schenectady, N. Y.

The progress that mobile radio has made in the past twenty-one years is graphically illustrated by the photographs below. The large picture, taken in 1924, shows the cumbersome equipment then necessary for mobile radio transmission. The insert shows a Motorola handie-talkie being used to do the same job today. The 1924 unit was designed by Westinghouse for use in connection with relays to their pioneer radio station, KDKA, in Pittsburgh, Pa. It was comprised of a quarter-kilowatt transmitter mounted in a truck body nine feet long by six feet high. Power was obtained from a 110-volt lighting circuit at the point of program origin. The 33-foot antenna was made of three sections of copper pipe and was stored under the truck when not in use. Today, the same type of work that required over a ton of equipment in 1924 is accomplished by the self-contained 5-pound two-way handie-talkie.
A CONDENSER CHECKER AND OUTPUT METER

An easily constructed condenser checker and output meter is shown in Fig. 1. I used a 2E5, but a 6U5 or a 6L5 would work just as well. Provision is made for two sets of test prod connections. Prods A are used for checking condensers, either paper or electrolytic. Prods B serve as an output meter or signal tracer, in the a.f. portion of a receiver. The value of \( R_1 \) (about 3300 ohms) is adjusted until the shadow just closes with prods A shorted. \( R_2 \) is a gain control. The condition of condensers can be determined after a little practice. The polarity of the prods should be observed in checking electrolytic condensers. — L. R. Hecox, W7FGB.

BLUEPRINT NAME PLATES

In Hints and Kinks for April, 1945, Earl Schoenfeld wrote regarding equipment name plates from hand-drawn negatives.

I have used a series of name plates of this general type but made a little differently. I, like many other hams, do not own photographic equipment and would, no doubt, make a mess out of any attempt to handle the stuff.

My name plates are drawn with black drawing ink on pure white paper, then taken to my blueprint maker and photostated. Care must be taken in cleansing the original drawing since the photostat will show dirt marks as well as the drawing. These prints turn out very well and are glued right to the panel with any good grade of glue, or they can be glued to a thin sheet of brass to make the usual type of removable name plate. The background of the print is more gray than black and looks well on either gray or black panels. After the glue has dried, the surface of the print is given a coat of lacquer (clear fingernail polish) and when dry will remain new-looking for a long time.

A word about the cost. An 8½ x 11 inch drawing will hold about 12 switch plates or about 70 small one-line name plates (1 ½ x ½ inch) and costs 30 cents to photostat.

It pays to make your own and have just the wording you want and any design you want. Of course, your own spare time labor comes cheap and a bottle of glue will last a long time.

Hams who do not have a large amount of blueprinting and photostating done may have to pay a little more for their prints, but even so it is worth the additional cost. — Charles F. Morrow, W1KLN.

A SUBSTITUTE DISCRIMINATOR TRANSFORMER

Experimenters constructing f.m. carrier-current receivers usually have difficulty finding a suitable discriminator transformer. I made an excellent transformer from an ordinary 2.5-mh. r.f. choke.

First, disconnect the two middle pi windings as shown in Fig. 2. (A sharply pointed pencil makes a good tool for this job.) Mount the choke on a terminal strip and connect the wires to the terminals as shown at (A). The transformer is then connected into the circuit shown at (B), using
trimmer condensers of suitable capacity to operate on the frequency desired. In my receiver, I used 360-µµfd. trimmers to cover the range from 69 to 130 kc. The transformer should be mounted adjacent to the trimmers. I cut holes through the chassis to permit adjustment of the variable trimmers. — G. A. Lyerly, 403 65th St., N. E., Washington 19, D. C.

MINIATURE BASS REFLEX CABINET

Whether it's a three-, four- or a five-inch speaker on your communications receiver or a midsize broadcast receiver, the quality of reproduction will be greatly enhanced by mounting the speaker in a bass reflex cabinet. A cost-free enclosure can be provided through the use of a cigar box obtained from your friend in the corner store. Cut a round hole of the proper size in the bottom of the box for the speaker as shown in Fig. 3. Then cut a rectangular aperture below the speaker hole. This should have an area approximately one quarter that of the speaker opening. A small notch cut in the lid will permit the entrance of the leads. Then nail the lid tight. The improvement in quality will surprise you! — M. V. Winston, W2EZC.

WIRE-LOOP FORMING TOOL

Here's a handy tool for forming loops of wire to fit over meter studs or bolts. Take a screwdriver having a tapered shank and grind or file off the blade or bit of the screwdriver. If the shank is not tapered sufficiently, cut it down until you have a round tool, shown in Fig. 4, slightly larger than the diameter of the studs to be fitted with loops. (A tapered shank permits the forming of various sizes of loops, thus one tool will take the place of several.)

Now, by grasping the end of the wire with a pair of long-nose pliers, you can wrap the wire around the tool. A little practice using scrap wire will result in a neat, professional-looking loop. — Bert Felsbury, W8VD.

SCOTT SHIPBOARD RECEIVERS

The c.w. gain of a Scott receiver is greatly improved by connecting the switch contact points marked "Mod" and "C.W." on the reception switch. This is not my brain storm but I have used this set-up for the past eight months and have not had any trouble with this modified arrangement. The modulation gain goes down slightly, but the improved c.w. reception amply compensates for this. — Irving Landow, RM2/c, Navy 920, FPO, San Francisco.

FOX-HOLE RADIO

Many reports have been circulated concerning the various types of fox-hole radio sets constructed by members of the armed forces throughout the world. Naturally, tubeless and batteryless radios must be used by most of the boys in the field. Few parts are required for a razor-blade set. The most difficult item to locate is a pair of 'phones. The wire may be hard to obtain, but the rest of the parts usually will be available.

Fig. 5 shows both the schematic and pictorial diagrams of a typical razor-blade set using parts found in most localities.

Armed Forces radio stations up to twenty-five miles away have been heard, using a fairly good antenna and ground. Greater distances have been reported on similar sets. — Lt. Paul M. Cornell, SC, W8EFW.
GI PROCEDURE AND THE HAM

Hq. AAF, Office of the Air Comm. Officer,
Washington 25, D. C.

Editor, QST:
I have read with interest the article "Military Radio Operating Procedures," in July QST by Lt. Col. Robert Hertzberg, W2DJJ, and I would like to pass on a few comments which I think would be of interest to the ARRL members.

During the past year I have represented Headquarters Army Air Forces in discussions which have taken place concerning postwar allocations of radio frequencies. Throughout this work I have had an opportunity to observe the reactions which various officers of the Army and the Navy, together with other government officials, have towards the radio amateur, and found it interesting to determine just why it was that there was a universal belief that frequencies should be provided for the amateur in the postwar picture. Strange as it may seem, these universal beliefs were not all based upon the same reason. In general, the amateur and his hobby has been accepted as a national requirement for one of the following reasons:

1) He provides a large pool of specially trained technicians who are available as radio operators and maintenance personnel in time of national emergency.
2) He provides a vast network of communications circuits which are available for the public interest during periods of disaster.
3) He develops through his research and experimental work equipment of value to the nation.
4) Frequencies assigned to amateurs form a supply which can be readily tapped in time of emergency for expanding military requirements.

It goes without saying that the first reason is most predominant. However, I was quite surprised to find that there are a few officials who, if it were not for the last reason, would look with disfavor on allocating to the amateur these much sought-after frequencies. These officials unfortunately passed judgment from swivel chairs in Washington and have not had the opportunity to obtain first-hand observations of the magnificent work accomplished by the amateurs in the field. Although they are in a distinct minority there are others who are concerned over the fact that many amateurs now in the military services continue to use informal procedures and ham expressions at variance with those approved in the various emergency for expanding military requirements.

Some may wonder what difference it makes whether we use "DE" or "V," why we shouldn't end our transmissions with "CU" and what harm would be caused by a little friendly rag-chew when the circuit is not too busy. Suffice to say that there are definite reasons why these things should not be done and that strict compliance with the approved military procedures and instructions is absolutely necessary. Naturally, it is no one's wish to prohibit the amateur during peacetime from using such expressions as OM, XYL, GN, etc. However, in that portion of our hobby where we intend to have some form of operating procedure for our traffic, I think it behooves us all to attempt to model that procedure along official military lines and not after some independent procedure which builds up habits and customs difficult to overcome.

I therefore definitely recommend that the League attempt, where possible, to popularize the official military procedures and to push for their universal use throughout the amateur fraternity.

— Lt. Col. Henry R. Pemberton, AC, W3DPU

Co. C. 33, Sig. Tng. Bn., Camp Crowder, Mo.

... Come the day W6PZW fires up the old rig again, there will be no corporals, sergeants or colonels ramming anything down my throat — particularly GI procedure.

It behooves all hams to use any doggone procedure that pleases them.

— H. E. Stewart, Pvt., W6PZW

229 Broadway Ave., Toronto, Ont., Canada

Editor, QST:
It certainly would be a grand idea to streamline amateur procedure to include the best parts of the system as now set up by the Combined Communications Board.

Military procedure as a whole cannot be used for amateur operating because it is constructed to serve one purpose — security. It is designed to cover the following: concealment from the enemy of names of formations, probable strength of formations, locations of formations, besides many other reasons too numerous to mention.

Many amateurs and potential amateurs in the Allied forces have been taught military procedure, and I believe a good deal of it will be carried into amateur radio.

Lt. Col. Hertzberg states that the Army and Navy would like to see military procedure used in peacetime as this would provide many partly trained operators in an emergency. Military
procedure would have to be modified to serve amateur requirements. I suggest that a start could be made with the Army message form, leaving the spaces as they are but changing the components. By making these changes every amateur operator would learn the sequence of the message form and could readily change over to the military form.

Some day the go-ahead signal will be given, but in the meantime a good deal of thought could be given to improvements in operating.

— A. J. Vivian, Sgt., RCOS, VESYY

ASC, MOMU, 1848 SOU, Camp Hood, Texas

Editor, QST:

No, no a thousand times, no! Please leave the Army out of our great hobby. I don't think there are very many hams who will agree with W2DJJ's article. I think W2DJJ has been in the Army too long. We hams had our own way of getting along before the war and we sure can do it after the war. We who have been in the Army want to forget it.

— G. J. Chandler, Plc., W1MMN

3329 Abner Pl., St. Louis, Mo

Editor, QST:

Lt. Col. Hertzberg's article was very fine and to the point. For a long time I have been wanting to suggest that amateur radio operating procedure should be revised for use after the war. I would not urge hams to adopt military procedure in toto, but there are several advantages and improvements over the procedure we used before the war. In fact, military procedure seems to me to be just amateur procedure revised and improved.

We say, "Well, we did understand each other," but some of us will have to admit that we did some bluffing and many a message was answered with an "R" that should not have been receipted. I have told many a man I was an XYL and had him come back with "OK, OM, CUL." No harm done, and I probably did worse, and it was only rag-chewing anyway, but when it comes to handling messages I think a more exact procedure would give us a greater feeling of satisfaction, and much time could be saved in emergencies.

We use too many IMIs, have too many different ways of ending transmissions, and we are too indefinite in message handling. Our voice procedure is sloppy and requires many repeats when QRM is bad. We should adopt the INT for questioning. I do not find it hard to use. In fact, it commands attention and prepares one for what constitutes for "Q" signals and ham slang on radio-telephone. Undoubtedly, ham slang was, and always will be, overdone, but, I still maintain that we are amateurs for our own enjoyment and it is not necessary for us to make an effort to please the SWLs, or others.

To my mind, the question of military operating procedure parallels this "old stand-by." And as a former AARS and present military operator and
THE HAMS' OWN PHONETICS
PAAB, TAU. P. 0. 6605, Pueblo, Colo.

The writer to offer the following list of words for amateur use.

Experience has proven the use of phonetics necessary in radiotelephone communication, but why the obsolete lists? They are a disconnected jumble concocted in the dark ages and unrelated to radio. Why not the hams' own list?

A — Auto
B — Band
C — Carbon
D — Delta
E — Eddy
F — Farad
G — Grid
H — Hydro
I — Image
J — Jam
K — Kilo
L — Log
M — Micro
N — Negat
O — Oxide
P — Plate
Q — Quartz
R — Radio
S — Sign
T — Tank
U — Ultra
V — Volt
W — Wire
X — X-ray
Y — Yoke
Z — Zero

AMATEUR RADIO IN HOLLAND

H. Snitstraat 41, Hilversum, Holland

Editor, QST:

When the Jerries occupied Holland in 1940, they took our radio amateur league under their control. Transmitting was forbidden, of course, and as a matter of fact all members left the NVIR (Dutch section IARU) so that it no longer existed. Our transmitters were picked up and moved to Germany. Twice we were promised to get money for our rigs, but they never paid, as usual. So, when we will be allowed to go on the air again, most of us will have to begin entirely anew.

At present we are establishing one new amateur league here in Holland (prewar there were three and we are now joining them together). No doubt you will soon hear more about it.

I am living in West Holland so I was very, very hungry for food last winter; but at present I am very hungry for QST and a new Handbook, as I did not see them during the last five years. I hope to receive them very soon.

Let me not forget to tell you that I hooked up with VEE5EE and VESOB. They visit my home frequently and are my best friends. They are quite well and send 73 to their parents, YLs and friends.

73, and cheerio!

— M. J. Hoogland, PABXAD

RESEAU BELGE

32, rue Capitaine Crespel, Brussels, Belgium

Secretary, IARU:

In a previous letter I wrote about the resistance movements in Belgium, saying, "Most important of these is the Armee Secrete." This statement is, of course, incorrect and unfair. Every resistance movement is equal because they ran the same dangers and worked and fought for the same cause. I should have written, "One of these resistance movements is the Armee Secrete."

— L. Richard, ON4UF
Now Is The Time: To look over your old QSL cards to find out whether or not you are eligible for WAS, 20-Year Club, DX Century Club, etc. We still award certificates of merit for certain of the achievements, as in the past, and now is a good time to check up on your qualifications! We would like to urge service men home on leave to do this, also — a shiny new certificate, which will make a nice addition to that postwar shack you're planning, awaits those who have the proof to show for their efforts.

The WAS (Worked All States) award is available to amateurs everywhere in the world who can show proof of two-way communication with amateurs in all forty-eight states, having used any or all amateur bands over any period of years. (The District of Columbia also counts for Maryland.) The only stipulation is that all contacts must have been made from one location — defined as any place or places within a twenty-five-mile radius. Check your cards and send them in to us with sufficient postage for their return. This is a certificate of outstanding operating proficiency and one you will be proud to own, if qualified!

The 20-Year Club does not have a certificate, but lists of newly accredited members, such as the one appearing on this page, are published in QST from time to time. To be eligible for listing, an amateur must have held an amateur operator license for the past twenty or more consecutive years and must be a licensed amateur at the present time. It is only necessary that you send us information concerning amateur licenses you have held, including the date of issuance of each one.

The DX Century Club award is granted those amateurs submitting confirmation of communication with 100 or more different countries, according to the official ARRL list. DX CC listings have been discontinued until further notice, but certificates will be issued to those meeting the announced requirements. Amateurs are invited to start submitting proof to ARRL when they have confirmations from seventy-five countries. Start adding your countries, and work through the authorized amateur bands using amateur calls. All stations contacted must have been "land stations" — contacts with ships, anchored or otherwise, cannot be counted. Contacts may have been made over any period of years, provided they were made from the same state or call area (or country, where no call areas exist) and by the same station license. Confirmations submitted should be accompanied by a list of claimed countries and stations represen-
Each month under the accompanying heading we shall publish the story of an outstanding WERS organization as an item of general interest to all WERS participants. Contributions are solicited from any radio aide or WERS participant, whether he be an amateur or a WERS permittee. Descriptions of organizations which have already been featured in QST articles will not be considered. The story may describe the organization in general, how it came into being, how it was set up and how it operates or it may describe some particular phase of the organization which makes it unusual or unique. Contributions should be brief (two or three type-written pages, double-spaced, is maximum) and may include photographs if desired, although only one photograph per page will be printed with each story. Each story must be released for publication by the radio aide of the licensee, in writing. Address your contribution to the Communications Department, ARRL, and mark it: “For WERS of the Month.”

wers of the month
burleigh county, n. dak.

preliminary plans to organize wers were conceived when major l. silverborg, aus, communications officer of the 7th civilian defense region, contacted state and local ocd to establish a secondary communications system to function in the event that existing facilities failed or were deemed inadequate. the management of local broadcasting station kpsy deserves much of the credit for the success of the initial meeting. one of its large offices was provided and an invitation was extended to radio operators and other interested persons to meet there on the evening of february 7, 1944. at this meeting, presided over by major silverborg, seventeen volunteers were enrolled and a tentative radio aide selected. it was planned to incorporate burleigh, morton, and other interested counties under one license, but this plan presented difficulties and group licensing has not been accomplished as yet. the situation was unique inasmuch as ocd was not officially represented at this meeting. this area had no industry directly affiliated with the war effort other than the food-producing agricultural activities which had been so long established. however, bob kyllingstad was able to convince the county commissioners that this vicinity had many vital strategic installations.

on april 5, 1944, the board passed an elaborate resolution empowering r. a. greenwood, deputy sheriff, to execute the necessary documents and make application tofcc for a wers license. john s. glass, ws8sw, was approved as radio aide and the project finally was under way.

then a problem which seemed unsolvable presented itself. just prior to, and during the early part of the war, a number of the small capacity variable condensers were conspicuous by their scarcity — only seven were available. permits for them were received on july 30th.

one of the problems causing considerable exasperation was the old band-spotting procedure. for those of you who used other wires to spot oscillators without dragging the frequencies over four other bands, no details need be recorded. this haphazard system was replaced by a reliable frequency meter, designed and built by ole orson, w6qji, and calibrated by a staff comprised of birch, gorder, barnes, and orson. the harmonic of an oscillator on 28 to 30 mc, made the frequency problem nonexistent. the caa has since established a channel on 116.1 mc, which helps us to keep our hand in on spotting the frequencies.

the honor of first receiving a call goes to ernie benham, w6dxc, while the credit for the first successful transmission goes to the acting control station, operated at the time by the radio aide.

during the 1945 spring break-up of the Missouri river, kihu units and operators were ordered on the alert, but no emergency operation was necessary.

the mobile units have proved surprisingly efficient, considering the low power and height of antennas employed. during allotted test periods successful operation has been conducted with the mobiles 7½ to 11 miles. simple half-wave verticals only have been used and the highest control station antenna tried was about 24 feet above ground.

since the terrain is somewhat rolling, reflection and direction by natural visual obstructions have been noted. at some points, having the mobile unit at the highest point has not always proved the most advantageous. it has been found that moving to a certain point on the upgrade, or even to a point on the opposite side of the hill, at times results in better operation to and from a given point.

the present status of burleigh county wers is as follows: kihu-1, control station — in charge of radio aide; nos. 2, 4, and 5, portable-mobile — installed as mobile; nos. 3 and 6, portable-mobile — used as portable. operating personnel consists of john s. glass, ws8sw, radio aide; ole orson, w6qji; robert kyllingstad; don birch; ray v. barnett, w6evp; ernest r. benham, w6dxc; wilfred h. roya, w9kzl; and j. roland gorder.

as more experience is acquired and components can be obtained it becomes apparent that it desirable to replace some of the original circuits. plans are under way to license more units and it is hoped that an intercounty agreement can be worked out to cover morton county.

—john s. glass, ws8sw, radio aide, kihu

brief

the wjbbs net has a new and tested procedure for local drills and statewide tests, where the net serves as a vital relay point. copies of the procedure can be had by any radio aide upon request to clarence margerum, w1aqm, 15 knowlton ave., shrewsbury, mass., radio aide of the worcester net.

this picture was taken by gskt at an informal rsbg meeting, which took place at taunton, somerset, england. left to right, front: g4cm, w7jxc, w9aamq, w3jbb and w4jfg. back row: g6ly, 2drw, gskt, g5ak, gslm, g4bn and gw3cr.
The Month in Canada

MARITIME—VE1

From E. S. MacLaughlin, VE10JH:

The Halifax Amateur Radio Club recently held their closest meeting so far in the nine months, with hams from all over the Dominion in attendance, all branches of the services were represented. One of Halifax's leading manufacturers donated their cafeteria and recreation hall to the club for the occasion. Highlights were the splendid meal, motion pictures, sing-song and the piano playing by Ken Warren of the Royal Canadian Navy. Hams in attendance were: SJAU, M. Purvis; SJAV, A. Baxter; 4OE, A. J. Neilson; 40E, A. J., Stewart; 4UB, R. O'Connell; 4AG, C. Underwood; 3HS, C. Ames; 3WV, C. Wigle; 3ANW, G. O'Leacque; IG, N. Mac Kelgan; 1BC, W. S. Bligh; 1DB, F. Webb; 1E6, W. Street; 1ET, W. Wooding; 1EY, G. Brown; 1HE, W. Maclean; 1HP, M. Fitzgerald; 1JF, F. Totten; 1JS, C. Kenny; 1KB, H. Scott; 1KY, F. Higgins; 1LZ, D. Bain; 1MZ, R. Hart; 1NE, J. Burke; 1NO, D. Coppe; 1NP, W. Robinson; 1HQ, E. Harrington; 1NW, G. Cooke; 1OB, H. Bishop; 1OK, J. Whitely; 1OH, E. MacLaughlin. Also others who will be joining the ham fraternity when the bands are opened again. The lecture and demonstration on antennas by 5IN, Lt. Brown, RCNVR, captured the attention of all at the April meeting of the club, and was declared the best ever put on in this area.

ONTARIO—VE3

From L. W. Mitchell, VE3AZ:

Floyd Grippen 3LR, after three years temporary residence in Montreal doing VE2GE's work while he fought in Europe, has received a promotion and announces that he will take up permanent residence in VE2. VE3 in Toronto, who was doing 3LR's work temporarily, is now permanently on the job, all three with the CBC. LH says his absence will make some Toronto BCLa happy. 3SE, P/O Ron Harris of Toronto was last reported at Halifax airport doing air traffic control work. 3LS, Sgt. "Milt" Wilson of Galt, is still radio maintenance man at Charlottetown RCAF station. 3XR, "Don" Cummings, formerly of Toronto and now of Galt, is back with the Westinghouse Tube Lab. in Hamilton after teaching RCAF personnel radio and electronics in Europe. 3MB, Gordon Phalen, has resigned his rank in the Navy and has moved his family to Montreal. Probably will be a new VE2, 1ET, Bill MacLean (formerly traffic network man in Charlottetown, P.E.I.) now of the Royal Canadian Navy, has been assigned to a destroyer. 40E, A. J. Neilson has received his discharge from the RCAF, and has left for his home in Alberta, followed by the good wishes of all his friends in the HARC. 1E6, Capt. Walter Hyland has taken his discharge from Headquarters Staff M.D., No. 6, and has returned to his former business in Charlottetown, P.E.I. He is anxious to get on the air and talk with all the friends he made in Halifax.

QUEBEC—VE2

From L. G. Morris, VE2CO:

Gordon Yull, 2GE, back from overseas, is trying to arrange a passage for his bride. Sid Chapman, 2LV, passed through Ottawa while on furlough and dropped in at Naval Service Headquarters for a brief rag-chew with 2EE, 2LC, 2DR and 2CO. He expects to be back in civilian life before long, having been with the RCAF on foreign duty for four years. Gord Storey, 2PF, is with the Aluminum Company of Canada at Kingston. Ve1 Sharp, 2CR, a sergeant in the reserve army, met several hams during his two weeks' summer training period at Petawawa Camp. 2CO is back in Montreal busily looking for a place to live—any leads, fellows? Sorry to hear that Lyle Ward, 2HF, has been ill. Lyle gave up his position at Research Enterprise, Toronto, and returned to Montreal last October. Best wishes for a complete recovery, OM. Bill Skarstedt, 2DR, has been promoted to the rank of A/Commander (SB) RCNVR. Majo. Colin Dumbrihle, 26K, is back home after completing a staff course at Kingston.

The Halifax Amateur Radio Club supper meeting held recently was attended by, left to right, front row: A. J. Neilson, VE40E; Don Bain, 1LZ; Second row: D. Coppe, 1NO; C. Underwood, 4AGP; W. Robinson, 1NP; Ken Warren; W. Street, 1EK; E. MacLaughlin, 1IJH; N. Mac Kelgan, 1AG; M. Purvis, 5AJU; M. Koz; Cpl. Ames, 3HS; M. Fitzgerald, 1HP; R. Hart, 1MZ; Third row: Stewart, 4UH; R. O'Connell, 4ABU; N. Looker; G. Brown, 1BE; E. Harrington, 1NO; Sg t. Patterson; Sgt. Duvall; M. Armstrong; Fourth row: S. Mendelsohn; O. Sandos; W. Bligh, 1BC; E. Schaffer; H. Yeadon; Cpl. North; Cpl. O'Donnell; R. Morrison; C. Wigle, 3WL; J. Whitley, 10K; Sgt. Cann; M. Pearce. Fifth row: F. Totten, 1JK; C. Kenny, 1JS; J. Burke, 1NE; Len Foster; F. Webb, 1DB; W. MacLean, 1EY; H. Bishop, 10B. Members of the club missing from the picture are A. Baxter, 5AJV; Les Poppin; W. Wooding, 1ET.
ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3EBS — We regret to report the untimely death of 3DVE. SCM is back in the States. 3DAG has been visiting in YU and VK. 3JB is operating WPQX-1, the Swarthmore police station, during July and August. A recent letter from 3HQL stated that 3HQL has been assigned to field duty with the Hazelbine Corp. 3IXN is refreshing his new shack. 3IFD has a new QTH three doors away from the old one. SE0Z expects to move to New York City in the near future. 3GHM is now in NJ. 3JSI is teaching radio in Germany. 3IGK expects to leave New York City for duty in the Far East. 3FWH has slipped out on foreign duty. 3LJE is back temporarily and reports meeting 3EFH and PA6 in Africa. We are sorry to hear that the 95 points collected by 3GTV will not bring him home yet.

4BOB, expects that there will be plenty of activity in Western Florida to help the Sweepstakes drive. 3BYS, former EC of Philadelphia, is established in Florida with the Eastern Air Lines. Two generators have been added to the Frankford Radio Club’s field day equipment. 73, Jerry.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — SCM, Hormann E. Holbs, W3CIZ — Civilian Defense was trained in June and Bellhop, No. 26, took over and conducted the entire drill under very adverse weather conditions, spending the whole evening out in the pouring rain with a raincoat. Orders were relayed through mobile unit No. 26 in the pouring rain with a raincoat. Orders were relayed through mobile unit No. 26.

Mobile units participating in this drill were Nos. 10, 26, 13, and 3. The DK-2 under his fireman’s cap was handed over and conducted the entire drill under very adverse weather conditions. The 90-line test was held on June 30, 1945 and at the same time WERS for the District of Columbia, for which they were the sponsors, was discontinued. However, the active members of the WERS expect to continue their activities in the near future.

The Western New York WERS emergency net is developing into a permanent net, with regular July meetings every Monday evening. The net is networked with W8MC, W9EJS, W6M, W6MS, and W6MC - The WYRA finished another successful sweepstakes season and reports that the net has been operating successfully.

WESTERN NEW YORK — SCM, Ray Tomlinson, W3DQJ — Asst. SCM, Ed G. Hauer, W3ZJ — Regional EC for So. N. J., Technical Radio Adviser for N. J. State Defense Council, N. J., State Radio Aide for WERS, and W8MC — We regret to report the untimely death of 3DJH. The regular July meeting of the Delaware Valley Radio Association was held at the Hotel Walt Whitman, Camden, on July 18th, at which time a detailed discussion of our worldwide war effort was held, including the reading of a special communication from headquarters dealing with this subject. Attendance was unusually high, including several visitors. The WERA seems to have been hibernating with the club-house bug, too, and a discussion was held as to what would best suit its needs in this respect. The July issue of the WERA News carries a very interesting article by JNG entitled “Amateur Intolerance.”

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has been in the services for over three years, feels that his amateur experience has paid big dividends. He is very busy with farming these days, is constructing a code practice oscillator to run o.c. as batteries are unobtainable. We are sorry to hear that VVU's father is seriously ill and that he will be unable to receive OQSL at Jamestown Tech this semester. From PER we learn that CPO FP6 is home on a thirty-day leave, after two years overseas duty in North Africa, Sicily and Italy. Sgt. NID, returning home after twenty-five months in the Army Signal Corps, is billing as WMS, Philadelphia, Pa., and is visiting friends and members of the Radio Association of Erie at a recent meeting. Sgt. Shaper is spending a fur-}


hams in our area: 3BYF, 7HDM/8NCQ, REJ, and WQB, San Francisco, Calif., says activity on Luzon has lessened comes regularly, although a month or two late, and receives gang. Here are a few words just received from 9ALU, in Pecan Petes at Blicks. Let's hear from more of our AARS and have a gabfest. JLK is helping to keep them rolltng on the Alton priority over all other mail. ALU's: J,rother-in-Iaw, GVP, is home out of about fifty that the club boasted as members. According to a recent issue of Corny picked up a bit of Nazi iron and spent quite a bit of
dropping a card from the West Coast. Jack has been in the Army Signal Corps since before Pearl Harbor and has married a YL from Western Pennsylvania, so expects to settle down in this section after the war. RMic WRK just announced the arrival on July 11th of twin sons. The SCM and WLB stopped in to visit DXN while in the Northeast and looked over his swell seventy-foot wood, lattice-type, antenna tower. DXN has been active in Erie County WERS and puts a strong signal into the City of Erie, a distance of about fifty miles. With his fourteen beam antennas, Erie WERS, WJWE, drills each Monday evening, according to BEH. The Radio Association of Erie is proceeding with plans to raise funds to secure permanent headquarters. Substantial contributions have been received and the sub-committee will report at the next meeting. Members and friends of the Association are invited to attend regular meetings held on the first and third Tuesdays of each month at 133 West Seventh Street, Erie, Pa., 73, Ray.

CENTRAL DIVISION

ILLINOIS — SCM, David E. Blake, II, W9NUX — TLTQ is now a major in the CAP, communications officer, IL. T/S 5/MZW writes from the Bavarian Alps of the battles of the Rhine, Rubber at Berneman, Ruth P, and the Redoubt (the four "Rs"), and the battle of the English pubs. He wants to attend RCA after V-E Day. Other hams in his company are SNGL and X65DR. He would like to hear from BYZ. A note came through from IAT with the following news: The Quad City Amateur Radio Club reorganized on V-E Day. The WERS section of the club is going strong with field days, hidden transmitter hunts, much doing about antennas, rigs, and what have you.

WHII, Chicago, FM comes in regularly. AKO, who was in the So. Pacific for two years, is getting a medical discharge from the Seabees. His boy, in the Army in the Philippines, was transferred to the States. W9ALU, who works for the United Air Lines at Moline Airport, is 1st Lt. in the I. AARS: SXL/WLTH says the gang in the Bloomington area is now regular. Ray at the Club reorganized on V-E Day. The WERS section of the club is going strong with field days, hidden transmitter hunts, much doing about antennas, rigs, and what have you.

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assignments on 25 Mc. OCC is very busy getting his new factory lined up for business. FWT got a long-wave converter that extends the receiver range from 44 Mc. to 95 kc. 0TYV still is pounding brass in the Army and sweetering out the point system. FX, our good secretary, compiles that list. TAH wants to write to his friends. He is beginning to draw on paper the postwar FX 3663. The DARV held its monthly meeting July 12th at the home of Charles Wycoff. 0RN is very busy getting his new factory lined up for business. The Fontais WERS unit is thinking of being released as an emergency network to cover the entire county. This would give contact with Flint and Detroit, and possibly Lansing, in case of an emergency. The Fontais Club recently made a very interesting test with a portable job and found that its coverage to the north extends beyond their expectations. Don't forget to send in your cards re the Oct. 7th hamfest. 73,

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seems to have undergone a similar change of address.
FIR/FOR wrote from Belgium that he did not
fit there. FIR/FOR wrote from Belgium that he did not
in the television department of RCA in New York City.
the first day of the invasion - and is the only ham in his
while on business to Wright Field. 73,
promoted to sergeant. NLM was in Dayton, Ohio recently
in radio at Ft. Monmouth officers' school; he is getting mar­
in the contest and games committee; and YDC and XYL,
souvenirs, including an insulator, off of a Jap landing barge,
reports that he has put his soldering iron away as his HY75
able. ZPZ and XYL, YMU, and FQB were the committee­
in-charge; ZPZ, VHS, ZZG, YMU, and FQB were on
furnished gobs of ice cream. Capt. HTE reports his XYL
day furlough and reported
UEV and YL, made up the welcome committee. EEK
pop-eyed looking for a decent used receiver. MHJ1' and
was received from RM3c Nick Camenares, who says he's
for 2½ years, writes from Panama, where he has been for a
year. NFZ worked for a while in production test at Ray­
ther and has returned to Northeastern U. He was an
operator at KDF before the war. ALT says that those of
the WERS that are left have joined the State Gu11Jd. He will
Germany soon. HWE has four baby woodchucks. LTR
in Africa and Italy almost three years. IQJ
Germaine and has returned to Northeastern U. He was an
meters. The Ak­
get hold of April QST and enjoyed reading about the gang.
He built a little one-tube regenerative receiver made from
American and Jap parts and copies c.w. from Japan on
it. He would not have reported on the many fine contests,
which he often had articles in
but left before he knew it. His new address is c/o San
the simple reason that the mailbag contained nary a report.
the WERS which are left have joined the State Gu11Jd. He will
in the Pacific area. KMY returns to the Pacific area about
for 2½ years, writes from Wisconsin that he is mar­
the operation of the Middletown network. 73,
MIDWEST DIVISION
KANSAS — SCM, Aviva B. Larch, W9AWP— OXU, an
anomalous radar at M. T. T. AVY is working in the television
development of RCA in New York City. Lt. LEE, in the Signal
Corps, expects duty in the Pacific theater. IVO is a lieutenant in the Signal Corps, instructing
radio at Ft. Monmouth officers' school; he is getting mar­
in the Pacific area, KMY returns to the Pacific area about

MAINE — SCM, G. C. Brown, W1AQL— MGP writes from
Atlantic City that he has an XYL. Sam is back after
being in the invasion — and is the only ham in his

EASTERN MASSACHUSETTS — SCM, Frank L. Baker, jr., W1ALP— EU writes that the M.A.X.
Radio Club, founded in 1921, is going strong with ARN, BAQ,

WESTERN MASSACHUSETTS— SCM, William J. Barrett, W1JAI— Last month's write-up was missing for
the simple reason that the mailbag contained nary a report.

NEW ENGLAND DIVISION
CONNECTICUT— SCM, Edmund R. Fraser, W1KQY — WERS News: GTI writes that WJQA, Stamford
district, ceased operation as of July 15th by order of EER,
district radio side, and the licensee, the Town of Stamford. Waterbury: Carl Weyand, operator of WKGQ-70, reporting
working WKRM-3, New Brunswick, N. J.; WXW-8, Verona, N. J.; 25, up landing buoys in the sound and
bounced around on a destroyer in a typhoon. He visited
Saipan, Tinian, Guan, Ulutahi, Palau, the Philippines, For­
mosa, and Honshu, and also made a little trip to pick up a
couple of pilots in a spot near Tokyo Bay. We still are look­
ing for a letter from NBJ. 73,
W9OUD - KPM still is on Okinawa - he went ashore on
the invasion. IVO is a lieutenant in the Signal Corps, instructing
radio at Ft. Monmouth officers' school; he is getting mar­
in the Pacific area. KMY returns to the Pacific area about
for 2½ years, writes from Wisconsin that he is mar­
the operation of the Middletown network. 73,
ED

September 1945

63
Dick Atwood reports again for WJBB, Worcester. KJG has
left the WJBB net because of a transfer to the I.B.M.
lab in Endicott, N. Y. The Worcester gang will take
part in the weather bureau's plan if enough other licensees
awaiting call. WHKW units are continuing drills on Mon-
tue nights. AZW and IFE are fathers, IFE for the second
time and Roy for the third. JIFP, of Needham, recently
visited WLY. The Pittsfield Radio Club held its annual
Picnic, July 15th, and for the benefit of relatives and friends
of members, staged an hour-long drill during which the con-
trol center dispatched mobile units to various spots with in-
structions for action on arrival. Operators participating in-
cluded LUD, IZK, IFE, LIKO, BEK, AZW, and Bob Seace.

NEW HAMPSHIRE — SCM, Mrs. Dorothy W. Evans, W1FX/4—MMG sends a letter containing interesting
data on how to build audio amplifiers. GAN and family spent
a grand job for the Navy constructing radio stations and in-
struction for action on arrival. Operators participating in-
cluded LUD, IZK, IFE, LIKO, BEK, AZW, and Bob Seace.

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EACH TIME that this series on phonograph reproduction seems to be finished, we discover another point that deserves mention. This one relates to the effect of frequency response compensation on distortion.

Any device which raises high frequency response will increase the harmonic distortion of the signal supplied to it. This is basic, and has nothing to do with the circuit used.

It works out this way. Suppose an amplifier is designed to have a rising frequency characteristic of 6 db per octave. Suppose this amplifier is perfectly free from distortion in other respects: — all it does is increase the highs. If the input signal has 5% second harmonic and 5% third harmonic, the output will have 10% second harmonic and 20% third harmonic.

The reason for this is quite clear. Since the second harmonic is twice the frequency of the fundamental, it will be amplified twice as much (6 db) as the fundamental. Two X 5% = 10%. The third harmonic is three times the frequency of the fundamental. This is two octaves higher, so the amplifier will give it 12 db more gain. Simple arithmetic makes the output harmonic 5% X 3.98 = 20% (approximately). Similarly, a 1% fifth harmonic would jump to about 30%.

This same effect operates in reverse, of course. An amplifier having a falling characteristic, with the gain becoming less as the frequency increases, will reduce the harmonic content of the signal.

As a practical matter, the pickup used should have sufficient high-frequency response. Any attempt to improve the high-frequency response of a cheap pickup by compensation usually results in pretty awful distortion.

On a phonograph record, the velocity of the needle point is proportional to the amplitude multiplied by the frequency. Thus a perfect velocity type pickup has about 6 db more gain per octave than a perfect amplitude type pickup. This is why magnetic or moving coil pickups (velocity) require bass boosting, while crystal pickups (amplitude) require boosting of the highs. This seems to us to be an inherent advantage in favor of the former type, and it is one of the reasons why we prefer pickups of the velocity type.

If the compensation required by a crystal pickup is located immediately after the pickup itself, only the distortion in the crystal head itself is increased by the compensation, and results are good. However, sometimes in cheap outfits the compensation is accomplished in the output stage. This is convenient because a pentode driving a speaker gives a rising characteristic automatically, due to the inductance of the speaker and output transformer. In such a case, the compensation magnifies the distortion in the pentode output stage and the entire amplifier as well as the pickup. This explains why some of those cheap jobs sound the way they do.

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1. High efficiency — resulting in lower battery drain.
2. Excellent temperature characteristics.
3. No greased bearings to stiffen and freeze.
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5. Low initial cost.
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ROCKY MOUNTAIN DIVISION

COLORADO — SCM, H. F. Hekel, W9VGC — FQT was found running around on the streets of Denver recently; WYX took it after him and finally ran him down. It seems FQT bought a new peach orchard out on RDF 1 near Grand Junction and was celebrating. MGX was acting as his pilot, and being an old-style railwayman Herb can turn corners on two wheels. GMB is located in San Francisco. Seeing on buttons got to be quite a job for him and his marriage plan went on hold. Last year GMB married last spring. GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet. He bought another coal mine; he expects next winter to be another tough one and he is not going to get caught with an empty coal hod. Judy got married last spring; GDC has not grown a bit; he is still 6' 5" in his bare feet.
WHAT DO YOU WANT?

WRITE NOW! You’ve had four years to dream about a new transmitter or a new receiver. Tell us just what you think it should be and what it should do. We’ve had four additional years of engineering and research during which we have better equipped ourselves to bring you the finest in communications equipment.

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THIS MONTH—BROWN-DUVEL MOISTURE METER

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Burgess Industrial Batteries first choice in a recent nationwide survey of dry battery preferences! If you need a special battery for a new instrument or a new application let Burgess engineers solve your problem with the correct battery type.

Burgess Battery Co., Freeport, Ill.

THE JOB AHEAD—JAPAN!

BURGESS BATTERIES

VOTED FIRST IN NATION-WIDE SURVEY

(Continued from page 66)

SOUTHEASTERN DIVISION

ALABAMA—SCM, Lawrence J. Smyth, WA4GBV—IDZ, of Montgomery, sped through the RM course at Truax Field in one week and took his place as No. 5 on the list of the week's graduates. GW1 is stationed at the Naval Air Station in Norfolk. GVC writes that Key West, FL, may be close to home. Two Burgess engineers of RNMO, FIC, a newly-made CPO, is in Warley, R.I. FRC is in the Signal Corps somewhere in Italy. FCI also is in Key West. GOX is in Frankfurt, Germany. The rest of this column was sent in by DGS, our former SCM. HNG, after a year in England, France, and Germany, and six months in Washington with the Signal Corps, was put aboard a C-64 for China recently by DGS. RT1e DMZ, in the Navy, is attending the Navy Radio Materiel School in Washington. EBZ moored an FC200 receiver on a ship and from his post in Kandy, Ceylon, listens in on the U.S.A. stations. DAU, a lieutenant in the Signal Corps, travels out of Washington. AJY is Navy ensign with air control group in Navy Bureau of Aeronautics. As our Marine major, and DGS lunch together often in D.C. APJ has been sent out to the Pacific Islands by Raytheon, CNT and BFP are doing excellent radar design work in Boston. DRZ and DGS work in adjoining offices. DRZ is Navy lieutenant. Lt. (jg) DUM is Naval inspector in Jersey. CMD travels between Dayton and New York handling Army Air Corps business. 73, Larry.

EASTERN FLORIDA—SCM, Robert B. Murphy, W4IP—On one of his Pacific journeys BXL contacted the ship next to his via blinker and asked if there were any radio operators aboard. The answer was, "Three, which one do you want?" "Put the ham on." The answer came back, "No one here by that name, what is his first name?" Canfield wishes to be remembered to BFY, CFC, JO, EH, BQR, DER, BDD, and others. Your SCM will gladly furnish his address to anyone who wishes to write him. Two ex-operators of AWD and commercial WOE, Geo. Aldrich and Jim E浔ne, are district managers in Wilmington, Calif. and Mobile, Ala., respectively for the RMCA. Correspondence is invited. ES has been named to the Dade County Planning Board; he also is very active as vice-president of the Coconut Grove Civi Club. Ena. B. M. McNamara has travelled 100,000 miles and now is back in the U.S.A. and has been stationed in Jax. HINZ, from Framingham and Gloucester, Maas., is a new addition to the PAA Line Radio Crew Shop coming up from Dinner, Key GAJ seems to have settled down in Palm Beach, Germany. He has acquired eighty-two pets and was made a sgt. on V-E Day. Hall C-327 will stick all through the neal, the SCM has his address. EYI is holding down the fort in St. Pete and would appreciate some rag-chewing from some of the ole gang now overseas. EWS has been out of the picture for a short leave after a year of sea duty and now is based in New Smyrna. BYF and GJI had a powwow in Palm Beach about organizing a 2 ½-meter group in the county up there. BYF sees no reason why it shouldn't work direct to Miami for we have heard the field at Morrison modified to cover 75 stations instead of 45. Things are sure becoming crowded. There are 86 names attached to a list hanging in the control station and you figure out how we are going to get them in on a 75-station permit. The old Dade County Radio Club with the American Red Cross behind it and BYF as radio aide will see that things work out in the best possible way. For those "Doubling Thomases" in and around Miami who doubt that we have contacted Homestead, EFZ set up his rig in his store and definitely worked into the control station with the help of WKNW-14. Bumpus went down there one Sunday and set up the station, your SCM, W4IP-WKNW-7, operated at the control station and not only worked Homestead but heard No. 14 in and around Homestead. 73, Merz, that Key W4.

WESTERN FLORIDA — SCM, Lt. Edward J. Collins, WA4MS—Thanks for the job, gang, and I hope I can do as well as AXP has. AXP wishes to thank the Western Florida boys for their fine cooperation in the news summary possible every month. 6LLH was a visitor to the section. The second operator of 7CHU is with air control group in Navy Bureau of Aeronautics. As our Marine major, and DGS lunch together often in D.C. APJ has been sent out to the Pacific Islands by Raytheon, CNT and BFP are doing excellent radar design work in Boston. DRZ and DGS work in adjoining offices. DRZ is Navy lieutenant. Lt. (jg) DUM is Naval inspector in Jersey. CMD travels between Dayton and New York handling Army Air Corps business. 73, Larry.
RAYTHEON

TYPE 6J6

Miniature Dual Triode

For a considerable time Raytheon has been assigned a major role in supplying the essential requirements for a versatile, miniature, dual triode tube, type 6J6.

The precise manufacturing techniques which must be maintained are obvious when the physical structure of this tube is considered. Two high transconductance triodes are obtained from a single relatively large flat cathode, which also acts as a shield to prevent interaction between two separate half-grids. These are wound with extremely fine wire and are accurately spaced a few thousandths of an inch on either side of the cathode. Two individual half-plates complete the tube.

Applications utilizing Raytheon Type 6J6 are varied and numerous, ranging from a diode detector to an ultra high frequency push-pull oscillator capable of producing useful energy at frequencies of several hundred megacycles. Its unique construction lends itself to connection as a high permeance diode, a single very high transconductance triode, or a dual triode with a common cathode. The 6J6 is also used in cathode follower service and high frequency mixer applications.

Raytheon's continuing development work and long manufacturing experience means better tubes. Use Raytheon High-Fidelity Tubes in your postwar products!

SPECIFICATIONS OF 6J6

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<tr>
<th>DIMENSIONS:</th>
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<tr>
<td>Maximum Over-all Length</td>
<td>2 1/4 inches</td>
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<td>Maximum Seated Height</td>
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<tr>
<td>Heater Current</td>
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<tr>
<td>Maximum Plate Voltage</td>
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<tr>
<td>Maximum Plate Dissipation (per unit)</td>
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<tr>
<th>DIRECT INTERELECTRODE CAPACITANCES (Approx. for each unit) — Unshielded:</th>
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<td>Input</td>
<td>2.2 µf</td>
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<td>Output</td>
<td>0.4 µf</td>
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<th>CLASS A CHARACTERISTICS (Each triode):</th>
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<tr>
<td>Amplification Factor</td>
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<tr>
<td>Plate Resistance (Approx.)</td>
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After the war, it will be "the survival of the fittest." Employers will once again be "choosey." Only the best qualified men will be selected for the best jobs.

Now is the time to take the time to prepare yourself for these important career jobs in radio-electronics engineering. CREI can show you the way by providing you with the "tools" to build a firm foundation of ability based on a planned program of technical training.

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(Continued from page 68)

peeta to be a $ from Minnesota after the war. EQR has an FB new location for his rig. DAO has his new shack ready and has already moved the transmitter in. He is rebuilding with p.p. 756a in the final. S & C has been in our midst but is returning to Washington soon. 6CNI is working hard to build a receiver for our new uhf, allocations. AOCB, in Tallahassee, is ready to get going again. BCF is very busy with FNG work but dreams of ham days. KB is busy with construction work but is looking forward to getting back on 75-meter 'phone. UC plans the HCM a visit and we find he has some nice DX cards in the QSL Manager's file.

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If you have had professional or amateur radio experience and want to make more money—let us prove to you we have something you need to qualify for a better radio job. To help us intelligently answer your inquiry—please state briefly your background of experience, education and present position.

Capitol Radio Engineering Institute
Home Course in Practical Radio-Electronics Engineering for Professional Self-Improvement
Dept. Q-9, 3224 16th St. N. W., Washington 10, D. C.
Contractors to the U. S. Navy, U. S. Coast Guard and Canadian Broadcasting Corporation
Producers of Well-trained Technical Radiomen for Industry

(Continued from page 68)

After the war, it will be "the survival of the fittest." Employers will once again be "choosey." Only the best qualified men will be selected for the best jobs.

NOW is the time to take the time to prepare yourself for these important career jobs in radio-electronics engineering. CREI can show you the way by providing you with the "tools" to build a firm foundation of ability based on a planned program of technical training.

In our proved home study course, you learn not only how but why! Easy-to-read and understand lessons are provided you well in advance, and each student has his personal instructor who corrects, criticizes and offers suggestions on each lesson examination. This is the successful CREI method of training for which thousands of professional radio-men have enrolled since 1927.

Investigate now the CREI home-study course best suited to your needs, and prepare for security and happiness in the coming New World of Electronics! Write for all the facts now.

WRITE FOR FREE 36-PAGE BOOKLET
If you have had professional or amateur radio experience and want to make more money—let us prove to you we have something you need to qualify for a better radio job. To help us intelligently answer your inquiry—please state briefly your background of experience, education and present position.

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Contractors to the U. S. Navy, U. S. Coast Guard and Canadian Broadcasting Corporation
Producers of Well-trained Technical Radiomen for Industry
In one important respect there is a striking similarity between the millions of Bliley crystals which we now produce and the mere handful of custom made units that constituted our annual production when radio was still young.

In those early days of radio, when each quartz crystal was painstakingly cut and ground by hand, a tradition was born. It was a tradition of craftsmanship that has grown with the years—a tradition that Bliley engineers have successfully translated into the more intricate techniques of volume production.

Etched crystals are an outstanding discovery and development of Bliley research engineers. This technique, by means of which crystals are finished to frequency by acid action rather than abrasive action, was an established part of Bliley production long before Pearl Harbor. It has since proven to be an essential element in the manufacture of crystals that have the dependable characteristics necessary for military communication in global warfare.

We have been called upon to solve some knotty problems. But that is nothing new at Bliley. It has been our habit to parallel new developments in radio with the right crystal for each application.

Things will be different soon. Peacetime projects will again come first. But our engineers and craftsmen will be ready, as always, with the right answer to your requirements. Don’t fail to include Bliley crystals in the component specifications for your peacetime equipment.
LET STANCOR HELP FINISH YOUR WAR JOB!

A limited schedule can be accommodated now for designing and manufacturing special transformers to your specifications. The same facilities and personnel which put Stancor in the front rank of war auxiliary producers—are still on the job and are your guarantee of top-flight engineering and production experience. Write enclosing specifications, or wire.

Incidentally that's a good thing to remember too for your future needs. Expert planning, modern equipment, precision winding machinery, special samples division with competent sales engineers—all will represent the highest efficiency in satisfying your most exacting transformer requirements.

STANDARD TRANSFORMER CORPORATION
1500 N. HALSTED STREET • CHICAGO, ILLINOIS

(Continued from page 70)

return to the University of Texas to complete her work towards her degree. IVM reports that he is ACRT with a carrier-based dive bomber outfit. He says that his biggest thrill came last year when ILR hooked a ride on his carrier. Seth would like the QTHs of IZO and IXS. IXM reports since the spring of 1942, during which time he was in the Navy, that his ship has turned in the Solomon's push; IVG says that he has encountered hundreds of hams in the Navy and that they are the best operators and technicians afoot. FPH advises that his present QTH is Kemmer, Texas, where he is working for the Magnolia Petroleum Company. Bob would like the QTHs of HYV and IZO. Bob sends along the following dope: IMQ is in the So. Pacific, and JQH was last reported in Oklahoma City. BNQ says that IMH is back home after serving a hitch in the Navy. ICC has his eye on a windmill tower; it looks like Zeke will soon have a beam antenna for the neighbors to wonder about. ILJ reports from the Philippines, where he is pounding brass. Joe says that IWE is also on Luzon after spending a lot of time in Australia, and that ITH is in the Dutch East Indies. HHR was home on a 30-day leave awaiting reassignment, after two years in Iceland, England, and North Africa. Jim is ACRT and says that NY is a "big shot" Juke box operator. CF says he has a new rig ready to go and that his son, GKA, went to the Berlin YMCA Radio Club, G1SYM, where he also met EI9F. He says that QST has a wide circulation in Ireland and is well read. Maurice also advises that JFW is in Japan and that the Marines is somewhere in the Pacific. FU is looking for radar men for Western Electric. If any of you fellows are interested, please contact the SCM. 73,

JACK.

SOUTHERN TEXAS—SCM, James B. Rice, W5JC—AQK reports the following for Corpus Christi: EPU and Joe Woods are with Central Power & Light, IFU and EEY are in civil service with the Navy, IPE is working with Schlumberger Company. BOY is projectionist at one of the C.C. theaters. HP is making plans for postwar u.h.f., and is building antenna rotating equipment for his beam. BGR is in the Army and is stationed at New York. CDD and AQN are holding things under control at Galveston; AQN is an enlisted personnel to fly airplanes. TO is doing civil service work on the East Coast. EBI has completed his Navy duty as instructor at Ward Island and has gone to Refugio. EYV is at Refugio doing a good job keeping civilian radios pounding brass. Joe advises that Zeke will soon have a beam antenna for the neighbors to wonder about. ILJ reports from the Philippines, where he is pounding brass. Joe says that IWE is also on Luzon after spending a lot of time in Australia, and that ITH is in the Dutch East Indies. HHR was home on a 30-day leave awaiting reassignment, after two years in Iceland, England, and North Africa. Jim is ACRT and says that NY is a "big shot" Juke box operator. CF says he has a new rig ready to go and that his son, GKA, went to the Berlin YMCA Radio Club, G1SYM, where he also met EI9F. He says that QST has a wide circulation in Ireland and is well read. Maurice also advises that JFW is in Japan and that the Marines is somewhere in the Pacific. FU is looking for radar men for Western Electric. If any of you fellows are interested, please contact the SCM. 73,
COLLINS 32RA RADIO TRANSMITTER*

A deservedly popular 50 wattter....

The Collins 32RA* was introduced in 1939 as a quality designed, quality built radio communication transmitter, broadly adapted to most applications within its power and frequency scope.

It, or its d-c version—the 32RB†—was immediately put into service by airlines for control towers, by oil pipelines for emergency systems, by fishing companies for fleet control, and by other widely different types of industrial users.

It was found to be rugged, simple to operate, easy to service, and so thoroughly and universally satisfactory that a rising commercial demand was halted only by the war. During the entire war the Armed Forces have employed thousands of these transmitters. A typical use has been that of control towers on air training fields throughout the country.

Of the several up-to-the-minute transmitters which Collins has ready for its civilian customers as Government requirements are cut back, this one represents a type of which limited quantities are now being manufactured for essential civilian uses. If you would like specifications and design data, write us for new, illustrated bulletin. Collins Radio Company, Cedar Rapids, Iowa; 11 West 42nd Street, New York 18, N. Y.

*COLLINS 32RA—Power source: 115 volts alternating current. Power output, 50 watts phone; 75 watt CW. Frequency range, 1.5 to 15 mc. Four frequencies instantly selected by panel control.
†COLLINS 32RB—Power source: 12, 24, 32 or 110 volts direct current. Dynamotor, self contained. Otherwise identical with 32RA.
ALBERTA—VE4

From W. W. Bulchak, VE4LQ:

Well, Pete Fair, 4YD, Peace River, breezed into Edmonton a week or so ago and at that time was heading north again to P.R. on his two weeks' annual furlough. Upon completion of the holidays he will return to Calgary to pick up his discharge from the RCAF. By the way, boys, in case you haven't been advised, Pete is a flight lieutenant. As for postwar plans, YD says that he has quite a range in choice of his new QTH. The Canadian Bank of Commerce gave him a good choice in that respect. See you in civvies soon, Pete! By the way, YD has placed an order for parts for his postwar rig with Radio Supply Co., Ltd., 4BW. Grapevine telegraph tells us that Slim Marsden is considering opening up a radio service shop in Sylvan Lake. How about that, Slim? A letter from 4AEV, N. Lockhart, Vulcan, refreshes our memory this month on the progress of "Alberta's Envious Villain." Norm states that he is looking forward to a discharge one of these days, and has since signed up the situation as to where he locates in business. (He's a live-wire grocery man, boys.) To date he has several "iron in the fire," but he will not be setting up in his old QTH, Vulcan, again. 4XE, Dick Bannard, of Edmonton, is Soree Camp in charge of Signals, etc., and presents the entire BT and BW line in preferred RMA ranges which will now be standard Distributors stock. Also included is the data on the IRC "Century Control" line ... 100 controls that will solve over 90% of the average control problems.

Get your copy of this informative booklet from your IRC Distributor or write direct to Dept. 18-1.

The Month in Canada

(Continued from page 59)

Here's a handy new catalog that quickly gives you the "dope" on the resistance components you'll be needing for that postwar rig you're planning.

Primarily edited for Servicemen, this latest booklet contains much information of value to "Hams." For instance, an entire page is devoted to the new, smaller, highly efficient Types BTA (one watt) and BTS (one-half watt) resistors as well as presenting the entire BT and BW line in preferred RMA ranges which will now be standard Distributors stock. Also included is the data on the IRC "Century Control" line ... 100 controls that will solve over 90% of the average control problems.

Get your copy of this informative booklet from your IRC Distributor or write direct to Dept. 18-1.
Centralab medium duty power switches are now available for transmitters (has been used up to 20 megacycles) power supply converters and for certain industrial and electronic uses.

It is indicated in applications where the average Selector Switch is not of sufficient accuracy or power rating. Its accuracy of contact is gained by a square shaft, sleeve fit rotor, and individually aligned and adjusted contacts. It is assembled in multiple gangs with shorting or non-shorting contacts. Torque can be adjusted to suit individual requirements. Furnished in 1 pole . . . 2 to 17 positions (with 18th position continuous rotation with 18th position as “off”); and 2 or 3 pole . . . 2 to 6 position including “off”.

Centralab

Medium Duty Power Switches

- 7½ amp. 115 V. 60 cycle A.C.
- Voltage breakdown 2500 V to ground D.C.
- Solid silver contacts
- 25,000 cycles of operation without contact failure
- Fixed stops to limit rotation
- 20° indexing
Valpey is now ready to help solve your...

CRYSTAL PROBLEMS

Valpey Crystals are still required for vitalizing the wartime communications systems. But the Big Job is drawing ever closer to completion, and we can feel justified in thinking how our post-war products will be made.

Consequently, we invite you to submit your crystal problems to Valpey engineers for their advice. There is, of course, no charge for this consultation service.

CBC-0
Where utmost in stability requires constant temperature control.

CM-1
A design for normal frequency control applications.

VP-3
Developed for use in limited space...in mobile equipment.

Valpey Crystals are still required for vitalizing the wartime communications systems. But the Big Job is drawing ever closer to completion, and we can feel justified in thinking how our post-war products will be made.

Consequently, we invite you to submit your crystal problems to Valpey engineers for their advice. There is, of course, no charge for this consultation service.

From A. W. Morley, VE4AAW:

As promised 4TX is in Winnipeg taking a course at TCG. 4QG is on leave and passed through Wpg. on his way east. Bill is back on the west coast with the RCAF. 4ALE is with the Army Sigs and is somewhere in Australia. 4AHE is still on the farm. Harold was supposed to have caught some nice fish on a recent fishing trip to Kenora. (Is this another fish story?) 4AAL and 4ADC are in Toronto doing war work with Research Enterprises Ltd. There might be something else to report fellows but I don't know about it. With holidays, etc., pickings are very slim so if there is nothing in this column, remember the news comes from you. 73.

MAILBAG

From PO Tel. D. Scholes, VE5DY, comes the following:

Now a few notes on doings around Victoria. 5PX is building a home for himself directly across the street from 5EY, the V.S.W.C. station and clubhouse. 5EC is also building himself a home in the Gorge district, and at present is residing next door to 4MN's home in Victoria. 5ACE has returned to Canada, and at present is awaiting discharge at an RCAF station at Vancouver after a long spell overseas in Britain, Ceylon, India and Burma. He hopes his wife, whom he married in England en route home, will join him in Victoria soon. Now a correction: the address of 5HP, listed as Victoria, should be Vancouver. He hails from the province of Alberta and B.C., and on many occasions could spare a half hour or so to visit hams in the various parts of these two provinces. Frank notes that in five years of traveling here he has not met exactly the same QTH, Alberta. Of course we must consider the fact that his traveling has been done during war years, but any of you chaps who can contact Frank, or who would dare to let him know where you are and what you do, can drop a line to Frank Meadows, VE4AC, 1708 6th Ave., N.W., Calgary, Alberta. While spending the evening with LQ, Frank showed genuine interest in my dual turntable and p.a. system, and it would seem to indicate that he intends to build up a similar outfit.

We'll be seeing you next month.

MANITOBA—VE4

From Burnas, of Squadron Leader J. A. (Jimmie) Elliott, 4IF, of Brandon, along with Gert, 4AMS, his XYL, and the jr. op, Peggy, met at the C.P.R. Depot by 4AC, Frank Meadows, and only one of his jr. ops (he has four of 'em, fellows), they quickly and none too quietly melted out of the crowd and home to AC's suburban home. After the usual preliminaries, 4ALE, Glen Phillips of Upland, and Maudiel, 4APF, same QTTH, and incidentally Alberta's unofficial Chamber of Commerce, were QSO'd by land line and convinced that it would be a good idea to drive into Calgary and meet personally the folks with whom they had recently been in touch. Jim, Gert and Peggy departed for Prince George on the Monday morning to visit their respective parents who live at the coast. AHZ convinced Gert that she will be courting trouble to return east again without at least a one-week stopover at Chancello. Jim will return to Winnipeg to get his discharge from the RCAF, after which he will return to his former duties as principal of the Brandon Tech. School. We wish him every success, and may the day roll round rapidly when we shall hear that sonorous (so help me, Gert, that's what Frank has written down here) voice of Gert's singing out, "This is VE4IF, COME IN SUMBUDDY PUH LEEZEB!

That, gang, ends Frank's report, and I have these few words to tack on. 4AC is constantly covering the provinces of Alberta and B.C., and on many occasions could spare a half hour or so to visit hams in the various parts of these two provinces. Frank notes that in five years of traveling here he has not exactly the same QTH. Of course we must consider the fact that his traveling has been done during war years, but any of you chaps who can contact Frank, or who would dare to let him know where you are and what you do, can drop a line to Frank Meadows, VE4AC, 1708 6th Ave., N.W., Calgary, Alberta. While spending the evening with LQ, Frank showed genuine interest in my dual turntable and p.a. system, and it would seem to indicate that he intends to build up a similar outfit.

We'll be seeing you next month.

(Continued from page 74)
Best, or nothing—this is the standard set for himself by T. R. McElroy, and this is the standard we set for all radiotelegraph equipment bearing our name. Even as T. R. McElroy became, and still is, the world's champion radiotelegraph operator, so have we grown to be the largest company of our kind on earth. Best, or nothing—this is the source of our growth, this is what makes our equipment so desirable on land, sea and in the air, this is what gives us the "drive" to forge new trails in the field of communications. Many have been our contributions to the art of radiotelegraphy in the past and the present. As we face the future, we pledge strict adherence to the McElroy Standard—best, or nothing.

Available Now for Immediate Delivery...

McElroy "600" Series Complete Automatic Radio and Telegraph Transmitting and Receiving Assemblies and Associated Equipment. Write for complete details.

McElroy engineers never copy...never imitate. We create, design, build. We are never satisfied with mediocrity.

McElroy

MANUFACTURING CORPORATION
82 BROOKLINE AVENUE   BOSTON, MASSACHUSETTS

THE NEED IS STILL URGENT...DONATE A PINT OF YOUR BLOOD TO THE RED CROSS
...this is the single unit* construction of the
SHURE “556” Super-Cardioid Dynamic Microphone

A. Single moving coil diaphragm.
B. Rugged 4 point diaphragm suspension.
C. First wind screen.
D. Spring mounted mechanism.
E. Shock absorbers.
F. High fidelity transformer.

* Using the “Uni-phase” principle, an exclusive patented Shure development, this single unit construction is possible in a unidirectional Microphone. This eliminates the problems of matching two dissimilar units. This advantage, plus compactness and ruggedness, is available at less cost to you.

Hams in Combat
(Continued from page 47)

one corner of a large room. There I found my shipmates—helping themselves to a case of champagne! They handed me three bottles. One for the CO, one for the chief, and the other for me.

At dusk the Hurricanes left us. Within a half hour the sirens sounded and again the fun started. This happened with the regularity of clockwork for the next two days. By the third day the enemy was within three miles of the city. It seemed as though the RAF had deserted us; not only were we being bombed and machine-gunned but we came near to being shelled by long-range guns. This shelling was not so funny, for we seemed to be tied up right in the middle of the enemy’s range. Following one near miss the captain moved the ship further up the quay. But Jerry must have spotted our move, for immediately he started ranging on us. Again we moved, but this time right to the harbor entrance, where we found a destroyer standing by. We tied up alongside. This was fine for me because she carried four operators. Upon hearing my story, they immediately took over the watch.

No sooner had I rested my head on the deck than I was fast asleep. This, however, was too good to last. Orders were received to proceed to Dunkirk, and soon we were on our own again.

We tied up alongside the “harbor defense” battery, consisting of one 16-inch gun mounted at the end of the harbor entrance. Each time that gun fired my receiver was rendered insensitive by the shock. I remember taking down an important message and having to ask for one four-letter group to be repeated no less than six times! Each time Dover w/t started to send the four letters I needed this confounded gun would spout flame and shake the whole ship.

On the morning of the fourth day the enemy had taken one side of the harbor completely. Again we found ourselves parked in the wrong place, for he started to range his guns on the shore battery against which we were moored. This proved to be too much for our CO. He gave orders to move outside the entrance, but no sooner had we started to move than the Germans tried to range on us! I suspect they had taken d/f bearings on my transmissions and, even if they had not broken down the code, had at least become suspicious.

However, we managed to get out of range and I was told to send a signal requesting that we might return to Dover, to be replaced by a fleet of destroyers. The reply came back almost immediately: “Return to Calais; assistance will be sent...” We returned, staying long enough to pick up two hundred high-ranking officers. In due course two very old destroyers arrived. They sailed straight into the harbor, guns ablaze.

Later we heard that they had orders to retake Calais. Whether this was true or not I do not know, for no one ever saw them again.

So we returned to our base, tired and hungry. Twenty-four hours later we received sailing orders for Dunkirk. But that is another story...
The list of Hytron's customers for the standard OC3/VR105 and OD3/VR150 reads like the social register of electronics. Proved quality products, these Hytron tubes are found literally by the millions in military radar, communications, and electronic equipment.

Now in space-saving miniature bulbs, the new Hytron OA2 and OB2 offer the same careful engineering design, rigid control of processing and assembly, and adherence to tight factory specifications which have made the standard Hytron regulators famous. Life and performance of the miniature OA2 and OB2 equal those of the standard tubes, except that maximum operating current is 30 ma. for the miniatures. Construction is both simple and rugged. Note, for example, use of both top and bottom mica supports and the heavy stem leads. Compare the characteristic data given. Consider the possible space economies. Order your Hytron OA2 and OB2 tubes from your jobber today.

### COMPARATIVE DATA

**HYTRON MINIATURE AND STANDARD GASEOUS VOLTAGE REGULATOR TUBES**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Physical Characteristics</th>
<th>Average Operating Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max. Length (inches)</td>
<td>Max. Diam. (inches)</td>
</tr>
<tr>
<td>OA2</td>
<td>2⅞</td>
<td>⅜</td>
</tr>
<tr>
<td>OD3/VR150</td>
<td>4⅞</td>
<td>1¾</td>
</tr>
<tr>
<td>OB2</td>
<td>2⅞</td>
<td>⅜</td>
</tr>
<tr>
<td>OC3/VR105</td>
<td>4⅞</td>
<td>1¾</td>
</tr>
</tbody>
</table>

| Sufficient resistance must always be used in series with the tube to limit current through it as follows: OA2 and OB2, 30 ma.; OD3/VR150 and OC3/VR105, 40 ma. |
| Regulation (either positive or negative polarity) is defined as the difference in voltage when the current is varied from 5 ma. to 30 ma. |
| Operation for extended periods of time at low current will temporarily increase regulation of tube. |

OLDEST MANUFACTURER SPECIALIZING IN RADIO RECEIVING TUBES

BUY ANOTHER WAR BOND

MAIN OFFICE: SALEM, MASSACHUSETTS
PLANTS: SALEM, NEWBURYPORT, BEVERLY & LAWRENCE

79
tentative, and second, is shown in (P). Signal strengths from Prospect to New Haven should be very good and they are, usually, S8 to S9. They would be better, however, if it were not for the north end of West Rock Ridge blocking the line-of-sight path. That they could be better is borne out by WKNQ-25’s ability to “suppress” WKWG-70’s signal when transmitting over a 3½-mile greater distance and a 400-foot lower altitude on Buckwheat Hill in Meriden, but with a line-of-sight path, as shown in (H).

(S) shows an alternate relay route into Haddam via Portland. Signals over this route are about, the same as those over (D). The advantage gained by the ground falling away directly in front of WKNQ-12 as compared to the rising ground in front of WKNQ-1 is offset by the slightly higher hills in between. (T) shows the only path over which we have been able to establish direct communication from the city of Middletown to the city of New Haven. It was found quite by accident in a rather low part of the city while cruising around one drill period. Signal strengths are of the order of S3 to S4 and the only reason they are that good is probably because of ground falling away into the marshy stream bed at the Middletown end. The signal goes over the top of the Three Notches at the 700-foot elevation which is 100 feet higher than the path shown in (J) with the remaining terrain approximately equal in both contour strips.

Conclusion

In general when selecting a v.h.f. or u.h.f. location, bear the following in mind:

1) The best possible path will be a visual one.
2) If there must be hills in between have them as far away from you as possible, preferably midway between you and the other station.
3) A lower location off to one side is better than a higher one that shoots right into the side of a near-by hill.
4) Signals will be stronger at a greater distance if the more distant location is more nearly in the clear.
5) Be sure the ground slopes down from you towards the other station or at least that it is level. Rising ground directly in front of your station is bad, and at both ends of the circuit it is very bad.
6) Avoid locations near busy highways since the spark-plug interference will be unbearable.
7) Keep a good distance from manufacturing plants which might use induction heat treating at some later date even if they are not at present doing so. (A plant about four blocks away practically ruins our f.m. receiver as well as our 112-Mc receiver at WKNQ-1.)
8) Be sure there is plenty of room for a couple

(Continued on page 88)
A manufacturer of metal cabinets recently installed resistance welding with electronic control—to replace other forms of fabrication.

Here's what came out of his fabrication costs in one year: 600 tons of steel, 10,000 man-hours of labor, 3,000 pounds of welding rod. The total saving amounted to $100,000.

The reasons? Resistance welding with precision electronic control permitted use of lighter gauge stock in the whole structure—with strength and tolerances maintained. This, in turn, permitted better-planned shearing that greatly reduced scrap losses.

Resistance welding control is but one of the many ways electronics is serving industry as a production tool—speeding fabrication, cutting costs, improving products.

For full information on electronic applications for your industry, consult your nearest Westinghouse office. Electronic Specialists are ready to help with your application problems. Or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

For resistance welding equipment provides accurate control of weld time, heat and timing sequence. Through the precision of electronic tubes, accurately controlled current may be sent stabbing through metal as many as 1,800 times per minute.
Prepare to get your "ticket"!

With the Revised Edition of
DREW'S
HOW TO PASS
RADIO LICENSE
EXAMINATIONS

By Charles E. Drew, I.R.E. A.I.E.E.

This book will give you the help and the knowledge you need to pass the government exam and get your "ticket."

So easy to follow, to understand. Questions and answers cover every field of radio communication — transmission or reception — whether in marine, aeronautical, police, or broadcasting.

It explains Basic Radio Laws; Basic Theory and Practice; Radiotelephone; Advanced Radiotelephone; Radiotelegraph; Advanced Radiotelegraphy.

The "Bible" of the radio field — quickest, surest way to acquire the knowledge you must have!

Send for YOUR Copy Today!

Second Edition, 1944 320 Pages $3.00

ON APPROVAL COUPON

JOHN WILEY & SONS, Inc.
440 Fourth Avenue, New York 16, N. Y.

Please send me on ten days' approval a copy of Drew's How to Pass Radio License Examinations. At the end of that time, if I decide to keep the book, I will remit $3.00 plus postage; otherwise I will return the book postpaid.

Name. .............................................

Address. ..........................................

City and State ..................................

Employed by ....................................

(Continued from page 80)

of towers out back for the lower frequencies and a signal squirter or two.

9) Lack of near-by neighbors also would be a distinct help for BCL trouble. (You can still have BCL trouble on u.h.f.)

10) Be sure you are not surrounded by steel-framed brick buildings or your signals will probably just bounce back and hit you in the face. WKNQ-1 has four- or five-story buildings on two sides and they distinctly do not help.

11) If you build a new house make provision to run a short direct feed line from your transmitter to your antenna in your building plans and see to it that there is a special a.c. line from your meter to your shack.

12) If you use concentric cable for a feed line to the antenna, as may be necessary, remember that 75 feet of the best Army-Navy stuff will cut your power output in half at 112 Mc. and 25 feet of it will do the same thing at 1200 Mc.; so make your feeders short.

Postwar Station Calls

(Continued from page 80)

This revised plan has now been approved by the League's Board and sent to FCC. No further changes are contemplated, as there is a definite need for the Commission's early action to implement arrangements for the resumption of licensing. Further alterations would not only upset the balance between call areas but would cause months of delay at a time when it cannot be afforded.

"Bismarck"

(Continued from page 89)

left of Bismarck was a few charred wires and parts in the r.f. can.

"We buried his remains quietly at dawn the next day. It was a brief ceremony. He received full military honors. His casket was an empty beer can. We enclosed his history — written in fourteen foreign languages, including English — inscribed on a bit of stainless steel." He showed me a card:

<table>
<thead>
<tr>
<th>Bismarck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Born</td>
</tr>
<tr>
<td>Died</td>
</tr>
</tbody>
</table>

By this time we were both in tears, so Joe brought us another beer.

(Author's Note: Due to military secrecy there will be no further information on this subject until restrictions are lifted.)

Strays

The name of the Westinghouse Electric and Manufacturing Company has been changed to Westinghouse Electric Corporation.
Up where there are no tracks or signposts, bombers wing faultlessly to their target—a tiny speck on the map half-a-thousand miles away. Helping to guide them to their objective are Delco Radio products that harness the magic of high-frequency waves to the functions of communication, navigation, detection and ranging. From compact radio sets to highly intricate radar equipment, these products represent Delco Radio's effective combination of engineering vision—manufacturing precision.

Keep Buying
More War Bonds
HARVEY brings you America's leading radio lines

To meet your critical radio and electronic needs, HARVEY offers you a wide selection of components and equipment from the factories of America's leading manufacturers. The BUD line, a fraction of which is described below, contains many typical examples of the high quality, dependable products that can be supplied to you without delay.

STREAMLINED CABINETS

STREAMLINED METER CASES
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Compact, sturdy, convenient, BUD Midget Condensers feature high mechanical and electrical efficiency. Many types for many purposes.

PROMPT DELIVERIES...
Upon receipt of suitable priority

Telephone orders to: LONGACRE 3-1800

Those Singing Masts (Continued from page 41)

principal island of Luzon where Manila, one time pearl of the orient is located, that the standard B.C. frequency transmitter was put into service.

Hams to the Fore

Construction and installation of the radio facilities was engineered and performed by Signal Corps personnel. Once again the amateurs were represented. Of the four officers connected with this project, all are hams. They were 1st Lt. Sanford T. Terry, W3AGH, previously with WRVA, Richmond, Va., who handled the engineering problems on this project. 1st Lt. Luther A. Pierce, jr., W8CHQ, acted as OIC and operations officer. Before entering the Army he was part of the staff of WABC, New York. Lt. Paul H. Juengel, jr., W8TED, was designated studio officer and was formerly with WBCM, Bay City, Mich. The writer, W6EOU, was with the police radio system KNOP of Sacramento, and served in the capacity of transmitter officer on the ship. Five enlisted men also were assigned to the project and among these was Sergeant Vert Mandelstamm, W8VJD. He also was previously employed by WBCM of Bay City, Mich. W8VJD was one of our busiest men, his job being to handle studio programs and also work RCA San Francisco direct to maintain a program-easing circuit with them.

Due to time differences between here and the U.S.A., many of our transmissions necessarily originate in the early morning and late evening hours. Sleep is to be had if and when one can get it, especially during our busy periods.

Tokyo evidently had no trouble picking up our transmissions as we have heard Tokyo radio reporters refer to "The enemy propaganda broadcasts from Leyte" in many of their news commentaries. At times we were thoroughly convinced that they were gunning for us, as no doubt they would have liked to silence our installation. Even Tokyo Rose was reported as having said in one of her broadcasts, "Look out, Apache, we know where you are" — and at times we found ourselves inclined to believe just that!

A constant stream of listener reports have been received through mail channels from Australia and New Zealand. Reception reports also have been received from Borneo and New Guinea. Some of the Armed Forces radio stations have even rebroadcast our transmissions on a scheduled basis to the local GIs. The ten kilowatts of power which we were putting into our limited antenna facilities were giving us very satisfactory results.

Daily schedules and thousands of words of press have been handled with San Francisco with minor interruptions from QRM or QRN.

The Apache was the origin of practically all radio network broadcasts during the early phases of the Philippine campaign. If you heard some of them, as you probably have, then that was the Apache. Keep listening and looking for us as we are still going strong — and we hope to be seeing you from other places soon!
G-E Cathode-Ray Tubes range from 2 inches in screen diameter to 12 inches—are available in different fluorescent screens and characteristics to match all needs—constitute a complete line of service-proved tubes for home television, oscilloscopes, and other applications.

General Electric leads in cathode-ray tube design and manufacture, as it leads in other phases of television! Consult your nearest G-E office or distributor for information on the tubes described or listed on this page, or write Electronics Department, General Electric, Schenectady 5, N. Y.

**CHARACTERISTICS OF THE TUBES ILLUSTRATED**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>GL-5CP1</th>
<th>GL-12DP7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen diameter</td>
<td>5 inches</td>
<td>12 inches</td>
</tr>
<tr>
<td>Heater voltage</td>
<td>6.3 V</td>
<td>6.3 V</td>
</tr>
<tr>
<td>Heater current</td>
<td>0.6 amp</td>
<td>0.6 amp</td>
</tr>
<tr>
<td>Focusing method</td>
<td>Electrostatic</td>
<td>Magnetic</td>
</tr>
<tr>
<td>Deflecting method</td>
<td>Electrostatic</td>
<td>Magnetic</td>
</tr>
<tr>
<td>High-voltage electrode, max voltage</td>
<td>2,200 V</td>
<td>7,700 V</td>
</tr>
<tr>
<td>Supplementary high-voltage electrode, max voltage</td>
<td>4,400 V</td>
<td>— — — —</td>
</tr>
<tr>
<td>Grid No. 1, max voltage for cutoff</td>
<td>— 66 V</td>
<td>— 75 V</td>
</tr>
<tr>
<td>Grid No. 2 (accelerating electrode), max voltage</td>
<td>— — — —</td>
<td>330 V</td>
</tr>
</tbody>
</table>

**Standard General Electric cathode-ray tubes are listed below**

- GL-2AP1
- GL-3AP1
- GL-3BP1
- GL-3DP1
- GL-3EP1/1806P1
- GL-5BP1
- GL-5BP4
- GL-5CP1
- GL-5CP7
- GL-5FP7
- GL-7BP7
- GL-9BP7
- GL-9CP7
- GL-12AP4
- GL-12BP7
- GL-12DFP7
- GL-12GP7

---

**GENERAL ELECTRIC**

**TRANSMITTING, RECEIVING, INDUSTRIAL, SPECIAL PURPOSE TUBES • VACUUM SWITCHES AND CAPACITORS**
Signal Corps Radio Relay

(Continued from page 15)

the relay chain back to Algiers. The teletype-writers at either terminal chattered incessantly, the steady stream of vital operational traffic increasing in intensity as the days went by.

The immediate success of the system brought urgent demands for two more mobile teletype terminal stations. The crew rushed back to Algiers. Perkins again utilized his "secret" resources—plus the opportune assistance of a former schoolmate of W5EZD, on duty at the local signal depot. After three days and nights of continuous effort, two mobile stations were on their way to provide a radio teletype circuit from II Corps to the 1st Armored Division in its drive upon Mateur, Terryville and Bizerte.

But there had been neither time nor suitable parts to make these units as good as their predecessor. So simple a fault as a short circuit in the antenna system on the truck assigned to the 1st Armored Division resulted in failure of communications. Yet the outfit kept going through a hail of enemy machine gun fire and bombing attacks. Word of the failure reached Headquarters and W2GUM set out in pursuit, but he couldn't catch up until Bizerte had fallen. There he repaired the fault and provided the first teletype contact to AFIHQ from Bizerte.

W2GUM Among First Into Tunis

Taking time out during all this, W2GUM found opportunity to be in "at the kill" in Tunis. With a party from the Hill 609 relay he rode the radio-jeep into Tunis on the day of its capture, May 8, 1943, following the victorious British forces, and announced the event over the system to AFIHQ. If not the first, he was one of the first, American civilians to enter the city.

After II Corps made its final move into Mateur and had withdrawn for a much-needed rest, the mobile terminal remained there with a supply base, and the other two terminals moved near Tunis to serve with Advanced AFIHQ and British First Army Headquarters. Thereafter, until June 15th, the three terminals maintained operation on a shared-time basis, working with AFIHQ and each other to handle a traffic load reaching a daily peak of over 16,000 word groups. Approximately 12,000 groups were handled with AFIHQ through the complete radio relay system, the remainder directly among the three forward terminals through the fourth relay station at Hill 609.

All this time the crew from Coles were beset with nearly every difficulty imaginable. Crystals were available for only four usable frequencies—they needed six frequencies for the current operation plus spares and alternates and additional ones for operations still to come, a total of 321 crystals in all. Upon receipt of a frantic appeal, W2OEF flew to Chicago, gathered up every rock in sight and shipped them off by air express. Weeks went by but still no crystals arrived in Africa, having been "bumped off" at every stop on route for higher (?) priority cargo. In despera-
The wire you see with the parachute on the end of it is a telephone wire, being payed out from a C-47 cargo plane.

Bell Telephone Laboratories, working with the Air Technical Service Command of the Army Air Forces, developed this idea. It will save precious lives and time on the battlefield.

A soldier throws out a parachute with the wire and a weight attached. The weight drops the line to the target area. From then on, through a tube thrust out of the doorway of the plane, the wire thrums out steadily—sixteen miles of it can be laid in 6 2/3 minutes. Isolated patrols can be linked quickly with headquarters. Jungles and mountain ranges no longer need be obstacles to communication.

This is in sharp contrast to the old, dangerous way. The laying of wire through swamps and over mountains often meant the transporting of coils on the backs of men crawling through jungle vegetation, and in the line of sniper fire. It is reported that in one sector of the Asiatic theater alone, 41 men were killed or wounded in a single wire-laying mission.

Bell Telephone Laboratories is handling more than 1200 development projects for the Army and the Navy. When the war is over, the Laboratories goes back to its regular job—helping the Bell System bring you the finest telephone service in the world.

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Recently introduced by Western Electric. Recommended by Newark engineers for a wide range of applications. Bakelite case fits 3½" hole. Radium dial. 150-0-150. Can be used with 0-200 micro amp scale listed below. Excellent as a 20,000 ohm-per-volt meter, or null, sound device. $7.50

0-200 paper scale for above $1.50

General Electric Meters

The Famous Newark Bargain
Oil Filled, Oil Impregnated

Filter Condensers

Big shipment just received. We waited 8 months to get them... but they're yours for immediate delivery!

Filter Condensers
11 mfd. 15 v. DC 3¼ x 1¼ x 1½ $2.00
17.5 mfd. 1300 v. DC 3¼ x 3¼ x 4.25 2.75
8 mfd. 2000 v. DC 3½ x 3½ x 2½ 2.75
2 MFD. and 4 MFD. in ONE GUN 80c

Thordarson Transformers

(Power Transformers and Chokes)
T-4555 or T-92R21 leads out of side. 778 v. C.T. at 200 MA.
115 v. 60 Cycle 6 4½ v. C.T. at 3 A.
At 20 amp 9 lb. $5.29
T-13C30 $44 150 MA. 200 ohm 1600 v.
Insulation 244 lbs. 1.41

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At 20 amp 9 lb. $5.29
T-13C30 $44 150 MA. 200 ohm 1600 v.
Insulation 244 lbs. 1.41

With the imposition of radio silence, there was no way in which to determine whether the 148-mile gap between Pantelleria and Malta could be bridged with v.h.f. So the crews stood by chewing their fingernails until D-day, July 7th. When, to their relief, operations began they experienced unbelievably strong signals and circuit reliability. This circuit had been expected to carry a heavy bulk of traffic for the invasion commanders, but the rapid development of the campaign required the handling of only 15,158 word groups during the period of operation ending August 9th.
Hints & Kinks

Amateurs are noted for their ingenuity in overcoming by clever means the minor and major obstacles they meet in their pursuit of their chosen hobby. An amateur must be resourceful and a good tinkerer. He must be able to make a small amount of money do a great deal for him. He must frequently be able to utilize the contents of the junk box rather than buy new equipment. Hints and Kinks is a compilation of hundreds of good ideas which amateurs have found helpful. It will return its cost many times in money savings — and it will save hours of time.

Price 50 cents

The Radio Amateur’s License Manual

To obtain an amateur operator’s license you must pass a government examination. The License Manual tells how to do that — tells what you must do and how to do it. It makes a simple and comparatively easy task of what otherwise might seem difficult. In addition to a large amount of general information, it contains questions and answers such as are asked in the government examinations. If you know the answers to the questions in this book, you can pass the examination without trouble.

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How to Become a Radio Amateur

Universally recognized as the standard elementary guide for the prospective amateur. Features equipment which, although simple in construction, conforms in every detail to present practices. The apparatus is of a thoroughly practical type capable of giving long and satisfactory service — while at the same time it can be built at a minimum of expense. The design is such that a high degree of flexibility is secured, making the various units fit into the more elaborate station layouts which inevitably result as the amateur progresses. Complete operating instructions and references to sources of detailed information on licensing procedure are given.

Price 25 cents

Lightning Calculators

RADIO, Type A — This calculator is useful for the problems involving frequency, wavelength, inductance, capacity, etc. It has two scales for physical dimensions of coils from one-half inch to five and one-half inches in diameter and from one-quarter to ten inches in length; a frequency scale from 400 kilocycles through 150 megacycles; a wavelength scale from two to 600 meters; a capacity scale from 3 to 1,000 micro-microfarads; two inductance scales with a range of from one microhenry through 1,500; a turns-per-inch scale to cover enameled or single silk covered wire from 12 to 35 gauge, double silk or cotton covered from 0 to 36 and double cotton covered from 2 to 36. Using these scales in the simple manner outlined in the instructions on the back of the calculator, it is possible to solve problems involving frequency in kilocycles, wavelength in meters, inductance in microhenrys and capacity in microfarads. Given the direct reading answers for these problems with accuracy well within the tolerances of practical construction.

Price 25 cents

OHM'S LAW, Type B — With this concentrated collection of scales, calculations may be made involving voltage, current, and resistance, and can be made with a single setting of a dial. The power or voltage of current or resistance in any circuit can be found easily if any two are known. This is a newly-designed Type B Calculator which is more accurate and simpler to use than the justly-famous original model. It will be found useful for many calculations which must be made frequently but which are often confusing if done by ordinary methods. All answers will be accurate within the tolerances of commercial equipment.

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More Raytheon Field Engineers
TO SERVE
THE NAVY
In the U.S. or Abroad

THE NAVY has asked Raytheon to greatly expand its Field Engineering force to take care of the Raytheon Electronic Equipment now playing a vital part in all naval operations.

Raytheon invites you to join this essential group if you have (1) practical experience in building amateur rigs, (2) extensive experience in installing or maintaining classified military electronic equipment during the war, and (3) are physically fit. The job is supervision and installation of vital radio detection gear at a United States base or Naval activity abroad.

You will serve the Navy, and you will gain experience of inestimable value in any future position in this growing field.

WRITE TO CLARK C. RODIMON, W1SZ, Raytheon Manufacturing Company, Field Engineering Division, Waltham 54, Massachusetts. All hiring will conform to War Manpower Commission regulations.

(Continued from page 89)

W2DSY and W1CIW returned to the States about the middle of July to utilize their experience in developing a strictly GI version of the radio relay equipment. As replacement, Harold H. Kinnaman stayed on after completing another technical mission.

With the materialization of plans for the use of radio relay in Sicily and eventually in Italy, W5EZD and Durrer set out in the radio-jeep for reconnaissance in Sicily. They landed during the peak of the fighting and managed to get into more excitement than space permits recount. Durrer's penchant for hard-cooked eggs, which he was boiling over a camp fire one afternoon, apparently was shared by others. When shots came whistling by their ears with unmistakable intent, Durrer and party evacuated with equally unmistakable intent. He's still wondering who ate the eggs!

The boys selected Mt. Laura as the site of the relay station for a circuit from the American Seventh Army at Palermo to the 15th Army Group near Syracuse. Again with utter disregard for theory, which claimed that v.h.f. couldn't work that 135-mile jump from Mt. Laura to Palermo, the boys set up the equipment. Had they plotted the contour ahead of time, perhaps they would have thrown in the sponge. As it was the circuit worked nicely without excessive fading. They really knew then that v.h.f. could "go places and do things" despite all talk about line-of-sight operation.

All wire circuits across Sicily were destroyed by retreating enemy forces. The only available primary communication between the major headquarters had been by battle-weary SCR-299s. But now radio relay was on the scene, with teletype providing four times the 299's traffic-handling speed. So the manual circuits were closed and v.h.f. radioteletype took over until its need on the island no longer existed.

Shortly after its installation the Mt. Laura relay was placed under observation by the Luftwaffe in daily sweeps over the Bizerta area in Tunisia. This site was directly in their path. As the heavy bombers thundered over, barely 500 feet above, the fighter escort would peel off and circle the area while the relay crew struck poses of innocence and nonchalance. When Perkins swore he was going to bag a couple of Nazi planes, the firing pins of the two .50-calibre machine guns mysteriously disappeared. Finally, the pilots apparently became convinced that the crew was harmless, and thereafter gave them no trouble.

Arriving in Algiers, they tarried long enough to see the original AFHQ relay system dismantled and on its way to Italy to establish new records and win new laurels. Information received subsequently has revealed that this radio relay equipment won its greatest fame in providing communication from the Anzio beachhead through a relay at Naples to the Fifth Army first at Caserta and later at Presenzano. This circuit bridged enemy-held territory in a manner impossible by wire, furnishing for this vital operation the primary means of communication with all the relia-
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since the beginning of radio broadcasting
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Applicants must comply with WMC regulations.

(Continued from page 90)

bility and traffic capacity of a wire teletype circuit, handling approximately 20,000 word groups per day during the operation.

Description of a Radio Terminal

Basically, the radio terminals included a 50-watt (or 250-watt) Motorola f.m. police radio transmitter and an associated receiver operating in the 30–40-Mc. band. The antennas were either Link vertical coaxial types supported on 30-foot poles or vertical half-rhombics (inverted “V”), four wavelengths on a side, supported by poles or convenient trees. The half-rhombic was end-fed directly from the transmitter's antenna coupling coil against a counterpoise laid directly on the ground for the full length of the system.

The intermediate step to teletype operation was the British two-tone telegraph apparatus. This unit was located with the radio transmitter. In transmitting, it was keyed by the teletypewriter contacts and sent “marking” pulses on one frequency and “spacing” pulses on another frequency, several hundred cycles apart. The two-tone output was impressed upon the modulator input in the same manner as a voice signal. In receiving, each filtered and rectified incoming tone produced a voltage which was amplified to actuate the teletypewriter receiving mechanism.

The fixed radio terminal at higher headquarters generally employed a 250-watt transmitter and a heavy-duty 5-kw. gasoline engine power unit or a commercial power source. For simplex operation the transmitter and receiver were installed together with one antenna. For duplex operation the receiver and transmitter were separated up to 500 feet or more to avoid mutual interference and utilize individual antennas. The two-tone unit was remotely controlled over a d.c. signaling circuit from the teletypewriter in the Headquarters signal center, usually several miles away.

The mobile radio terminal was entirely self-contained with 50-watt transmitter, receiver, two-tone unit and teletypewriter in the body of a ¾-ton weapons-carrier. Two 2½-kw. portable gasoline-engine power units were carried in a ¼-ton trailer towed by the weapons-carrier. For duplex operation, the receiver was removable for installation at a distance. Vertical coaxial antennas were used. It was possible to operate these terminals in motion on a simplex basis by providing a vehicular whip antenna. The self-contained feature was of considerable value in permitting the stations to move rapidly behind an advancing headquarters, being ready to operate immediately upon arrival at a new location.

The relay stations used the same equipment as the fixed high-power terminal station, without provision for teletype monitoring. In communicating from a relay station to a terminal or another relay, voice was used when teletype operational traffic could be suspended. Receivers were located 500 to 3000 feet from the transmitter site, depending upon terrain, to avoid interference from harmonics radiated by the transmitters and spurious responses in the receivers.

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The complete relay station operating complement included one officer and fifteen men, operating as an independent detachment with respect to supply, administration, and maintenance. The enlisted personnel included two radio repairmen, one power plant attendant and motor mechanic, two clerks, one cook and nine radio attendants who doubled as guards. They were equipped with first class cooking facilities and tents for long periods of operation in inclement weather. Vehicles comprised one ½-ton jeep, with trailer, one 2½-ton cargo truck and a 1-ton trailer with installed power unit. The crew was armed with one .50-caliber anti-aircraft machine gun, four sub-machine guns, and twelve .30-caliber rifles.

Jamming

On a few occasions adjacent long-range radar installations and I.f. high-power c.w. stations caused interference to the AFHQ terminal station resulting in cessation of service for several hours at a time. For a number of days after the beginning of the Sicilian campaign, operation of the relay systems created interference to Allied intercept activities in the band from 38 to 40 Mc.

It became the practice of the enemy stations to adjust their operating frequencies close to those utilized by the relay systems thereby preventing interception by Allied Forces operating in areas within or adjacent to those served by the relay stations. It was necessary to suspend operation completely for five days until the enemy air activity had withdrawn partially whereupon service was resumed on full-time basis during night hours but on a restricted basis during daylight hours for an additional several days until the activity ceased within the range of the relay station.

Suspected attempts at jamming the relay system by the enemy on three different frequencies were unsuccessful. The signal strengths were below the minimum level to actuate the receiver relay circuits. Had the signals been of sufficient strength to actuate the receiver relays, it is probable that operation could not have been continued in view of the presence of those signals on more than one frequency which would have given rise to a tendency for the simplex system to operate in both directions simultaneously or for a "lock-in" of two or more relay stations. The jamming enemy signals were received with horizontal polarization as indicated by appreciable signal increases when horizontal antennas were substituted for the vertical coaxial antennas used normally. Possible effects of jamming need not be given as much consideration in the operation of a duplex system wherein transmission is continuous in both directions simultaneously in view of the "capture effect" of f.m. signals, or the ability under normal conditions of the stronger desired signal to override the interfering signal without interference from the latter.

Teletype Operation

The potential capacity of a duplex system is approximately twice that of a simplex system and may be achieved with the addition of relatively
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0-10 megohms (60,000 ohms center scale)

DIRECT READING OUTPUT LEVEL
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TEMPERATURE COMPENSATED
CIRCUIT FOR ALL CURRENT
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little extra equipment. The British 7B teleprinter machines were capable of "blind duplex" operation so that one machine could be used at each terminal. However, local copy was not printed during transmissions giving rise to delays in correction of errors in typing unless the operator was highly experienced. Converting the simplex radio relay system to duplex thus required the addition of one relay transmitter to each relay station with a slight change in the wiring of the receiver control circuits and the provision for simultaneous operation of both receiver and transmitter at each terminal station involving physical separation of the two units or operation on frequencies sufficiently separated to avoid interference in the receiver from the local transmitter.

American teleprinters are commonly used in pairs for duplex operation, one for transmitting and one for receiving. This arrangement is desirable since local copy is made of all transmissions for record and correction of transmittal errors can be made at the moment.

Although the teleprinter is capable of operation at a speed of 60 words per minute, the actual speed achieved in manual keyboard operation rarely exceeds 40 w.p.m. However, with auxiliary type perforators and automatic keying apparatus the maximum possible speed may be achieved.

**Conclusion**

Once the bugs were ironed out of the technical and administrative phases of operating a radio relay system, the Motorola and Link equipment really settled down to do a job which should go down in the annals of military and radio history. Actual figures gleaned from traffic reports reveal conclusively that the v.h.f. radio relay could provide communication reliability 50 to 100 per cent greater than that of wire lines installed under equivalent combat conditions.

In several cases the radio relay became the only means of primary communication between two or more headquarters. The technique evolved on the battlefields of Tunisia opened up new and revolutionary fields in tactical military communications. Little did the Signal Corps engineers, sweating and slaving to prove out their first single channel radio relay principles, visualize the giant this radio relay would become within the following two years. With design based in general upon their equipment, but incorporating many new features such as provision for three two-way telephone conversations and up to twelve two-way teletype conversations simultaneously over one radio relay system, demands from the overseas combat forces for the new standard equipment have poured in to the extent that there is now available for use enough gear to provide a circuit mileage running well into six figures.

Looking into the future, one can readily visualize radio relay for radio amateurs in the postwar era, providing solid communication over hundreds and perhaps thousands of miles on v.h.f. — wholly unaffected by the vagaries of propagation normally encountered in our conventional DX bands on the lower frequencies.
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Splatter

(Continued from page 60)
tenna design—and has worked on all bands. Almost equally a motorcycle enthusiast, OM Kahn has employed this hobby also to good advantage during the war. His flying figure thundersonly the bike between the three Electro-Voice Mfg. Co. plants is a familiar sight on the highways and byways around South Bend, Ind. . . . John G. Marshall, W9ARL, whose contribution to the art of antenna matching starts on page 23, received his first license in 1930 with the call he still holds. His earlier amateur activity was on 7 Mc., but for six years before Pearl Harbor he was to be found exclusively on 14- and 28-Mc. 'phone and c.w. On the rolls as Century Clubber No. 18, he participated in the 1937 and 1938 DX contests. In 1938 he was national fifth place winner—and the leading W9. DX being his chief interest, it was only natural that most of his experimenting has been in connection with directional antennas. W9ARL holds a radio telephone first-class license, and for a short time he served as a civilian radio instructor for the Enlisted Reserve Corps of the Army Signal Corps when it was active in 1942. More recently he was discharged from the Navy, having served in that branch of the service as a radio technician. . . . Capt. Oliver D. Perkins, ex-W7MH-W7NK, operated exclusively on 7- and 14-Mc. c.w. from 1925 to 1938. Interspersing ham activity, brass-pounding aboard WGX and KUTG, local b.c. station KOAC, and the addition of an XYL with his higher education at Oregon State, he received a B.S. degree in communication engineering and a commission in the Field Artillery Reserve in 1931—adding an M.S. degree in physics in 1933. On becoming a professional engineer in 1934, Perkins served as an engineer at KOIN in Portland, and later as consultant for KGU, Honolulu. Entering Civil Service in 1936 as a radio engineer with the Signal Corps, his duties took him to Washington, Fort Sam Houston, and Fort Shafter, T. H., doing engineering and installation jobs including some of the first Army Airways Communication System radio nets. In 1940 W7NK was transferred to the Signal Corps Engineering Laboratories to develop vehicular radio equipment for combat troops. Donning a uniform in 1942, some of his subsequent activities are discussed beginning on page 11 of this issue. Now on the Engineering Staff at the Headquarters, Signal Corps Engineering Laboratories, Capt. Perkins' personal postwar plans naturally include a prompt return to the ham bands.

Two old-timers—so far as QST appearances are concerned—return this month with the by-lines of Paul J. Palmer, W8UGR (Splatter, January, 1943, p. 16), appearing over a description of another QSL-type rig (p. 18), and of Philip S. Rand, WIBDM (Splatter, November, 1942, p. 12) atop a discourse on choosing u.h.f. sites by plotting favorable transmission paths on contour maps (p. 16).
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