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QST

devoted entirely to

amateur radio

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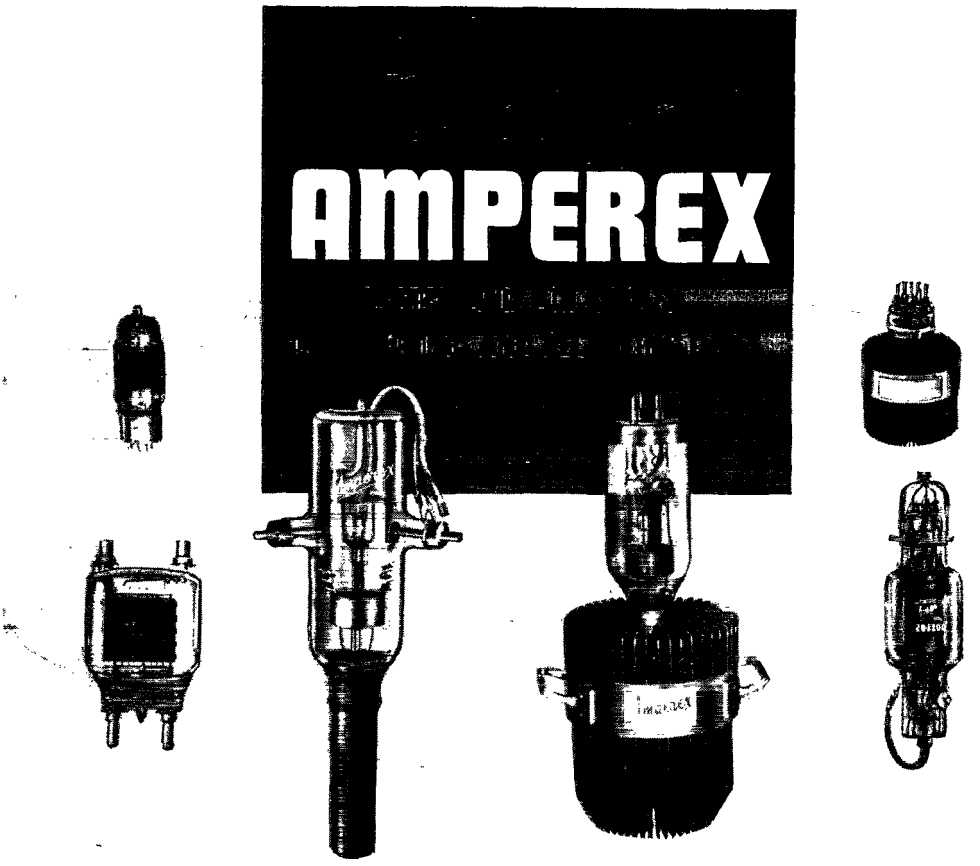
V.H.F. Ground-Plane Antennas

New Tubes • A Better Electronic Key

QST Voyages on a USMS Training Ship •

Volume Expander for Record-Player Amplifiers

AMERICAN RADIO RELAY LEAGUE



Colloquially speaking, we of *Amperex* have "broken our necks" to provide dependable service to our customers during these war years. This statement, we feel sure, will be supported by those who have made us their source of tube supply. Important to note is that the "Amperextra" of dependable service has been matched by the "Amperextra" of dependable quality. In commercial broadcasting — AM, FM, Television — in electro-medical apparatus, in communications systems, in industrial applications, *Amperex* tubes have delivered and still are delivering high efficiency over a longer period of time. The *Amperex* Application Engineering Department, another "Amperextra", will be glad to work with you on present or postwar problems. *This is Service.*

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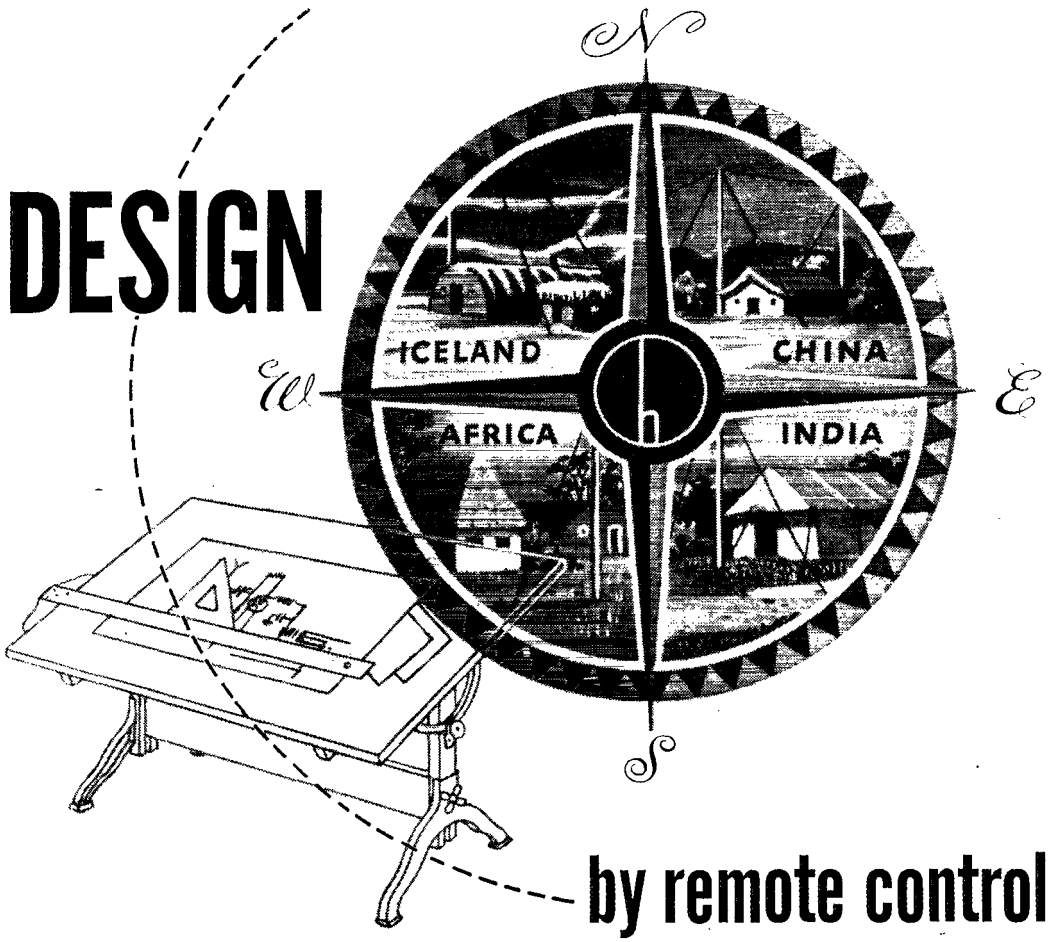
WASTEPAPER IS VITAL WAR EQUIPMENT...SAVE EVERY SCRAP

DESIGN



by remote control

The design of radio equipment that will come from Hallicrafters is already shaping up – determined largely by thousands of hams who, from their remote control locations all over the world, are sending advice and suggestions on new radio ideas to Hallicrafters engineering department.

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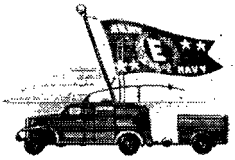

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AUGUST 1945

VOLUME XXIX

NUMBER 8

★

★

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QST *devoted entirely to*

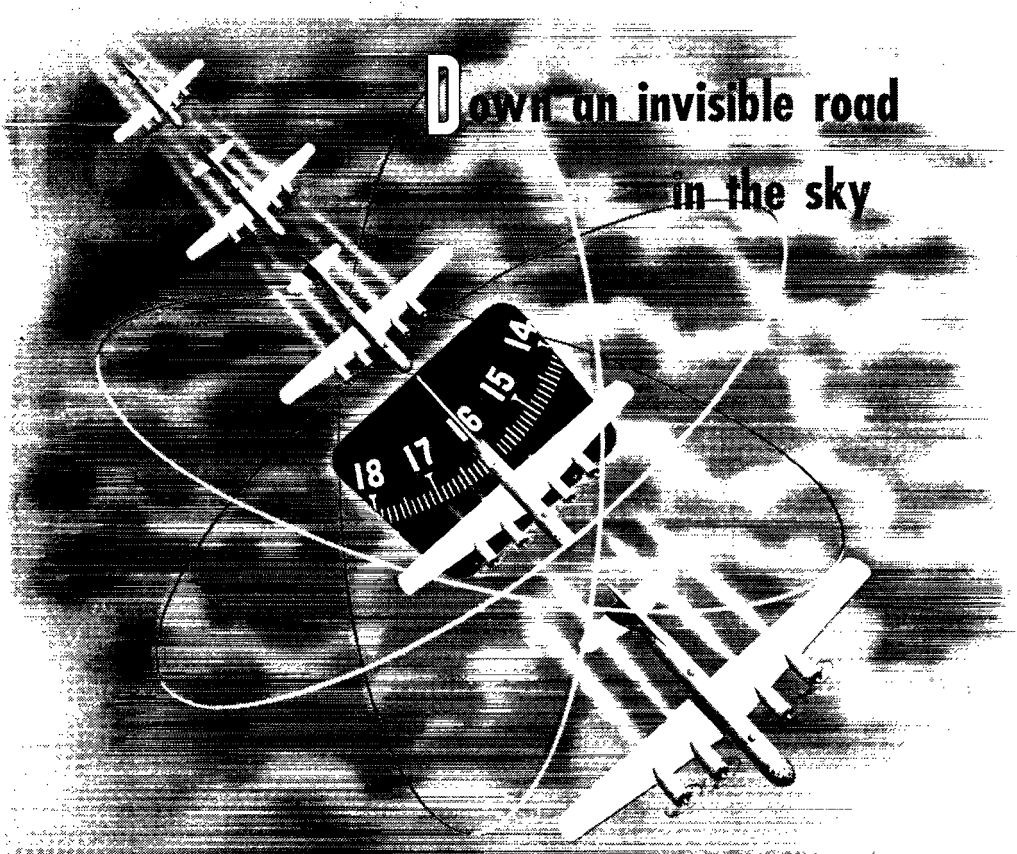
AMATEUR RADIO

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

CONTENTS

¶ All material appearing in *QST* conforms with the "Code of Wartime Practices for the American Press" of the U. S. Office of Censorship.

¶ All material involving military security has been reviewed by appropriate military, naval or other competent authority.



There are no road signs on clouds, yet Allied fliers, aided by electronic impulses, are daily arriving over the target after long flights over endless water. On accuracy in aerial navigation depends the success of a bombing run on Tokyo—and a safe return home. High-frequency impulses assure steady communication, aid in locating planes and ships, and coordinate movements of aircraft, armies and ships. Delco Radio Division is proud of its contribution to final Victory through the development and production of compact mobile radio sets and highly specialized electronic and radar equipment. Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

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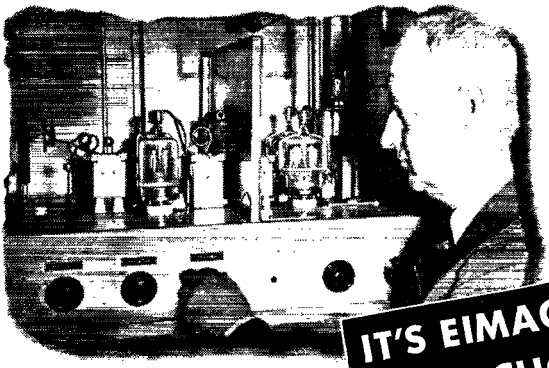
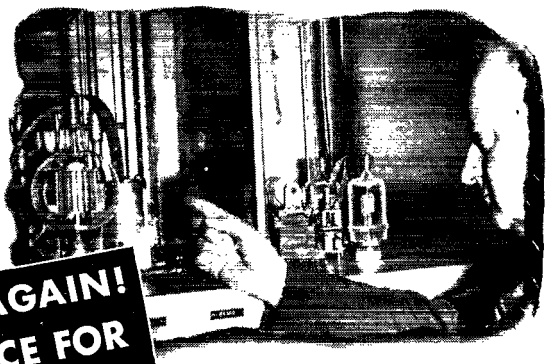
WAR BONDS ARE FIGHTING BONDS

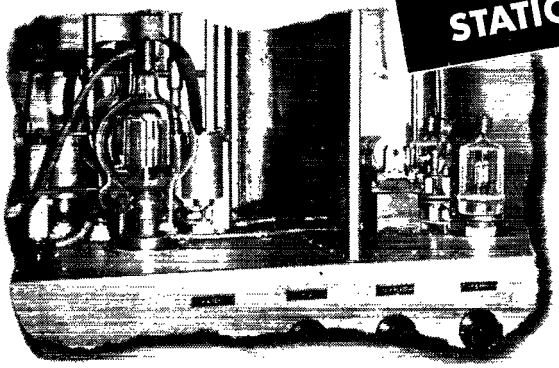


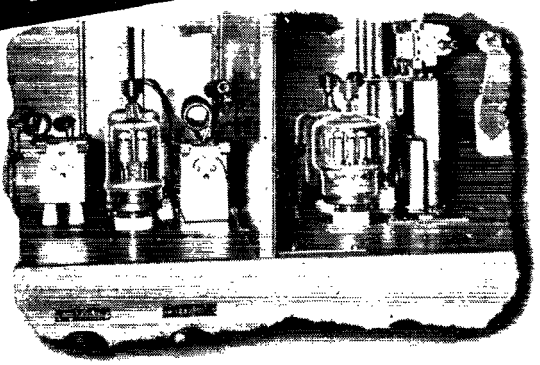


IT'S EIMAC AGAIN! FIRST CHOICE FOR THE KEY SOCKETS AT TELEVISION STATION WBKB

A. H. Brolly . . . Chief Engineer of Television Station WBKB, Chicago, adjusts the grid circuit of the Eimac 304-TL's in the Class B linear stage of the video transmitter.

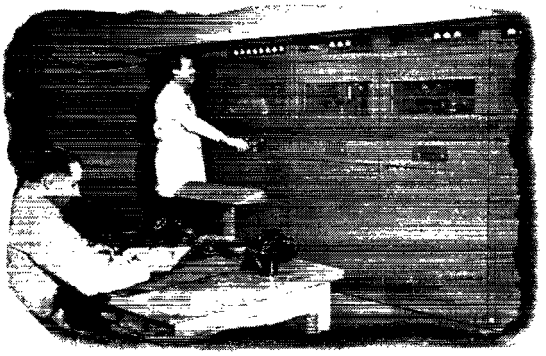
Mr. Brolly calls attention to the Eimac 1000-T's in the final stage of the Audio FM Transmitter which operates at 65.75 megacycles. It is a very stable amplifier of good efficiency.





The video transmitter operates at 61.25 megacycles; peak power output is 4 KW which provides a television service throughout metropolitan Chicago and reaches suburbs out to 35 miles or more.

Eimac 152-T's are used in the modulated stage and 304-T's in the first Class B linear amplifier of the video transmitter.



E. F. Cawthon and W. R. Brock are operating the station which has been broadcasting television programs with the present equipment since 1942 and began operation on a commercial schedule in October, 1943.

Grid modulation is employed at WBKB and a broad band of frequencies must be passed in all stages following the modulated amplifier. Multiple-tuned resistance loaded coupling circuits are used between stages.

Performance, stability, dependability are good reasons why Eimac tubes are to be found in the key sockets of the outstanding new developments in Electronics. Balaban & Katz, owners of television station WBKB of Chicago, offer potent confirmation of the fact that Eimac tubes are first choice of leading Electronic Engineers the world over.

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

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THE AMERICAN RADIO RELAY LEAGUE, INC.,

is a noncommercial association of radio amateurs, bonded for the promotion of interest in amateur radio communication and experimentation, for the relaying of messages by radio, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

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

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

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

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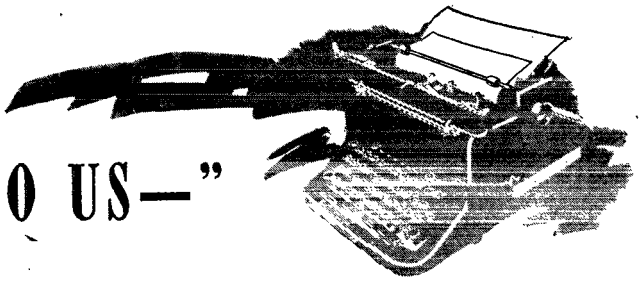


"IT SEEMS TO US—"

INVENTORY

A LOVELY idea of ours has gone phut, invalidated by nothing but the march of time. We want to tell you about it because it is time we all changed our thinking about a certain aspect of amateur radio — the relative widths of our bands.

Many years ago we acquired the ambition to publish a better spectrum chart — one that would portray the radio spectrum accurately from the physical standpoint, which was something that had never been done. We collected a file of data. We even made a rough model, about fifteen feet long, covering the then known spectrum up to 100 Mc. In those days all oscillators were unstable, and instability was a percentage of frequency, so the number of kilocycles necessary to support a signal varied directly with the frequency, and the higher the frequency the wider the "channel." The Federal Radio Commission had recognized this by adopting a channeling system in which each channel's width was approximately 0.2% of the frequency, and had recently doubled the number of available frequencies by deciding that it was safe to go to 0.1% channels. But they only approximated it. For administrative convenience they would make all channels of a width, say, of 5 kc. for a certain stretch of spectrum, then abruptly change to 10-kc. channels for a bit more, then go to 15 kc., and so. This arbitrary action wasted space, we said, and gave a false impression of the actual contents of the spectrum, the actual widths of the bands assigned various services. From the standpoint of physics we wanted a count of the actual number of channels in the spectrum, each exactly 0.1% of its center frequency, and we then wanted to lay out our chart absolutely to scale, so that one could place a scale on the chart and see that from the physical standpoint the number of potential channels between two specified frequencies was so-and-so, neither more nor less. We were greatly intrigued with a table prepared by Colonel (then Major) Wm. R. Blair at Fort Monmouth, who put the formula for a spiral in a computing machine and ground out five columns of typewritten figures in a tabulation eleven feet long, listing exact center frequencies for potential channels, each exactly 0.1% greater than its predecessor. It provided excellent data for the construction of our chart.

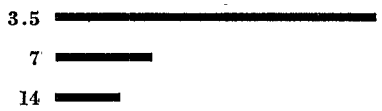
We never found the time to finish the job and meanwhile the art made strides. Our old notes remind us that we intended to conclude our projected *QST* article on the subject by emphasizing the importance of all work to improve stability, so that the art could escape this geometrical ratio. We would aspire to the day when this chart became junk, when every kilocycle accommodated its station, and when the usefulness of a band could be measured directly by its width in kilocycles.

Well, the idea is junk now. Remember all the charts that have been drawn to show the relative widths of the amateur bands in terms of their harmonic relationships? They are still useful to see at a glance what frequencies can be covered by a given crystal but their usefulness beyond that point has now ended. It is true, of course, that in terms of a constant percentage of instability of oscillators, a band 100 kc. wide at 1,000 kc. will accommodate three times as many stations as a band of the same width at 3,000 kc. — assuming that this instability is of significant magnitude. But this latter assumption isn't true. Transmitters are of such stability these days that the allocation philosophy has changed with respect to frequencies at least as high as 50 or 100 Mc. The commercials and the Government services have shoved in extra stations in all their channels — they've had to. Even an amateur transmitter of just ordinarily-good stability does not vary significantly during a given transmission. Gone are the days of thinking that a channel at 25 Mc. must be five times as wide as one at 5 Mc. Selectivity throughout the high-frequency part of the spectrum is to be thought of in terms of beat-note separation, an arithmetical separation constant for all bands. Say a thousand cycles for c.w., or even 100 cycles for a sniggle-snooper cranked up to maximum; or say a constant 6 kilocycles for 'phone. Therefore in the modern approach a hundred kilocycles in one part of the h.f. range is about as good as a hundred kilocycles anywhere else in that range. Somewhere above 50 Mc. the philosophy changes and allocation people are still willing to think in terms of a constant percentage instability until the art makes further progress.

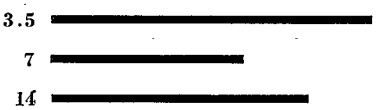
But in the h.f. range, where our DX bands lie, experts now multiply the necessary band of emission by the desired number of channels and say that they need an allocation so wide,

regardless of location. For instance, "We are requesting 92 channels, totaling about 600 kilocycles." And all this comes about because the instability of ordinary gear is now insignificant in this part of the spectrum. A kilocycle is a kilocycle.

Now recall again those prewar amateur band charts. Remember how we've always thought of "80–40–20" this way?:



This figure says that "80" is a great wide band but that "40" is only three-tenths that wide and that "20" is only two-thirds as wide as "40". That was an entirely accurate rendition in the days of wobbulated oscillators. Except when something is temporarily out of kilter we never have such a condition now, and any such signal is in violation of regulations. Our short-term stability is excellent from the simplest equipment that has any chance of compliance. These frequencies are practically d.c. when looked at postwarwise — what's a mere matter of fourteen million cycles per second? The business of separating signals in all these bands is a question of beat note, an arithmetical or audio difference between signals, constant over the whole range. Now that we know that the technique assures us stable oscillators in both transmitters and receivers, we can and should look at these bands purely in terms of their widths in kilocycles. This way:



"20" isn't our narrowest effective bandwidth after all, we now see. It has 400 kc. to the 7-Mc. band's 300 kc., in actual effective usefulness. And both of these DX bands are properly to be regarded as having a much greater effective width than our prewar thinking accepted. Moreover, if we get a new band at 21 Mc., and supposing it's only 500 kc. wide, it's not to be thought of as a tiny smidgin in the top figure but as a long line in the bottom figure — exactly as long as the line for the 3.5-Mc. band.

Thus does improved technique help to solve the problems of congestion, in amateur radio as in all the art. But to realize these potentialities we must have good oscillator stability, so plan that postwar station well and prepare yourself to be content with nothing short of practical perfection. K. B. W.

★ SPLATTER ★

OUR COVER

TRADITIONALLY, summertime at ARRL Hq. is synonymous with the construction program for the annual edition of the *Handbook* — and so it is this year. Though necessarily somewhat restricted during these war years, this activity still goes on. Here Asst. Technical Editor J. Venable Fitzhugh and Frederic B. Albright, our up and coming lab technician, are putting the finishing touches on a new "zero-drive" beam-tube amplifier in *QST*'s transmitter lab.

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FOOTNOTES

THOUGH the recent years have been ones of war and consequently curtailed amateur activity, an astronomical number of dots and dashes have been transmitted through the ether since the peaceful (in the U. S.) springtime of 1940. Moreover, the character and quality of many of those dots and dashes have been determined by electronic gadgets based, in part at least, on ideas set forth in an article by **Harry Beecher, W2ILE,** in the April, 1940, issue of *QST*. For the electronic key as we know it was originated by Beecher. Shortly before his article appeared, OM Beecher asked the ops at W1AW to be on the watch for his signals and to listen for some pretty classy didahs — electronically controlled! The signals were reported FB, and the article followed. The result is history! W2ILE knew that his ideas were patentable but he chose to release them, unhampered, for the use of the entire radio gang. He felt that he, himself, owed much to amateur radio and that this was one way he could repay that debt. Recently Beecher, now an RM1c in the Navy, visited Hq. while on leave and brought with him the latest model of his electronic key, which is described on page 44. In the five years between Beecher's two *QST* appearances, seven other articles on electronic keys have been presented in these pages. He really started something! Beecher has long since departed for the South Pacific aboard his frigate which, according to him, is just an "overgrown corvette." Well, we don't know about Beecher's sea-going definitions, but we do know that a lot of postwar ham dots and dashes will be controlled by his ideas on electronic keys. . . . In the January, 1925, issue of *QST*, page 21, there appeared an article entitled "Mercury Arc Rectifiers," by Earl D. Smith, 3PZ-3XO. Now in this year of 1945, on page 28 of this issue, there is an article on ground-plane antennas by **E. Dillon Smith, W3PZ.** Yes, you've guessed it. They are one and the same man, except that W3PZ has packed a tremendous amount of study and work into those intervening twenty years and can now add B.S. and M.S. and Ph.D. after his name, by virtue of engineering degrees received at Iowa State and

(Continued on page 92)

FCC Allocates 44–108 Megacycles

Our 5-Meter Band Becomes 50-54 Mc. in Speeded-Up Action; Television Gets Low End; F.M. Moves Upstairs

OUR postwar 5-meter band is to be 50 to 54 Mc. It is now definitely allocated and you may plan your postwar gear accordingly. Our neighbors remain the No. 1 and No. 2 television channels.

Unexpectedly, FCC took up the unallocated range 44–108 Mc., held further argument, and on June 27th announced its decisions, effective immediately:

44–50 Mc.	— Television, Channel No. 1
50–54	— Amateur
54–60	— Television, Channel No. 2
60–66	— Television, Channel No. 3
66–72	— Television, Channel No. 4
72–76	— Non-Government fixed and mobile. Aviation markers remain at 75 Mc. as long as necessary
76–82	— Television, Channel No. 5
82–88	— Television, Channel No. 6
88–92	— Noncommercial educational f.m. broadcasting
92–106	— Commercial f.m. broadcasting
106–108	— Facsimile broadcasting

In last month's issue we told you what everybody believed and what FCC announced, that it would wait until autumn to decide its allocations of the range 44 to 108 Mc., after running transmission tests on f.m. during three summer months. WPB had said that FCC was safe in delaying, since the release of raw materials was not imminent and 90 days' notice could be given if any change loomed. Then things began to happen. Cut-backs and labor lay-offs commenced in the industry. WPB told FCC it could no longer guarantee the 90 days and that materials might be released very soon. FMBI, TBA and RMA petitioned the Commission for the immediate adoption of Alternative No. 1 for these frequencies — see table in July *QST*, page 13. The industry wanted to get rolling. RTPB Panel 2 polled its members and found a heavy majority for this alternative (although ARRL was one of four dissenters). There was increasing technical evidence in favor of Alternative No. 3. So FCC suddenly announced a further oral argument before the *en banc* Commission to permit an immediate decision on which of the three alternatives to put into effect at once.

Argument was held June 22nd–23rd and what we mean is it was argument. From the first, the problem in this range has revolved around the question of the best place to put f.m. broadcasting. Unlike the other services, f.m. has no other allocations and this one must be good — permanent and as free from shortcomings as possible. Commission engineers have long felt that f.m. must go up to escape transmission vagaries. The industry, for reasons of its own, wanted to stay where it was. As the final argument opened, the Commission staff played a recording of Paxton coming in at Grand Island on Sporadic E, 1370 miles, and showed field-strength recordings made in recent days of f.m. skywave transmission at considerable distances. Propagation experts testified pro and con; but, as FCC says in its report, "In those cases where exception was taken, no substantiating data were offered." The Commission was alert and tough, questioning witnesses closely to get at the truth and roundly castigating some unrealistic industry spokesmen who only knew that they wanted what they wanted because they wanted it. Again quoting, "the Commission has a duty to consider the long-range effects of its action as well as the effects during the months immediately ahead, and it does not propose to provide an inferior f.m. service during the decades to come merely because of the transitory advantages which may be urged for an inferior type of service." It was, definitely, a good show.

Four days later FCC announced its decision. Alternative No. 2 (page 13, July *QST*) was regarded as unfeasible and the choice lay between Alternatives 1 and 3. The decision was for Alternative No. 3 with a modification that transferred the non-Government fixed and mobile services from 104–108 Mc. to 72–76 Mc. and moved f.m. up 4 Mc. higher than originally contemplated in that alternative. Quoting the Commission report:

> The advantage of this change is that it makes possible immediately the use of all 13 television channels below 300 Mc. Under Alternative No. 3, as originally proposed, the entire 6-Mc. television channel between 72 and 78 Mc. could not be used until the aviation markers centering on 75 Mc. were moved. The non-Government fixed and mobile services are not under the same disability. They can use the entire band between 72 and 76 Mc. at once, with the exception of approximately one-half megacycle in the vicinity of 75 Mc. to protect the aviation markers.

Alternative No. 2, which retained our 56–60, never had a chance. Between the other two, we were strongly for No. 3, our Board having previously approved 50–54 as certainly preferable to 44–48. So we have got our band where we want it, as part of a decision which followed the most thoroughgoing study of allocation problems ever undertaken. Though it took plenty of courage for the Commission, under the circumstances, to make the decision it did, we are confident that it well serves the long-range interests of the art.

In this proceeding the interests of amateurs were again looked after by the Segal-Warner team. For a variety of reasons the League came out strongly for Alternative No. 3. Believing our

members interested in what ARRL says in their behalf, *QST* has frequently published the testimony of our witnesses. Following is the statement of Secretary Warner in this matter:

On behalf of the amateur service the American Radio Relay League wishes to make a brief statement of its preferences in the matter of the several alternatives now before the Commission, and to give the reasons therefor.

When we were last before you in this matter your proposals for the allocation above 25 Mc. were the subject of oral argument. You proposed to shift our band of 56–60 Mc., the first allocation ever made to a radio service in that part of the spectrum, to 50–54 Mc. We said, in effect, that we would embrace and accept that proposed shift but that it must be regarded, for reasons that we cited, as the limit of acceptable displacement. Today there are before you three alternative proposals, this one and two others, one of the latter involving a suggested amateur allocation at 44–48 Mc. which we have previously deplored when it was in a much more tentative stage. (Tr. 4987–4992.)

We remain altogether of the convictions previously expressed to you. From our standpoint as amateurs we do not like Alternative No. 1 but would willingly embrace either Alternative No. 2, which provides the existing amateur band 56–60 Mc., or No. 3, which carries the allocation we have previously agreed to accept, 50–54 Mc. Alternative No. 1 is decidedly distasteful to us because it would move the amateur band to 44–48 Mc., and we would much prefer not to move below 50 Mc., if move we must. We cite the following reasons:

1) We have done much previous work, before the war, in the vicinity of 56 Mc., observing and studying the behavior of these waves. We regard that job as incomplete and we hope that the frequencies on which we work after the war will be so nearly the same that the results will be strictly comparable, so that they may be added to the story of what has gone before to yield eventually a complete whole. We consider 50 Mc. the lowest frequency to which we could move and still permit this continuity.

2) The frequencies in the vicinity of 56–60 Mc. have a particular interest for amateurs because they are located at what seems to be a unique transition spot in the spectrum. Sporadic E transmission occurs with just sufficient frequency to maintain amateur interest at white heat, and such frequencies are near the top limit of where F_2 transmission ever normally occurs. We have previously characterized the performance of this band to you as being erratic, unpredictable, unreliable and unexpected, a band where anything can and generally does happen; and we have explained to you that its very eccentricities give it a peculiar charm for us, though they make it singularly bad for regular service. If the assignment were moved to 44–48 Mc. it would be in a region where both Sporadic E and F_2 transmission occur with such frequency that they would possess small novelty and much of the eager interest of amateur observers would disappear. The band would be neither fish nor fowl and would be regarded simply an exceedingly unreliable long-distance band. Although not at issue here, we remark that a move of similar proportions upward in frequency would similarly reduce the band to substantially a line-of-sight band, where these transmission vagaries occur with insufficient frequency to reward even the persistence of an amateur. We mention this to underline our statement that the region 50–60 Mc. seems to be the borderland possessing a unique attraction for us because of its unreliable properties.

3) The traditional separation between amateur bands has been an octave. We value this to permit the uniform sampling process we have previously described to you. You have now given us allocations at 28–29.7 Mc. and 144–148 Mc. Should you now move the band under consideration to 44–48 Mc. it would be much too close to the first-mentioned allocation, much too far from the second. Either of your other alternatives much better fits our requirements in this respect.

Thus we find ourselves in strong objection to the amateur provisions of Alternative No. 1 and satisfied with either No. 2 or No. 3. There is an additional reason why Alternative No. 3 would be the best from our standpoint:

Large numbers of amateurs and f.m. listeners are going to live in close proximity in postwar days. Many low-cost f.m. receivers inevitably will possess inadequate preselection and shielding and consequently will have inadequate image suppression. Receivers for the postwar f.m. band will have to employ an intermediate frequency of at least 10 Mc. Under either Alternative No. 1 or No. 2 such receivers, as customarily built with the oscillator on the low side, will inescapably pick up interference from neighborhood amateur stations, though the emissions of the latter be pure and on frequency. It seems to us that this can become a difficulty of great magnitude. We point out that it could not occur under Alternative No. 3, because of the considerable separation between the amateur and f.m. assignments.

We have the further objection to Alternative No. 1 that, as observers of the art, we consider it provides an unwise assignment for f.m. broadcasting. Because of the close-down of amateur radio and the dispersal of its personnel to war tasks, we have been unable to contribute any particularly pertinent quantitative data to your technical studies. But it requires no deep lore or complicated calculations for the practicing amateur to feel with conviction that the allocation of 50–68 Mc. to f.m. would be quite unfortunate. Considerations of tropospheric and F_2 transmission, we think, can be ignored beside the much larger fact of Sporadic E. Without being able to cite figures, any amateur who has been active in the 5-meter band simply knows from experience that Sporadic E occurs with sufficient frequency and for sufficient duration to make a shambles of that projected band for days on end. Any person, amateur or not, who has heard Sporadic E bring in signals of local strength from a thousand miles away, on the humblest receiver, knows that considerations of Sporadic E alone compel the location of this service at a frequency sufficiently high to prevent this phenomenon from reaching it. To our mind, the problem is just that simple.

Opposing Alternative No. 1, we repeat our acceptance of and approval of Alternative No. 3.

Strays

The beginning of the Sporadic E season here was May 7th when I heard WSM-FM and WBRL(?). The latter faded out before an announcement. There also were some stations around 39 Mc.

— *Bill Tynan, Chestertown, Md.*

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Calls beginning with A and B have never been assigned to countries, having previously been reserved for the international code of signals. The United States and Great Britain both having run out of calls, they intend to apply for these respective letters at the next international conference, and meanwhile have tentatively begun their assignment. You can hear some of them on the air. Easy to remember: A for America, B for Britain.

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One of the New Jersey communities wrote to the FCC making inquiry about using the new Citizens Radio communication band, 460 to 470 Mc., for their volunteer fire department. In reply they received a letter from the FCC enclosing a report of the frequency allocation hearings, a condensed book of rules and regulations for municipal radio systems and a book on *astrology!* It appears that at last some one in the FCC has hit upon the proper tool for interpretation of government rules and regulations.

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Coincidence: At the same time our ITS department was answering a letter from *W9OPA* a similar letter was being written to a *Roger Wilco!*

QST Goes Voyaging on a USMS Training Ship

Four Days Aboard the "American Navigator"

BY A. DAVID MIDDLETON,* W2OBN

U. S Maritime Service photographs

HAVE any of you land-locked brass-pounders ever wondered what it would be like to walk up the gangplank of a sea-going ship and sail as a full-fledged "Sparks?"

Well, this Indiana-born amateur often dreamed of such an adventure, but it took a lot of waiting until the big moment came — and then the "operator" part was only simulated. But even though it was only "make believe" — that part about being the ship's radio operator — most of the thrills were still there.

This is the way it happened. And these are some of the things I saw and did.

Remember those articles by Rodimon[1] and DeSoto[2] about the U. S. Maritime Service radio operator training program at Gallups Island? And the story in *QST* a year ago[3] telling about the cruise Clint DeSoto and Cy Read made on the *American Mariner*, a Liberty ship converted into a USMS training ship? These articles, and especially that last yarn, made such a hit with the U. S. Maritime Service people that they invited *QST* again this year to send a representative for a four-day "sample" cruise. This trip, from Baltimore to Boston, was made as a preliminary to the celebration of Maritime Day, during which period one of their finest training ships, the *American Navigator*, was open for inspection by a keenly interested public at Central Wharf in Boston Harbor.

So, on the night of May 13th, I stepped from a taxicab in front of Municipal Pier No. 1 on East Pratt street in Baltimore and approached the barred gate. After the guard checked my credentials I was admitted and courteously shown down the dim length of a warehouse, up a gangplank, through the *American Engineer*, to my ship, berthed on the port side of the *Engineer*. Two USMS trainees followed me aboard and carefully saluted as they stepped onto the *Navigator*. In fact, one of the boys, slightly confused, saluted twice, once towards each end of the ship — "Just in case," he said.

The business of logging me aboard, the passing out of a padlock and key for my clothes locker and a cheerful "Glad to have you with us, sir" from the master-at-arms took only a few minutes. I was then conducted to the forecastle where the visitors were quartered. There I found row after row of three-tiered steel framework beds. Being an early boarder, I had a choice of a location. Choosing a "lower," halfway between a ventilator and a porthole, I matched the number of my bunk to the proper locker and stowed my gear.

All night long the forecastle was aglow with both lights and noisy excitement. Both trainees on liberty passes and visiting civilians straggled in all through the night, with a large contingent of Boston newsmen arriving noisily very early in the morning. All in all, that first night aboard ship was like I have imagined it would be to have a bunk set up in the middle of Grand Central station or at the corner of Hollywood and Vine — but without any YLs.

Daylight brought real activity as all hands hit the deck, shaved, washed up, and ready for

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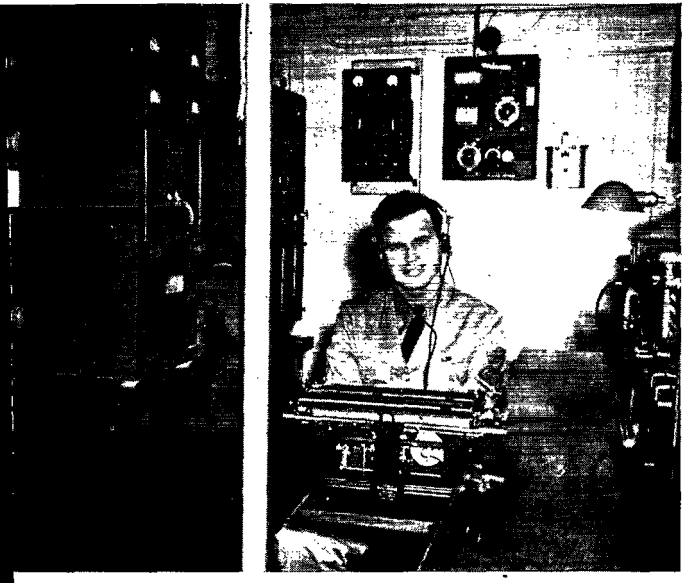
* Assistant Editor, *QST*.

[1] Rodimon, "QST Visits Gallups Island," *QST*, June, 1941, p. 9.

[2] DeSoto, "QST Returns to Gallups Island," *QST*, June, 1943, p. 14.

[3] DeSoto, "QST Cruises with the Maritime Service," *QST*, July, 1944, p. 9.



The radio shack aboard the *American Navigator* with Chief Radioman Francis V. Guidice at the mill. At the left stand the three RCA transmitters. The battery power-panel and the emergency transmitter are fastened to the bulkhead behind the operator.

breakfast. Funny thing — neither that morning nor at any time on the cruise did I hear any "chow bell." The ship's company — and the visitors — all seemed to know when and were ready for the line-up preceding those swell meals which appeared at regular intervals.

After a breakfast just as good as I have at home, I went topside to see what was going on. Imagine my surprise when, as I puffed up the last ladder (stairway to you, landlubber), I walked past a cabin marked "Ship's Office," and there, right in front of me, was a door over which a sign read "Radio Room." The door was locked. I looked in and saw a neat line-up of receivers, a mill, a trio of capable-looking transmitters — but no operator.

I moved on past the shack and the captain's office and stood by the wheelhouse watching the waterfront scene. The ship was preparing to sail and there was much of interest to be seen and heard. I kept one eye on that door leading into the radio room and one on the proceedings below (a most difficult feat) and before long I saw a man approach the radio room door, a cheerful-looking chap dressed in a neat khaki uniform and with a chief's chevrons bearing the familiar lightning streaks in the center.

I Meet a Gallups Island Graduate

Was he the radio man? He was, and very proud of it, I could see as we exchanged introductions. "So you're from ARRL?" asked Chief Radioman Francis V. Guidice, of Edgewood, Md., with a friendly twinkle in his eyes. "Yes, I'm W2OEN from *QST*," I told him. "How about you — a ham?" "Nope," answered Guidice. Then he gave that classic retort one hears from so many of the fellows these days — "Nope, I'm not a ham, but you can bet I'm going to be!" And with his next breath he said, "Come on into the shack!" And you can bet I did.

The ship somehow got under way, right on the dot of 8 A.M. — without my assistance. I thought I heard the skipper call for me once or twice, but I was too busy getting acquainted with the radio shack and the chief. He said that they often navigated without his assistance, either, so it was okay if neither of us helped the captain.

After the usual verbal sparring back and forth, typical of two newly met radiomen, I discovered that here was a fellow who had a genuine love for radio, a chap who had needed only the proper training to bring out his inherent, though latent, interest in radio, with the result that the Maritime Service and the radio gang in general gained another brother-in-arms, for the good of the game. For, in the lengthy rag-chews that followed, I learned that Guidice was not a "wartime" radio man, but that he would eventually settle down in radio, somewhere and at some time in the future. It is in his blood now — and, OM, you know what that means.

Francis V. Guidice, Chief Radioman, USMS, has led a rather busy and different life these past years. Let's look at his record, and trace the trail which brought him to the radio shack aboard the *American Navigator:*

Enlisting in the Army in 1936, Francis served in the Medical Corps and received an Honorable Discharge in 1938. He then joined the Veterans Administration as a civilian medical technician. Then he transferred to the Ordnance Department at Aberdeen Proving Grounds. From there he moved to the Edgewood Arsenal where he was employed, first in Plant Security, and later in the Military Intelligence and Internal Security section. When f.m. radio equipment was installed at the Arsenal, he became radio supervisor on his shift and started on his radio career.

In 1943 Guidice rejoined the Army as a volunteer officer candidate in the Chemical Warfare Service and was sent to Camp Seibert, Alabama. After he served five months the CWS quota for officers was reduced and this particular officer-candidate found himself a civilian. He rejoined the Intelligence and Security section at Edgewood Arsenal in September, 1943, and once more had the f.m. fixed and mobile radio equipment under his supervision.

In June, 1944, Guidice enlisted in the United States Maritime Service and was sent to St. Petersburg, Florida, for his basic training consisting of signaling, drills, deck training, lifeboat handling, fire prevention, general seamanship, as well as training in how to get ashore in a breeches buoy. They even taught him how to steer a ship!

After being "screened," his radio IQ was determined and he was given a lot of other aptitude tests. After successfully passing these preliminaries, Guidice reported to Gallups Island in

September, 1944. He took the full course and was graduated in April, 1945. Just before graduation he learned of a vacancy in the radio shack on the *American Navigator*, a USMS training ship assigned to Baltimore. Guidice asked for and received this assignment.

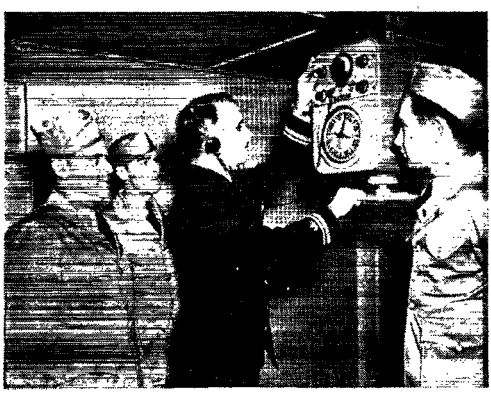
Chief Radioman Guidice is 29 years old and has been married five years. His wife and their three-year-old son live in Edgewood, Maryland. His youngster, says Guidice, is going to be an operator. Mrs. Guidice is already learning the code.

In the several days we spent together, I found Guidice an intelligent, friendly and able fellow. His sincere interest in radio and his eagerness to improve his knowledge by practice and experience will help make him a good all-round operator and, in addition, he has the qualities necessary to make a good radio amateur. His formal radio education did not stop when he left Gallups, as he at once enrolled for a correspondence course in radio theory, available to all graduated in their radio schools, by the USMS Institute.

Guidice was both a good instructor and a clever student. I found that out in our close contacts in the days that followed. He accepted eagerly the small bits of amateur radio lore that I was able to give him and likewise he was patient and thoughtful in instructing me in the various details of the shack and the duties and responsibilities therein. His equipment was in good order and both clean and neat. Obviously, he takes great pride in his work, and did it cheerfully and with an air of confidence. In the only case of trouble that arose during our voyage (a defective switch on the d.f. gear) Guidice located the trouble quickly and made temporary repairs. Then, when the d.f. was not in use, he replaced the switch as skillfully as would a veteran service man.

CRM Guidice Shows Me the Radio Shack

Now for a description of the radio shack on the *American Navigator*. The shack is located just aft of the wheelhouse, separated from it by the captain's office. The room is about 12 × 14 feet. A battery of receivers lined the shelf above the operating table extending cross-ship the width of



Officer-trainees observing the adjustment of d.f. equipment. On-the-job-training plays an important part in the USMS schooling of both officers and seamen.

A Gallups Island student-operator copying "off the air" at one of the school installations. This man will feel quite at home in front of one of these "coke-machines" aboard his ship. Many ships carry these consoles.

the radio room. There were two RC-123s (a Federal Telephone and Telegraph battery-powered t.r.f. job covering 15 to 650 kc. in four bands); two RC-105s (National HROs, a.c. operated, with complete sets of coils from 100 kc. to 30 Mc.) and a small TRC-109 (a compact Coast Guard transmitter and receiver, battery-powered, operating on a frequency range of from 2000 to 3500 kc.). In a row behind the two operating positions stood three RCA transmitters, an ET-8019 (200-watt, 2-22 Mc. c.w./i.c.w.); an ET-8010 (200-watt, 375–500 kc. c.w./i.c.w. rig), and an ET-8012-B (75-watt radiophone transmitter and receiver combination for ship-to-shore radiophone on frequencies between 2100 and 2738 kc.). On the port bulkhead hung an RCA ET-8003 (a 50-watt emergency transmitter for 375–500 kc.). Beside it on the forward bulkhead was an AR-8600 auto-alarm. Dual operating bench positions included keys, 'phone jacks, speakers and, in the center, the control panel for the ET-8003 emergency transmitter. Overhead was an electric fan, fastened to the bulkhead. Individual gooseneck lamps and ceiling lights provided ample illumination throughout the shack.

A handset and the push-button ship's PBX was conveniently located on the forward bulkhead above the center of the table. A mill and a pair of comfortable chairs plus a lot of instruction and operating notes completed the furnishings of the radio section of the room. The navigating officer had a desk and chair behind the transmitters and shared a large filing cabinet with the radioman. Off the starboard was a small compartment for storage and the motor generators. The chart room and the battery charging panels were in another adjacent small compartment. There were two entrances to the radio shack, a point that was of considerable interest and was highly approved of by this land-loving radio man, who likes two exits, — especially on shipboard.

The Ship and Her Skipper

After becoming acquainted with the radio operator and his shack I was taken on a tour and I

also picked up a few facts about our ship. The *American Navigator* is a former passenger ship, *City of Chattanooga*, converted for U. S. Maritime Service training purposes. Her 7500 tons displacement and her 52-foot beam, plus an over-all length of 401 feet, make the *American Navigator* a comfortable craft in which to travel. The 2700 horsepower available drove her at good speed, and yet to me the vibration from the engines seemed almost negligible.

The normal complement of the *American Navigator* is 25 officers, a regular crew of 109, and a large group of trainees — 400 of them — fresh from their basic training at Sheepshead Bay.

In charge of this training ship and her personnel is Comdr. Almer W. Beale, USMS, a veteran master mariner. Commander Beale is truly an outstanding example of the men who command the ships of the Maritime Service. He went to sea while still in his teens and at the age of 23 was master of an ocean-going windjammer. After a full and active experience in sail, Commander Beale turned to steam and commanded vessels on coastwise and West Indies trips. Then followed eighteen years in charge of large pleasure craft on the Atlantic coast. In 1944 he joined the U. S. Maritime Service with the rank of commander. After a special assignment at Gallups Island he took command of the training ship, *American Navigator*.

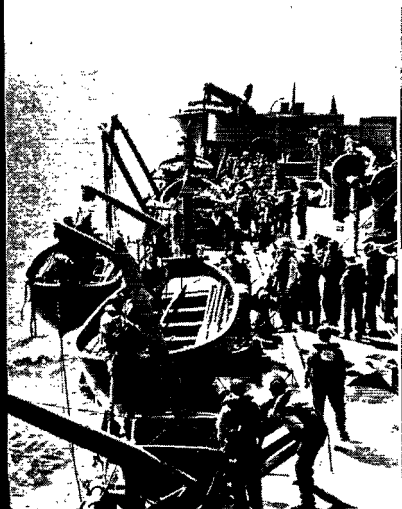
The writer watched Commander Beale at his work, during what appeared to be rather trying conditions of sea, fog and blackout. And after observing the commander and his crew perform their exacting duties, I realized that here was a skipper who knew every phase of his business. Commander Beale radiated an air of quiet competence and the "know-how" that comes only with a life full of actual practice in doing the job at hand.

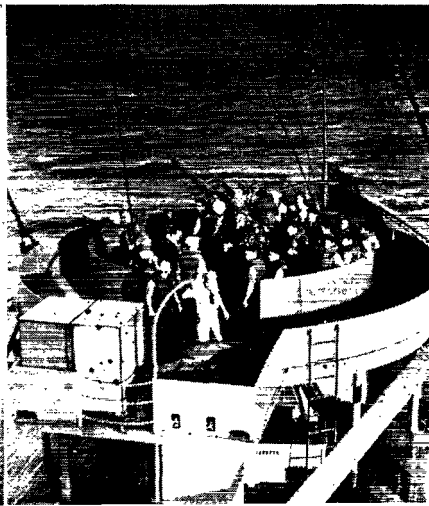
All Hands Participate in Boat Drills

Shortly after the ship was under way the visitors were issued billet slips showing our stations for the various types of emergency conditions that might prevail during the voyage. Fortunately, my station for all emergencies was in or near Boat No. 4, located on the port side of the boat deck so I had only one location to remember, and as it was directly aft of the stack, I could find it easily — or so I thought! There is something about a ship with all its compartments, passageways, ladders and hatches that addles the mind of a landlubber. Somehow I always found my station and stood by, life jacket strapped on in the prescribed manner, ready to abandon ship, put out a fire or to fend off possible boarders.

There was *no* "sham-battle air" in connection with the ship's drills, staged at least twice a day. Nor did the officers "telegraph" their alarms, but sprung the drills at irregular times, and in all types of weather. There were four types of drills practiced; Fire, Abandon Ship, General Quarters and Man Overboard. Each had its distinctive alarm and each drill requires specific duties of every man aboard, from the skipper on the bridge to the mess boys. While it was confusing to the visitors who had no previous indoctrination into the mysteries of the different alarms, there was little confusion among the ship's company! The boys clambered up those ladders, donned their jackets, manned the boats or the fire hose smartly, and with eagerness. It was the real thing to them! And to me, too. For with the first cry of "Abandon Ship," I struggled into a life jacket, scrambled (and that is fairly descriptive of 215 pounds of ham, plus a bulky life jacket, going over the side) down an unstable network of rope and wooden steps, into a lifeboat that had been hastily, yet carefully, swung out, lowered, and fended off the ship by two designated crew men. I am afraid that my presence in that ship's boat was superfluous, especially as I sat on the coxswain's feet, and must surely have gotten in the way of his sweep. But his cry of "Stand by to give way! Give way TOGETHER!— S-T-R-O-O-O-K-E!" never faltered although it was the very first time that this crew of trainees had ever put out a boat from a ship in the open sea. (They get plenty of practice from the various

Three typical scenes aboard a USMS training ship. *Left* — Life-jacketed seamen handling boats following a drill. No. 3 boat has been brought aboard and is being cradled. No. 5 boat is about to be swung inboard. Note the line-up of men awaiting their turn at the winch handle. *Center* — That ever-lovin' paint brush. *Right* — Forward guncrew standing by after readying gun in drill. Frequent practice pays high dividends later.





ships lying at dock, but this was a new experience for these men.) While a few of the men "caught crabs" they soon smoothed out and went smartly about on the pitching waves at the direction of the coxswain, a veteran of a year or two at sea.

After the signal to "Secure from drill" a roll call was made and absentees were logged for extra duty. Nor were the visitors' names omitted from this roll call. I was both startled and pleased when my name was sung out by the roll keeper, much to the enjoyment of my lifeboat mates. From this I realized that, although I was a visitor, should the occasion arise and the ship be abandoned, I would eventually be missed and my whereabouts determined! This was consoling and brings forth another interesting observation. I was usually on deck or in the vicinity of one of the speakers that sounded the alarms. But it occurred to me, what if I were asleep? Would I hear the ship's whistle, or the bells? I needn't have doubted that they had taken proper precautions in the layout of the alarm system, for once while I was doing a bit of extra sack duty in the cozy cabin Chief Guidice shared with a chief gunner's mate, General Alarm was sounded. And I don't use that word "sounded" conservatively. For, outside in the passageway, the great-grandfather of all Klaxon horns gave tongue in the loudest clatter that I have heard since I quit riding tanks over the test course at Fort Knox! Yes, OM, you'll wake up, — and how!

I observed many things during my stay aboard the *American Navigator*, but there is one thing that I'll remember a long time. That's the wonderful patience and persistence of purpose of the various officers, both commissioned and noncommissioned, in charge of the trainees and the crew. Their comments and corrective measures were employed with what appeared to be kindness and a sincere interest in the welfare and instruction of all hands — a particular trainee as well as his companions. While there were sharp orders given, not once did I hear what is usually called a "bawling out." Both the men and the officers were doing their best, and were respected for it. Some of the petty officers told me that they had attempted to obtain transfers from the training program to a more active duty but having been denied the transfer, they had pitched in to do all they could to speed the training and to make better seamen of the trainees.

Action on 500 Kc.

But avast this landlubber talk! Let's get back to the radio room. What was going on, and what did we do? Well, to be perfectly truthful, we didn't do very much. We listened on 500 kc., copied some weather, picked up some transmissions from other ships to the shore stations and kept up the log. Several times we attempted to put a call through to the home port of one of the newsmen but all attempts were foiled by the marine telephone operator whose final words were, "What is the code word for today?" and since this was not available, the newsman was

Helmsman on the flying bridge of the *American Navigator*. His white cap indicates that he is a member of the regular ship's crew. The trainee standing forward is a "talker," equipped with a telephone headset. His job is to relay orders from the bridge to the helmsman.

turned away each time. This little activity on the ship-to-shore radiophone was all the transmission we had. There stood those two beautiful 200-watt c.w./i.c.w. jobs ready and able to get to work, if we needed them, under the call WFCL. As for me, I got a great kick out of copying on 500 kc. Honestly, I had never before listened to 500 kc. for more than a few minutes at a time. I was amazed at the signals we heard, and particularly thrilled by the fist of one op at WSL, obviously an old-timer. You could almost taste the salt on his fist! Some of the ops on the other ships were having a bit of trouble at times, but for the most part it was snappy, clean-cut and intelligent operating. I jumped a foot at the first CQ I heard. I had almost forgotten what a CQ sounded like! No, OM, we did not answer those CQs of WSL and the others, as coaxing as they sounded!

There was another piece of radio gear aboard, a lifeboat transmitter, a USCG TPC-119. This compact little unit has an output of 5 watts on 500 kc., with the equipment and accessories entirely self-contained in a water-tight chest about 15 × 24 × 8 inches. It appeared foolproof and is a simple gadget to get into operation. The storage battery is good for several hours intermittent automatic transmission for which no code knowledge was necessary (for SSS or SOS).

A USMS Training Ship Is a Complex Institution

This *American Navigator* is a thoroughly equipped training ship, having large school rooms below deck, with ample instruction facilities completely outfitted with wall charts, silhouettes,

rope-knot charts, flags, and even a complete lifeboat of the latest type in which dry drills were held regularly. Another item in the below decks classroom was a working gunbreech, for loading practice. There were several small booms, rigged with tackle for demonstrating that type of operation. These classrooms were in use most of the time. Work below was followed by actual practice on deck, while the lessons were still fresh in the mind of each trainee.

The trainees stand regular watches and assist in every type of work on the ship. Their duties include both deck and engine room watches where they get actual on-the-job instruction from experienced crewmen and officers in charge of every type of work. In addition, I watched the lads paint the deck, putty sky-lights, build neat-looking cabinets in a well-equipped carpenter shop and operate the equipment in the machine and electrical shops. Well-filled lockers with all types of raw materials and fittings are available to fill the needs of almost any kind of repair. There are a lot of details to learn before one becomes a good seaman — and the Maritime Service makes sure that the trainees get every opportunity to learn the right way — doing the actual work. I saw trainees bending a line, making a splice, and sewing canvas, all in the approved and traditional sea-going manner. Not once did I see a job that appeared to be "made." All hands were doing useful, important and necessary duties. When off watch, the trainees gather in groups where smoking is permitted and chew the fat in the old familiar fashion. Some of the boys fished from the stern of the ship and I was told that sometimes they make nice catches. Their luck will soon be increased by the availability of some really good tackle to be furnished the ship by "*The Salt-water Sportsman,*" a fishermen's publication. The editor, George J. Hill, jr., ex-W1CEE and an ardent fisherman, was also a visitor aboard.

The *American Navigator*, like other USMS training ships, carries modern, fully equipped sick bays, and a dental office that smelled just like Doc's down on the corner. There is a barber shop (haircut — two-bits), a tailor shop, a canteen (that always seemed to close right at the wrong moment, for me), a complete ship's laundry, as well as a lounge and a library. Ordinarily they have movies several times a week, but during this cruise they carried no films. No one seemed to miss the movies very much.

The radio officer of the *American Navigator* and his three helpers (?) during the training cruise from Baltimore to Boston. *Left to right:* A. David Middelton, W2OEN; Willard Hauser, W1KXO; CRM Guidice, WFCL; Geo. J. Hill, jr., ex-W1CEE.

Chow's Down!

As reported earlier, no "chow-bells" were necessary. There were three good reasons for this: — breakfast, lunch and dinner! As a past master at eating GI and Navy chow (or any other kind for that matter) I feel qualified to appraise the food served on the *American Navigator* which, I'm told, in no way differs from that served on any other ship in the Maritime Service. We visitors ate with the crew and the trainees. We got the very same service, quantity and quality that the ship's company received in the cafeteria-styled mess. We stood in line, picked up a stainless steel compartmented tray and passed along a steam table, where our trays were filled with food, both appetizing and nourishing. We had a balanced diet, for example: vegetables, soups, fresh salads, milk, roast beef and pork, *butter*, flannel cakes (really hot, too) and maple syrup, eggs, jam, juicy apples, fresh from the cold-room, and even ice cream! There was always that ever-welcome pitcher of hot coffee on the tables. It took a lot of will power but I restrained myself from hitting the line for "seconds." I saw many of the boys do it with success. However, after seeing the crew scramble around all over that ship and pull on those heavy oars and lines, I can see why they need — and get — plenty of the "internal stoking" to keep their "engines" running and their spirits high.

Want to Really Help Win the War, OM?

Shortly after I met Chief Guidice I asked him why they did not have the usual three radio operators aboard. The answer was simply this; the USMS just does not have enough radiomen to go around. In short, they are desperately in need of radio operators as well as all other skills, too. We cannot overstress the urgent need for more and more men to volunteer for the Maritime Service. Remember, no men are drafted into the USMS. All hands are volunteers. If you are between 17 and 35, have at least 3½ years of high school (this is a requisite) there is a place for you aboard one of the USMS ships on the high seas. Men 18 to 26, classified 1-A, *must* secure written permission from their local boards to enroll in the United States Maritime Service.

Let's consider the opportunities in radio. If you have a commercial radiotelegraph second or higher-grade license, you will be operating on a ship at sea, in quick order. If you have no commercial ticket, and lack even the barest knowledge of radio, there is a swell place for you in the Service, as they will train you in one of the finest radio schools in the country. After finishing basic schooling and after complete radio training you will be assigned to one of the ships carrying the

(Continued on page 98)

A Volume Expander for Audio Amplifiers

Reducing Time Constant for More Rapid Response

BY LT. HENRY K. WEIDEMANN,* USNR, W6HKN

IT is recognized rather universally that improved reproduction of commercially pressed phonograph recordings often is made possible when the amplifier circuit incorporates a variable-gain stage popularly known as the *volume expander*. The amateur who has attempted to build amplifiers incorporating volume expansion knows from experience that the usual circuit employing a variable-μ tube, such as the 6L7, operates in a fairly satisfactory manner only when the a.v.c. bias filter networks are very carefully designed to compromise between rapidity of response of bias level, as the volume level changes, and adequate suppression of the ripple voltage produced by the bias rectifier. It is commonly recognized also that the non-linear characteristic of the 6L7 signal grid (No. 1) makes it necessary to operate the signal grid at signal levels under one volt peak if serious distortion is to be avoided. Reducing the signal level on the No. 1 grid to maintain low distortion for the signal easily can result in the a.v.c. bias pulses on the No. 3 grid being amplified in the plate circuit of the 6L7 and passed on to the speaker as a disagreeable click or thump accompanying any musical passage where there is a sudden and great change in signal level.

Most of the conventional circuits, with their numerous compromises, lack the ability to change the volume level fast enough to make the change appear instantaneous to the listener without simultaneously introducing undesirable transient speaker noises. The author finally has hit upon a circuit design which overcomes the difficulties outlined above. The unit to be described was designed as an "insertion device" to be connected between the phonograph pick-up and the amplifier. As such, it is recommended for installation in practically any commercial radio-phonograph.

It will be recognized, of course, that this installation can in no way modify the maximum power output of the amplifier and speaker system already installed. This device will not improve the fidelity of circuits to which it is coupled. In most cases it is not worth the time and effort for construction and installation unless the amplifier system has a reasonably high maximum undistorted power-output level to the speaker. This circuit, with a reasonably good ten-watt amplifier and speaker, will greatly enhance the beauty of recorded symphonic music and also will greatly reduce apparent record scratch without impairing the upper-frequency response of the over-all system from record to speaker. Record scratch between musical passages is almost completely suppressed, since under these conditions the expander is operating at minimum amplification.

*10 Boody St., Brunswick, Maine.

The Expander-Signal Circuit

The circuit employed is shown in Fig. 1. It is designed to operate from the usual high-impedance crystal pick-up but will operate from any signal source having a peak output between 3 volts and 0.2 volts r.m.s. The maximum signal is limited by the distortion introduced in the signal channel, while the minimum signal is the lowest level for which the circuit will provide the full range of expansion. The output circuit is intended for direct coupling to the grid circuit of the first amplifier tube in the record-player amplifier. The output of the pick-up is coupled to the grid circuits of the input tubes of both the signal channel and the bias-amplifier channel. Of the two channels, the signal channel, shown in the upper portion of Fig. 1, is by far the most interesting and therefore the design of this section will be described in some detail.

The 6J5 tube of the signal channel is connected in conventional manner as a simple "phase-splitting" circuit to provide output voltages 180 degrees apart in phase. The voltage amplification of this stage is of the order of 0.8 from grid to either output point. Considerable care was taken to match the load resistors, R_3 and R_5, on an ohmmeter in order that the output voltages would be of equal magnitude. Checking the final circuit with sine-wave input shows that balancing the load resistors insures equal output voltages within the limits of the accuracy of measurement on a standard three-inch oscilloscope.

The 6J5 phase splitter operates with the cathode about 22 volts positive with respect to the grounded heater. No objectionable hum in the output seems to be attributable to this connection in the 6J5 circuit. With the gain control, R_{19}, set at its maximum-level position, the 60-cycle hum level is of the order of 0.02 volts r.m.s. at the output jack.

Since the expander circuit is designed to contribute no average gain in volume level, all load

One of the major problems in the design of a satisfactory audio volume expander is that of obtaining rapid control without distortion or objectionable speaker "thumps." In this article, the author describes a system in which most of the objections common to the usual expander circuits are eliminated. The arrangement also has possibilities as a quick-acting compressor. The circuit may be inserted between microphone or pick-up and any conventional amplifier.

resistors in the signal channel are of rather low magnitude. The values selected resulted in an uncompensated upper frequency half-power point of the order of 40,000 cycles. The shunting condenser, C_4, was chosen for size and installed to reduce this upper limit of frequency response to approximately 7500 cycles for the completed unit. If it is desired to extend the upper frequency limit of the expander, adjustment of C_4 will accomplish this result.

The variable-gain amplifier consists of two 6L7s operating in push-pull for signal frequencies and in parallel for a.v.c. bias pulses. The outputs of the 6L7s are combined by means of the 6SJ7 phase-inverter tube, which operates with a gain of unity and serves only to invert the phase of the output of the upper 6L7 tube and thus combine the outputs of the two 6L7s for delivery to the output jack. The two 6L7s with the 6SJ7 inverter provide an over-all circuit with all of the desirable properties of the conventional push-pull amplifier with regard to operation at signal frequencies. With a high-quality sine-wave generator connected to the input-signal grids in push-pull and the output waveform compared with the input waveform by means of a straight-line Lissajou figure on a three-inch oscilloscope, no harmonic distortion was detectable in this stage so long as the signal input was limited to less than 5 volts r.m.s. from grid to grid.

It will be noted that the a.v.c. bias pulses are applied to the No. 3 grids in parallel. The bias pulses appear amplified and in phase in the plate circuits of the 6L7s and finally are combined through the inverter tube exactly out of phase. Thus they can produce no effect at the output jack so long as the phase-inverter gain is properly adjusted. To achieve this balance, potentiometer R_{14} is provided in the circuit. The degenerative action of the cathode-biasing network for the 6L7s aids in reducing the amplitude of the plate-voltage excursions arising from the bias pulses on the No. 3 grids. Balancing out the a.v.c. bias pulses by the method outlined above makes possible the employment of unusually short time constants in the bias-filter network, thus permitting very rapid changes in volume level with no accompanying transient thumps or clicks apparent in the speaker.

It is particularly important that the 6SJ7 phase-inverter tube be connected as a d.c. amplifier as shown. A coupling condenser employed in place of R_{13} will result in large-amplitude (compared to the signal amplitude) exponential transient voltages at the grid of the 6SJ7 as the result of the alternate charge and discharge of this condenser as the average plate potential of the 6L7s changes with application of a.v.c. bias pulses on the No. 3 grids.

Since adjustment of R_{14} changes the grid d.c. voltage as well as the stage amplification, the cathode bias on the 6SJ7 should be at such value that adjustment for cancellation of amplified bias pulses at the output jack also will place the grid-cathode voltage at such a value as to maintain the 6SJ7 at an operating point well within the region for linear amplification. The resistance values shown in the circuit provide a relative grid-to-cathode voltage which fluctuates between −3 and −2 volts as the a.v.c. bias on the 6L7s rises from zero to a maximum of +13.5 volts, referred to ground.

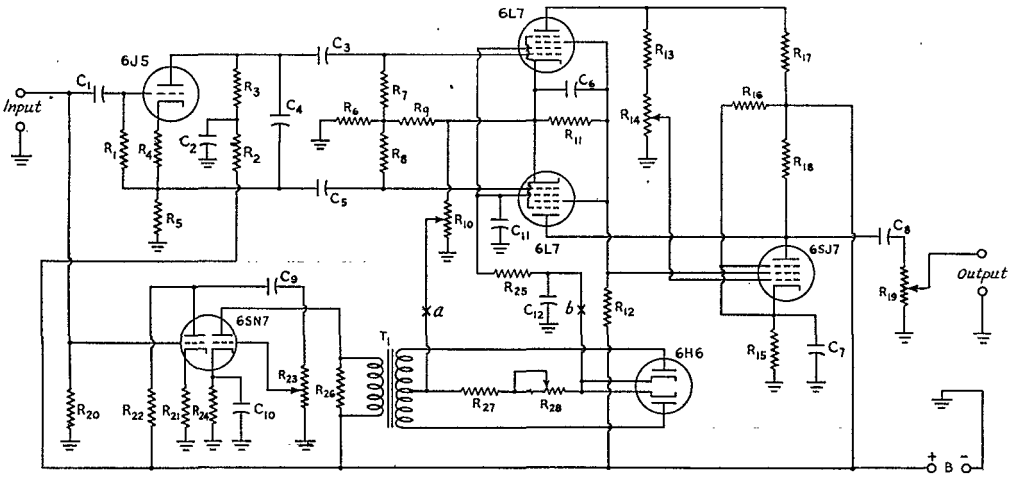


Fig. 1 — Circuit diagram of the volume expander.

C_1 — 0.01-μfd. paper.
C_2, C_6 — 8-μfd. 450-volt electrolytic.
C_3, C_5 — 0.05-μfd. paper.
C_4 — 0.006-μfd. paper.
C_7 — 50-μfd. 50-volt electrolytic.
C_8, C_9, C_{11}, C_{12} — 0.1-μfd. paper.
C_{10} — 25-μfd. 50-volt electrolytic.
R_1 — 0.5 megohm.
R_2, R_{25} — 0.1 megohm.
R_3, R_5, R_{11}, R_{17}, R_{18} — 10,000 ohms.
R_4, R_{21} — 1000 ohms.
R_6 — 165 ohms.
R_7, R_8, R_{20} — 1 megohm.
R_9 — 430 ohms.
R_{10} — 50,000-ohm potentiometer.
R_{12} — 7500 ohms.
R_{13} — 5 megohms.
R_{14}, R_{19}, R_{23} — 0.5 megohm pot.
R_{15} — 800 ohms.
R_{16} — 15,000 ohms.
R_{22} — 20,000 ohms.
R_{24} — 2000 ohms.
R_{26} — 5000 ohms.
R_{27} — 0.25 megohms.
R_{28} — 4-megohm potentiometer.
T_1 — Three-to-one plate-to-push-pull grid interstage transformer.

The output-volume control, R_{19}, was included in the circuit in order that the output signal might readily be limited to the level required at the grid of the first stage of the amplifier with which this unit may be used. With R_{19} set for full

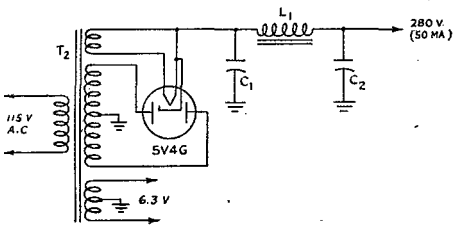


Fig. 2 — Circuit of power supply for the volume expander.

C_1, C_2 — 8-μfd. 450-volt electrolytic.
L_1 — 30-henry, 500-ohm, 70-ma. smoothing choke.
T_1 — Power transformer: 700-volts, c.t., 70 ma.; 6.3 volts, c.t., 5 volts, 3 amp.

volume, the over-all voltage amplification for the signal channel varies from 0.4 to 6.9 as the bias voltage on the No. 3 grids of the 6L7s is changed from zero to +13.5 volts. The cathodes of the 6L7s rise to a maximum of +13.5 volts above ground. Since the bias-rectifier circuit acts as a high-impedance source of voltage, it is difficult to drive the potential of No. 3 grids much above that of the cathodes.

A.V.C. Bias Amplifier and Rectifier

The bias amplifier is a conventional two-stage amplifier using the two triode sections of a single 6SN7. To reduce the over-all amplification, R_{21} is left unby-passed. R_{24} is by-passed in order that the effective internal impedance of this stage will not be increased. To reduce the stage amplification and still further reduce the impedance appearing across the primary of T_1, resistor R_{26} is connected as shown. The net resistance shunted across the primary of T_1 is of the order of about 3300 ohms. Reflected through T_1, this impedance appears across each half of the secondary as approximately 7500 ohms. It is this impedance, plus the transformer losses and the plate resistance of one section of the 6H6 diode tube, which appears in series with the charging circuit for the bias-filter network. Thus this total series impedance is of the order of 10,000 ohms. The time required for charging C_{12} only therefore is approximately 1000 microseconds. Since R_{25} and C_{11} comprise a 10,000-microsecond circuit, the approximate total time constant for the charging circuit is about 12,000 microseconds or 0.012 seconds. This time for rise of volume level (i.e. 63 per cent of maximum rise in one time constant) is so short that the ear cannot detect the delay in operation of the circuit.

A full-wave rectifier circuit is used to facilitate filtering of ripple voltage in the bias-filter network. At a signal frequency of 50 cycles the ripple frequency at C_{12} is 100 cycles. With R_{28} set at minimum, the ripple factor at C_{11} is slightly greater than 2 per cent, while with R_{28} set at maximum, the ripple factor at C_{11} is slightly more than 0.1 per cent. The filtering is ample for all settings of R_{28} but it will be found that R_{28} usually is operated near maximum, which means that the filtering would be adequate even at much lower frequencies of operation than have been indicated in this discussion. R_{28} controls the discharge time constant for the bias network. When set at minimum, the total discharge time constant is approximately 0.07 seconds. With R_{28} set at maximum, the total discharge time constant is approximately 0.9 seconds. It was found by actual test in operation that too rapid a recovery time produces unnatural emphasis effects in the reproduction of certain types of recordings. With the shortest possible recovery time, vibrato effects, such as are common in organ recordings, are emphasized to unnatural proportions. A recovery time constant of about 0.5 seconds is about the minimum permissible to prevent unnatural emphasis of this nature. R_{28} should be adjusted finally only after listening to many types of recordings.

The setting of R_{10} determines the minimum positive potential for the No. 3 grids and therefore determines the minimum amplification for the signal channel. Where it is not desired to use the maximum range of expansion available, the minimum amplification level can be set by means of R_{10} and then R_{23} may be adjusted to provide maximum amplification for the peak-signal amplitudes.

The power supply used for the expander circuit is assembled on the same chassis with the expander and bias amplifier. The circuit used is shown in Fig. 2 and is perfectly conventional in every respect.

Expander Characteristics and Preliminary Adjustments

Fig. 3 shows the over-all frequency response for the signal channel with R_{10} and R_{19} set for maximum amplification. For this characteristic R_{23} was set for zero amplification. The shape of the response curve is independent of the setting of R_{10} and will not be appreciably affected by the setting of R_{19} so long as the output terminal feeds into a high-impedance circuit, such as a grid circuit. Condenser C_4 is almost the sole determining

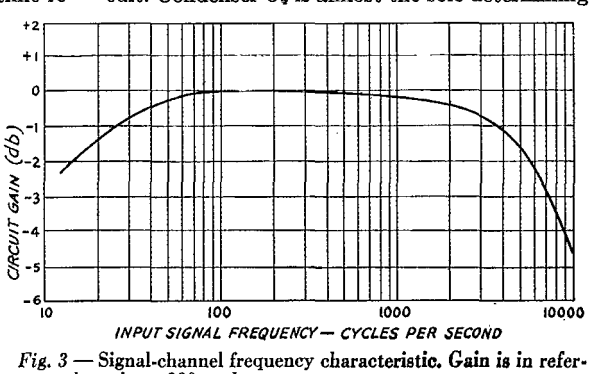


Fig. 3 — Signal-channel frequency characteristic. Gain is in reference to the gain at 200 cycles.

factor in setting the upper half-power point at approximately 7500 cycles. Removing C_4 raises the upper half-power point to approximately 40,000 cycles.

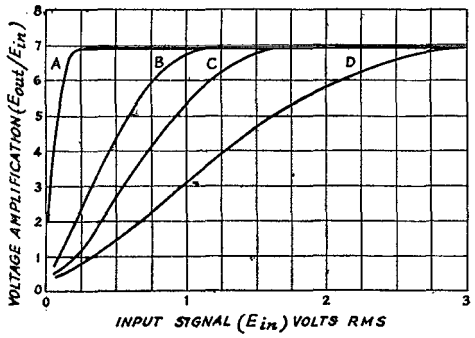


Fig. 4 — Expansion characteristic. Voltage amplification vs. input signal for difference settings of R_{23}. Curve A — R_{23} at maximum. Curve D — R_{23} set for full expansion of maximum permissible input signal. Curves B and C are for intermediate settings of R_{23}.

Fig. 4 shows the over-all expander characteristic. For this characteristic R_{10} was set for zero grid bias and R_{19} was set for maximum gain. R_{23} then was set for various amplifications to provide maximum signal amplification for all signals above selected minimum input signals. Expansion then occurs throughout the signal range from zero up to the minimum input necessary for maximum amplification.

The following procedure is suggested for adjustment of the 6SJ7 phase inverter:

1) Set R_{23} for zero amplification.
2) Set R_{10} for zero grid bias.
3) Set R_{19} for maximum amplification.
4) Short the input terminal to ground.
5) Connect any convenient high-impedance output meter to the output terminal and ground. Set for maximum scale reading of approximately 10 volts r.m.s.
6) Connect a wire from one side of the heater circuit to the grid side of C_{11}. (This provides approximately 3 volts r.m.s., 60 cycles.)
7) Adjust R_{14} for minimum output-meter reading. Where two minimums occur, set R_{14} for the minimum which places the tap on R_{14} nearest the ground end.

For proper adjustment of R_{23}, the expander should be in operation with the record player and amplifier. R_{10} should probably *not* be adjusted above zero unless the constructor finally is convinced that the range of expansion is too great. Therefore, R_{10} should be set for zero bias. With a high-impedance electronic voltmeter, such as the RCA Voltohmyst Junior (11 megohms input impedance), the potential of the 6L7 cathodes to ground should be measured next, and R_{10} should be advanced to its most positive position which should cause the cathode potential to rise about 1.5 volts. This maximum cathode potential should be recorded and R_{10} returned to its zero-bias setting. Now the electronic voltmeter should be connected to the grid side of C_{11} and R_{23} set for maximum recovery time and R_{23} adjusted until the loudest passages of the recording just swing the grid potential up to but *not above* the maximum cathode potential already determined. It will be found that adjustment of R_{10} requires a reduction in setting of R_{23}, since the rectified bias voltage adds to the minimum-bias level set by R_{10}. In no case should the grid voltage swing above the cathode potential unless it is desired to *prevent* expansion occurring at the highest levels of input signal.

Suggested Circuit Variations

There are possible variations of this circuit which the author has not had time to explore but which seem to hold promise of considerable usefulness. Referring to Fig. 1, it seems normal to expect that with R_{10} set for cathode potential for the fixed grid bias, reversal of the bias connections a and b in the bias rectifier should produce excellent compressor action. The action of the circuit as a compressor should be so fast as to be entirely undetectable to the ear even where the volume-level change is abrupt and of large amplitude. With R_{28} set for minimum, the circuit recovery time is faster than the average syllabic period of ordinary speech. This circuit probably could be used in the ham 'phone transmitter for DX work sometime in the future. Since the circuit is capable of a maximum compression or expansion range of the order of 20 db., the circuit used as a compressor might well be an item of considerable interest to the amateur whose interest for the duration has turned to the problems of cutting instantaneous recordings.

The circuit as shown in Fig. 1 or modified as a compressor network might be incorporated as a fixed feature in a complete amplifier. In this case the experimenter is warned to recognize that operation of the circuit causes the average plate potential for the 6L7s to fluctuate in phase through a range of about 18 volts. Removal of the 6SJ7 network and capacity coupling of the 6L7 plates to push-pull grids of following stages is not likely to meet with success. Sudden volume changes might easily cut off one or more of the following stages as the result of transient voltages set up in the RC coupling networks.

A circuit for coupling to following stages, which appears on paper to offer a satisfactory solution, is shown in Fig. 5. The author has not had the opportunity to test this circuit and offers it here only as a suggestion for trial.

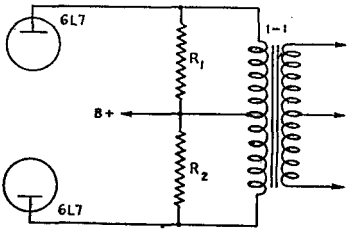


Fig. 5 — Suggested circuit for coupling the expander to following amplifier stages.

HAPPENINGS OF THE MONTH

CALL AREAS

LAST month we described to you a plan adopted by the ARRL Board of Directors for the rearrangement of call areas to provide an adequate postwar supply of amateur station calls, and transmitted to FCC with a request for its adoption. One item of this plan would provide that the state of New York alone comprise the W2 area, with W3 consisting 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 has been proposed that our plan would be a better one if W2 consisted of New York and New Jersey, and if the proposals for W3 and W4 were then correspondingly rearranged, since such alterations in the plan would result in the dislocation of a much smaller number of calls. At this writing the Board of Directors is considering the possibility of so amending its pending recommendations. If the Board approves, these alterations, and possibly some other minor ones, will be made in the request now on file at FCC. No indication of the Board's point of view is available as we go to press but we should be able to report its decision in our next issue.

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. Nominating petitions are hereby solicited. Ten or more Full Members of the League residing in any one of the above-named divisions may join in nominating any eligible Full Member of the League residing in that division as a candidate for director therefrom, or as a candidate for alternate director therefrom. No person may simultaneously be a candidate for the offices of both director and alternate. Inasmuch as the by-laws 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 ....., of ....., as a candidate for DIRECTOR; and we also nominate ...., of ....., 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 nominee must be a Full Member and must have been both a member of the League and a licensed radio amateur operator for a continuous term of at least four years immediately preceding receipt by the Secretary of his petition of nomination, except that a lapse of not to exceed ninety days in the renewal of the operator's license and a lapse of not to exceed thirty days in the renewal of membership in the League, at any expiration of either during the four-year period, will not disqualify the candidate; 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 peti-

tions 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, Walter Bradley Martin, W3QV; alternate, Herbert M. Walleze, W8BQ. Dakota Division: director, Tom E. Davis, W9VVA; alternate, Aaron E. Swanberg, W9BHY. Delta Division: director, E. Ray Arledge, W5SI; alternate, Samuel H. Dowell, W5ERV. Midwest Division: director, Floyd E. Norwine, jr., W9EFC; alternate, C. A. Colvin, W9VHR. Pacific Division: director, J. L. McCargar, W6EY; alternate, Elbert J. Amarantes, W6FBW. Southeastern Division: director, Wm. C. Shelton, W4ASR; alternate, Wm. P. Sides, 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 to file nominating petitions immediately.

For the Board of Directors:

K. B. WARNER,
Secretary

July 1, 1945.

ALLOCATION BELOW 25 MC.

IN AN article last month we laid before you the proposals of FCC for the allocation of frequencies below 25 Mc., so far as they interest amateurs, and explained that they were to be the subject of oral argument in June. The argument duly came off on June 20th. Attendance was considerably smaller than in the matter of frequencies above 25 Mc. and the job was finished in one day. Press Wireless was the only interest to attack us and that didn't get anywhere.

The Commission has now the task of assimilating this new testimony on its proposals and of determining, in conference with IRAC, its final allocations (subject, wherever they deviate from Cairo, to the decisions of the next international conference). This final FCC announcement should come along in time for our next issue.

In this matter the League was again represented by General Counsel Paul M. Segal and Secretary K. B. Warner. Members will be interested in reading in detail the position taken by the League concerning our lower frequencies. Following is the text of the League's brief for the amateur service:

Pursuant to the Commission's order of May 21, 1945, the American Radio Relay League, Inc., on behalf of the amateur service, submits the following observations and makes the following requests concerning the assignment proposed in the Commission's report of May 21, 1945 (Mim. 82260).

Introduction

Under current regulations, the Commission has assigned for the exclusive use of the amateur radio service the following bands of frequencies in the range 0.1 to 25 megacycles:

1,750– 2,050 kilocycles
3,500– 4,000 "
7,000– 7,300 "
14,000–14,400 "

Under its proposal in the present proceeding, the Commission lists for assignment to the amateur service the following bands of frequencies:

A provision for amateur disaster networks somewhere in the range 1,605–1,800 kc.

3,500– 4,000 kilocycles
7,000– 7,300 "
14,000–14,400 "
21,000–21,500 "

In this discussion, the various frequency bands will be discussed as against their present assignments.

As Concerns the Band 1,750–2,050 Kilocycles

This is a band of frequencies that from the first days of radio allocation in this country has been assigned exclusively to amateurs. Up to the beginning of the war it was very heavily employed by amateurs for their shorter-distance domestic communications. It is now proposed to assign the frequencies 1,800–2,000 kc. to a certain long-distance navigational aid; to devote the frequencies 2,000 2,050 kc. to fixed and mobile Government needs; to throw the frequencies 1,750–1,800 kc. into a general allocation for the fixed and mobile services covering the range 1,605–1,800 kc.; and, as the only remaining amateur activity in that entire band, to permit amateurs to operate disaster-communications networks on undetermined frequencies at an undetermined location somewhere within the range 1,605–1,800 kc.

The navigation aid presently occupying the frequencies 1,800 2,000 kc. is a secret war device. The proposal to assign these frequencies for this purpose originates with the Interdepartment Radio Advisory Committee and has been accepted by the Commission at the request of that agency. The League concedes the present importance of this device. It also concedes its importance as long into the era of peace as American navigators continue to depend upon this device operating upon these frequencies.

But we wish to point out that this situation is not necessarily, or even probably, a permanent one. This device is a new wartime invention. It was put into operation with the greatest possible haste to fill a pressing wartime need. It was established in a range of frequencies that had always been amateur frequencies because those frequencies were temporarily unoccupied through the closing down of amateur stations during the war. There is grave doubt whether it is good engineering practice to permit transmissions of the type emitted by this device to occur in this part of the spectrum. Competent Government engineers are of the belief that this device sooner or later will be moved to a different part of the spectrum, thus vacating these amateur frequencies.

There is, moreover, room for doubt whether this system, on these or any other frequencies, will remain as important to navigators in the years of peace as has been the belief

until recently. The progenitors of this system have visualized a globe-circling network of these installations which would be relied upon by mariners and aerial navigators of every nation. The League has been told by representatives of the armed forces that only a device of such transcendental usefulness to a peacetime world would warrant the displacement of amateur radio from these frequencies. Yet it is now known that there are a number of other systems to accomplish this same objective; and, in the opinion of competent persons, some of these other systems may well be superior to the American one. There is also some evidence that some other nations have committed themselves to the employment of some of these other devices and will not rely upon the American device, as had been originally contemplated.

The League therefore cannot feel persuaded that it is established that this is a device of such enormous potential value to the world that it must be deemed the permanent assignee of these amateur frequencies. On the contrary, the League believes that it is only a question of time until, for one reason or the other, this device will no longer be in operation on these amateur frequencies. We therefore request that the Commission regard the tenure of the navigational aid in these frequencies as a temporary one, and earmark the frequencies to be returned to amateur radio if and when the navigation aid can be moved. To make such a reassignment immediately practicable in that event, the League requests that the Commission alter its proposed international allocation for the frequencies 1,800–2,000 kc. to provide for a shared assignment to both the navigation aid and the amateur service. Thus the way will remain open for the return of these frequencies to amateurs if and when the navigation aid can be moved.

Even the temporary loss of these frequencies is a serious blow to amateur radio. The right to operation on even a part of them would be of considerable benefit in our expected increased congestion after the war. The League believes that it is feasible from the technical standpoint for the range 1,800–2,000 kc. to be shared between amateurs and the navigation aid. It is our understanding that certain frequencies in this range, employed for this purpose in certain portions of the country, are not employed in other portions of the country and could be utilized by amateurs there without interfering with the operation of the device in those sections of the country, where the frequency is under employment for the navigation aid. While such a system of geographical sharing would result in amateurs in one part of the nation having a different subassignment within this range than amateurs in another part of the country, there would be no great practical disadvantage since these are relatively short-distance frequencies. In consequence, the League requests the Commission to make inquiry of the appropriate Government agencies concerning the possibility of authorizing shared operation in this frequency range, with the objective of making half of the 1,800–2,000 kc. range available to every amateur. We also point to this prospect as an additional reason for requesting that the proposed international allocation of these frequencies read in terms of both amateurs and the navigation aid.

Coming now to a consideration of the proposed amateur disaster networks in the range 1,605–1,800 kc., we have first to approve the Commission's general provision in this matter. We believe it to be a wise national policy, as it has been established that amateurs can render a service of incalculable value on these frequencies in time of emergency. We request, however, that the Commission arrange that the frequencies provided for this amateur service shall lie between 1,750 and 1,800 kc. The frequencies 1,605–1,750 kc. have not been assigned to amateurs for many years and there is almost no equipment for them in the hands of amateurs today. On the other hand, not only are the home stations of most amateurs capable of operating on the frequencies lying immediately above 1,750 kc. but a considerable amount of portable and other special equipment has been built for such frequencies by amateurs, for the special purpose of serving emergency-communication needs. Additionally it is to be observed that all amateur transmitting equipment designed to multiply frequency into the higher-frequency amateur bands would be capable of operation on frequencies beginning at 1,750 kc., and so a considerably greater number of stations would be available for disaster-relief operation.

To permit the efficient organization and coördination of the amateur's work in this service, the assignment made available to amateurs for this purpose should be an exclusive one. We believe it to be in the national interest for the Commission to assign the range 1,750–1,800 kc. exclusively to amateurs for this purpose. The minimum assignment under which amateurs could be expected to make an effective contribution to the relief of disasters would be three 10-kc. channels in this range, and a much more effective organization can be planned if the whole range 1,750–1,800 is made available.

When the Commission reaches the stage of drafting its regulations for this operation we request that adequate provision be made both for testing of the apparatus and for drills of the personnel engaged in a communications plan. Apparatus cannot be counted upon to work in an emergency if it is never tested, nor can networks be counted upon to give the expected performance unless the personnel is drilled in the actual establishment of communication between the necessary points. The League, drawing upon its long experience in this field, offers its consultative services to the Commission when this stage in the development of the matter is reached.

Until some arrangement is reached for a shared use of the frequencies 1,800–2,000 kc. there is no provision for any amateur operation in the band 1,750–2,050 kc. except that relating to disaster relief and its necessary attendant drills and tests. There is another type of amateur activity for which it is desirable that some provision be made in this band. Many amateurs are experimenters and investigators, and the whole philosophy of the assignment of amateur bands about an octave apart is intended to put small "test slices" of the spectrum at the disposal of such experimenters so that they can sample performance throughout the portion of the spectrum through which amateur bands extend. Amateurs making serious investigations of transmission phenomena, for example, should not unnecessarily be deprived of the use of all frequencies below 3,500 kc. when their results could readily be extended another octave by making some frequencies available in the 1,750-kc. range. Accordingly the League requests that the Commission devise appropriate regulations which, without inviting unrestricted amateur operation on such frequencies, will nonetheless permit amateurs engaged in bona-fide transmission investigations to use, from time to time and for sufficient lengths of time, the frequencies in the range 1,605–1,800 kc. which are made available for amateur disaster networks.

Considering the desirability, mentioned above, of positioning such amateur frequencies above 1,750 kc., rather than below, we point out to the Commission the desirability of maintaining the present language of the international allocation of the frequencies 1,750 to 1,800 kc., namely, Amateur, Fixed & Mobile. Under such an international allocation the Commission of course would retain, as does any signatory nation, full freedom in its domestic allocations. Thus if our suggestions are adopted in this respect, the Commission's column of "Proposed International Allocation" in this part of the spectrum would read as follows

1,605–1,750 kilocycles	Fixed; mobile
1,750–1,800 "	Amateur; fixed; mobile
1,800–2,000 "	Amateur; navigation aids

We urge this course.

In the light of the importance of the proposed reorganization of the mobile service on frequencies above 2,000 kc., and in view of other considerations hereinbefore mentioned, we assent to the reassignment of our frequencies 2,000 2,050 kc. to the Government service.

As to the Band 3,500–4,000 Kilocycles

The Commission's proposal is the existing band. This disposition is acceptable to us. We observe in passing that this

ARE YOU LICENSED?

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

is one of the most important of the amateur bands, traditionally devoted to radio telegraph operator training and experience in the handling of traffic, and that with the loss, however temporary, of a considerable portion of the band 1,750–2,050 kc., it acquires added necessity in our structure as the only band of amateur frequencies capable of reliable communication over moderate distances.

As to the Band 7,000–7,300 Kilocycles

The Commission's proposal is the existing assignment as allocated to amateurs in the American region. This is the narrowest of the amateur bands, yet it is extensively employed by the amateurs of every nation for their international contacts, and consequently suffers from the most intense interference. Prior to the effective date of the Washington Convention at the beginning of 1929, this amateur allocation ran from 7,000 to 8,000 kc. Their intense congestion in the present narrow band of 300-kc. width has caused amateurs all over the world to hope most fervently for a widening of this band. No longer ago than last month the Board of Directors of the League, examining amateur problems at their annual meeting, voted to transmit to the Commission the request that you endeavor to find some means of widening this amateur band to embrace the frequencies 7,000–7,400 kc., in view of the loss of frequencies which the amateur service apparently is suffering in the 1,750–2,050 kc. range.

As to the Band 14,000–14,400 Kilocycles

The Commission's proposal is the existing band. It is acceptable to us.

As to the Band 21,000–21,500 Kilocycles

This proposed new amateur assignment will be a most welcome addition to the amateur family of bands. Although of only marginal value for commercial and Government purposes, we are confident that we can make an excellent employment of these frequencies in the amateur service.

The original proposal of the Interdepartment Radio Advisory Committee in this respect, and the request of the League at the original hearing of this matter, was for the assignment to amateurs of the band 21,000 to 22,000 kc. The Commission in its report of its proposed actions states that it is primarily on behalf of international broadcasting that it cannot accede to the original proposals and requests. In view of the reduction which the Commission made in the width of the amateur band 28,000–30,000 kc. in its final report of allocations above 25,000 kc., the League has been exceedingly desirous of obtaining for amateurs the whole of the originally-proposed band 21,000–22,000 kc. Should there be any change in the national policy concerning high-frequency broadcasting, in either the immediate or the more distant future, or should the determinations of international conferences fail to give effect to the Commission's wishes as they concern international broadcasting in this part of the spectrum, we request that the amateur service be given the benefit of such changes by the appropriate widening of this proposed amateur band.

Conclusion

It is accordingly shown that the public interest and the most effective and efficient use of the radio spectrum require the following *changes* in the proposed allocation below 25 megacycles.

1. As concerns the band 1,750-to-2,050 kilocycles:

(a) Regardless of present and immediately-imminent prospect for the use of navigational aids within this band, it should continue to be designated as in present international arrangements, so that, when feasible, the frequencies may lawfully be assigned within the United States to the amateur service.

(b) Meanwhile, frequencies within this range which are immediately to be used by navigational aids should be so used upon a geographical sharing basis with the amateur service. This will permit the exploitation of the frequencies by amateurs in areas where operation will not interfere with the navigational aids.

(c) Any frequencies within the band set aside for distress communication should be in the range 1,750 to 1,800 kc. Provision should be made for communication by amateurs upon such terms as to authorize frequent testing and drill. The assignment should be exclusive.

(d) Provision should be made for experimentation and research in the range 1,605 to 1,800 kilocycles.

2. The amateur service should be admitted to the band 21.5 megacycles to 22 megacycles upon such a basis that the amateurs may use the frequencies should there be any reduction in the proposed range of frequencies assignable to the "international broadcasting" service.

WAR SERVICE RECORD

ATTENTION, returning service men! ARRL, as the national amateur organization, has been compiling during the war a record of the fundamental facts concerning each American and Canadian amateur who employed his radio skill somewhere in the war effort. We don't want to know very much — just the essentials shown on the form on the bottom of this page — but that little we want very much, so that we shall have the statistics to support the amateur position in case of need. We have a vast number of names but there are thousands of you not yet registered with us and you may be seeing this appeal in *QST* for the first time. In addition to those in uniform, this information is desired from the other categories of people shown on the form.

Won't you take a moment to fill it out? Or produce its essentials on a post card, if you prefer not to cut your copy of *QST*. TU vy.

AMATEUR WAR SERVICE RECORD

Name

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

Present mailing address

SERVICE

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

Rank or rating

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

W.E.R.S. AMENDMENTS

PARTICIPANTS in WERS should take down their copies of the WERS rules and note the following minor amendments enacted by FCC on June 12th last:

1) Sec. 15.26 says that the frequency-measurement means shall be of enough accuracy to insure operation within the deviation permitted under Sec. 15.25. This reference now reads "Sections 15.25 and 15.89," latter referring to State Guard.

2) When WERS rules were recently expanded to cover disaster communications, Sec. 15.63(b) was overlooked. To the reference at the end of the first sentence, to civilian defense and national security, makes a correction so that it reads "civilian defense, national security or public safety."

3) Sec. 15.76 permits drills during certain circumstances "as may be requested by" certain authorities or agencies. This is now made more formal by altering the quoted language to read "as may be initiated or ordered by" these authorities or agencies.

RED CROSS AND W.E.R.S.

IS YOUR city about to chuck WERS because civilian defense is over? Do you feel that your community needs WERS to be prepared for natural disasters? You will be interested in knowing that the American Red Cross, acting at the suggestion of ARRL, is addressing its chapter chairmen and local disaster-relief directors, telling them about WERS. They are asked to intervene with municipal authorities now licensed for WERS and urge the maintenance of the license and any necessary conversion of the set-up to make it useful for natural-disaster emergencies. If your city fathers are about to disband your WERS, and you need help, go to your local Red Cross people immediately and see if they won't help you.

Local Red Cross officials are also being asked to endeavor to interest unlicensed municipalities in organizing WERS and taking out licenses to be prepared for disaster relief. If you've never had WERS but have a local gang that could do the job, perhaps you can find friendly assistance from the local Red Cross chapter.

R.S.G.B. NOTES

THE June issue of the *R.S.G.B. Bulletin* carries the important announcement that preparations are now being made for the reissue of amateur licenses. Applications can now be submitted by the prewar holders of "full" licenses. It is not to be inferred that licenses are to be reissued immediately but, as the result of discussions with R.S.G.B., the GPO is accepting applications so as to give them as much time as possible for the work involved.

American hams should not get excited over the G7 stations that were to be heard during May and early June on the 7-Mc. band — this was not a return to ordinary operation. Some selected stations were doing a special job, now ended, by special authority. But things do move closer!

EXECUTIVE COMMITTEE MEETINGS

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

Meeting No. 182, July 26, 1944. Examined nominations for alternate director in special election in Midwest Division. Finding only one eligible candidate, declared him elected without balloting.

Meeting No. 183, Oct. 30, 1944. Examined nominations in regular autumn elections, determined eligibility of candidates. In cases where there was only one eligible candidate, declared him elected without balloting. Ordered ballots sent on others.

Meeting No. 184, Dec. 21, 1944. Opened and counted ballots in regular autumn elections, certifying winning candidates. Ordered a new election for director in the New England Division because of a tie vote. Affiliated one club.

Meeting No. 185, Feb. 20, 1945. Opened and counted ballots in re-run of election of New England director, certifying the winner. Authorized secretary to execute lease for certain storage space at $100 per month. Affiliated one club. Appointed Charles A. Service, jr., Acting Communications Manager effective Dec. 13, 1944.

BAILEY ADDRESSES CHINESE AMATEURS

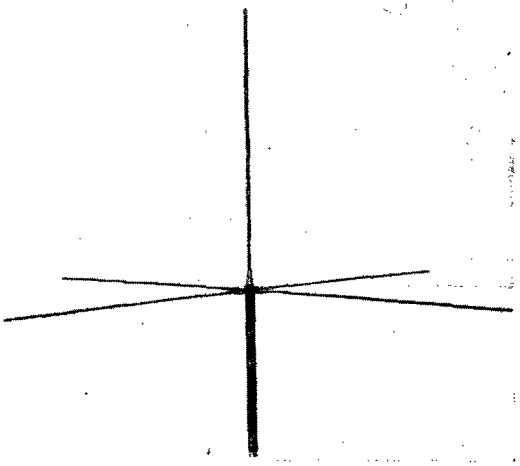
MAY 5th is, by national proclamation, celebrated in China as China Amateur Radio Day. In recent years the officers of ARRL have had the pleasure of addressing the membership of the China Amateur Radio League, on this day, through the facilities of OWI. The programs are rebroadcast from Chungking over a network of special Chinese amateur stations working in collaboration with the government, and thereby reach the Chinese amateurs in all major cities where chapter meetings are in progress to celebrate the day set aside in their honor by the government. Following is the text of President George W. Bailey's message this year:

Kung Shao-Hsiung who formerly was the manager of the Chungking Branch of the Chinese Amateur Radio League and at one time an operator of station XU6KL. His description of the activities of the CARL appeared in *QST* for May, 1945.

This is W1KH calling all Chinese amateurs on China Amateur Radio Day, May 5, 1945.

I send you affectionate greetings from all the members of the American Radio Relay League to all the members of the China Amateur Radio League. On this, my third annual day of greeting to you, I feel that I know you better than ever, and that we here in America are closer than ever before to you in China. For recently I received a letter from your President, Dr. Hsu, brought all the way from Chungking, and delivered to me in person by your Mr. Kung. I was thrilled to receive your greeting, Dr. Hsu, and I hope that some day I may greet you in person in Chungking, in your proposed new headquarters building. We enjoyed the visit here in Washington with Mr. Kung, and were glad to learn from him the news from Chungking. Your old friend K. B. Warner joins me in greeting you. He reports that the

(Continued on page 96)



The complete ground-plane antenna with its support.

Ground-Plane Antennas

Design Data for the 112-Mc. Band

BY E. DILLON SMITH,* W3PZ

In v.h.f. work the ground-plane antenna has many advantages. In non-directional work it is considerably superior to the simple vertical dipole. In this article, W3PZ gives the formulas for computing the essential dimensions with special reference to the 112-Mc. band.

THE effectiveness of radio transmission and reception above about 30 Mc. is determined principally by the efficiency of the antenna and its feed system, other things being equal such as power input, etc. In the case of operations at 112–116 Mc., where a non-directive antenna with a circular radiation pattern might be desired for ground-to-ground communications, as in the case of Weather Bureau-WERS networks, at least the following requirements should be met:

1) The greatest possible ground circular propagation pattern should be secured for a given power output from the final amplifier and/or input to the antenna.

2) The transmission line should be properly terminated regardless of the height of the antenna above the ground.

3) The external sheath of the concentric transmission line should not be exposed to high-frequency fields.

* U. S. Weather Bureau, Washington 25, D. C.

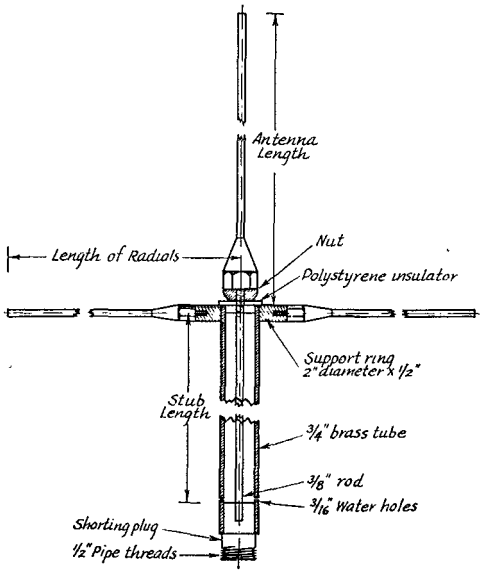


Fig. 1 — Sketch method of assembling the ground-plane antenna. Dimensions may be taken from the accompanying table.

4) The antenna structure should be grounded.

5) The antenna should be simple and rugged from a mechanical standpoint.

6) No field adjustments of the antenna should be required.

The ground-plane antenna generally fulfills all of these requirements. A typical illustration of a 115-Mc. antenna for matching to a 72-ohm concentric line is shown in the accompanying photographs. But one will immediately raise the question as to the desirability of constructing an antenna of this type when a simple half-wave doublet can be utilized. To answer this question, comment might be made on the requirements for a good nondirectional radiator. Generally, in the order of the points itemized above, it is well-known that an appropriate vertical antenna over a perfect ground gives low-angle radiation.

Second, if a concentric transmission line is used to feed the antenna and it is not properly terminated, standing waves will be present in the line and high-frequency fields may be set up on the outside of such a line, resulting in wasteful radiation from this source. Therefore, it is desirable not only to terminate properly the transmission line but also to shield it adequately from external high-frequency energy.

Third, the antenna structure proper should be grounded. Practically, this gives partial protection from lightning; such grounding also provides an essential static drain when the antenna is used for reception purposes.

Fourth, the antenna should be simple and rugged, and easily mounted. It should not require special means of feeding the antenna.

Lastly, no cut and try procedure should be required for determining the resonating frequency of the antenna as the antenna changes its position above ground or as the position of the feeders with respect to the antenna is altered.

All of these requirements are met by the ground-plane antenna design. The ground-plane antenna provides its own simulated ground; it utilizes essentially a quarter-wavelength vertical radiator; it has an impedance-matching stub for matching the concentric transmission line to the antenna, and at the same time is so designed that the supporting mechanism can be grounded; standing waves in the line, either upon the supporting

structures or upon the outside of the concentric *feed line, are not present.*

The fundamental details of design for the antenna with general dimensions are shown in the sketch of Fig. 1.

The physical dimensions for the ground-plane antenna are easily computed. The general computational technique will be presented with an illustrative example for a 115-Mc. antenna. The notation will express dimensions in electrical degrees and inches.

One electrical degree, L, expressed in inches of length, at the operating frequency, f, in Mc. is given by

$$L = 32.8/f. \tag{1}$$

The constant 32.8 is obtained by dividing the free-space wavelength by 360 degrees and converting to inches in terms of megacycle units.

Now if the ground radial is to be one-quarter wavelength long, its length, R, in inches then is given by

$$R = L\,90^\circ \tag{2}$$

It follows then that the antenna length, A, in inches is

$$A = L\,(90^\circ)\,(0.96) = 86.4\,L \tag{3}$$

where the constant 0.96 expresses the shortening (expressed as a fraction of unity of 90 degrees or one-quarter wavelength) necessary to secure zero reactance.

Now, for any given antenna length, the effective resistance or resonant impedance, r, presented to the transmission line with the support stub parallel-resonated to the antenna is given by

$$r = (r_a^2 + x_a^2)/r_a, \tag{4}$$

where r_a is the antenna resistance and x_a is the antenna reactance. Thus, it is theoretically possible to match the characteristic impedance of any transmission line to that of the radiator.

The support stub parallel inductance, x_s, necessary to produce parallel resonance follows from (4) as given by

$$x_s = (r_a^2 + x_a^2)/x_a \tag{5}$$

Obviously x_s is inductive when x_a is capacitive and vice versa.

Dr. George H. Brown of RCA has shown [1] that the stub length is not critical if its impedance is about 41 ohms. In other words, the stub length, s, in degrees is given by

$$\tan s = x_s/41, \tag{6}$$

where x_s also can be written as

$$x_s = 138.15 \log (D/d), \tag{7}$$

where D is the inside diameter of the outer conductor of the concentric transmission line and d is the outer diameter of the inside conductor.

[1] G. H. Brown and J. Epstien, "An Ultra-High-Frequency Antenna of Simple Construction," *Communications*, July, 1940.

G. H. Brown, "Ground-Plane Antennas," *Electronics*, December, 1943.

DIMENSIONS FOR GROUND PLANE ANTENNAS

Frequency, Mc.	*Length in Inches* Antenna, A	Radial, R	Stub, S
116	24.4	25.5	12.9
115	24.6	25.7	13.0
114	24.9	25.9	13.1
113	25.1	26.1	13.2
112	25.3	26.3	13.3

The stub length, S, in inches then is given by

$$S = s\,L \tag{8}$$

By way of illustration, the design for a 115-Mc. ground-plane antenna is computed as follows: From (1) the length in inches of one electrical degree is found to be

$$L = 32.8/f = 32.8/115.0 = 0.285 \tag{9}$$

from which (2) gives the length in inches of the radial as

$$R = 90\,L = (90)\,(0.285) = 25.7 \tag{10}$$

From (3) the antenna length in inches is

$$A = L\,(90)\,(0.96) = 86.4 \tag{11}$$
$$L = (86.4)\,(0.285) = 24.6$$

In order to compute (6), Equation (7) is first solved. If the stub-section tube has an inside diameter of ¾ inch and the rod is ⅜ inch in diameter, the impedance is

$$x_s = 138.15 \log (D/d) \tag{12}$$
$$= 138.15 \log (0.750/0.375) = 138.15 \log 2 = 41.6$$

The impedance then is substituted in (6) giving

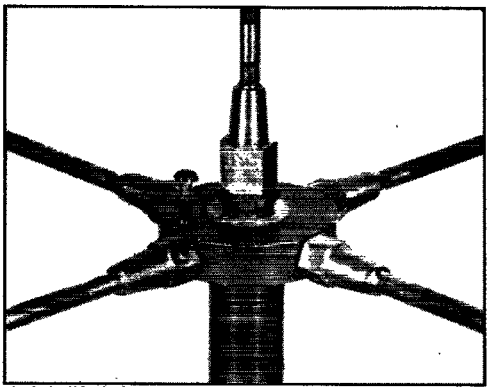
$$\tan s = x_s/41 = 41.6/41 = 1.015, \text{ or,} \tag{13}$$
$$s = \tan^{-1}1.015 = 45.5 \text{ degrees}$$

From (8), the stub length in inches is

$$S = s\,L = (45.5)\,(0.285) = 13.0$$

The foregoing computed values are summarized in the accompanying table which gives the cal-

(Continued on page 96)



Constructional details of a 115-Mc. ground-plane antenna showing the method of attaching the concentric transmission line.

IN THE SERVICES

WE'VE heard of ham calls on box cars, johnnie walls, jeeps and tanks, but this is a new one. S1c Ralph Guenther, W6THN, writes that one 5-inch loudspeaker on a dynamic demonstrator in a Treasure Island lab had the following calls pencilled on it: W1BK, W2KKI, W2LET, W2UEH, W3JUZ, W3ZEY, W6EK, W6FQI, W6OFU, W6OIM, W6PHZ, W6QXD, W6RFF, W6RK, W6SCS, W6SSN, W6SUW, W6SYX, W6THN, W6UFV, W7ESL, W7EVL, W7FDT, W8MTZ, W9HXZ, W9JZM, W9MRN, W9QVN, W9TGZ, W9YHX and W9ZUM. One speaker with thirty-one calls!

NAVY—AERONAUTICS

2HBR, Vogel, ART1c, Litchfield Park, Ariz.
3GZF, Moritz, ART3c, Corpus Christi, Texas
5GMM, Humphrey, Sp(Y)2c, Corpus Christi, Texas
6LDJ, McNeal, ART3c, Corpus Christi, Texas
6MNA, Wilson, ACRM, foreign duty
K6RNU, Pollock, Lt. Comdr., Oceana, Va.
6RRL, Zucker, ARM2c, San Diego, Calif.
6UPJ, Fisher, ART1c, foreign duty
ex-9AFW, Spanheimer, ART1c, address unknown
9IZR, Behr, A/C, Ottumwa, Ia.

Operator's license only:

Dolmatz, ACRT, foreign duty
Evans, ART1c, foreign duty
Liebermann, ARM1c, Santa Ana, Calif.
Notaro, ART1c, Banana River, Fla.

ARMY—GENERAL

3GEW, Weiner, T/5, foreign duty
3JNC, Gordon, T/5, foreign duty
3JRC, Wheelock, Pvt., foreign duty
4GUL, Hawkins, Pfc., foreign duty
6IWN, Craig, Lt., foreign duty
6MJF, Phillips, foreign duty
8TQH Woodmansee, Cpl., Camp Atterbury, Ind.
9JFG, Erp, T/4, foreign duty
9WCQ, Kane, S/Sgt., Aberdeen, S. D.

Operator's license only:

Greene, Sgt., foreign duty
Howerton, Pvt., Camp Maxey, Texas

Major Maurice R. Gutman, W2VL, communications officer of a fighter wing, 12th Air Force, is decorated with the Bronze Star Medal by Brig. Gen. Chidlaw, commanding general, for meritorious conduct in connection with military operations in the Mediterranean theater. His citation reads, in part: "Major Gutman's tireless efforts kept communications equipment on Corsica and Sardinia at peak efficiency. As a result of superior communications maintenance, more than 235 Allied airmen were saved by air-sea rescue units of the wing."

ARMY—SIGNAL CORPS

1NTF, McLaughlin, T/4, foreign duty
2MHV, DeClark, T/3, foreign duty
3IAC, Matysik, T/4, foreign duty
4DWU, Blackburn, Lt., Miami, Fla.
4GGI, Kenny, Col., foreign duty
K4GQO, Nicholson, W/O, foreign duty
5HDP, Turner, S/Sgt., Carnegie, Okla.
5IDZ, Miller, S/Sgt., foreign duty
ex-6DLT, Hughes, W/O (jg), foreign duty
6PLK, Martin, Pfc., foreign duty
6PMN, Horstmeyer, T/4, foreign duty
7CVM, McKernon, Sgt., foreign duty
7HKT, Squier, Cpl., Turlock, Calif.
7HON, Smith, Lt., foreign duty

Both Cpl. John C. Connor, W8UAV, *left*, and S/Sgt. William R. Davies, W9KGQ, have been installing radio gear for the AACS in the Aleutians for the past year. They are keen to leave that tourists' paradise and get back to their U.S.A. QTH and rigs.

8TYC, Bristol, Pfc., Owosso, Mich.
8UDN, Kopp, S/Sgt., foreign duty
8VTK, Moore, T/5, foreign duty
9DZL, McCarthy, M/Sgt., foreign duty
9ECL, Fastner, S/Sgt., foreign duty
9IOA, Gray, T/Sgt., foreign duty
9YZI, Tibbles, Sgt., foreign duty

Operator's license only:

Cochran, T/5, foreign duty
Cooke, Sgt., Quantico, Va.
Frank, Lt., Camp Callan, Calif.
Hogshead, T/4, foreign duty
Madison, T/4, foreign duty
Mroz, Pfc., foreign duty
Yoxthimer, S/Sgt., foreign duty
Zitzow, Cpl., Ft. McIntosh, Texas

ARMY—AACS

8TXG, Earle, M/Sgt., foreign duty
ex-8US, Mahoney, Cpl., foreign duty
8WNG, Newell, Sgt., foreign duty
ex-9CFI, Colby, S/Sgt., foreign duty
9CUI, Gavin, Sgt., foreign duty
9CZQ, Cerverie, S/Sgt., Columbus, Ind.
9DIQ, Baruth, T/Sgt., foreign duty
9DMM, Klefsky, M/Sgt., Love Field, Texas
9EGM, Fender, M/Sgt., foreign duty
9EPW, Svec, S/Sgt., foreign duty
9IWP, Norwich, T/Sgt., foreign duty
9JIZ, McCulligh, Cpl., foreign duty
9KYH, Bard, Lt., foreign duty
9LGB, Smith, T/Sgt., Fairfield, Calif.
9LJG, Lamott, Pfc., foreign duty
9LRK, Fuller, Lt., foreign duty
9LWL, Hamer, T/Sgt., foreign duty
9MWF, Goode, S/Sgt., foreign duty
9MZB, Young, S/Sgt., foreign duty
9PHX, Steinberg, Capt., foreign duty
9PJS, Baumgartner, Sgt., foreign duty
9PXT, Kralovec, 2nd Lt., Peterson Field, Colo.
9QCQ, Witowski, Capt., foreign duty
9QWV, Catania, W/O (jg), McClellan Field, Calif.
9RNI, Eckes, T/Sgt., foreign duty
9RRF, Heer, Sgt., Bolling Field, D. C.
9SAJ, Houseworth, Pvt., foreign duty
9TVJ, Kimmell, Maj., foreign duty
9TZG, Doran, Pvt., foreign duty
9UDI, Bates, Lt., foreign duty
9UVE, Lovelace, Pfc., foreign duty
9VHL, Petersen, Sgt., foreign duty
9VNG, Mercer, M/Sgt., foreign duty
9VPZ, Duncan, Pfc., foreign duty
9VTY, Hauff, Cpl., foreign duty
9VVB, Goodfellow, Pfc., West Palm Beach, Fla.
9WCP, Geiger, T/Sgt., foreign duty
9WHP, Margala, Lt., foreign duty
9WNW, Borger, Pfc., Hill Field, Utah
ex-9YWK, Winske, S/Sgt., Truax Field, Wis.

Operator's license only:

Allett, S/Sgt., foreign duty
Austin, Sgt., foreign duty
Bannon, Cpl., foreign duty
Beier, Cpl., foreign duty
Beresford, Sgt., foreign duty
Berger, Pfc., foreign duty
Bern, 2nd Lt., foreign duty
Bienstock, Sgt., La Junta, Colo.
Bingham, Sgt., Pyote, Texas
Brodie, Sgt., foreign duty
Chambers, Lt., Sherman, Texas
Childree, T/Sgt., foreign duty
Colvin, Lt., address unknown
Dean, S/Sgt., foreign duty
Elwood, Pvt., foreign duty
Feigenspan, 2nd Lt., foreign duty
Fischer, Pvt., Chanute Field, Ill.
Frazer, Pfc., foreign duty
Glaser, 2nd Lt., foreign duty
Gray, Sgt., foreign duty
Greene, Cpl., Offutt Field, Nebr.
Grether, Sgt., foreign duty

ARMY—AIR FORCES

3JCS, Bradley, Pvt., Sheppard Field, Texas
4AEJ, Reid, Sgt., Panama City, Fla.
4EZK, Woodward, Pvt., Sioux Falls, S. D.
4FUY, Dent, F/O, Boca Raton Field, Fla.
4HXL, Linn, Cpl., Coffeyville, Kans.
K6UCB, Smith, Capt., Wright Field, Ohio
8QNM, Eberle, Sgt., Truax Field, Wis.
8SNX, Palviscak, S/Sgt., Boca Raton, Fla.
9GIB, Martin, Capt., Westover Field, Mass.
9IWJ, Janda, S/Sgt., Greenville, S. C.
ex-9OEZ, Zurian, M/Sgt., foreign duty

Operator's license only:

Butler, Pfc., Scott Field, Ill.
Combs, Lt., Chatham Field, Ga.
De Frances, Lt., Sheppard Field, Texas
Kaminski, S/Sgt., Port Hueneme, Calif.
Kelly, Cpl., Hunter Field, Ga.
Risk, S/Sgt., Roswell, N. M.
Smith, Cpl., Tonopah, Nevada

NAVY—GENERAL

ex-1BOD, Dukat, Lt. Comdr., foreign duty
ex-1CIA, Findlay, RM1c, Treasure Island
1KZL, Fairfield, CRM, foreign duty
1LFF, Stanley, RM3c, Sampson, N. Y.
1MXY, Anderson, Ens., Boston, Mass.
1MYK, Fowlie, S1c, Great Lakes, Ill.
2DHI, Schnaars, S1c, Chicago, Ill.
2LRU, Campanelli, RM2c, foreign duty
3DFM, Stanton, RM3c, foreign duty
ex-3EJI, Selover, CRM, Sampson, N. Y.
3IDD, D'Avanzo, RM2c, Sampson, N. Y.
3JON, Buzzard, S1c, San Diego, Calif.
4EXX, Clamp, CEM, Port Hueneme, Calif.
4GOO, Hettinger, RM2c, foreign duty
4IGY, Merryman, CRM, Charleston, W. Va.
5BFJ, Stewart, Lt., foreign duty
5IVB, Hoipkemeier, Ens., foreign duty
K6LEP, Connolly, CRE, foreign duty
6QJQ, Scott, Lt. (jg), foreign duty
6UQA, Townsend, foreign duty
7BJK, Truman, RM3c, foreign duty
ex-7DQV, Nelson, Lt., foreign duty
8IW, Weston, Lt., foreign duty
ex-8JIE, Johnson, RM3c, Sampson, N. Y.
8KZC, Roller, RM1c, foreign duty
8MSG, Shafer, CRM, foreign duty
8UVE, Schottke, S1c, Gulfport, Miss.
8WUE, Reber, S1c, Great Lakes, Ill.
9BQL, Dempsey, S1c, foreign duty
9BWQ, Niswonger, CRM, National City, Calif.
9FBI, Hodgson, RM1c, foreign duty
9GDQ, Driver, Sp(X)1c, Washington, D. C.
9JFD, Brewer, Lt. Comdr., San Diego, Calif.
9QEF, Graves, RM3c, foreign duty
9VZE, Matala, CSp (T), Jacksonville, Fla.
9YYK, Anderson, Ens., Boston, Mass.
9ZGT, Swenson, Lt. (jg), foreign duty
9ZIU, Boyd, S1c, foreign duty
9ZNL, Detwiler, Ens., Washington, D. C.
9ZXD, Hockfield, Ens., Washington, D. C.

Operator's license only:

Barton, RM3c, foreign duty
Brophy, A/S, Chicago, Ill.
Cannon, CSp (T), Jacksonville, Fla.
Davidson, RM2c, foreign duty
Davis, Y3c, Bremerton, Wash.
Jeffrey, Chicago, Ill.
Landau, RM2c, foreign duty
Pedersen, Lt. Comdr., foreign duty
Wright, S1c, San Diego, Calif.

NAVY—SPECIAL DUTY

1KTJ, Graham, RT2c, Washington, D. C.
2HBA, Thogersen, RT2c, Chicago, Ill.
4ENN, Wilson, S1c, Great Lakes, Ill.
4HYR, Rippy, S1c, Atlanta, Ga.
4IAB, Seals, RT2c, foreign duty
6MHH, Warner, S1c, San Diego, Calif.
6SFS, Jackson, CRT, foreign duty
6THN, Gunther, S1c, Treasure Island, Calif.
6URS, Hansen, RT1c, foreign duty
ex-K7FOY, Blankenship, RT2c, foreign duty
ex-8KTK, Staskus, RT1c, Chicago, Ill.
8VQI, Freeder, S1c, Great Lakes, Ill.
8VWD, Carment, CRT, foreign duty
9EST, Pierce, RT2c, Madison, Wis.
9HDD, Fitzgerald, RT3c, foreign duty
9QAZ, Atchisson, RT2c, San Diego, Calif.
9ZTV, Fox, RT3c, Treasure Island, Calif.

Operator's license only:

McWhorter, RT2c, Seattle, Wash.
Peterson, S1c, Great Lakes, Ill.

MERCHANT MARINE AND MARITIME SERVICE

ex-1BEA, Vitko; 1KSJ, Hamilton; 2HUO, Cunningham; 2LSY, Verton; 3CKN, Dean; 4CJM, Baird; ex-5ASJ, Atwood; 6MXO, Kelly; 6NEW, Simpson; 6QJB, Meadows; 6RDP, Danforth; 6RTZ, Hall; 6TLM, Nobrega; 7FQP, Brant; 8AIE, Sellwood; 8TKE, Scearce; 8TUN, Harmon; 8VWK, Gates; ex-9EMH, Blauvelt; 9EWR, Swan; 9JQD, Koziol, and 9PLA, Ritz. Aronson, Bulkley, Cole, Holden, Lang, Levine, Ottney, Reynolds, Salzman and Schmulenson hold operator's license only.

CIVIL SERVICE

ex-3CDC, Myers, FCC, monitoring officer
4BVD, Hight, CAA, jr. radio engineer, Atlanta, Ga.
5KSS, Penton, Navy Dept., electrician, Corpus Christi, Texas
ex-6CQP, Leavitt, CAA, airway traffic controller, East Boston, Mass.
6FCJ, Johnson, FBI, Arlington, Va.
6MOR, Kingsland, OWI, radio engineer, foreign duty
6RZR, Albright, CAA, air carrier inspector, foreign duty
8VYF, Lewis, FCC, RID, monitoring officer
9CPS, Hrycej, ASF, radio mechanic technician, Chicago, Ill.
9FGB, McCullin, FCC, monitoring officer
9FWF, McCartney, FCC, RID, Washington, D. C.
9WFN, Neher, OWI, associate field representative, Chenoa, Ill.

Operator's license only:

Hastings, FCC, Miami, Fla.

100 PER CENT WAR WORK—INDUSTRY

American Telephone & Telegraph Co.

1CWO, Wallace
1FSH, Melbert
2GE, Wells
4HLG, Hatchett
ex-6AWM, Murphy
6AZK, Meals
6DDO, Gompertz
ex-6FDY, Dickie
ex-6GD, Wright
6HGL, Ellis
ex-6HTK, Hulett
6ITU, Donahue
6IWH, Graham
6LJT, Agnew
6MFM, Thompson
6MQW, Ferrer
8AXV, Pitzer
8AZW, Weaver
9KKP, Nielsen
9QZY, Geiling
9TFV, Clark

Operator's license only:

Bowman

Bell Telephone Labs

1KEB, Barnes, radio engineer
2ALW, Lowdon, technical staff
ex-2CBN, Stucky, technical staff
2CUR, Cole, radio mechanic
2CY, Chisholm, engineer
2DOV, Thompson, technical staff
2GBQ, Frisch, technical staff
2GNS, Haight, field engineer
2HRN, Pope, draftsman
2IMF, Baulch, technical staff
2IPM, Geils, technical staff
2JLH, Crawford, technical staff
2KSZ, DeGhett, project analysis supervisor
2LCD, Just, laboratory technician
2LJO, Lane
3COP, Harms, engineer
3FKK, Cowperthwait, technical staff
3HLR, Harris, technical staff
3KAD, Hammann

Serving with the Office of Strategic Services overseas, this group of amateurs demonstrate a keen appreciation of approaching VE-Day. The photo was taken when that event was in sight. *Standing, left to right:* T/Sgt. Yaciw, W8TBX; T/Sgt. Helm, W7GFG; 1st Lt. Ranney, W8OQJ, and 1st Lt. Olson, ex-W9ELW, commanding. *Sitting, first row:* Sgt. Samaras, op license; T/4 Weiswell, op license; T/4 Ferguson, W9RHK, and T/Sgt. Shirey, W8WHQ. *Second row:* Pfc. Blahunka, W9RCJ; T/Sgt. O'Brien, W9YJW, and T/4 Jones, W9PLX. *Rear row:* T/4 Taschler, W9ZCJ, and T/4 Eakman, W9AHV. Not appearing in the picture are S/Sgt. Swift, W9IQT; Sgt. Bianchi, W9GRZ, and T/4 Smith, W9YOZ.

8JBY, Rosier, technical staff
8NTY, Ketchledge, technical staff
8PBS, Poulson, technical staff
9AHZ, Shirling technical staff
9MF, Scholz, technical staff
9QPI, Thatcher, technical staff

Operator's license only:

Emmons, mechanic & electrical draftsman

Bendix Aviation Corporation

3CDG, Royer, inspector, Westminster, Md.
3DHG, Snyder, engineer, Towson, Md.
3EIM, Lindner, project engineer, Baltimore, Md.
3EPD, Eckersley, field representative, Baltimore, Md.
3EZJ, Warriner, radio engineer, Baltimore, Md.
3FUI, Korzdorfer, project engineer, Red Bank, N. J.
3IBP, Aldrich, engineer, Baltimore, Md.
3IKX, Taich, engineer, Baltimore, Md.
3IWQ, Yates, project engineer, Towson, Md.
ex-5IK, Moon, branch manager, Los Angeles, Calif.
6CDO, Beasley, radio technician, Yucaipa, Calif.
6FUS, Summerlin, North Hollywood, Calif.
6IUS, Carroll, radio tester, North Hollywood, Calif.
6IVU, Lewison, radio technician, North Hollywood, Calif.
6JME, Gemmell, North Hollywood, Calif.
6KCU, Moline, contract administrator, North Hollywood, Calif.
6LYI, Lussier, North Hollywood, Calif.
6MCY, Horn, North Hollywood, Calif.
6NAM, Anderson, North Hollywood, Calif.
6NVI, Carter, laboratory technician, Burbank, Calif.
6OEG, Rudolph, field service engineer, North Hollywood, Calif.
6OIM, Ray, service supervisor, Los Angeles, Calif.
6RVL, Harris, inspector, Los Angeles, Calif.
6SZQ, Jones, field service engineer, Los Angeles, Calif.
6SZS, Rice, project engineer, North Hollywood, Calif.
6TDW, Kesselhuth, engineer, North Hollywood, Calif.
8LUR, Hamilton, field engineer, Unadilla, N. Y.
8QDQ, Maylott, engineer, Sidney, N. Y.
8QJS, Stutler, trouble shooter, Baltimore, Md.
9AFF, Bingham, radio engineer, Fox Lake, Ill.
9BYI, Banning, accountant, South Bend, Ind.
9GBS, Schachte, Towson, Md.
ex-9SBM, Rodgers, analyst, North Hollywood, Calif.

RT1c R. H. Lesser, W3ITP, after graduating from Bliss Electrical School, Treasure Island, and MIT, is now on foreign duty in the Navy. Prior to his enlistment in June, 1942, he was employed for a year as a test-man with RCA.

Boeing Aircraft Corporation

5DIW, Cunningham, Wichita, Kansas
5HXW, Hickerson, Wichita, Kansas
5JBV, Clifford, technical flight engineer, Wichita, Kansas
7BL, Dailey, instructor, Seattle, Wash.
7EJA, Williams, radio technician, Seattle, Wash.
7IGS, McHenry, Seattle. Wash.
7ITI, Jolley, technical flight engineer, Wichita, Kansas
7TQ, Rodenhouse, instructor, Seattle, Wash.
9AWP, Unruh, Wichita, Kansas
9BCY, Dunlap, Wichita, Kansas
9BCZ, Richardson, Wichita, Kansas
9BMO, Tate, Wichita, Kansas
9DJL, Chambers, Wichita, Kansas
9DMF, Miller, Wichita, Kansas
9EOU, Moore, Wichita, Kansas
9FYD, Dunn, Wichita, Kansas
9GSW, Evans, Wichita, Kansas
9HCU, Webster, technical flight engineer, Wichita, Kansas
9HFP, Hamilton, Wichita, Kansas
9JTN, Peterson, technical flight engineer, Wichita, Kansas
9JXT, Ussery, Wichita, Kansas
9JYZ, Shadomy, Wichita, Kansas
9KNQ, Tracy, Wichita, Kansas
9LCC, Orndoff, Wichita, Kansas
9QIM, Brooks, Wichita, Kansas
9QQI, Beckett, Wichita, Kansas
9RMJ, Hall, Wichita, Kansas
9TUG, Le Roux, Wichita, Kansas
9VBK, Divinia, Wichita, Kansas
9YVI, Zinn, technical flight engineer, Wichita, Kansas
9ZJE, Perry, Wichita, Kansas
9ZUY, Yarbrough, Wichita, Kansas
9ZVP, Holloway, mechanic, Wichita, Kansas

Operator's license only:

Rauch, assistant foreman, Wichita, Kansas

American Airlines

1BBJ, Stempel, flight communications officer
ex-1BGJ, Bargamian, radio maint. mechanic
1MBU, Caldwell, flight radio officer
2EFI, Phillips, radio maintenance mechanic
2FDM, Mulhern, flight communications officer
2FJH, Seiter, flight radio officer
2IFX, Ordloff, ground radio mechanic
2JYY, Grech, radio inspector
2LVF, Hallinan, flight radio officer
2LUE, Hallinan, ground operator
2MRT, Driesbach, flight radio officer
2MWB, Jayne, radio maintenance mechanic
2NFO, Van Gorden, foreman
3AJC, Borrow, communications officer
3GXB, Blazek, assistant radio shop foreman
3UVA, Waff, flight analyst
4HEX, Doyle, flight radio officer
ex-5AAQ, Meador, flight radio officer
5ESC, Budd, flight radio officer
5GBL, Faulkner, radio operator
5JJJ, Berge, flight radio officer
6MFX, Winn, flight radio officer
8DQC, McDuffee, flight radio officer
8EVI, Vinay, flight radio officer
8IUI, Michaelis, flight radio officer
8PCI, Pollard, flight radio officer
8SCV, Edward, radio operator
8SZP, Roeger, flight radio officer
8UUW, White, radio mechanic
8VPH, Dale, flight radio officer
9EUN, Kron, flight radio officer
9GFM, Hotoph, flight radio officer
9KRR, Brady, flight radio officer
9OMU, Clough, radio inspector
9RJV, Duncanson, flight radio officer
ex-9TMX, Miner

Operator's license only:

Rupp, flight radio officer

Braniff Airways

5HMH, Beasley, flight operator, Denver, Colo.
5IOT, Fix, flight operator, Dallas, Texas
5IRI, Dalby, flight operator, Dallas, Texas
5IUA, Loomis, flight operator, Dallas, Texas
5IXK, Fridrich, flight operator, Dallas, Texas
5JNK, Wells, flight operator, Dallas, Texas
5JTS, Ashford, flight operator, Dallas, Texas
5JUR, Lane, flight operator, Denver, Colo.
ex-8KPG, Weiner, flight operator, Dallas, Texas
8RBZ, Killian, ground station operator, Dallas, Texas
8SGQ, Vester, flight operator, Dallas, Texas
9AJD, Miller, flight operator, Denver, Colo.
9FYZ, Koppen, flight operator, Dallas, Texas
ex-9HXK, Powers, flight operator, Dallas, Texas
9IQI, Terrill, flight operator, Denver, Colo.
9NXV, Lewis, flight operator, Denver, Colo.
ex-9OYO, Harris, flight operator, Denver, Colo.
9PDX, Smith, flight operator, Denver, Colo.
9QNC, Brunett, ground station operator, Denver, Colo.
9RJQ, Drumm, flight operator, Denver Colo.

A CRO in the merchant marine, William L. Farmer, W9YCT, has served approximately eighteen months on oil tankers and Liberty ships, and has traveled the equivalent of three trips around the globe. Gibraltar, North Africa and Malta were among his ports of call and he escaped a German bombing in Naples harbor without injury.

Miscellaneous

2NFI, Falato, foreman, Allen B. Du Mont Labs.
2NJZ, Nurmela, Polytechnic Institute
2NLM, Marshall, foreman, Allen B. Du Mont Labs.
2NPD, Podolinski, Pilot Radio Corp.
2NRM, Jack, radio tester, Hamilton Radio Corp.
2ODP, Keech, radio mechanic, Barker & Williamson
2OGP, Hollands, Bethlehem Ship Yards
2OPJ, Collier, Weather Bureau, Buffalo, N. Y.
2PL, Lindsay, engineer, Horni Mfg. Co.
2UL, Smith, assistant engineer, Hammarlund
2WE, Clarke, flight radio operator, TWA.
3ADM, Roehm, supervisor, Commercial Crystal Co.
ex-3AEH, Downes, tester, Star Electric Motor Co.
ex-3AZU, Compton, Eastern Airlines
3BDV, Shaffer, Blaw-Knox Co.
3BEI, Filson, New York Shipbuilding Corp.
3BTM, Emswiler, electrician, Hercules Powder Co.
3BVY, Hundertmark, Luscombe Aircraft Corp.
3BWR, Norcross, Atlantic City Electric Co.
ex-3CAZ, Jackson, electrical engineer, Eastman Kodak Co.
3CHO, Roberts, OSRD, Princeton, N. J.
3EBC, Coleman, engineer, Cornell-Dubilier Electric Co.
3ECS, Winter, engineer, E. I. DuPont de Nemours & Co.
3EGK, Montcalm, Ferris Instrument Co.
3EKK, Swedloff, engineer, Hazeltine
3ELV, Franciscus, G. C. Hunt & Sons.
3EO, Bonsted, New York Shipbuilding Corp.
3FHO, Powell, instructor, Hawthorne School of Aeronautics

3FKD, Johnson, Jansky & Bailey
3FPQ, Reed, engineer, Jansky & Bailey
3FUS, Anders, engineer, Brown Instrument
3FZA, Ripani, engineer, Remington Arms Co.
3FZM, Tehan, tech., Hudson American Corp.
3GAL, Hillers, Norfolk, Va.
3GBB, Cooke, Mackay Radio & Telegraph Co.
3GEB, Stout, instructor, War Production Training Program
3GIW, Schulz, engineer, OSRD, Philadelphia, Pa.
3GVR, Zugermayer, Southampton, Pa.
3GXZ, Brewin, technician, Cates & Shepard
3GYA, Altomare, instructor, Capital Radio Engineering Institute
3ID, Baxter, technician, International Resistance Co.
3IEW, Woodard, Williamsville, N. Y.
3IKR, Hibbs, tester, Philadelphia, Pa.
3IQW, Lindquist, engineer, Glenn L. Martin
3IVZ, Stello, engineer, Jansky & Bailey
3JFC, Keyes, electrician, International Resistance Co.
3JSD, Smoll, research technician, Albuquerque, N. M.
3JTX, Sobol, Glenn L. Martin
3PW, Van Horn, Philadelphia Wireless Technical Institute
3QY, Pearson, engineer, Leeds & Northrup Co.
3UK, Todd, engineer, Somerville, N. J.
3UT, Smith, supervisor, Hazeltine
ex-4AUE, Rockwell, engineer, Communications Co.
4AXD, Randolph, tech., Patuxent River, Md.
4BNI, Coady, flight officer, ATC.
4BTI, Brannen, inspector, Bell Aircraft Corp.
4CBU, Welch, Knoxville, Tenn.
4CP, Worsley, engineer, Johns Hopkins
4DAN, Allen, engineer, Interservice Radio Propogation Lab.
4DFW, Mattes, Tampa Shipbuilding Co.
ex-4DLV, Ireland, radio engineer, Finch Telecommunications Inc.
4DOF, Bailey, supervisor, Knoxville, Tenn.
4DQI, Caldwell, elec. engineer, Durham, N. C.
4DSM, Smith, technician, Finch Telecommunications Inc.
4EFZ, Dodd, inspector, Communications Co.
4EID, Newton, technician, Washington Institute of Technology
4EOC, Swan, Knoxville, Tenn.
4FI, Perdue, Bell Aircraft Corp.
4FRM, Fox, Knoxville, Tenn.
4GDI, Victor, electrician, McDonnell Aircraft
4GHP, Long, radio officer, Eastern Airlines
4GKQ, Talkington, Brunswick Ship Yards
4GOV, Leap, engineer, Communications Co.
4HER, Apple, engineer, Airadio Inc.
5ADG, Williams, technician, Henry Mfg. Co.
5AIR, Sears, engineer, Sound Sales & Engineering Co.
5AJJ, Shields, radio mechanic, Chapman Air Service
5AMU, Miller, manager, Texas Electric Service Co.
5AOZ, Simo, radio mech., New Orleans, La.
5AUT, Hallmark, instructor, College Station, Texas
ex-5BDW, Halt, tester, Stewart-Warner Corp.
5BYC, Cox, Douglas Aircraft Co.
ex-5CJY, Ellis, Brown Shipbuilding Co.
5CY, Ash, foreman, North American Aviation
5CZZ, Brewer, technician, Terrell Aviation
5DI, Bradford, instructor, Little Rock, Ark.
5FRL, Beistle, Maguire Industries.
5FSL, Kincaid, Todd-Houston Shipbuilding
ex-5FVJ, Johnson, Homestead, Fla.
5GHU, Davis, engineer, San Diego, Calif.
5GKP, Craig, electrician, Consolidated Steel
5GMR, Cagle, electrician, Consolidated Steel
5HAI, LaVasque, technician, Douglas Aircraft
5HF, Doss, technician, Pantex Ordnance Plant
5HJX, Childers, supervisor, Bluebonnet Ordnance Plant
5HRS, Henry, control tower operator, Glenn L. Martin Co.
5HXN, Simcox, engineer, Aircon Mfg. Corp.
5INZ, Hustow, research engineer, Electro Mechanical Research Inc.
5IZU, Sewell, radio instructor, ESMWT
5JEZ, Vasilescu, radioman, Todd Dry Dock
5JKF, Richards, seismograph operator, Shell Oil Co.
5KNW, Newton, instructor, Texas A & M
5KOR, Russ, Pan American-Grace, foreign duty
5KQD, Young, flt. comdr., Miami, Okla.
ex-5OP, McCarty, manager, Magnolia Petroleum Co.
5PU, Behrendt, supervisor, War Industries Training
6AAU, Johnson, foreman, Moore's Dry Dock Co.
6AKB, McClara, leaderman, Moore's Dry Dock Co.
6AM, Wallace, radio field engineer, Long Beach, Calif.
6AOZ, Zimmer, Radiomarine Corp., San Francisco, Calif.
6BKZ, Cartwright, engineer, San Diego, Calif.
6BLZ, Marriner, engineer, Div. of War Research
ex-6BM, Silent, NDRC-OSRD project
6BMQ, Clowes, radio operator, United Airlines
ex-6CLH, Gordon, Radio Development Lab.
6DH, Short, Douglas Aircraft Corp.
6DJZ, Harwood, radio engineer, Hughes Aircraft Co.
6DXA, Camenisch, electrician, Mare Island Navy Yard
6DZI, Lynch, elec., R. H. Lynch Mfg. Co.
6EPC, Williams, engineer, Div. of War Research
6ERT, Goodyear, draftsman, Todd Shipyards
6EYZ, Ellis, engineer, Div. of War Research
6FTA, Burke, cable carrier, P. T. & T. Co.
6GKO, Stoddard, technician, Bethlehem Steel
6GMD, Miller, Minneapolis-Honeywell Regulator Co.
ex-6HT, Hahmens, flt. radio ofcr., Consolidated Airways
6IBK, Adams, radio supervisor, San Diego, Calif.
6ITH, Tibbetts, Cyclotron Specialties Co.
6JMA, Hicks, physicist, Berkeley, Calif.
6KFK, Gabrielson, flt. radio ofcr., PAA
6KJT, Herrin, Douglas Aircraft Corp.
6KQQ, Thunen, chief engineer, Electric Products Co.
6KSY, Parker, engineer, Airesearch Mfg. Co.
6KZN, Browne, Oak Ridge, Tenn.
6LFA, Joslin, flt. radio ofcr., United Airlines
6LFL, Wasmansdorff, Maguire Industries
6LHI, Berger, Douglas Aircraft Corp.
6LVR, technician, Radio Lab.
6LVX, Neubauer, foreman superintendent, Los Angeles, Calif.
6MEB, George, flt. radio operator, Consolidated Airways
6MEP, Gentry, Lockheed Aircraft Corp.
6MHW, Sample, radio mechanic, foreign duty
6MQM, Click, radio operator, Air Transport Command
6MTS, Henderson, engineer, Gilfillan Bros.
6NBK, Younger, OSRD, Burbank, Calif.
6NIH, Hendricks, Douglas Aircraft Corp.
6NQI, Kurkdjie, lab. technician, Aviola Radio Corp.
6NRC, Savage, flt. radio operator, Air Transport Command
6NRM, Weitbrecht, physicist, Berkeley, Calif.
6OLO, Marshall, engineer, Marshall Radio Engineer Labs.
6PHV, Just, technician, Gilfillan Bros.
6PTR, Rau, engineer, Higgins Industries
6QAP, Keller, flt. radio ofcr., Pan American-Grace
6QDE, Wright, radio tech., Ford Motor Co.
6QHI, Hollenbeck, OSRD, Pasadena, Calif.
K6QHX, Reid, instructor, PAA, San Francisco, Calif.
6QKB, Lazarian, engineer, Richmond Shipyard
6QOZ, Wall, inspector, Los Angeles, Calif.
6QPN, Rosene, Pan American-Grace, foreign duty
6RKG, Gittins, radio operator, Consolidated Airways
6RWF, Gilson, technician, Henry Mfg. Co.
6RX, Ismand, technician, Mackay Radio & Telephone Co.
6RZC, Lee, Heintz & Kaufman
6SAF, Nowak, engineer, Harvey Machine Co.
6SDX, Medeiros, Heintz & Kaufman
6SEX, Schantz, technician, Navy Lockheed Service Center
6SHD, Stiles, Pasadena, Calif.
6SK, Campbell, sonar engineer, Div. of War Research
6SPK, Binder, Western Airlines
6SYT, Akin, jr. engineer, Memovox Industries
K6TCF, Soares, radio operator, foreign duty
6TGH, Amendt, Eimac Co.
6THE, Sermay, foreman, Fellows & Stewart
6TKZ, Hughes, technician, Los Angeles, Calif.
6TLE, Didriksen, San Francisco, Calif.

True ham hospitality has been extended many amateurs moving through the Hawaiian Islands by Paul and Eleanor Christensen, K6OQM and K6ROJ, of Kukuihaele, well known to many of the prewar 10-meter 'phone gang. Sgt. Anderson, W2MZC, who had several QSOs with them before the war, here shows the effect of a five-day furlough spent as their guest.

6TLF, Wilson, radio operator, Air Transport Command
6TNB, Holder, technician, Pasadena, Calif.
6TOS, Smith, engineer, Crosley Corp.
6TWU, Wells, Higgins Industries
6UCJ, Schmidt, PAA
6UOU, Henry, radio engineer, Henry Mfg. Co.
K6UPG, Smith, flt. radio ofcr., PAA
6UTJ, Elleby, engineer, Henry Mfg. Co.
6UTU, Rannie, draftsman, Sound Equipment Corp.
ex-7ACX, Connell, radio inspector, Kaiser Co.
7AEF, Lucas, leaderman, Commercial Iron Works
7AMQ, Sells, engineer, Specialty Mfg. Co.
7AOY, Bloss, Portland, Oregon
7ATE, Peterson, radio technician, Northern Radio Co.
7AVW, Murphy, Goodnews Bay Mining Co.

HAM HOSPITALITY

FROM far-away Mauritius (if your atlas isn't handy, it is an island in the Indian Ocean 500 miles east of Madagascar) comes a cordial invitation from Paul Caboche, VQ8AS, for any W or VE hams calling at the port of St. Louis to get in touch with him. They will be welcome at any time. He can be reached at his office, Mauritius Hydro Electric, Rose Hill, where he is assistant technician.

Ron Henderson, 18 Madden Grove, Burnley, Melbourne, Australia, is second op for VK3AH and VK3HI, hopes to get his ticket after the war and guarantees visiting amateurs news from home via his short-wave receiver.

John Heffernan, W9JPY, now in the merchant marine, relays word that Wilf Bowen, GW4CC, Killay, Swansea in South Wales, entertained him in true ham fashion several months ago and would welcome visits from other amateurs who happen to be in that vicinity. Just ask for him at the Swansea American Red Cross Club.

Taming the Vacuum-Tube Voltmeter

Part II—Construction of a Practical Instrument

BY McMURDO SILVER *

IN PART I of this article an examination of some of the more usual deficiencies of the vacuum-tube voltmeter was made. Certain novel methods of correction were evolved progressively, both individually and in combination, to the end of producing a final instrument capable of measuring voltages from pure d.c. through a.c. over a range extending from below 20 cycles to over 100 megacycles, measuring d.c. current from 1.2 milliamperes through 12 amperes, decibels over a range useful for power-output measurements in receivers and audio amplifiers, and resistances from 0.2 ohms up to 2,000 megohms. In this, the second part, additional factors contributing to all-round utility, probable limits of accuracy, and a final practical example of the formulated teachings will be examined and described.

It has been mentioned that extension of the a.c. voltage range by the simple device so useful for d.c., a resistive input voltage-divider stick, is not satisfactory. This is true even if the stick be capacitatively compensated for frequency. It is possible to build a stick of a total resistance of several megohms which may be used for a.c. up to possibly several hundred kilocycles. To the writer this is an undesirable solution. It necessitates individually adjustable capacitors shunting each section or certain portions of the stick. Usually of compression mica-trimmer capacitor construction, they leave much to be desired in permanence and stability. Such an arrangement will not satisfactorily extend the a.c. voltage range nor the input resistance up to anywhere near the top radio-frequency limit desirable today in receiver servicing. As soon as a diode rectifier is followed (in its d.c. output circuit) by a resistive range-multiplier stick everything works out happily, and there is no need for capacitive a.c. compensation at the stick. Again, it is not practicable to precede the diode with a resistive range-multiplier of a total resistance high enough to be particularly satisfying, because experience has shown that the behavior of the diode appears to differ for different values of input resistance in a manner so difficult to compensate for as to be close to unworkable in practice.

Such an a.c. range multiplier may be used, with appropriate capacitative compensation, preceding a voltage-actuated rectifier such as the infinite-impedance detector. But this device does not push the frequency limit up sufficiently high. Using the infinite-impedance detector as a rectifier directly connected to the source of voltage to be measured imposes decided limitations upon the maximum voltage which may be handled — always less by a significant percentage than any built-in, plate-supply voltage which can be conveniently employed. Passing rapidly over matters of comparative input capacitance, possible input resistance and the multiplicity of scales necessary for successive a.c. ranges, the diode seems to win by a very comfortable margin.

When the diode is followed by the usual d.c. range-multiplier stick, truly small circuit-loading effects are impressed and a multiplicity of meter ranges is obtainable, all at the expense of but one added meter scale (for the non-linear a.c. voltage range of 3 volts and less). The a.c. voltage to be measured may be applied directly to this diode dividing it down *after* it is d.c. to actuate the basic single-range d.c. v.t.v.m.

A diode rectifier suitable for use up to high radio frequencies must have low inter-element capacitance, low lead inductance and no deleterious transit-time effects. This suggests the type 9006 miniature diode as an optimum choice. It spells close element spacing and consequent relatively low inverse-peak voltage rating. To obtain a 1200-volt a.c. range this r.m.s. voltage must be applied to the rectifier. But this exceeds the tube manufacturers' rating. The 300-volt range is just about permissible under the ratings for the 9006. What to do? "Try it," is the time-honored amateur answer (likewise the usual engineering-laboratory answer). So it was tried with a number of 9006 tubes over a considerable period of time, *in exactly the manner as the instrument would be used.* This involved not the *steady* application of 1200 volts to the little "bottle," but the intermittent application of voltage to the tube, exactly as one would use the meter in service to measure an unknown voltage by touching a prod tip to the circuit, reading the meter and then removing the prod. So operated, no 9006 tube yet tested, even after repeated cycles, has shown any noticeable deterioration.

Thus the inference that the tube manufacturers are most conservative in their ratings, as all amateurs are quite positive at heart, seems justified. Be that as it may, the cautious user need not employ the 1200-volt a.c. range of the instrument, since in any event its continuous or even frequent use normally is not required. In cases where such use is necessary the user possibly may have to pay the modest price of an occasional new tube for the a.c. rectifier probe. As justification it will be noted that momentary overloads of tubes is a quite popular practice today, even for the purists, otherwise there would be no instantaneous high-power pulse transmission so useful to the military. A momentary overload, at the price of no thus-far-discovered failures in this case, is a

* 1240 Main St., Hartford, Conn.

desirably simple means of obtaining a useful 1200-volt a.c. range.

When the r.f. probe of the v.t.v.m. is withdrawn for direct contact to an r.f. circuit in which voltage is to be measured, it will shunt this circuit about as would 6.6. megohms of non-inductive resistance. This will introduce little error indeed in practice, for few ordinary circuits will suffer noticeably when shunted by 6.6 megohms. But the probe adds a shunt capacitance of about 8 $\mu\mu$fd. to the circuit to be measured. For an r.f. circuit this means that resonance will have to be re-established for purposes of momentary voltage measurement by retuning of the circuit. This fact must be recognized — it is inherent in all v.t.v.m.s produced commercially to date. Yet it is one that even experienced engineers have been observed to forget occasionally in serious laboratory work! This slight drawback is as nothing, however, when it is realized that with a v.t.v.m. such as the one illustrated, actual stage-gain measurements which have heretofore been available with good accuracy only in the most costly laboratory instruments now may be made by the radio service man.

Probably the most important measurements to be made, in receiver servicing at least, are those of d.c. tube-element, a.v.c. and power-supply voltages, and a.c. power output. With the extraordinarily high input resistance provided, all may now easily be made. But a.v.c. voltages usually are measured most conveniently at the grids of r.f. or i.f. tubes, while the same is true of oscillator voltage in that it is measured conveniently as d.c. bias developed at an oscillator grid. Circuits must be functioning normally to permit useful measurements. Shunting an ordinary d.c. meter across such circuits alters the operation so that measurements with any degree of accuracy are impossible. This is true even with the 50- to 125-megohm input d.c. v.t.v.m. But a simple little device gets around the problem of the meter input capacitance affecting the r.f. or i.f. circuit tuning. A special pair of test prods is required. One, the common, or negative, usually black in color, is conventional. The second, the red prod, has a prod point on *both* ends. The point nearest the point of cord emergence is directly connected to the cord, and is used for a.c. measurements where no series resistance may be permitted. Between it and the second point on the prod a 2-megohm ± 1 per cent metalized resistor is installed, an allowance for it is made in the initial d.c. meter calibration, and the problem is solved. If the *resistor end* of the combination prod now is touched to an r.f. grid to measure a.v.c. voltage, all the grid "sees" as a shunt is 2 megohms in series with the hand close to the other end of the probe, plus lead and instrument capacitance (shunted by the ubiquitous 50-megohm stick), when the capacitative unbalance becomes practically negligible.

Accuracy

It is obvious that if one thing is maintained uniform from example to example to within plus or minus 2 per cent, this will be the absolute order of resultant accuracy. But if *two* of these abstract things are taken together their individual errors can add up to as much as plus or minus 4 per cent, the sum of their individual errors. The more we combine, the greater the possible, but not necessarily the probable, error. To attain maximum error all factors must deviate in one direction to the allowed limit. They probably seldom will fall that way in practice, but the idea illustrates something of the problems of obtaining high accuracy in a v.t.v.m. which, if it is to be made generally available at low cost, certainly must not require hand calibration of the meter scales. Any design deviating within successive examples of itself to a degree serious enough to require hand calibration of its meter scales to stay within a few per cent of absolute is open to the suspicion of inherent inconstancy within itself.

It is customary to rate meter accuracy at ± 2 per cent of full-scale reading. This means that the permissible error at one-tenth of full scale can be 20 per cent of the indicated reading! This is usual test-equipment-meter rating. Quite obviously it won't do for an accurate v.t.v.m. However, by controlling meter production, careful inspection and test of each and every instrument, the over-all accuracy can be held to about ± 1 per cent of the indicated reading over the upper half of the scale, and to about ± 3 per cent over the lower half. It will be necessary to pick and choose to do this, but it can be done, even in quantity production. Thus the average meter accuracy may be rated at around ± 2 per cent.

It has been seen how, by heavy degeneration and balanced circuits, the problem of instability in the ordinary v.t.v.m. has been circumvented, how the effects of tube and line-voltage variations have been washed out almost completely. These constitute a big step, for they mean that the sum of the errors in d.c. voltage measurements should be not greater than that of the sum of the 1-per-cent resistors used in the range-multiplier stick and the average 2-per-cent meter error which add up to ± 3 per cent. This compares very favorably

Despite the many functions of the v.t.v.m., the panel looks quite simple. In this photograph the r.f. probe is plugged into its housing as it would be for all measurements except those for r.f.

with the accuracy claimed for some of the most expensive v.t.v.m.s where such claims usually are to be relied upon. The same order of accuracy will be obtainable in current measurements if ±1-per-cent resistors are used for the current shunts.

In a.c. measurements the accuracy will start out the same as that of the d.c. voltage accuracy but, since a rectifier has been added, the accuracy must decrease as a consequence. Through the use of large values of load resistance it seems possible that the effect of variations in individual diode internal resistance has been minimized, while a check of a number of tubes which are known to differ in characteristics in the diode socket has confirmed the essential independence of operation with respect to differing diodes. From this it seems permissible to rate the a.c. voltage accuracy at ± 5 per cent.

But at what extremes of frequency will this be true? It is known that the a.c. diode load resistor itself will diminish in apparent resistance with increase in frequency, for example. This effect will not be too serious in practice, since the tube load will remain effectively high in operation if the 20-megohm a.c. load resistor is selected judiciously. The effect of diode shunt capacitance at high frequencies is no problem so long as it is tuned out by temporarily retuning the r.f. circuit being measured. Probe inductance which will promote probe resonance as the frequency is raised up above 100 megacycles (in this particular case) can be held to a minimum by using the utter minimum of inter-connections between the diode plate, the input condenser, the necessary probe tip and ground. If this is done, things should work out well. As for low frequencies, the use of a 0.03-μfd. diode input capacitor in conjunction with the 20-megohm a.c. load and 50-megohm d.c. stick will hold the accuracy up nicely to frequencies less than 20 cycles. A careful investigation of the actual accuracy from 20 cycles to 100 megacycles, shows that it should be within ± 5 per cent.

Since the resistance scale is not linear, being in fact logarithmic in character, it is necessary to start off with the meter accuracy, then add to it the ± 1 per-cent accuracy to which the resistance multipliers are held. Actually the accuracy will be greatest at low-scale readings. The basic scale will read from 0 to 10 over the left-hand 50 per cent thereof, and rise rapidly from 10 to 2000 between mid-scale and the right-hand end. It is obvious that accuracy of reading the meter scale alone will be a big factor above mid-scale. So, while resistance measurements up through 2000 megohms may be made, the instrument accuracy, plus the operator's possible reading error, will increasingly cloud the accuracy above 10 megohms — or above mid-scale on any range. This is why not just three or four, but six resistance ranges are desirable. With six well-proportioned ranges measurement of resistances of up to 10 ohms, 100 ohms, 1000 ohms, 10,000 ohms, 100,000 ohms and 10 megohms may be made quite accurately with progressively diminishing accuracy because of meter-reading difficulties over each of these six ranges up to 200 times the above figures. But such ranges, decidedly more useful than have been generally available in the past, are more than enough for most needs today.

So far nothing has been said of db. measurement. With the v.t.v.m. this will be nothing more than the usual measurement of a.c. voltages appearing across known load resistances, then translating these a.c. voltages into db. relationships. But this can be done easily on the meter scale itself. If the basic reference level of 0 db. = 1 milliwatt in 600 ohms is selected, the 3-volt a.c. range may be made to read from −10 to + 10 db., the 30-volt range from + 10 to + 30 db., and the 300-volt range from + 30 to + 50 db. The meter will probably be used most often as a power-output meter connected across voice-coils which usually have a resistance of around 6 ohms. Whatever their resistances may be is of little relative consequence, since for a fixed load the progression of the scales will be satisfactory, while the use of simple arithmetic will determine real powers upon the basis of the 600-ohm, 1-milliwatt meter-scale calibration.

Meter Scales

Except for the most precise order of laboratory work where operational skill and time are of secondary importance, the fewer actual meter scales required the less will be the probability of confusion to the user. An examination of the photograph of the panel will show that this meter face is pleasingly open and free from the often-encountered proximity and crowding of successive scales. Starting at the top is the resistance scale, reading from 0 to 2000. This single scale serves for all six resistance ranges, since each successive step involves only the proper placing of the decimal point in the reading noted to reveal true resistance. Immediately below is the slightly non-linear scale used only for the 3-volt a.c. range. All higher a.c. ranges, as well as all d.c. voltage and current ranges, are read on the two center scales in contrasting color for rapid visual differentiation from the other scales printed in black. All of the "3" ranges (except 3-volts a.c.) are read upon the upper center scale and all of the "12" ranges upon the lower center scale. The slope of each scale is linear, but it seems wise to print two scales, one for each group of ranges terminating with the multiples of 3 and 12 for ease in reading. It would have been possible (and probably confusing) to use but one scale with its significant graduations surmounted by two rows of figures. This has been done for the db. scales, as can be seen at the bottom of the meter face where there is plenty of room below the actual scale to set three rows of figures. To avoid an extra scale (to match precisely the 3-volt a.c. scale), some liberty has been taken with the −10 to +10 db. scale by making its slope the same as for the higher ranges. It will be read approximately 2 db. high if read directly, which difference can be "washed out" in operation through comparison of the 3-volt a.c. and the 3-volt d.c. scales.

A Practical Instrument

The photographs show most of the constructional details of a modern v.t.v.m. built to employ the teachings and improvements set forth in this article and Part I which preceded it and the circuit diagram is shown in Fig. 1. Conventional construction technique, possible in almost any amateur shop, as well as primarily standard parts, have been used in the construction of the instrument shown in the photographs. It is only proper, however, to warn the constructor that the accuracy of this instrument depends directly upon the accuracy with which the various divider and shunt resistors are selected. In this case, each resistor unit consists of two units in series, one whose value is slightly above half of the desired value and the other slightly below half of the desired value. In this manner and checking the resultant resistance with a meter of high accuracy, it is possible to use standard resistors which cost much less than those which are guaranteed by their manufacturers to be accurate within close tolerances.

The panel of the v.t.v.m. shown in the photographs is a piece of 3/32-inch aluminum 7 inches high and 12 inches long. It is fastened to a 12⅜ × 7⅜ × 5-inch metal cabinet by means of four thumb screws. After drilling, the panel was thoroughly "satined" by rubbing with coarse, then fine, steel wool, washed clean in water, dried, and given a protective coat of clear lacquer. It was then taken to an engraver for engraving (it could have been lettered, as with a LeRoy lettering set and India ink, before lacquering).

At the upper left in the front-view photograph are four husky insulated tip-jacks intended to receive the test-prod leads in appropriate order for the ranges to be employed for any measurement. At the upper left is the 3000-volt jack, for d.c. voltage measurements in this range, or in any of the five lower-voltage ranges (each with a 2.5 multiplier mentally applied to the d.c. meter

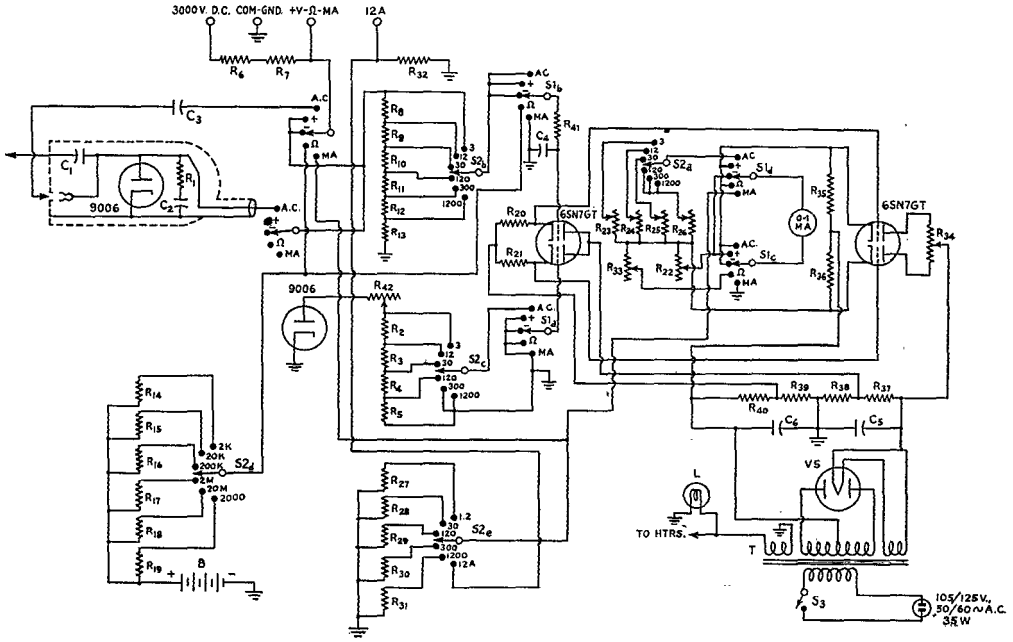
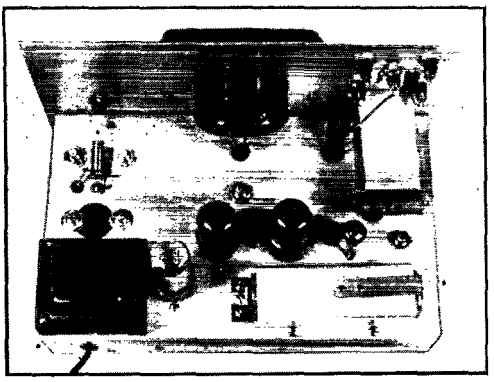


Fig. 1 — Circuit diagram of the vacuum-tube voltmeter.

C_1 — 0.0005-μfd. silver-mica.
C_2 — 0.002-μfd. mica.
C_3 — 0.03-μfd. 3000-volt tubular.
C_4 — 0.005-μfd. mica.
C_5, C_6 — 8-μfd. 350-volt electrolytic.
R_1 — 20-megohm, ± 5 per cent, ¼-watt carbon.
* R_2, R_9 — 7.5 megohms, ½ watt.
* R_3 — 1.5 megohms, ½ watt.
* R_4, R_{11} — 750,000 ohms, ½ watt.
* R_5, R_{13} — 125,000 ohms, ½ watt.
* R_6, R_7, R_8 — 37.5 megohms, ½ watt.
* R_{10} — 3.75 megohms, ½ watt.
* R_{12} — 375,000 ohms, ½ watt.
R_{14} — 10-ohm, ± 1 per cent, ½-watt wire-wound.
* R_{15} — 100 ohms, ½ watt.
* R_{16} — 1,000 ohms, ½ watt.
* R_{17} — 10,000 ohms, ½ watt.
* R_{18} — 100,000 ohms, ½ watt.
* R_{19} — 10 megohms, ½ watt.
R_{20}, R_{21}, R_{41} — 5-megohm, ± 5 per cent, ½-watt metalized resistor.
R_{22}, R_{23}, R_{24}, R_{25}, R_{26} — 3000-ohm wire-wound potentiometer.
R_{27} — 270-ohm, ± 1 per cent wire-wound.
R_{28} — 1.819-ohm, ± 1 per cent wire-wound.
R_{29} — 0.428-ohm, ± 1 per cent wire-wound.
R_{30} — 0.171-ohm, ± 1 per cent wire-wound.
R_{31} — 0.042-ohm, ± 1 per cent wire-wound.
R_{32} — Set experimentally to give 12-ampere range.
R_{33} — 10,000-ohm, wire-wound potentiometer with s.p.s.t. switch.
R_{34} — 3000-ohm wire-wound potentiometer.
R_{35}, R_{36}, R_{37}, R_{40} — 40,000 ohms, ± 5 per cent, 2 volts.
R_{38}, R_{39} — 4,000-ohm, ± 5 per cent, ½-watt metalized.
S_1 — 5-position, 6-circuit, 3-section ceramic switch.
S_2 — 5-circuit, 6-position, 5-section ceramic switch (front section shorting).
T — Power transformer; 115-volt primary, 5-volts; 2 amp.; 6.3 volts; 1.6 amp.; 650 volts; 40 ma.

The resistor value given is the resultant of a pair of matched resistors of half value in series to give accuracy of ± 1 per cent.



Rear view of the v.t.v.m. chassis. The probe housing is at the upper right and the power transformer at the lower left. The can in the lower right encloses the dry cells required for resistance measurements. The tubes, left to right, are the power-supply rectifier, the two 6SN7GTs and the 9006. The screwdriver adjustment to the right is R_{34}, the contact-potential adjustment, the one at the center is R_{22}, the d.c. range-set adjustment. The group at the left is for a.c. range-set adjustments.

scales) and each with 125 megohms input resistance. Immediately below is the common or ground jack, for the test lead common to all measurements. To its right is what might be termed the "hot" or "high" jack used for ohms, ma., d.c. and low-frequency a.c. measurements, at 50 megohms input resistance for d.c. ranges of 3, 12, 30, 120, 300 and 1200 volts, and at effective 6.6 megohms for the same ranges of a.c. At the upper right of this group is the 12-ampere current jack. Here the shunt is directly between the common-ground and 12-ampere jacks, right behind the panel. This is to avoid the heavy wiring which would be necessary, but mechanically undesirable, to run 12 amperes through the range and function switching circuits — definitely not good for the switches themselves.

The cord and shield can, identified as "R.F. Probe," is the whole diode r.f. probe which is plugged into the instrument for low-frequency a.c. measurements or for portability. Examination of the rear-view photograph will reveal the aluminum shell into which to probe shield-can housing slides. The 0.03-μfd. 3000-volt capacitor, C_3, is substituted automatically by the act of pushing the probe into position for low-frequency a.c. measurements. For r.f., or high audio-frequency work the probe may be pulled out and, at the end of its shielded cord, contacted directly to the voltage source to be measured — anything from 20 cycles through 100 megacycles with excellent accuracy, and up beyond 200 megacycles at lessened, but qualitatively adequate accuracy.

The 4⅝-inch rectangular 0–1 ma., d.c. meter is in the center of the panel, with the zero-adjustment knob below it and to the left. The function switch, S_1, the range switch, S_2 and ohms-adjust, on-off switch knob are at the right. Five function-switch positions select a.c., r.f., db. + d.c. volts, −d.c. volts (polarity reversing switch), ohms and direct-current functions. The six-position range switch selects the desired range.

Let's see how many ranges we have ready for use. There are six a.c. and six d.c. ranges, plus the six d.c. ranges at 2.5 times the d.c. meter scale obtained at the common-ground and 3000-volt input terminals. There are also six resistance ranges, six current ranges, six r.f. ranges when the probe is pulled out of the instrument, plus three scale-calibrated decibel ranges. Thirty-nine ranges seems to be the sum obtained — enough to measure anything from dry batteries to auto-radio 6-volt input current, to receiver oscillator grid current or voltage, to resistance, and on through r.f. from 3 through 1200 volts up to well beyond 100 megacycles. Quite a lot for a small package, it would appear.

The rear-view photograph illustrates the interior construction. The tubes, left to right, are the 5Y3GT (or interchangeably 5W4GT or 5Z4) rectifier, the 6SN7GT balanced meter-actuating tube, the 6SN7GT balanced cathode follower, and the 9006 contact-potential-balance diode, with the 9006 a.c. rectifier diode in the removable r.f. probe. If desired, a single 6AL5 miniature dual diode may be substituted for the two single 9006s. This substitution involves the addition of only one more conductor to the probe cable. Directly behind the meter is the d.c. range-set resistor, R_{22}, screw-driver adjusted once and for all during initial calibration. To the right of the 9006 tube is the 10-megohm contact-potential balance adjuster, R_{34}, set once upon calibration to establish equality between measurement and balance-diode contact potentials (initially to set the a.c. meter zero). Distributed about the pilot light are the four a.c. range-set adjusting resistors, lower right R_{23} for 3 volts, lower left R_{24} for 12 volts, upper right R_{25} for 30 volts, and upper left R_{26} for 120, 300, or 1200 volts a.c. All these adjustments are set once in initial calibration, then sealed. They need never be reset in ordinary use until one or more tubes fail. Since the tubes are operated very conservatively and their individual variations "washed out" of operational effect most thoroughly by the proposed design devices, the probability of having to readjust any of these internal controls is most remote indeed. It has been found that new tubes even may be installed without any need for internal readjustment!

The shell to the lower right of the tubes in the rear-view photograph houses the two 1½-volt flashlight batteries used for resistance measurements. It would be better to dispense with spring contacts to these batteries, mount them in large fuse-clips, and solder them into the circuit for low contact resistance. The life is very long anyway, so the bother of having to unsolder to install new batteries is negligible.

The third photograph is an "engine-room" view. Identification of parts already discussed should not be difficult. The function switch at the left is a 5-position 6-circuit ceramic unit — ceramic to prevent development of possible leakage in 50-megohm circuits, a not impossible probability with usual cheap phenolic switch heads. To its right is the 6-position 5-circuit ceramic range switch. Matched-pair metalized resistors

are soldered directly to the appropriate switch lugs. The "current" group (S_{2e}) is at front, ohms group (S_{2d}) next, contact-potential-balance group (S_{2c}) next, then the range-multiplier 50-megohm stick (S_{2b}). At the rear is another switch head, S_{2a}, operated to select the proper a.c. range-set resistors seen in a group of four at the right. All range-set resistors are wire-wound for stability and permanence, the only carbon control in the instrument being the 10-megohm contact-potential adjuster seen at the left in the bottom view.

At the lower center can be seen two 8-μfd. 350-volt tubular metal-cased electrolytic capacitors. Such capacitors have a definite life factor, must eventually, even in the dim, vague future, be replaced, therefore they are not soldered in permanently but plugged in.

So much for the construction. What of its final, necessarily somewhat complex, circuit? Fig. 1 tells the story of the combination of all the new developments previously discussed into a most flexible and utilitarian whole. In dotted lines at the upper left is the r.f. diode probe, the entire 9006 a.c. rectifier of the instrument, together with its r.f. input capacitor, C_1, a.c. load resistor, R_1, and filter capacitor, C_2. For low-frequency operation C_1 is dropped out and C_3 picked up through suitable contacts actuated when the probe is pushed into the instrument. Rectifier-developed contact-potential is balanced out by the second 9006 diode and switch S_{2c}. The desired balance potential is selected from the resistor stick consisting of R_2, R_3, R_4 and R_5. Since this is required only in a.c. operation, the function switch head, S_{1a}, either includes or omits it from the grid circuit of the lower balancing section of the 6SN7GT cathode-follower. Switch S_{1f} switches the "high" input jack about for desired functions, while the 37.5-megohm resistor pairs, R_6 and R_7, provide the 2.5 voltage multiplier for the six d.c. ranges of 7.5 through 3000 volts maximum at the 3000-volt panel jack. Switches (S_{1e} and S_{1f} switch the a.c. rectifier output and the d.c. input to the top of the range stick, R_8, through R_{13} with the desired range selected by the range switches S_2.

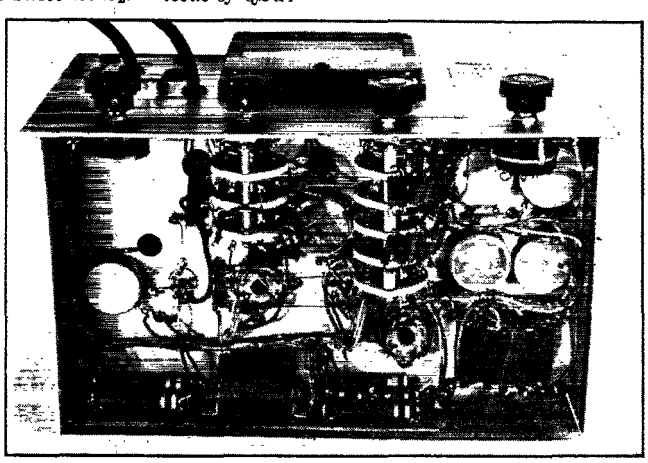
Since it is not desirable to have the primary cathode follower always to have its grid connected to S_{2b}, switch S_{1b} is arranged to disconnect it therefrom for resistance measurements, or to ground it for current measurements. The range switch head S_{2d} selects suitable resistors, R_{14} through R_{19}, for the six resistance ranges and connects the dry battery B. R_{20} and R_{21} are the two cathode-follower load resistors to the "high" ends of which the grids of the meter-actuating 6SN7GT are connected permanently. The function switches, S_{1c} and S_{1d}, shift the meter itself to suit the selected function, and also to serve to reverse polarity for differing a.c. input polarities. The wire-wound adjustable resistor R_{22} is used to set the d.c. voltage ranges on the meter scale, establishing full-scale reading for the 3-volt input which serves to place all d.c. ranges in proper step. Switch S_{2a} selects the different a.c. range-set resistors, R_{23} through R_{26}, which are required for the several a.c. voltage ranges. Switch-head S_{2e}, in conjunction with resistors R_{27} through R_{32} establish the six direct-current ranges.

R_{33} is the front-panel ohms-adjust control, used to set the meter reading to full-scale before starting resistance measurements. *One* setting of this knob serves for all six resistance ranges. The remaining parts have been sufficiently discussed in Part I, with particular reference to Fig. 6, as to necessitate no further definition.

Capacitance also may be measured with the v.t.v.m. To do this will require a pair of ordinary small potentiometers of 2000 ohms and 2 megohms resistance. We may connect one in series with the unknown capacitor across any reasonable and available a.c. voltage (even the 6.3-volt heater circuit, set the "pot" to give equal voltage measured across it or across the capacitor, measure the "pot" resistance, refer to a simple curve, and presto! — there is the capacitance — anything from 0.05 μfd. up to 100 μfd. or more.

Such, then, is what is possible today in the building of a thoroughly modern, war-born v.t.v.m. There is little to add — except one extraordinary point. This instrument is literally *self-testing!* By means of its voltage functions every internal operating voltage may be measured by the v.t.v.m. itself. Likewise the values of the voltage-divider-stick resistors, contact-potential balance and current range resistors may be measured by the vacuum-tube voltmeter. In practical fact only the resistance-range resistors may not be measured without another separate instrument, since the operational effect of every other resistor can be quite well determined in terms of the voltage across it.

Part I of this article appeared in the July, 1945, issue of QST.



Bottom view of the v.t.v.m. The "function" switch is to the left and the range-selector switch to the right.

OUR fading tests for the Bureau of Standards are completed and an analysis of the results, by S. Kruse, is to be expected soon, says *QST* for August, 1920. Now the ARRL QSS Tests begin, with much wider participation. . . . Static finally appeared about a month ago but we are still handling about half the normal winter traffic volume, perhaps largely because of the increasing number of daylight routes, which handle traffic with entire ease. . . . 6EA has been heard in Honolulu. . . . F. H. Schnell, Chicago City Manager, announces QRM regulations adopted by the Chicago Executive Council. 7 to 10 P.M. is to be for local traffic only, 10 P.M. to 6 A.M. for long distance only.

A. L. Groves describes the "Efficient and Flexible Receiving Set" which, as the result of much experimenting, is giving him exceptionally good reception. It is a 3-circuit tuner with coils 5¾ inches in diameter. The plate coil is in a tuned-plate circuit and not used as a tickler. . . . Horle's description of "Navy Receiving Equipment" concludes with a review of the SE-1420 receiver and SE-1599 amplifier. Tewpieye, later to be known as Zeh Bouck, makes his debut in *QST* with a story on "A Ham on the Telephone."

We have a page of photographs and a brief description of WCC, Marconi's old South Wellfleet station which has now been dismantled. There were four 200-ft. wooden towers in a 300-ft. square, with the station house in the center. An unusual feature of this famous old station was that the key broke the 22,000-volt circuit. Its spark has been heard five miles on a quiet night. . . . In sharp contrast is the announcement by RCA of plans to construct a Radio Central on a 6400-acre tract near Port Jefferson, L. I. It will supply simultaneous message service to many countries and will dwarf all existing wireless stations. There are to be six T antennas crossing in the center like the spokes of a wheel, supported on 72 towers 400 ft. high. The antennas will be of the Alexanderson multiple-tuned system, suspended between 150-ft. cross-arms on the towers and running a mile in each direction from the center. There will be ten Alexanderson alternators of 200 kw. each, a total of 2000 kw., 300 horsepower. Eventually there will be simultaneous transmissions to 10 points in the world, remotely controlled from Broad Street, New York. The receiving aerials are to be located 18 miles away and are of a new type, designed for operation with the improved Weagant system of stray elimination, and have been chosen by Dr. Alexanderson as the best available circuit for this work.

The editor complains that there are too many controls on a modern amateur receiver and pleads with manufacturers to produce something simpler for us, perhaps with just two knobs, one for tuning and one to control regeneration. . . . Advertisements display the prices of a considerable variety of apparatus. A variable condenser ordinarily costs $4 or $5, although better ones are priced at $6–$7. An average tuner without detector or amplifier costs $55. Detector-twostep combinations range from $48 to $70. A rotary gap is shown at $50. Imported headphones cost $22. Receiving vacuum tubes are $6 and $7.

Radio Relay Links Planned

The FCC has granted the Raytheon Manufacturing Company construction permits for five experimental radio relay stations to be installed between Boston and New York City. The stations will be located at New York City, Bristol and Tolland, Conn., Webster and Lexington, Mass.

These stations are for the purpose of developing new techniques for the transmission and relaying of high definition and color television programs, high-fidelity f.m. programs, and telegraph, telephone and facsimile communications. An important phase of the experimental program provides for the development of a system of aeronautical safety communications, aircraft traffic control and an automatic reporting service on the positions of aircraft which would be provided simultaneously with transmission of f.m. and television programs and other point-to-point communications.

The stations will operate with a maximum power of 100 watts on frequency bands to be assigned by the Commission's chief engineer.

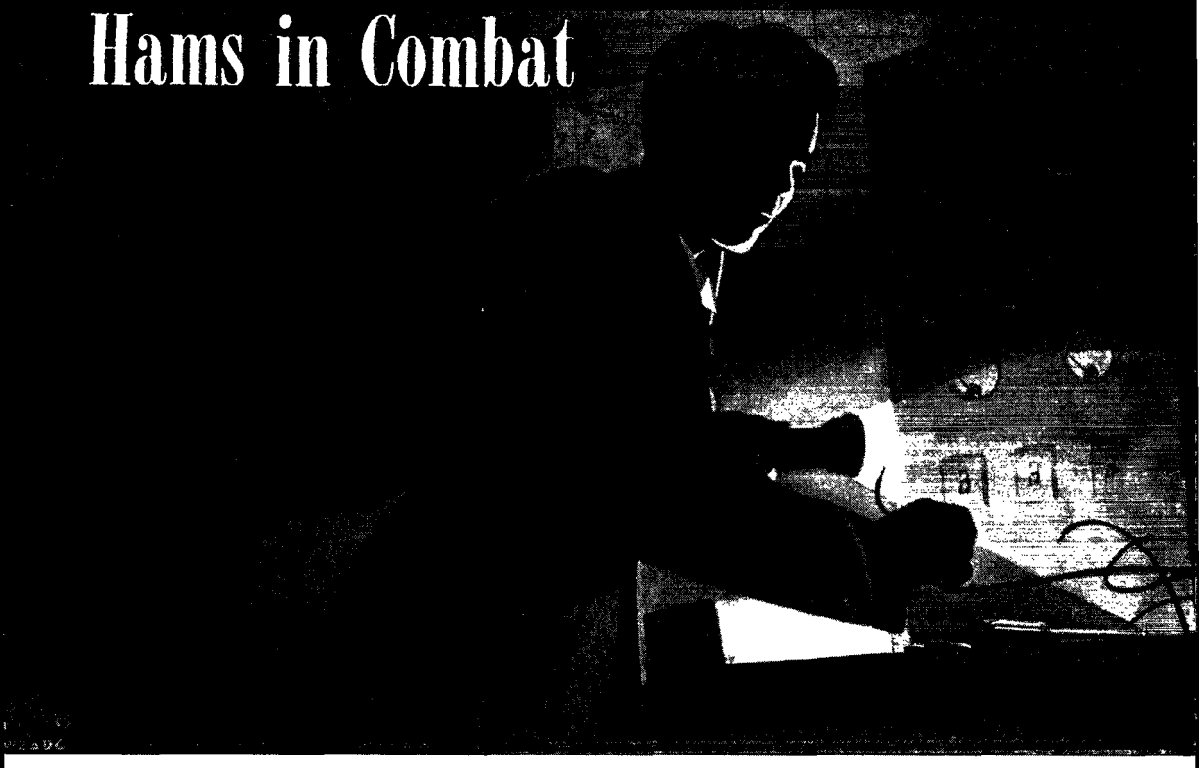
The radio relay system proposed by Raytheon is similar to those under construction at Boston and New York by AT & T reported in June *QST*.

—•••—

Extensive plans are being made by AT & T toward the establishment of a new public radiotelephone service between mobile units, such as cars, trucks, buses, railroad trains and harbor craft. The system will function much like the present police radio systems, except, of course, that it will serve as a link between the mobile unit and the nation-wide telephone system. Initial installations will be confined to the larger cities and the frequency band from 152 to 162 Mc. has been assigned for this service. A maximum power of 250 watts is contemplated for the fixed station and 15 watts for the mobile units.

Plans have been made for two-way service in which any mobile station may talk with any telephone-system subscriber, and a one-way system to notify mobile subscribers to call in at the nearest telephone for instructions.

Hams in Combat



Danger in the Early Morning

BY HERBERT H. TRIPP,* VE5AEU

IN THE days before Pearl Harbor there were quite a few VEs in the radio rooms of various liners and freighters plying deep water. After September, 1939, these boys were forced by events to forsake the old ham shack and again start listening to 500 kc. and the various other government frequencies. For most of us, war at sea was something new at the time. Except for a few moth-eaten novels describing U-boat warfare in the years 1914–1918, most of us had no inkling of what we were in for. Of course, there were a few of the "blue bloods" still around who had ensconced themselves aboard ship in the days when spark and crystal reigned, and in due passage of time were at last recognized as "here to stay." These chaps, many of them old-time hams themselves, used to greet us young squirts with cynical stories about "What was the future of operating coming to, if this was the kind of stuff they were putting out to pad the operator's chair?" And after the first shock of meeting they would give out all sorts of horror stories about U-boats in the last war, so that about sailing day our junior Sparks would be on the verge of quitting ship in order to follow the more peaceful wartime pursuit of Army life.

*Chief Operator, U. S. Merchant Marine, 825 West 8th Avenue, Vancouver, B. C.

Using bare wire I reconnected the transmitter power and antenna leads by the light from a flashlight.

For the first few months of the war the Atlantic crossing was more or less of a milk run — if you overlook the dirty weather and ice scares along the convoy routes. However, after the Huns became established in Norway and the French coast fell, misery descended on the North Atlantic like an avenging ghoul. The fall of Norway took a large number of escorts away from the Atlantic run. The Mediterranean flare-up likewise drained other available ships. It must be remembered that in those days all the escort duty was done by ships of the Royal British, Canadian, Australian, and New Zealand Navies. About all we saw of Uncle Sam at that time were the lonely little ships of the USCG out on their neutrality patrol. More than once I had occasion to feel a very warm glow in my heart when, sighting a Coast Guard cutter on the murky horizon, we would see his blinker flash out "Good luck" as he disappeared into the blackness. Just two little words, but they packed a lot of weight.

After leaving port several additional duties were put up to the operators in those days including, among other items, flag and lamp signaling. It was quite common practice for Sparks to spend several hours out on the navigation bridge in a snowstorm trying to pass messages from one ship to another. A common type of QRM while copying visual sigs was to have an excited skipper jumping up and down at your side, tearing his hair and yelling, "What's he saying, Sparks?

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.

What's he saying?" It was always good to get back to the sanctuary of the radio shack. "SSSS" calls were pretty frequent in the latter part of 1940, and it kept Sparks busy crawling into his cans to pick up the positions of the latest unfortunates. Required listening also included the rebroadcasts put out by various coastal marine stations on both sides of the Atlantic, giving the latest sub dope. QRN on a tropical run was another headache. And that static on 500 kc. made 7-Mc. QRM seem like paradise.

I was unfortunate enough to be on one of the victims, the 9000-ton British freighter *Goodleigh* at the start of this phase of the war. As a rule, sub attacks came from single U-boats or, at most, in pairs. About the time our escort problem was at its peak, the Hun decided to launch his wolf-pack tactics.

A brief description of the enemy's plan will show how ominous their dirty work was. As a convoy proceeded across the pond it would be sighted by the Hun and announced to the U-boat fleet. The convoy would proceed along unmolested for several days thereafter, while the various undersea craft maneuvered around, in force, for a favorable chance to attack. For the most part these attacks came at night, or just before dawn. Those of the crews who could slept during the day.

This particular voyage on the *Goodleigh* was pretty much routine until the mid-Atlantic was passed, if a good blow off the Newfoundland banks is overlooked. (A storm at sea holds little interest in the daily papers, except to the poor blokes who happen to find themselves in the middle of it.) All crew members slept in their clothes from that time on, with their life jackets close at hand. Ships were known to have gone down in ninety seconds after being hit.

Then came that fateful Monday morning in December. The preceding day had been lovely and sunny, with a smooth sea, but as nightfall approached the sea picked up until a heavy swell was running, and the sky clouded over. Our ship had received no visits from the enemy, although several lone "SSSS" calls had been logged. But our luck was not to hold out much longer.

At 2:45 A.M. ship's time I was pulled, feet first, from my sack by the other radio officer. "We are under attack," he yelled. "Hurry up to the bridge, the OM wants you PDQ!" Just as I was leaving my cabin door, after groping my way into a heavy bridge coat, a terrific explosion from a Scandinavian tanker astern rocked the air. The ill-fated vessel was lighted up momentarily by a vivid bluish white flash, and then all was pitch black. My eyes suffered from the glare and I had quite a struggle to find the bridge ladder on which I groped my way up. Reporting to the master, I was instructed to stand radio watch, while the other radio officer was to stand bridge watch.

I sat down in the shack's "pit" (chair) and drew up a fresh log sheet. A few minutes passed, and then a jerky, ragged, sputtering "SSSS" call split the air. One of the ships had managed to get her transmitter going and issue a position report and a call for help. I scribbled down the information and phoned it into the chart room. Several other calls were logged, quite close by, and then silence reigned. We had broken convoy by then and were speeding away into the blackness to safety. At 3:30 A.M., after about twenty-five minutes of running, I entered "all quiet" into the log. Two minutes later my world exploded with a terrific clatter.

I came to in an inky blackness, with a foggy head and a collection of bruises. The operator's chair and its occupant had been thrown across the cabin and smashed against a bulkhead. The tinfish had hit under the starboard side of the bridge, and had torn that structure adrift. The wireless office received its share of the explosion. The roof, along with its protective concrete blocks, had collapsed inwards, dumping the emergency batteries into the cabin. Contents of store cupboards, drawers, and files were scattered all over the deck. Both main and d.f. receivers disappeared through the starboard bulkheads to the deck below. All the steel frames were twisted like straws and buckled. How the transmitter (a Marconi ¼-kw. c.w./i.c.w. medium frequency set with parallel bottles in a Hartley oscillator) survived, is one of those mysteries! It had shifted about a foot on the operating table, tearing adrift all power leads and the antenna. Doubtless the fact that it was situated in the corner of the cabin on the port side had something to do with it.

With the aid of a flashlight the power leads were reconnected with bare wire. The vessel was going down by the head, and had taken a bad list to starboard. Anxious moments went by while I pulled over the main starter in the hope that engine-room power was still available. The high whine of the m.g. settled my doubts. All that remained was to see if the bottles would light up — and some r.f. come out. The glass faces of the filament, plate and antenna meters were all bashed in, but by using a lead pencil on the antenna and by watching filament color, I knew some r.f. evidently was going out. It was impossible to determine by dial settings if the rig was still on

500 kc. We just prayed it was and sent out a call and our position — blind.

While these operations were going on in the shattered wireless cabin, the crew was launching the two remaining lifeboats, while the engine room gang secured their fires and boilers. We had previously lost two lifeboats in a howling gale off Newfoundland.

Lowering a heavy boat over the side of a sinking vessel in pitch dark, with a good sea running, is dangerous work. One slip and you have a lot of useless matchwood on your hands. It's an eerie sensation standing on the boatdeck of a sinking ship with steam roaring up from the exhaust stacks. The first boat was launched okay, but the painter holding it to the ship parted just after the falls were released and the lifeboat had to sheer away in the bad weather, with only a partial load. We were luckier with the other boat, however, and with the exception of the master, chief officer, "bosun," a few seamen and me, all were taken off. We remained on board to see if the vessel would float long enough for Naval aid to reach us and perhaps salvage the ship. More than several score ships had been known to make port under their own steam, with large gaping box-car holes in their sides and bottoms. Fate willed otherwise for us, however, and about thirty minutes after the first torpedoes popped us, two more shattering explosions announced the arrival of a pair of "fish."

The first torpedo struck the port side of the engine-room. A shower of steel plates and the collapse of the funnel recorded the hit. Both main and emergency antennas came down. The other "fish" struck under the starboard bow anchor, and ripped the fo'castle open. It was high time to abandon ship, so we tightened our lifejackets and tumbled overside. It was logical for the Hun to remain in the vicinity of the ship as long as we stayed aboard.

Drifting astern of all that remained of our floating home, we saw her stern rearing up vertically as it made ready for the last plunge. Then a loud chugging was heard, and an enemy U-boat came out of the blackness. Fully surfaced, he approached closer and closer. We could see the bow wave very clearly as he splashed through the water. One of his deck guns barked rapidly several times in succession. We were beginning to wonder what they were shooting at, when several brackets of star shells glowed in the sky, casting a cold blue-white illumination on the heaving sea. The U-boat circled twice, evidently searching for something. We had a miserable feeling that we were the missing "object of his affection." Veering in his course toward the sinking vessel, the U-boat at last gave up his search as a towering column of smoke and water rose from where our ship had been. A fourth torpedo had been added to complete the job the others had done amply. Fortunately, for us, the U-boat disappeared.

After we floated around in the North Atlantic hanging onto some wreckage for several hours, one of our lifeboats pulled up and hauled us in.

After several hours had passed, we were cheered by the sight of several destroyers coming toward us in the dawn. It was not very pleasant to be seven hundred miles from the nearest land in our condition. We were pulled smartly aboard, and the injured crew members were attended to at once. Hot drinks and warm blankets soon brought the spark of life back into all of us.

Next morning, our rescue destroyer, H.M.S. *Viscount*, returned to escort the remainder of the convoy. The enemy made several more attempts to do damage on the way, but without success.

For us survivors the voyage had already ended. We were already looking forward to some good chow, a good time ashore, and a new ship in which to put back to sea.

It is very true that a lot of valuable cargoes were lost during those awful days, along with some stout and true ships, but enough managed to get through so that in later days when the armor of Uncle Sam was to move eastward across the Atlantic, it had its base on which to land — the British Isles. Thanks, in no small part, to the seamanship, courage and sheer guts of the men of the Allied Navies and the merchant marine who, in the traditions of the service, "*carried the goods through.*"

An enemy U-boat came out of the blackness. Fully surfaced, he approached closer and closer.

A Better Electronic Keyer

More Dependable Semi-Automatic Dots and Dashes

BY HARRY BEECHER, RMIc* W2ILE

Electronic keys have been the subject of considerable investigation and constant improvement and simplification since the author of this article described an original version in an earlier issue of *QST*. In the intervening time he has tried most of the suggested circuits, and this time he comes up with one which is more dependable and foolproof and easier to handle than any of its predecessors.

THE desirability of an electronic key has occurred to many amateurs since the original article which appeared in April, 1940 *QST*.[1] Other designs which have appeared in subsequent issues [2] have shown that the combinations and methods of accomplishing the production of semi-automatic dashes as well as dots are numerous, and the idea has stimulated experiments which are a credit to amateur radio.

The original key presented a workable idea, but obviously it is complicated; precise relays, accurately adjusted, are required for operation of the device. The various designs which have followed have evolved around the following general classifications of relay control: thyratron, multivibrator and blocking oscillator. Most of the various circuits have been tried by the author and have worked well, but the multivibrator type of circuit seems to have certain advantages over either of the other two types. However, it has been found that improvement could be made by stabilizing the supply voltage and adding an extra relay-control tube, which removes the relay from the *RC* circuits. With the addition of a grid-limiting resistor a perfect square wave can be obtained at the relay from a sawtooth or sine wave. The improved circuit is shown in Fig. 1.

Most operators have difficulty in holding the dashes for the precise length required. The key shown in the photographs will make a complete dot or dash merely by hitting either the dot or dash lever, respectively. In addition, the key will not start another "mark" until the space period has been accomplished. In other words the dash lever can be hit, the key thrown to the dot side and hit for a dot and a perfect N made with no strain. This allows precise, compact characters at high speeds with less effort. A square wave is applied to the control relay resulting in crisp operation and uncritical relay adjustment.

How It Works

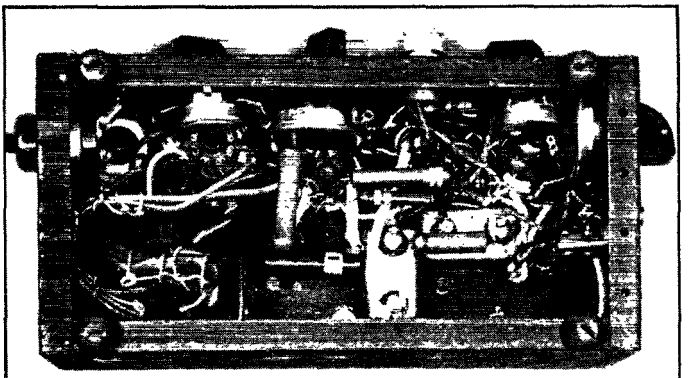
The design centers about a direct-coupled multivibrator neon-tube oscillator. V_2 and V_3 make the "mark," while V_4 makes spaces and provides the starting voltage which can be conveniently called a pulse. V_2 isolates the relay from the resistance-capacitance circuits and provides control for operation of the relay.

With the key open, C_5 is charged to 105 volts through R_7, R_8 and R_9 and V_4 is non-conducting so long as the key is open. The effect of the positive voltage on the grid of V_3 is washed out by the voltage drop across R_5 which also biases the tube to cut-off, but V_1 and V_2 are conducting and the relay, *Ry*, is held open. With the key closed, C_5 discharges instantly through the key contacts and R_{10}, which limits the peak discharge current, preventing damage to V_4, and a negative pulse of short duration is applied to the grids of V_1 and

*56 South Main St., Milltown, N. J.

[1] Beecher, "Electronic Keying," *QST*, April, 1940, p. 9.

[2] Grammer, "An Inexpensive Electronic Key," *QST*, May, 1940, p. 12.
Savage, "Improved Switching Arrangement for Simplified Electronic Key," *QST*, March, 1942, p. 36.
Gardner, "An Improved Electronic Key," *QST*, March, 1944, p. 15.
Page, "Another Multivibrator-Type Electronic Key," *QST*, March, 1944, p. 17.
Wiley, "Simplifying the Electronic Key," *QST*, July, 1944, p. 40.
Snyder, "A Versatile Electronic Key," *QST*, March, 1945, p. 42.



All resistors, fixed condensers and controls are mounted below deck in this electronic key.

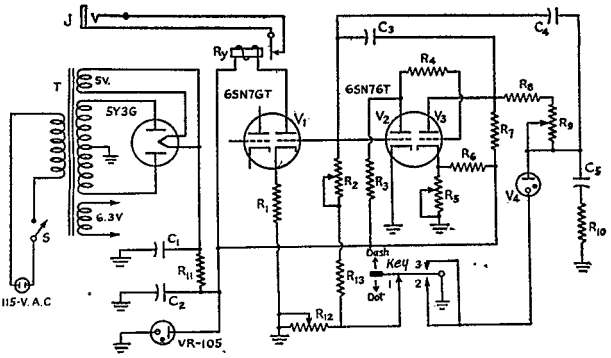


Fig. 1 — Circuit diagram of the electronic keyer.

C_1, C_2 — Section of dual 8-μfd. 450-volt electrolytic.
C_3 — 0.25-μfd. 600-volt paper.
C_4 — 0.01-μfd. 600-volt paper.
C_5 — 0.1-μfd. 600-volt paper.
R_1 — 1000 ohms, 1 watt.
R_2 — 75,000-ohm variable, 1 watt.
R_3 — 150,000 ohms, 1 watt.
R_4 — 250,000 ohms, 1 watt.
R_5 — 20,000-ohm variable, 1 watt.
R_6 — 15,000 ohms, 2 watts.
R_7 — 20,000 ohms, 1 watt.
R_8 — 50,000 ohms, 1 watt.
R_9 — 250,000-ohm variable, 1 watt.
R_{10} — 100 ohms, 1 watt.
R_{11} — 12,000 ohms, 10 watts.
R_{12} — 500,000-ohm variable, 1 watt.
R_{13} — 30,000 ohms, 1 watt.
T — Power transformer: 350-350 volts, 90 ma.; 5 volts, 3 amp.; 6.3 volts, 3.5 amp. (Stancor P-6012).
V_1, V_2, V_3 — Triode section of 6SN7GT.
V_4 — Type 991 midget neon voltage-regulator tube with bayonet base.
S — S.p.s.t. toggle.
Ry — Ward Leonard relay type 507-543.

V_2 through C_4. The effect of the negative pulse is to cut off V_1 and V_2. V_2 amplifies and inverts the negative pulse to a positive pulse at the grid of V_3. The highly amplified positive pulse is inverted by V_3 and applied to the grids of V_1 and V_2 as a negative pulse of high level, the action of which is to aid the pulse from V_4 and practically instantaneously cut off V_1 and V_2. V_3 now is fully conducting and the negative charge leaks off through R_2, R_{12} and R_{13}, this period constituting the "mark" period.

When the negative charge of C_3 falls below the cut-off value, V_3 and V_2 start to conduct causing the grid of V_3 to become less negative and an amplified positive pulse is applied to the grids of V_1 and V_2. The effect is to cancel almost instantaneously the negative charge on the grids of V_1 and V_2. V_1 and V_2 are now conducting and V_3 is cut off. C_5, which by divider action of V_3 and R_7 is held below the point of ionization of V_4 (87 volts) charges through R_7, R_8 and R_9. If the key is held down, V_4 will discharge upon reaching ionization potential and another "mark" will start. The values of R_7, R_8 and R_9 in conjunction with C_5 determine the length of the "space" period. R_2 is the dot-length control, and R_{12} the dash-length control. R_8 and R_{13} are resistors used to extend the useful range of space- and dot-length controls. R_2 limits the current of V_1 to 2 ma. for proper operation of the relay. R_4 limits the amplitude of the positive pulse applied to grid of V_3. R_3 is the coupling resistor from V_2 to V_3.

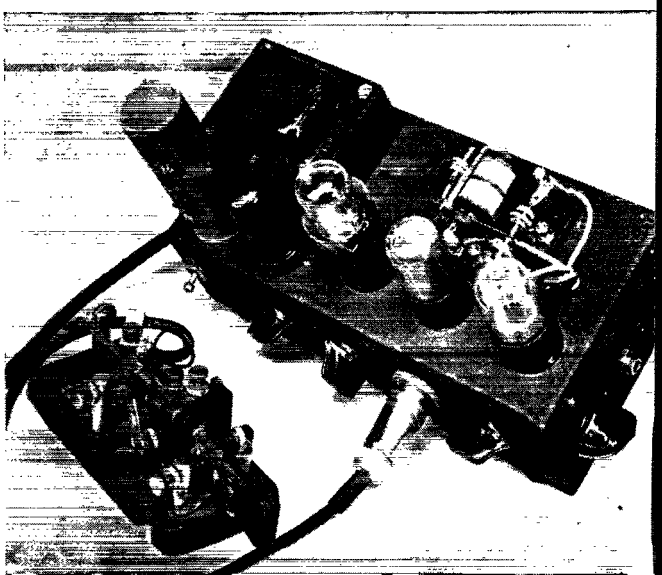
Construction

The model shown in the photographs was lashed up in the forward area aboard ship during spare moments from odds and ends of parts which happened to be available, which accounts for the "ventilation" holes in the chassis and the battle-scarred appearance of some of the components. The whole works, including power supply, is included in the 5 × 3 × 10-inch chassis. To the left are the half-shell-type power transformer, the dual-section electrolytic filter condenser, C_1C_2, and the rectifier tube which may be a 6X5, or a 5Y3G if the transformer has a 5-volt rectifier-filament winding. At the center is the VR-105 voltage-regulator tube. The two 6SN7GTs are to the right with the relay behind. Along the front edge of the chassis are the power switch, S, the dash-length control, R_{12}, the dot-length control, R_2, the key-input connector and the space control, R_9. At the right-hand end are the cut-off adjustment, R_5, and the jack for making connections to the external circuit which is to be keyed.

Underneath the chassis plenty of space is found for the numerous resistors and fixed condensers. All power-supply grounds, including the regulator-tube ground, should be connected to a common point on the chassis to prevent instability which may result in "triggering" of the circuits.

The key is a revised bug. The extra contact, No. 2 in Fig. 1, is made by insulating the lever-stopping screw on the dot side from the frame. This can be done quite readily by enlarging the

(Continued on page 94)



Topside the electronic keyer. The unit is complete including power supply. The key is a modified "bug."

New Tubes

Types 6N4, 2C40, GL-3C22, 1B48, CK510AX, 6AJ5, 2523N1/128AS, 0A2, 4-250A, 822-S

6N4

AMATEURS will be particularly interested in the Raytheon addition of the 6N4 to the miniature glass-button-base type of tubes designed especially to work efficiently into the u.h.f. regions. It is a sample of the type of tubes with which we will be working in the new ham bands up to the proposed 420- to 450-Mc. band.

The 6N4 is a triode capable of working as an oscillator, an amplifier, or a doubler up to approximately 500 megacycles. By reducing interelectrode capacitances, shortening lead lengths, and producing high transconductance in this tube, efficient operation at these frequencies is made possible. It looks as though this tube will be widely used in m.o.p.a. rigs, walkie-talkies, and portable mobile units.

The heater for its cathode takes 6.3 volts at 0.2 amperes. Maximum plate voltage is 180, and plate dissipation is 3 watts. It has an amplification factor of 32 and a transconductance of 6000 μmhos. As a Class-A amplifier with 180 volts on the plate, the recommended grid bias is −3.5 volts and the plate current 12 milliamperes.

2C40

Destined for use by amateurs in the new proposed bands up to and including the 2500–2700 megacycle band is General Electric's triode "lighthouse" tube, the 2C40. As a local oscillator it is capable of giving a power output on 3370 megacycles of 750 milliwatts with a plate voltage of only 250. As a Class-A r.f. amplifier in receivers it is good up to 1200 megacycles. It has a six-pin octal base and may be mounted in any position.

Electrical Characteristics

Heater voltage	6.3 volts
Heater current	0.75 amperes

Direct Interelectrode Capacitances

Grid-plate	1.3 μμfd.
Grid-cathode	2.0 μμfd.
Plate-cathode	0.05 μμfd.
Cathode r.f. connection-cathode	45 μμfd.

Average Characteristics

Grid voltage	−1.7 volts
Amplification factor	36
Grid-plate transconductance, Ib = 17 milliamperes	4850 micromhos
Frequency for maximum ratings	3370 megacycles

Typical Operating Conditions

Class-A Radio-Frequency Amplifier	*Typical Operation*	*Maximum Rating*
Grid Separation Circuit		
D.c. plate voltage	250	500 volts
D.c. grid voltage	−3	25 volts
D.c. plate current	15	25 milliamperes
Plate input	3.75	watts
Plate dissipation		6.5 watts
Noise figure (small signals)	8.5	decibel
Power gain (small signals)	15	decibel
Frequency	700	1200 megacycles

C.W. Oscillator	*Typical Operation*	*Maximum Rating*
Intended primarily as a local oscillator in the frequency range of 100–3370 megacycles.		
D.c. plate voltage	250	500 volts
D.c. grid voltage (Rg = 10,000 ohms)	−5	volts
D.c. plate current	20	25 milliamperes
Plate input	5	watts
Plate dissipation		6.5 watts
D.c. grid current, approximate	0.3	milliamperes
Plate power output	0.075	watts
Frequency	3370	3370 megacycles

GL-3C22

Another postwar ham tube will be the G.E. "lighthouse" triode, the GL-3C22. If you want 50 watts at 600 megacycles this is a good tube to choose; it will give this output as an oscillator with 1000 volts on the plate. However, forced air at the rate of 30 cf/m. is required for cooling. Above 750 megacycles the heater voltage should be reduced 0.5 volt below normal.

A stack of external circular fins is an integral part of the plate connection to this tube which permits the maximum plate dissipation to be so high. It has a six-pin octal base and may be mounted in any position.

Electrical Characteristics

Heater voltage	6.3 volts
Heater current	2.0 amperes
Heating time	1½ minutes

Direct Interelectrode Capacitances

Grid-plate, shield on radiator	2.4 μμfd.
Grid-cathode	4.9 μμfd.
Plate-cathode, shield on grid and on radiator	.05 μμfd.

Average Characteristics

Amplification factor	40
Grid-plate transconductance, Ib = 50 ma.	5000 micromhos
Frequency for maximum ratings	1000 megacycles

Maximum Ratings

Class-C radio-frequency power amplifier and oscillator. Key down conditions per tube.	
D.c. plate voltage	1000 volts
Peak plate voltage (under modulation conditions)	2100 volts
D.c. grid voltage	−200 volts
D.c. plate current	150 ma.
D.c. grid current	70 ma.
Plate input	150 watts
Plate dissipation	125 watts

1B48

The 1B48, a high-voltage cold-cathode miniature gas rectifier, also was recently announced by Raytheon. Designed for high d.c. voltage at relatively low current and minimum space, it is particularly suited to oscilloscope applications.

Besides its small dimensions, 2¼ inches over-all length and ¾-inch diameter, its lack of need for the usual filament power transformer means a saving of weight and power consumption as well as space. A single tube can deliver 1000 volts d.c. output at 6 milliamperes, but higher voltages are obtainable by adding tubes in series.

Its electrical characteristics are as follows:

Maximum peak inverse voltage	2700
Maximum peak plate current	50 ma.
Average d.c. voltage drop	100 (at 6 ma.)
Maximum d.c. output current	6 ma.
Minimum peak a.c. starting voltage	800
Maximum starter anode current	100 μa.

CK510AX

The CK510AX, a double space-charge tetrode voltage amplifier, is Raytheon's latest addition to their series of hearing-aid tubes. Isolation of the two tetrodes in the one bulb is sufficient to permit their use in cascade at audio frequencies.

Each zero-bias unit draws 60 microamperes of plate current and 200 microamperes of space-charge grid current at a plate voltage of 45 (maximum) and with a 0.2 megohm space-charge grid resistance. Its plate resistance is 0.5 megohm; amplification factor, 32.5; transconductance, 65 micromhos. The filament takes 0.625 volts and draws 50 milliamperes.

6AJ5

Tung-Sol has added to the list of v.h.f. and u.h.f. miniature glass-button based tubes the 6AJ5, a pentode intended for operation at plate and screen voltages of the order of 28 volts in low-power applications at these frequencies. In most applications where higher voltages are available the 6AK5 should be used.

In the case of a push-pull Class-AB_1 amplifier, however, 6AJ5 are the tubes to use. They will deliver an output of one watt with 180 volts on the plates, 75 volts on the screen, and −7.5 volts grid bias. Under these conditions the plate-to-plate impedance is 28,000 ohms, second-harmonic distortion is two per cent, and third-harmonic distortion is 5 per cent.

General characteristics of this tube are as follows:

Heater voltage	6.3
Heater current	0.175 amperes
Interelectrode Capacities	
Plate to control grid (with shield)	0.01 μμfd.
Input	4.1 μμfd.
Output	2.0 μμfd.
Maximum Ratings	
Plate voltage	180
Screen voltage	140
Plate dissipation	1.4 watts
Screen dissipation	0.5 watts
Cathode current	18 ma.
Typical Operating Conditions	
Plate voltage	28
Screen voltage	28
Cathode-bias resistor	200 ohms
Plate current	3.0 ma.
Screen current	1.2 ma.
Amplification factor	250
Plate resistance	90,000 ohms
Transconductance	2750 μmhos

2523N1/128AS

To the family of gas triodes, Du Mont adds the 2523N1/128AS. It is essentially an outdoor tube and field tests indicate a life expectancy of ten thousand hours when operated within its ratings.

Operating Characteristics	
Heater voltage	2.5 volts
Heater current	1.75 amperes
Average tube voltage drop	13 volts
Anode voltage (instantaneous)	400 max.
Peak anode current	300 ma. max.
Average anode current	1 ma. max.
Grid resistance	300 megohms min.

OA2

In the miniature type of cold-cathode, glow-discharge regulator tubes is the RCA OA2, designed for regulation of "B" and "C" voltages in compact equipment where space precludes use of the larger regulator tubes. The d.c. operating-current range for this tube is 5 to 30 milliamperes and its output voltage 150. Its characteristics are substantially the same as the OD3/VR-150.

4-250A

The big brother to Eimac's 4-125A is the 4-250A, a kilowatt tetrode that is capable of giving 75 per cent efficiency at 100 megacycles. The filament takes 5 volts at 10.5 amperes. Maximum ratings are as follows:

D.c. plate voltage	4000 volts
D.c. plate current	350 ma.
D.c. screen voltage	600 volts
Plate dissipation	250 watts

822-S

The Taylor 822-S is an all-around, general-purpose high-power triode limited in r.f. applications to the vicinity of 30 megacycles. Its appearance is very similar to the 810 with the plate cap on top and the grid cap on the side. Its carbon plate has a dissipation rating of 200 watts. A pair of them in a Class-B modulator will give a kilowatt of audio with 3000 volts on the plates (500 ma., max. average plate current). At 1500 volts and 390 milliamperes, the output is reduced to 400 watts. In Class-C telegraphy service a single tube is capable of 600 watts output at 2500 volts and 300 milliamperes plate current. Required driving power for this type of service is 17 watts. In plate-modulated Class-C amplifiers maximum plate voltage is 2500 and plate current, 250 milliamperes. Driving power required is 13.7 watts.

Electrical Characteristics	
Filament voltage	10 volts
Filament current	4 amperes
Interelectrode Capacities	
Grid to plate	13.5 μμfd.
Input	8.5 μμfd.
Output	2.1 μμfd.

Typical Operating Conditions		
Plate voltage	2000	2500
Plate current	300 ma.	300 ma.
D.c. grid current	51 ma.	51 ma.
Grid bias	−136 volts	−190 volts
Plate dissipation	140 watts	150 watts
Power output	460 watts	600 watts

— *W. E. B.*

Fig. 1 — Known by the AAF as "Mickey," by the RAF as the "black box" or the "gen kit" — the radar bombsight enables navigation in zero visibility and pin-point strategic bombing despite overcast or darkness. Ground-reflected u.h.f. waves trace in shadowy outlines on the fluorescent cathode-ray tube screen a panoramic picture of the terrain below by its electrical characteristics. Resembling an X-ray photograph, with surface features appearing as shadowy white patches or lines, bodies of water show up in solid black and coastlines appear in sharp, distinct outline. Skilled operators can identify distinguishing characteristics of specific targets in complex terrain. The area scanned can be spread out for navigational purposes; alternatively, "close-up" patterns can be cut down to sweep only a small region for locating specific target areas. Employing techniques adapted from television, circular scanning is used with a combination of linear and radial sweeps to provide a circular raster, giving dimensional perspective. A calibrated scale on the face of the tube indicates the relative radius of the area being viewed by the number of concentric rings visible as the range-finder timing control is adjusted. The rings cover approximately ten miles per additional radial increment. Except at center of screen where radial sweep lines blur, outlines are clear and distinct to permit precise navigation and reasonably accurate bombing. A radial timing marker facilitates observation of moving targets. Altitude indications are given roughly by area of pattern and more precisely by a separate indicator unit.

Radar Techniques

Part IV—Boundaries

BY CLINTON B. DE SOTO,* WICBD

WHEN the British first disclosed the existence of radiolocation, omitting details as to its functioning, from his own experience the practising amateur knew that conductive surfaces would reflect radio waves. It was quite within the realm of reason, then, that metallic targets such as aluminum-skinned aircraft and steel-hulled seagoing vessels would reflect radar pulses. But it was a moot point in ham circles whether nonconductors would similarly reflect. Would the use of plywood aircraft defeat the new weapon, for example?

In time tales began to trickle down the grapevine concerning unsuspecting flocks of southward winging geese being vigorously "intercepted" by hastily summoned defensive forces, or of huge enemy warships being "detected" on the North Atlantic patrol and promptly blasted into Kingdom Come — or, rather, into the component nebulae of what had been a nomad iceberg.

Then it began to be whispered that some of the smart hams among those early radarmen were supplementing the impersonal pips on the c.r.-tube screen with aural listening checks — having discovered that subtle differences in the overtones generated by the returning pulses were helpful in differentiating between an island and a battleship, or in distinguishing an enemy recon-

*Editor, *QST*.

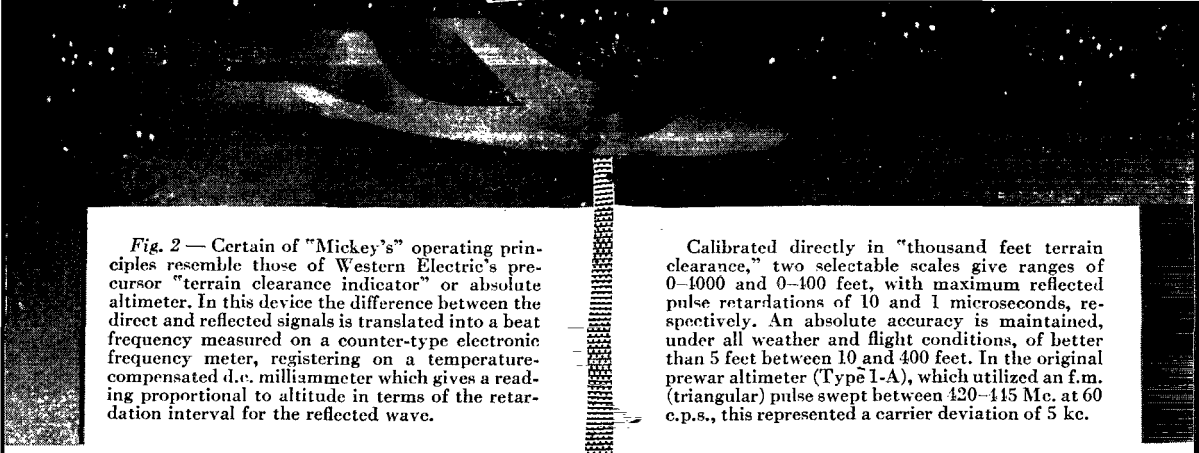


Fig. 2 — Certain of "Mickey's" operating principles resemble those of Western Electric's precursor "terrain clearance indicator" or absolute altimeter. In this device the difference between the direct and reflected signals is translated into a beat frequency measured on a counter-type electronic frequency meter, registering on a temperature-compensated d.c. milliammeter which gives a reading proportional to altitude in terms of the retardation interval for the reflected wave. Calibrated directly in "thousand feet terrain clearance," two selectable scales give ranges of 0–4000 and 0–400 feet, with maximum reflected pulse retardations of 10 and 1 microseconds, respectively. An absolute accuracy is maintained, under all weather and flight conditions, of better than 5 feet between 10 and 400 feet. In the original prewar altimeter (Type 1-A), which utilized an f.m. (triangular) pulse swept between 420–445 Mc. at 60 c.p.s., this represented a carrier deviation of 5 kc.

naissance plane from a covey of migrant mallards.

The fact that the distance, azimuth and altitude of a distant object can be measured by a reflected radar pulse represented a fascinating disclosure. But even more intensely interesting was the fact that the shape and general nature of the object itself can be determined by analyzing the character of the wave reflected from its surface. This accomplishment, like the radar echo itself, involves the function of retardation — of a measurable delay introduced by the relaxation time or time constant ("logarithmic decrement" to OTs; $1/Q$ to Young Squirts) of the reflecting boundary, and its discernible effect on the returned wave packet.

Impedances in Space

Every amateur knows that a transmission line will deliver maximum energy if the terminating impedance exactly matches the iterative (characteristic) impedance of the line. When the line is either open- or short-circuited (load impedance infinite or zero) all of the energy will be reflected back to the source, while for intermediate ratios of impedance between zero and unity and between unity and infinity some of the energy will be delivered to the load and only a part reflected. The returning reflected wave will combine with the progressive incident wave to form a system of standing waves, with a node of electric field, E, and a maximum of magnetic field, H, at the reflecting surface. If the situation is reversed, reflection again will be complete, or very nearly so; but the phase of the reflected wave will be opposite, with a maximum of electric field at the termination.

The sign of the load impedance controls the phase of the reflected wave. In a line a purely resistive load will cause a 90-degree phase shift. If the load resistance appreciably exceeds the characteristic impedance, the phase will be advanced; if it is lower, the phase will be retarded. An inductive load (corresponding to a short or constant-voltage section of line, less than one-eighth wavelength long) correspondingly will advance the phase angle, while a capacitive load (between one-eighth and one-fourth wavelength) will retard it.

These effects are in line with the discussion of transmission-line analogies concluding Part II of this series.

In a reflected space wave, shifting the phase of the E and H components produces standing waves in the same manner. This is customarily represented graphically by superposition of waveshapes on a single plane — the addition or cancellation of the two waves at points where they are in or out of phase — to produce a composite waveshape. The validity of the result is readily demonstrable by recording progressive voltage or current readings along a transmission line and plotting minima and maxima. In the space wave, of course, voltage and current do not exist, as such. Instead, substitute quantities are employed, such as electric (and magnetic) flux density and electric (and magnetic) field intensity gradients. Again, the linearly distributed parameters of L and C are written in terms of the specific inductive capacities of the transmission medium — the permeability, μ, and the dielectric constant (or permittivity), κ.

For all practical purposes the relationships are identical to those in more common use. It is for this reason that we can describe the characteristics of any transmission medium in terms of impedance. It reduces itself to an expression of familiar laws in substitute terms:

$$v = 1/\sqrt{LC} = 1/\sqrt{\mu\kappa}$$

and

$$Z_o = \frac{V}{I} = \sqrt{\frac{L}{C}} = \sqrt{\frac{\mu}{\epsilon}} \text{ ohms.}$$

It is found that all terms and relationships must be employed in duality to circumscribe the three-dimensional form of the space wave which depends for propagation on the mutual ratio of its electric and magnetic fields.

The transmission impedance of the propagated wave depends on the ratio of these fields — which is to say, on the ratio of displacement to conduction current, or electric and magnetic intensity and density.

In a uniform plane wave being propagated through space, the total energy densities in the E and H fields must be exactly equal; otherwise the field will cease to be uniform. It will be like a tricycle with a larger driven wheel on one side than on the other. Such a vehicle would probably run, after a fashion, but it wouldn't stay headed in one direction very long without considerable steering.

Or consider a more utilitarian version with paired wheels being propelled over a smooth pavement at a fixed maximum speed — say ten miles per hour. Suddenly the right-hand wheel of the tricycle drops in a hole, which abruptly ends the forward velocity of that wheel and brings it to a rapid halt. Thereupon the other wheel, driven by the total momentum of the tricycle, spins the vehicle around until, amazingly, it is headed back the way it came. That — assuming the driver continues pedalling — may be considered a reflected tricycle!

Now shift the season to winter. A puddle of water on the pavement freezes into slippery glare ice. Again the tricycle hits the spot with one wheel — but this time the increased velocity of the left-hand wheel, accelerated on the slippery ice, causes it to outstrip its sluggish partner. And again the vehicle spins around and reverses direction.

Numberless variations on this theme might be conceived. Either or both rear wheels of the tricycle, for example, could encounter a stretch of gooey, glutinous mud which would decelerate its forward velocity until all its momentum was gone — dissipated by friction. Again, the forward wheel might hit a rock at an angle, deflecting the forward direction of travel — refraction.

All of which, with a suitable leavening of imagination, constitute crude facsimiles of the mechanics of reflection.

In applying these rather trivial fables the conventional electromechanical analogies may be discerned, the fundamental conditions being that retarding frictional force or mechanical resistance is proportional to velocity (inductance), while restoring forces are proportional to displacement (capacity).

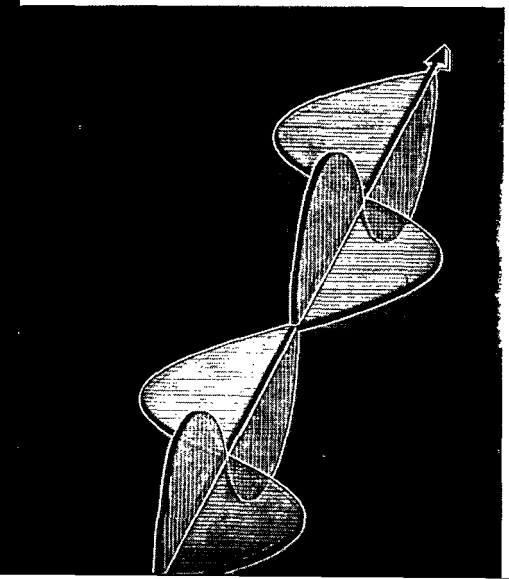


Fig. 3 — Waveshape phase diagram of incident plane wave, with E and H in time phase and space quadrature.

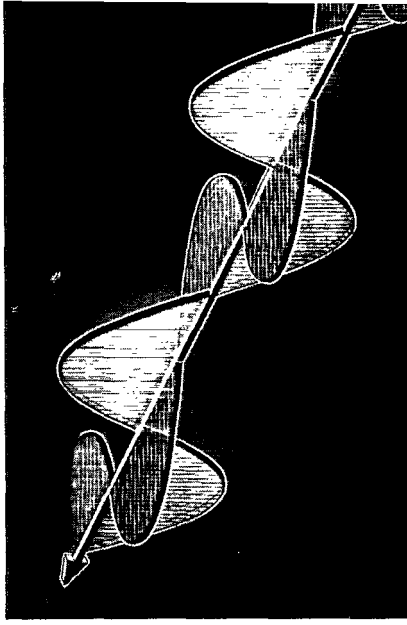


Fig. 4 — Waveshape phase diagram of standing reflected wave, with E and H waves in both time and space quadrature.

The elementary transmission-line and mechanical reflection analogies reviewed above are relatively simple and straightforward. They involve only time and two-dimensional space coördinates — and the latter can be reduced to a single-valued one-dimensional field for graphical representation. In the reflection of space waves, however, the process can become infinitely more complicated.

Consider that the space wave contains at least two separate components vibrating in different planes, that the incident wave may encounter a boundary at any angle — and that, because of the mutually perpendicular displacement of the E and H components, the angle of incidence for each component may be different. To simplify matters, consideration here will be limited to the case of a plane harmonic incident wave which is propagated at constant velocity and phase along a single axis in space, as depicted in Fig. 3. Even so, when all the variable quantities involved in the complex characteristics which may be encountered in the reflecting boundary are taken into consideration, the variety of possible conditions is astonishing. It all depends on the reflecting surface.

Reflecting Surfaces

Electrically, three qualities inherent to a conducting boundary control the characteristics of the reflected wave. These are, of course, the resistance (but it is more convenient to convert this value into conductivity), permeability, μ ($= 1$ for dielectrics and most nonferrous conductors), and dielectric constant, κ.

Matter consists of positive and negative

charges bound together by the forces of attraction between them. When an electric field is applied there is a tendency for the charges to move in opposite directions against these restoring forces of attraction. In the case of a molecule in which charges are prone to become concentrated at opposite ends of the molecule there is also a tendency for the molecule as a whole to turn, setting itself in the direction of the field. These are called "polar molecules." They may be likened to tiny dipoles which try to orient themselves in the direction of the field at any instant. The charged portions do not separate; they merely tend to rotate as a whole, depending on the magnitude of the charges, the size of the molecule, viscosity of the medium, temperature and other factors.

The behavior of any dielectric varies with frequency, depending upon the polarization of the molecules existing in that dielectric. The frequency at which maximum loss factor occurs, called the relaxation frequency, and the rates at which both loss factor and dielectric constant change with frequency, are determined by the molecular structure of the material, in particular as to whether it is polar or non-polar.

In an alternating field the movement of charged electrons or the rotation of the polar molecule attempts to follow the alternations of voltage. Since the molecular and ionic movements are opposed by the forces of attraction between molecules and the inherent viscosity of the material, there is in general a lag behind the electric field. This causes a power loss in the material. As the frequency increases the loss becomes greater up to a point at which the particles cease to respond to the frequency. Above this point the dielectric constant decreases. If the internal friction is low the peak takes place at high frequencies, while if it is high, as in glasses and many crystalline solids, the peak occurs at low frequencies. At relatively low frequencies the resonance effect is accounted for by surface charge and space charge effects, while at optical frequencies it is a function of electronic action in the molecules themselves. At radio frequencies the absorption is accounted for by the action of polar molecules.

Thus, for almost any substance, there will be some frequency or frequencies in the spectrum for which it will be transparent (or at least translucent) to electromagnetic waves, as well as some for which it will be opaque, and also one (or more) narrow range of frequencies at which it will be literally resonant — perfectly absorbing.

Characteristics

In essence, conductivity (or transmissivity) may be described as a measure of the density of the medium. The thicker the particles in a gas, for example, the more molecules per unit space, and therefore the better the transmissivity. Similarly, in a liquid or solid the less complex the arrangement of potential barriers the better the conductivity.

The phenomenon of resistance is said to be based on the freedom of the molecular structure of a material to adapt itself readily to the passage of electrical current. The reciprocal of a material's resistance — its conductivity, σ — is the criterion which defines its ability to adapt itself to the transport of electric current is expressed in mhos per meter.

The dielectric constant, while generally defined as the ratio of the capacity of a condenser with the dielectric material between the electrodes and the capacity of the electrodes alone when placed in vacuo, in electromagnetic wave propagation is defined as the square of the ratio of the velocity of propagation in vacuo to the velocity in the material, the ratio being dependent on the wavelength.

There are no known substances with vanishing dielectric constant, so that even in conductors some dielectric current will always be present. However, its value is so small that its presence is

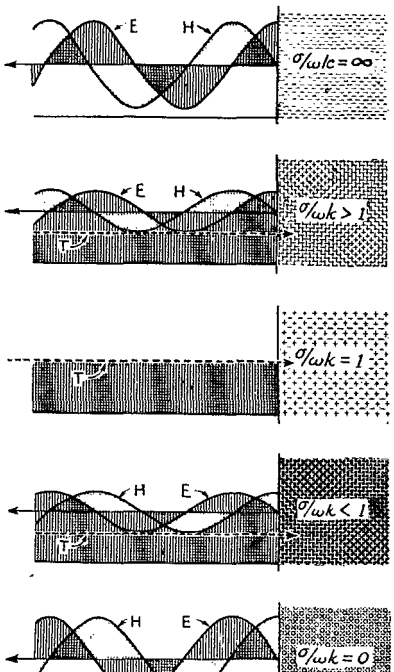


Fig. 5 — Standing-wave phase relations in reflected waves. At top, complete reflection from either perfect conductor or dielectric; electric field is zero and magnetic field maximum at the boundary. The same relationship applies to reflection from the perfect dielectric of much dielectric constant or smaller permeability, where high displacement current effectively shorts the electric field as does conduction current. Where reflection is from a perfect dielectric surface of much smaller dielectric constant or greater permeability, the phase of the reflected wave is opposite; *E* field at maximum and *H* field at minimum at the boundary, as shown at the bottom, where $\sigma/\omega\kappa = 1$, so that intrinsic impedances are matched, the incident wave is entirely transmitted and no reflection occurs as shown at center. Intermediate conditions are shown above and below where displacement and conduction currents both are present.

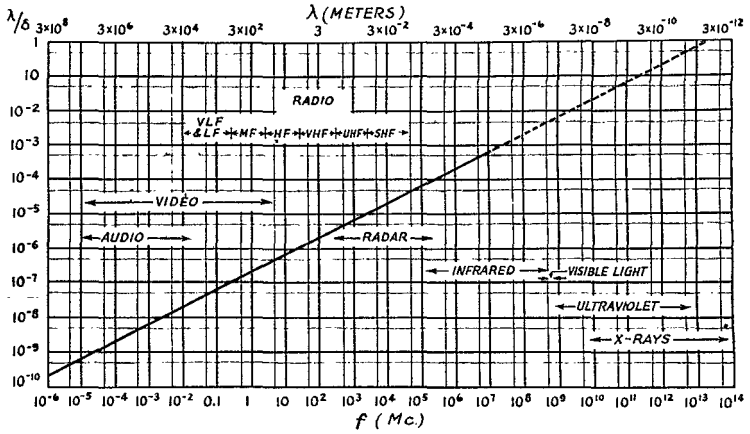


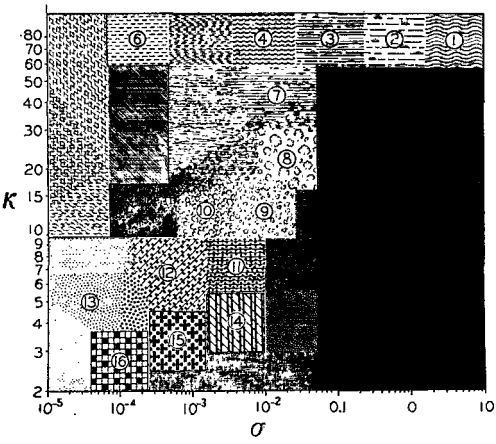
Fig. 6 — Ratios of skin depth of current penetration in good conductors proportional to free-space wavelength for frequencies throughout the electro-magnetic spectrum. Beginning in the infrared region (dashed line) above about 10^{-5} Mc. electronic absorption occurs in certain conductors at the resonance frequencies of the bound electrons, resulting in dispersion effects.

obscured by the conduction current, if the conductivity is appreciably large. The conductivity of various substances exposed to varying physical conditions ranges from practically infinity. Current practice, therefore, is to classify all substances under such headings as super-conductors, conductors, semi-conductors, and non-conductors or insulators. Substances capable of withstanding an applied electric stress, or dielectrics, include, in addition to the insulating materials, certain of the semi-conductors.

It is current practice to classify media for which $\sigma << \omega\kappa$ as dielectrics, and for which $\sigma << \omega\kappa$ as conductors. Substances for which σ is of the same order of magnitude as $\omega\kappa$ are classified as semiconductors.

Conductive Surfaces

A good conductor represents a highly inductive impedance. From the viewpoint of a uniform plane wave in free space impinging on it at normal incidence, however, the magnetic inductive capacity is cancelled by the dielectric inductive capacity, and only the negligible resistance remains as the net impedance. Thus the power factor of the conducting surface is always very close to 1.



Unlike the magnetic field which, once set in motion, will penetrate anything — even amorphous materials like wood and glass — the electric field is unable to maintain any appreciable charge distribution across the surface of a good conductor. Again, it's a matter of matched impedances. The impedance ratio between air and copper, for example, is something like 25,000 at 3000 Mc.

The significant factor in all this is the natural relaxation time, δ, required for the charge to decay to a certain value. For a good dielectric this will be very long; for a good conductor extremely small. The range is extremely great; in dielectrics such as fused quartz or polystyrene it may be as much as 10 days or more under ideal conditions at low frequencies while for copper it is likely to be of the order of microseconds.

For a progressive uniform plane wave the wavelength in the conductor can be defined as

$$\lambda_c = 2\pi\delta$$

Thus in copper the wave velocity is changed from 3×10^8 meters per second to 4.14×10^4, or about 1/46500 that of light. The wave is attenuated exponentially as it penetrates into the conductor. For δ the amplitude decreases to $1/e$, or about 36.8 per cent and for 3δ it diminishes to 5 per cent.

Note that the energy is not absorbed. The field is not dissipated; it is merely attenuated, slowed

(*Continued on page 86*)

Fig. 7 — At the left are charted typical ranges of conductivity and dielectric constant for average terrain. (1) Sea water. (2) Salt marsh, coastal. (3) Marshy plain near ocean. (4) Small fresh-water lakes. (5) Fresh-water rivers and inland lakes. (6) Pure distilled water. (7) Swamp land; wet soil (loam; 25 per cent moisture). (8) Black loam, fertile farm soil; flat or gently rolling. (9) Rolling low hills and little forestation; loam or sandy loam. (10) Medium hills and forestation; clay or sandy loam. (11) Flat, dry, rocky sand or shale; gravelly, broken loam or dry clay with rocks. (12) Broken mountainous stony land or rock. (13) Dry loam or sandy rocky soil (less than 1 per cent moisture). (14) Suburban residential areas. (15) Average city industrial areas. (16) "Downtown" metropolitan sections of large cities.

★ HAMDOM ★

Pictured in Hamdon this month are hams serving in the Air Corps and the Signal Corps, and in civilian war production. Each is doing vital work, his performance enhanced by earlier amateur training.

♦

Capt. Frederick W. Rockwood, AC, W1IOB, assistant chief of the Signal Communications Section of the Air Service Command, USSTAF, was responsible for much of the special signal equipment which helped our airmen pin-point targets deep in Germany. His section was in charge of repairing and modifying all the radio equipment used by the Eighth, Ninth and Fifteenth Air Forces in Europe. Time after time they invented improvements which saved our fliers' lives and made their missions more accurate. Regarded by his colleagues as one of the foremost experts on high-frequency radio technique in the United Kingdom, while attached to the RAF Capt. Rockwood was commended by the British Air Ministry for "excellent work . . . in fitting the Lancasters used on the Ruhr Valley dam-smashing raids with a special radio equipment under conditions of greatest urgency."

Radio has been W1IOB's hobby ever since he was a boy in school and for a while after his graduation from high school he taught radio in a WPA project in Lynn, Mass. Prior to his enlistment in the Air Corps in June, 1942, he was employed in the First Corp Area of the Signal Corps in Boston where he also taught radio classes.

Capt. F. W. Rockwood, AC, W1IOB
Official Air Service Command USSTAF photo

♦

Major Paul J. Moore, SC, W9MV, who is the assistant officer in charge of the Radio Division in the Enlisted Men's School at Fort Monmouth, N. J., has been a ham since 1921. Prior to enlisting in June, 1942, W9MV worked variously as a studio, control-room and transmission engineer at NBC in Chicago, and he credits his amateur experience with making possible this civilian career. His amateur background, plus his professional work and his early military training, which included four years in the Oklahoma National Guard and two years in the ROTC, made it only natural that he should be assigned to the Signal Corps. After completing the Company Officer Course at Fort Monmouth he served in various capacities at the Eastern Signal Corps School. At present, in addition to being assistant OIC of the Radio Division he has charge of several of the advanced courses.

Willard R. Clark, W2MUJ

Major Moore began his ham career with a Ford spark coil, crystal and Navy tuner. He worked up to a quarter-kw. Thordarson and Benwood spark gap, but in 1923 he gave this up when he became a c.w. convert, using an oil-immersed UV202 in a Hartley circuit. He finally graduated to a pair of 250THs with a full kilowatt at W9MV. Earlier calls were 5KV and 5AJC. DX has always been W9MV's main interest. Making WAC in 1934, it almost came to be a habit when, in the 1937 DX contest, he made WAC on the 28-, 14- and 7-Mc. bands twice in one day!

Major Paul J. Moore, SC, W9MV
Official U. S. Army Signal Corps photo

♦

Willard R. Clark, W2MUJ, was awarded, in October, 1944, the War Department Emblem for Meritorious Civilian Service. Clark also received the following citation signed by the Chief Signal Officer and the Commanding General, ASF:

"For outstanding work in the development of frequency modulated equipment at Camp Coles Signal Laboratory, and production of quartz crystal units used in connection therewith and in organizing and supervising development of radio relay equipment which provided a new method of communication employing a combination of wire and radio facilities. For exhibition of unfailing devotion to duty and a high degree of technical and organizational ability during 1942 and 1943, contributing materially to the successful prosecution of the work in which he was engaged and to the development and production of highly essential Signal Corps equipment."

Clark started in radio as 1NQ in 1927. While serving an enlistment in the Signal Corps (1930–33) he was one of the prime traffic movers at WVO (sined "O") and helped to organize the First Corps Area Radio Club (AARS station W1SC) at the Army Base in Boston.

After leaving the Army, Clark returned to his home at Medway, Mass., where he obtained W1EPI. He did most of his brass pounding (sined "OC") for Tropical Radio aboard the "banana wagons" in the Caribbean. In 1936, after a brief spell as a flight radio officer for Pan American Airways, he settled down in the communication department of Eastern Air Lines at Miami, and tacked up his ticket as W4ETJ. The present call, W2MUJ, was obtained in 1939 when Clark joined the engineering staff of the Signal Corps Laboratories at Fort Monmouth. Now assigned as chief engineer, Systems Engineering, Coles Signal Laboratory at Red Bank, Clark's main concern is the complex problem of connecting military radio and wire communication systems together so the generals on the telephones won't know (or care) whether they are talking by radio or wire.

STRAYS

The new Navy department known as the Office of Research and Inventions and headed by Rear Admiral Harold G. Bowen, USN, who previously was chief of the NRL, which was set up as part of the Office of the Secretary of the Navy, is equipped to handle inventions for Navy personnel with no cost to them. Inventors submit via their commanding officer a full description and sketches of any inventions made while in the service of the Navy, and the Office of Research and Inventions prepares and files a patent application reserving to the inventor the full commercial rights. The Government gets only a non-exclusive license for the duration of the patent to make or have made for Government use, and to use, the invention.

—•••—

An article in *Broadcasting* for July 2, 1945, by Mary Zurhorst, says that during the war the armed forces have trained 500,000 technicians.

Signal Corps: 145,000 in operations, maintenance and repair, 17,000 of whom are officers.

Army Air Forces: 143,000 including 4000 officers.

Navy radio schools have graduated 125,000, about 13,000 of whom are officers.

Marine Corps: 10,000, plus about 1700 "who have finished courses with the Marine Corps Institute."

Coast Guard: 6500 officers and enlisted men have received radio training.

Maritime Service of the WSA has graduated 5000 officers and enlisted men.

The Crystal Ball

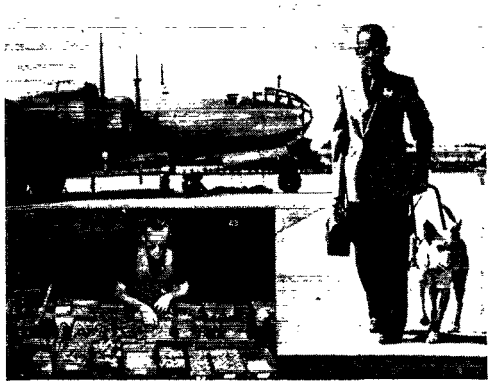
Last month we announced the forthcoming appearance in September *QST* of the Crystal Ball department in which will be presented new ideas sent in by *QST* readers for postwar gear and hamshack equipment. Prizes consisting of War Bonds and Stamps are offered for the best contributions used each month.

If this is the first you have heard of the Crystal Ball, take a look at page 27 of the July issue of *QST*. But if you are not lucky enough to have a copy available, don't be downhearted. Just write us a letter, telling about your "after V-J Day" ham plans and about that new all-band transmitter with hot and cold rotating nodal point attachment that you have dreamed up. Who can tell? Perhaps *you* will win a $25 War Bond or one of those War Stamp prizes.

Wat sa? How's DX on your Crystal Ball? Address —

The Crystal Ball Department.
American Radio Relay League,
38 La Salle Road,
West Hartford 7, Conn. — *A. D. M.*

Blindness has not prevented Leo Hobelman, W9ACA, from doing his part to win the war. With sure, sensitive fingers he has been working ten hours a day, six days a week, sorting parts used at the Continental-Denver Modification Center, operated by Continental Air Lines, in readying B-29 superfortresses for combat. In the photograph below he is shown walking to work with "The Baron," and, in the insert, sorting parts in the reclamation department.



Leo's blindness has been progressive — he has been totally blind for about two years — and, knowing that he would become blind he acquired all the radio knowledge he could. This of course led to a ham ticket, which he received in April, 1941. From then until December 7th he operated primarily on 1.75 and 56-Mc. 'phone. Ever since Denver received its WERS license Leo has been very active as KFND-20. W9ACA builds his own equipment, laying out the chassis, drilling the holes and mounting all the parts himself, leaving only the wiring to someone else. Leo's wife, incidentally, is an ardent booster of ham radio and regularly reads *QST* to him.

—•••—

In the war against Japan the Army now fights a "radio war," as contrasted to the European war which was predominantly a "wire war" except in cases where rapid movement made wire communications impracticable. This is so because of the distances and the kind of terrain involved in liberating islands and fighting over and through mountainous sections and jungles, and because of the general lack of established wire communications and even roads.

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According to official Signal Corps statistics, over 75 per cent of the officer staff of the Radio Division of the Enlisted Men's School at Fort Monmouth, N. J., are amateurs.

"In a stray on p. 52 of March *QST*, W2IOP gave a list of ham calls collected on his Short-Snorter bill. I took inventory of my accomplishments along the same line and find that according to the set standards, I'm way out in front. All the following calls have been collected on my Short-Snorter bills while in foreign countries (excluding Canda): W1DSA, W1GHQ, W1KVV, W1NUP, W2JTZ, W2LBL, W2MOZ, W3AKH, W3EJF, W3GGR, W3JGZ, W4AHK, W4APS, W4BIK, W4CQA, W4EFG, W4EOA, W4GYF, W4JO, W5DZE, W5EWY, W5GGW, W6BFK, W6CHA, W6CIS, W6CTN, W6FTT, W6GSN, W6HCV, W6IEQ, W6OUU, W6RJH, W6SER, W6TYP, W7DZA, W7FLH, W8ECV, W8HTM, W8ITS, W8LVM, W8NEU, W8QKE, W8WEV, ex-W9AHT, W9BMU, W9BPN, W9CA, W9DJG, W9EKY, W9ENY, W9IML, W9JXW, ex-W9MJE, W9NDA, W9NSP, W9OWA, W9PFG, W9SIQ, W9THG, W9UDE, W9VLT, W9VUS, W9WSU, W9YCB, K4AH, KF6PUL, KB4FCS, VE5LG, G2LB, GI5AM, GM6LT, GM6OA, SU1OA, VK3ML, ZL3HC, ZL3GZ, ZL2CA, PY7AI. There also were others whose signatures wore off the bills but they are lost as far as the count is concerned. In addition, these were picked up in domestic service: W1LIH, W2CUZ, W3AOH, W4CNY, W5DXW, W6JMI, W6JTN, W6RBQ, W9DUD, W9EAV, W9IUE.

"A hamfest can be started anywhere in the world today and, as usual, the W9s will predominate Hi!" — *Oscar Jaeger, W9VND.*

—···—

The 60,000-watt transmitter mounted on 17 trailers and known as SigCircus, which the Signal Corps has been operating in Europe for the past several months, has all the facilities of a modern fixed station of comparable power and can be set up for operation or dismantled in a little less than 24 hours. Capable of transmitting and receiving 200,000 words daily between Europe and the U. S., it also has complete broadcast facilities including a portable AFN studio, a modern broadcast studio and control booth, equipment for facsimile and radiophoto transmission and reception, and wire, film and disc recording. In addition, it provides local programs within a radius of 25 to 30 miles. All of the services are carried on simultaneously without interference.

—···—

A new communications weapon for Army ground troops, the SCR-619, designed for the use of field artillery and tank destroyer units is being produced by the Delco Radio Division of General Motors. The SCR-619 is a frequency-modulated radiophone with a normal range of about five miles over average terrain. Weighing about 50 pounds, the set may be carried by one man on foot or by pack animal, and with added accessories may be mounted in a vehicle. The SCR-619 operates in the v.h.f. on any one of 1200 crystal-controlled channels, with a choice of two preset channels instantly available. The set is powered by 6-volt or 12-volt batteries, depending upon whether it is operated by man pack or in a vehicle.

★ ★ ★ ★ ★ ★ ★ ★

Gold Stars

S/Sgt. Henry B. Hill, W3GEF, was killed in France March 20, 1945, when a bombed building in front of which he was stringing wire collapsed, burying him under the debris.

Only a few weeks previously Sgt. Hill had been awarded the Bronze Star for heroic achievement during the German breakthrough. While maintaining an outpost and observation post, elements of his troop were subjected to intense enemy artillery and mortar fire. With complete disregard for personal safety Sgt. Hill exposed himself to the enemy fire to restore vital radio communications and aided in delivering effective fire against the enemy, which repelled the attack. During this action Sgt. Hill's unit, the 38th Cavalry Reconnaissance Squadron, with the support of several other units, repulsed a total of four enemy attacks, thus preventing Von Runstedt from expanding his salient in that sector.

Before the war W3GEF was an active member of the Morris Radio Club of Summit, N. J. He also belonged to the 102nd Cavalry of Newark and at the outbreak of the war when it was federalized he moved with it to Fort Jackson, S. C., where he operated the troop transmitter under the call W2BQH/4.

Floyd R. Clarke, RT1c, USNR, W9RUJ, 37, was killed December 12, 1944, during the battle of Leyte when a bomb struck the destroyer on which he was serving as radar operator.

Although over the age limit of those being called to service and the father of eight children, W9RUJ enlisted in the Navy early in 1942. He took the elementary course in radar at Chicago and was in the first class to graduate there. He then went to Treasure Island, Calif., for secondary training and after completing the course was assigned to the destroyer on which he served in various actions in the Pacific until he was killed at Leyte.

W9RUJ was very active on the air, especially on 1.75-Mc. 'phone and 7-Mc. c.w., and was a member of the South East Nebraska Radio Club.

★ ★ ★ ★ ★ ★ ★ ★

HINTS AND KINKS FOR THE EXPERIMENTER

ONE-TUBE RECEIVER

I HAVE used many small receivers, but none have been as simple to construct or have required as few parts as this one-tube set incorporating a 3A5 twin-triode. The circuit, shown in Fig. 1, is a simple regenerative detector and one stage of audio amplification. I have a two-inch p.m. speaker in my receiver but 'phones could be connected instead of the speaker.

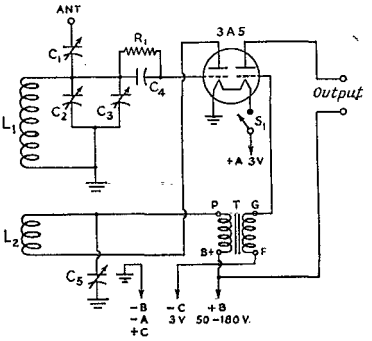


Fig. 1 — One-tube receiver using a 3A5 twin-triode.

C_1 — 3-35-$\mu\mu$fd. trimmer.
C_2, C_5 — 100-$\mu\mu$fd. variable (band-set, and regeneration, respectively).
C_3 — 15-$\mu\mu$fd. variable, bandspread.
C_4 — 100-$\mu\mu$fd. mica.
R_1 — 2 megohms.
S_1 — S.p.s.t. switch.
T — Audio transformer 3:1 ratio.
L_1 — 16–40 meters; 14 turns 1½ inches long. (All coil forms, 1 inch o.d., wound with No. 24E.) 40–70 meters: 24 turns 1½ inches long.
L_2 — 16–40 meters: 3 turns close-spaced, ⅛ inch from bottom of grid coil. 40–70 meters; 5 turns close-spaced, ⅛ inch from bottom of grid coil.

The entire set (minus batteries) is built into a metal case 4 × 5 × 3 inches. Midget-type parts are used and they fitted into the case without too much trouble. Two plug-in coil forms provide coverage from 16 to 70 meters. This ranges takes in all the commonly used short-wave bands.

I use a 25-foot antenna with this receiver.

While located in England, I have received signals from the States and from the Orient. — *Charles C. Richardson, W8RXY.*

—···—

A SOURCE OF KEY CONTACT MATERIAL

BUILDERS of electronic bugs may be interested to know that almost any jeweler can supply a few extra links from oversize identification bracelets. These are sterling silver and make FB key contacts. — *John F. Clemens, W9ERN, Newtown Neck, Compton, Md.*

IMPROVED HANDIE-TALKIE

WE BUILT a handie-talkie based on the article by Charles T. Haist, jr., W6TWL, in *QST* for June, 1944. In working with this equipment we found that a few simple changes improved the over-all performance considerably. Deviations were made from W6TWL's unit as follows:

Selectivity — Changed value of grid leak from 10 to 5 megohms. Relocated resistor in circuit to connect to plate r.f. choke. Omitted 0.005-μfd. condenser across the grid leak as shown by W6TWL.

Audio howl — By-passed regeneration control to ground with 0.01 μfd. We found that before by-passing this point the mike gain was affected by the regeneration control, even when in the transmit position.

Power output — A slight increase in power was gained by the substitution of three Mallory bias cells in the place of the 750-ohm biasing resistor.

Intelligibility — Obtained better intelligibility by omitting the 0.001-μfd. condenser across the primary of the output transformer.

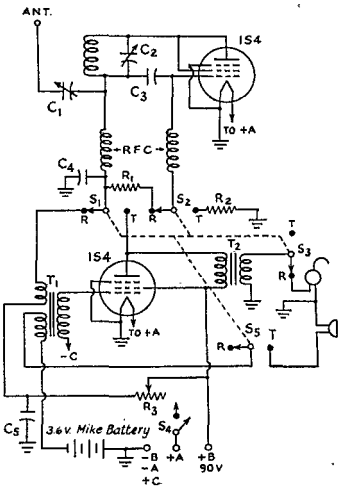


Fig. 2 — Modified circuit diagram of W6TWL's handie-talkie.

C_1 — 3–30 $\mu\mu$fd. trimmer.
C_2 — 10-$\mu\mu$fd. variable.
C_3 — 50-$\mu\mu$fd. mica.
C_4 — 0.003-μfd. mica.
C_5 — 0.1-μfd. paper.
R_1 — 5 megohms.
R_2 — 15,000 ohms.
R_3 — 100,000-ohm potentiometer.
T_1 — Transceiver transformer.
T_2 — Output transformer (plate-to-voice-coil). See text.
C — Bias source — three Mallory bias cells in series.
S_1, S_2, S_3, S_5 — Four pole, two position, ganged.
S_4 — S.p.s.t. switch.

Output transformer substitution — we used a "plate to 8-ohm voice coil" transformer with excellent results on a low impedance headphone.

Audio response — Used three pen-light cells, in series, as a mike battery with improved results.

Antenna coupling — Used simplified antenna coupling consisting of a 3-30-$\mu\mu$fd. trimmer in series with the r.f. choke side of the coil and the 24-inch antenna. A hole drilled in the top of the case permitted adjustment of this antenna coupling condenser.

We hope that the circuit shown in Fig. 2 and these modifications may prove useful to those who have built this equipment. — *J. D. Howard, jr., Paterson 1, New Jersey.*

—•••—

SHIELD FOR MINIATURE TUBES

HERE is an efficient and easy-to-make tube shield for "peanut" or miniature glass tubes. The shield is made of a short length of large diameter copper shield braid.

The size and length of the braid is determined by the tube used, and should be so chosen as to form a tight fit over the tube. See Fig. 3. Cut

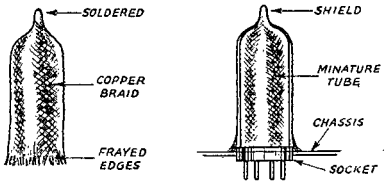


Fig. 3 — Simple shield for miniature tubes.

a length of braid about one-half inch longer than the tube. Twist one end of the braid together and solder. This makes the top of the shield.

The bottom of the shield is left frayed so that there will be numerous contacts with a metal chassis. A ground wire should be added to provide a permanent connection, if desired. — *Harry Star, W1MWO.*

—•••—

BASS AND TREBLE BOOST CIRCUIT

MANY hams who have built audio amplifiers for various purposes must have wished that there was a simple, foolproof bass and treble boost circuit that could be controlled by a couple of knobs on the front panel and used for equalizing the response by modifying it to any desired degree.

Such a circuit is given in Fig. 4. R_2 controls the treble response and R_5, the bass. C_2 must be small or the middle frequencies will be affected. Try the indicated value (100 $\mu\mu$fd.) first.

The over-all loss through the circuit at normal response just about neutralizes the gain of one triode stage so provision should be made for an extra stage. In one case this was done in an existing amplifier by substituting a 6F8G twin triode for one of the low gain stages. If the amplifier is capable of handling the gain of an extra triode stage without instability no trouble will be had from squealing or motorboating when the booster controls are opened up.

The boost possible on both the lows and the highs amounts to about 15 db. If attenuation is also desired on the highs a separate tone control could be incorporated in some other stage. — *W. K. Angus, VE4VJ.*

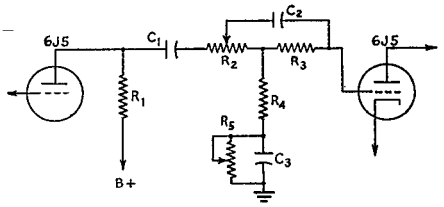


Fig. 4 — Bass and treble boost control circuit.
R_1 — 50,000 ohms, 1 watt.
R_2 — 100,000-ohm potentiometer.
R_3 — 100,000 ohms, 1 watt.
R_4 — 5000 ohms, ½ watt.
R_5 — 500,000-ohm potentiometer.
C_1 — 0.02-μfd. paper.
C_2 — 100-$\mu\mu$fd. mica.
C_3 — 0.05-μfd. paper.

—•••—

CONTROLLED REGENERATION ON RME-69 RECEIVER

BY PERFORMING an operation on my RME-69 I improved its performance, especially on the broadcast band. I removed the leads connecting the middle sections of the bandspread and main tuning condensers to the compensating condenser and replaced them with one jumper directly between the tuning condensers. I then added a two-inch wire, W, to the vertical plates of the middle section on the left, and placed this wire near the front section. By adjusting the proximity of this wire to the front section, regeneration may be controlled by the small compensating condenser in the center of the set. Fig. 5-A shows the arrangement before modification, and (B), after addition of the controlled regeneration. — *Leo E. Osterman, K7ENA.*

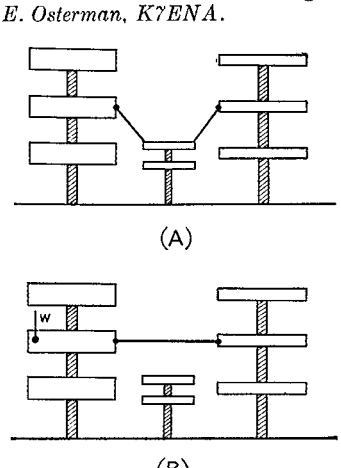


Fig. 5 — Modification of RME-69 receiver to add controlled regeneration. (A) shows the receiver before the wiring of the tuning, bandspread and compensating condensers is changed. A small coupling wire, W, is added to the middle section of the tuning condenser, as shown in (B). Rear compensating section is unused.

CORRESPONDENCE FROM MEMBERS

RÉSEAU DES ÉMETTEURS FRANÇAIS

Paris, France, May 8, 1945

Dear Mr. President, ARRL:

In this day of rejoicing for the United Nations the radio amateurs of France and of the French Empire address their sincere compliments to their American comrades and bow with emotion before those who fell gloriously on the field of honor for the common cause.

Receive, Mr. President, my best sentiments.

— *Robert Larcher, F8BU*
President, R.D.E.F.

UNION SUISSE DES AMATEURS

Zurich, Switzerland, May 6, 1945

Secretary, ARRL:

It is a great pleasure for me to be able to communicate with you again by mail and I take the opportunity of giving you a short report of what has happened during the last six years.

The amateur activity ceased completely on September 1, 1939, all licenses having been withdrawn and most of the hams having been mobilized to do military service in the Swiss Signal Corps — under my command! It is a pleasure for me to say that they did their job very well and thereby making the best propaganda for the amateurs' cause.

The official bulletin of the USKA, the *Old Man* had to cease publication temporarily. It appeared once in 1941, May; once in 1942, December; twice in 1943, April and September. An extraordinary meeting of the USKA was held on June 18, 1944, and a new council was elected, consisting of:

Dr. R. Stampfli, HB9AD, president
E. Iselin, HB9BJ, vice-president
Dr. W. Frei, HB9AC, secretary
Dr. M. Ebner, HB9BO, test manager
F. A. Bech, HB9CE, editor
F. Roder, HB9DZ, QSL-manager/assistant secretary.

It was decided to start again with the regular publication of the *Old Man* and to begin with a limited activity, consisting of "receiving tests" on the 3.5- and 7 Mc.-bands. A special arrangement with the military authorities made it possible to run different transmitters for this purpose. The *Old Man* appeared in September and November, 1944. In 1945 six numbers will be published; three have already appeared. The annual meeting was held on January 20th, in Lucerne. All members of the council were reëlected. A special committee was nominated, consisting of the president of the USKA, Dr. Stampfli, HB9AD; A. Ettinger, HB9CC; W. Schneeberger, HB9G and me, the purpose of which is close coöperation with the postal and military authorities in order to elaborate new licensing regulations.

Unfortunately we didn't get any news from the ARRL since 1942 but the *R.S.G.B. Bulletin* dropped in from time to time.

With very 73 to you, OM.

— *R. Stuber, HB9T*

RESEAU BELGE

Brussels, Belgium, V-Day

Secretary, IARU:

It is a pleasure for me to drop you a few lines on the activity of the Reseau Belge, before and during the war.

Under the clever leadership of the president of the Reseau Belge, ON4AA, our members with their own radio gear have been grouped in a special unit one hundred per cent amateur in the Belgian Army. This represents a nice achievement because the Belgian authorities have never been very inclined toward the amateurs. But the work accomplished by us during the May, 1940, campaign has changed their minds in our favor.

During the enemy occupation, our activity became underground. Amateurs are to be found in every resistance movement. Most important of these is the Armee Secrete for which our president, ON4AA, worked in close coöperation with Allied authorities, in London. I, although being arrested by the German military police, have been during the liberation chief of the radio network of the Armee Secrete High Command.

But the war was not ended with the liberation of Belgium, and ON4AA with other ON4s joined the Canadian Army where, due to his excellent work, ON4AA is a captain.

The Reseau Belge has achieved big faith in amateurs' history; therefore we are confident in the future of the amateur movement.

Today, V-Day, I bring to the IARU and ARRL amateur fraternities the salute of the Reseau Belge, and I express to you, dear Mr. Secretary, my very best 73.

— *L. Richard, ON4UF*
Administrator of the R.B.

TWO SM HAMS DESIRE QSOs BY MAIL

S. Sjötullsgatan 6, Gävle, Sweden

Editor, *QST:*

I suppose you will be rather surprised to get a letter from Sweden, but this letter is sort of a CQ-call. We are two Swedish hams, the writer and my friend Gunnar Steen (QTH Vågskrivaragatan 5, Gävle), who should like to correspond with some young American hams. I am a radio officer in the Swedish merchant marine and my

friend is a radio technician in the Swedish Army Signal Corps. For my own part, I should like to get an answer from some man serving as a radio officer in the U. S. Navy or merchant marine. So if you will give our QTHs to some hams who are in the writing market, we should be very grateful.

— *Sven-Eric Söderqren*

QSO OKICG, PA0XF, LA7A OR ON4IW?

1328 Hillside Ave., Honsdale, Pa.

Editor, *QST:*

Now that Europe has been freed of the Nazi yoke, millions of people need help. I propose that we radio amateurs do something to alleviate the sufferings of our fellow hams over there. I would be glad to contribute to a fund for their aid.

I would especially like to help a few with whom I used to work regularly and with whom I also corresponded. Do you have any information on Jindrich Pytel, OK1CG; E. Kerker, PA0XF; Arne Eikrem, LA7A, or Albert Hayenith, ON4IW?

— *Oscar G. Herrick, W8QLW*

WARTIME QSOs AND HAMFESTS

2656 East 27th St., Sheepshead Bay, N. Y.

Editor, *QST:*

Any "sea goin' " ham in our merchant navy who can be induced away from his sack around twilight while in most Pacific ports can be assured of some exceedingly satisfying QSOs — both blinker and v.h.f. convoy 'phone (where permitted). During one short stay in port last winter I worked W9FJS, W7FRK, W7IPP, W6OEV, W6OIK, W6IQZ, W2FSE, W2HVX and W2NFT, mostly on blinker. In some ports a quick run across the v.h.f. band will almost convince you you're listening to prewar 112 Mc. . . . In Honolulu I was pleasantly surprised to have K6BA, K6ESK and K6QA climb aboard to inspect the gear — respectively senior FCC inspector, assistant inspector and Mackay ship serviceman. . . . If you find yourself anchored near an Armed Forces radio station, a pull ashore will always reward you with a good time, a meeting with a few QSO-starved hams, and some sort of souvenir card as shown here.

— *CRO William R. French, W2NYC*

The souvenir card W2NYC received at Eniwetok Atoll.

CQ FBIS-RID-NDO MEMBERS

237 N. Warman Ave., Indianapolis 8, Ind.

Editor, *QST:*

As a former monitoring officer of the Radio Intelligence Division, and with the full approval of George E. Sterling, chief of the Radio Intelligence Division, I am preparing a directory of all RID and FBIS men and women. The directory is to include the names of those now in the service and those formerly connected with it. Those who served in the NDO section also are included.

The purpose of the directory is to maintain contact with all these men and women with the intention of laying the foundation for the RID Fellowship Association, a name tentatively suggested by Mr. Sterling. The Association is intended to perpetuate the close association of these men and women and to follow their careers.

All members and former members of RID, FBIS, and the former NDO are requested to file their names, addresses, and business association with either J. Melvin Bolger, c/o Cato Grease and Oil Co., Oklahoma City, Okla., or Carl J. Kunz, 237 N. Warman Ave., Indianapolis 8, Ind.

— *Carl J. Kunz*

THE SCR-506

Somewhere in Germany

Editor, *QST:*

Congratulations on the swell article on the SCR-506 in May *QST*. In my opinion A. David Middleton certainly gave the set the justice it had coming. As a combat radio operator who has operated the 506 through the Battle of Germany I think it is tops, and a set any true radioman is proud to operate.

— *Paul E. Jones, W2MCO*

Somewhere in Germany

Editor, *QST:*

Congratulations on the swell article about the development of the SCR-506, in the May issue.

Having joined the Sixth Armored Division in January as radio operator, I can testify to the remarkable performance of this set under combat conditions. My particular job was relaying enemy information from our M-8 armored car to the rear and to adjacent units. As W2OEN suggests, those quick frequency changes are indispensable for that type of work. Our own units using low-power f.m. sets for local communication were monitored by our station and pertinent information thus picked up was immediately relayed on our G-2 (intelligence) net, or given to nets of lateral units on their different pre-set frequencies. We also had available on our pre-set switch the frequencies of our own unit's command and administrative nets. The receiver would normally be tuned to our division G-2 net. All enemy information on this net was sent clear text for possible immediate action. When we sight a group of enemy self-propelled guns heading in our direction there's no time to encode or decode the

(*Continued on page 92*)

OPERATING NEWS

CHARLES A. SERVICE, W4IE
Acting Communications Manager

LILLIAN M. SALTER
Asst. Communications Manager

WERS Survey. A short time ago it was thought necessary to obtain information from radio aides in order to assemble facts regarding the continuance or discontinuance of the War Emergency Radio Service in communities all over the nation. Consequently, a card containing the following four questions was mailed recently to all radio aides on our mailing list: (1) Will you continue WERS after June 30? (2) Has your municipality indicated it will discontinue WERS, regardless of your wish to continue? (3) If you are continuing, will your primary concern be for local war defense or natural disaster relief purposes? (4) If disaster relief, who is primarily sponsoring WERS: your municipality, your municipal safety services, Red Cross, local citizens committee, any other organization? Radio aides, if you haven't yet returned this card to us, please do so at once so that we may be able to determine just how your community stands in regard to this matter.

A good response has been received, 61 per cent of the total number of cards sent out having been returned to us at this writing. We are glad to report the great majority of licensees intend to carry on regardless of the fact that CD activities have been discontinued. Thus far reports have been received on 174 licensees representing all sections of the country. While twenty-four licensees, including several large Eastern cities, have given up WERS operation along with CD discontinuance, 150 radio aides report that their licensees will continue even though national civilian defense has been disbanded. However, several of those reporting non-continuance or cancellation of licenses decided upon this action because of lack of interest, a deficiency of operators, and other reasons before notification was made of the closing down of civilian defense offices.

On Question 2, the great majority of those reporting indicated that the municipality will discontinue the War Emergency Radio Service regardless of the wish of its personnel to continue.

Of those continuing, the primary concern of 110 will be for natural disaster relief, five will be for local war defense and twenty-eight specify both. Two will engage in weather bureau reporting, one in State Guard work, one in work with State Troops, and one in any useful purpose permitted; four of the number reporting do not give any definite answer to this question.

In the greatest number of cases WERS will be sponsored by the municipality, followed closely by municipal safety services and the Red Cross. Others will be sponsored by local citizens committees, Boy Scouts Emergency Service Corps, State Guard, the county sheriff, the radio club, etc. Several do not know who will sponsor them.

Additional WERS Licenses. At the same time we were receiving notification of the disbanding of some units, we were being advised of additional and new licensees which had not heretofore appeared in our files. These include Frederick County, Md. (WMSK); Saunders County, Nebr. (KHBW); Burleigh County, N. D. (KHIU), a new State to add to our listings of those having WERS, and San Diego, Calif. (KKQL). We welcome these new members of the War Emergency Radio Service family. — *L. M. S.*

These hams and WERS operators were among those present at the Washington Radio Club picnic held in Rock Creek Park on May 20, 1945: *Kneeling:* Tex Hill, W5FVD. *Seated, left to right:* Ted Fisher, Barbara Peck, Mrs. T. Fisher, Rita Fisher, Jane Cunningham. *First row:* Don Engel; Ray Rosenberg; Elizabeth Zandonini, W3CDQ; Marie Zandonini; Mrs. C. A. Briggs; Rose Zandonini; Peggy Leith (from Scotland); Mrs. Bissell; Mrs. Murdock; Mrs. Sugar; Ellen Sugar; Dick Houston, W4GPW. *Second row:* Bert Engel; Donald Fox; Hank Cox, W8UPS; Bill Tynan; John Nagle, W2OFT; Mr. Sugar; George Sugar; Gil Dawkins; Eric Illot, G2JK; Edward E. Bissell, W8MSK; J. Alton Fitch, W8DT; Mrs. Fitch; Mrs. Cunningham and Chet Cunningham, W9GBA.

ELECTION NOTICES

To all ARRL Members residing in the Sections listed below:

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

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

Due to a resignation in the San Joaquin Valley Section, nominating petitions are hereby solicited for the office of Section Communications Manager in this Section, and the closing date for receipt of nominations at ARRL Headquarters is herewith specified as noon, Friday, September 14, 1945.

Section	*Closing Date*	*Present SCM*	*Present Term of Office Ends*
Vermont	Aug. 1, 1945	Burtis W. Dean	Aug. 16, 1945
East Bay	Aug. 1, 1945	Horace R. Greer	Aug. 16, 1945
Indiana	Aug. 1, 1945	Herbert S. Brier	Aug. 16, 1945
San Joaquin Valley	Sept. 14, 1945	Antone J. Silva (resigned)	
Hawaii	Sept. 14, 1945	Francis T. Blatt	Feb. 28, 1941
Sacramento Valley	Sept. 14, 1945	Vincent N. Feldhausen	June 15, 1941
Alaska	Sept. 14, 1945	James G. Sherry	June 14, 1942
Southern Minn.	Sept. 14, 1945	Millard L. Bender	Aug. 22, 1942
New Hampshire	Sept. 14, 1945	Mrs. D. W. Evans	Sept. 1, 1942
West Indies	Sept. 14, 1945	Mario de la Torre	Dec. 16, 1942
Idaho	Sept. 14, 1945	Don D. Oberbillig	April 15, 1944
South Dakota	Sept. 14, 1945	P. H. Schultz	May 18, 1944
Alabama	Sept. 14, 1945	Lawrence Smyth	May 22, 1944
Los Angeles	Sept. 14, 1945	H. F. Wood	July 1, 1944
Arkansas	Sept. 14, 1945	Edgar Beck	Aug. 17, 1944
Virginia	Sept. 14, 1945	Walter G. Walker	Oct. 15, 1944
New Mexico	Sept. 14, 1945	J. G. Hancock	Oct. 15, 1944
Santa Clara Valley	Sept. 14, 1945	Earl F. Sanderson	Oct. 15, 1944
Tennessee	Sept. 14, 1945	James B. Witt	Nov. 15, 1944
Georgia	Sept. 14, 1945	Ernest L. Morgan	Nov. 20, 1944
Kentucky	Sept. 14, 1945	Darrell A. Downard	Dec. 15, 1944
Western New York	Sept. 14, 1945	William Bellor	Feb. 15, 1945
Mississippi	Sept. 14, 1945	P. W. Clement	April 1, 1945
Rhode Island	Sept. 14, 1945	Clayton C. Gordon	April 15, 1945
North Carolina	Sept. 14, 1945	W. J. Wortman	May 3, 1945
Northern Minn.	Sept. 14, 1945	Armond D. Brattland	June 15, 1945
Eastern Pa.	Sept. 14, 1945	Jerry Mathis	Sept. 23, 1945
Northern N. J.	Sept. 14, 1945	Winfield G. Beck	Sept. 23, 1945

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

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

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

(Place and date)

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

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

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

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

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

— *Charles A. Service, jr., Acting Communications Manager*

ELECTION RESULTS

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

Utah-Wyoming	Victor Drabble, W6LLH	May 1, 1945
Washington	O. U. Tatro, W7FWD	May 27, 1945
New York City & Long Island	Charles Ham, jr., W2KDC	June 9, 1945
Southern N. J.	W. Raymond Tomlinson, W3GCU	June 22, 1945

What Is an SCM?

BY CARL AUSTIN,* W7GNJ

MANY of the new-timers, and some of the old-timers, have asked that question. It has even been suggested that an SCM is a cross between a fox, a dodo, and a scorpion. It ain't so. An SCM is a kinda worm, boring away at something. He don't know just what he's boring for, but he's just as happy. For the benefit of LSPHs, of which there are many, let me tell you about the more or less mysterious SCM. Wherever you live you are surrounded by a section. Several of these sections are bunched together and called divisions. Each division has a director, who don't have nothin' to do but go to Headquarters every year, expenses paid. But the SCM — he's the goat that gets plenty of buck passed to.

Of course there's the peacetime SCM and the wartime SCM. The peacetime SCM is a ham who tries to organize ten or more highly independent individuals into a cooperative network for the handling of traffic. Also he is supposed to appoint as Emergency Coördinator a capable ham in each town or city in his section, who organizes his local group for coping with any possible communications emergency. The wartime SCM has all the chores of the former with a few additions, and usually consists of old punks like me and W7FWD (Washington) and W7CPY (Montana), who are no good for the services, and therefore are trying to help out as SCM. Nowadays the SCM prepares a short paragraph each month for presentation in the Amateur Activities column of *QST*. Naturally he tries to gather as much dope as possible, but the allotted space is roughly in proportion to the memberships in his section. Thus, he is continually trying to increase the number of members so he can have more space. He will occasionally cast a glance at a neighboring section report, and if the neighbor has more dope he will work harder to catch up. If the neighboring section happens to have less dope, he will gleefully work harder to get yet further ahead, and so it goes, on and on.

Since both *QST* and hams now inhabit all crooks and crannies of the globe, what is more natural than that the SCM should try to have as many mentions as possible each month of calls known or worked, so a guy in Okinawa can say, "Well, well, I see by *QST* that ole XYZ is RT2c in Aachen. The ole son-of-a-gun!" The SCM fondly believes that other hams of his section, located in fox holes, engine rooms, planes, tanks, and LCs located in Guadalcanal, Dutch Harbor, London, and Iceland, will get a lift from reading his section news. You know, like when someone tells you a good story and your mind is temporarily diverted from the usual grind.

The SCM will descend to any depths, resort to innuendo, intimidation, slander or just plain lying to prod or prompt a card or letter from these scattered guys, so he can pad his paragraph. He will condense a letter into a line so he can have more lines. After a successful campaign of producing these letters he will glance gleefully at his stack of dope and remark gloatingly to himself, "Well, I'll sure have an FB bunch of stuff this month." He'll do this for several days, then the disturbing knowledge will dawn on him that all these letters and cards must be answered. Since his H & P fingers are already worn down half an inch shorter than the others, he will sort through the pile trying to find some which he can get out of answering. Then the ole conscience will say, "Yes, but maybe those guys are lonesome or homesick, and will appreciate a good letter." So, he will start whittling away at the stack, vowing that never again will he invite such a mess of correspondence. Then comes *QST*. A glance at the next-door section shows an equally big paragraph, maybe with even more dope, so he will craftily plan a new campaign of news-getting. So it goes, on and on.

(Continued on page 62)

*SCM Oregon, 1137 Federal, Bend, Ore.

Some day I'm gonna do like DXF did to me about six years ago. I'm gonna pick some ham who has the League at heart, and I'm gonna knock at his door some bright morning at dawn when his resistance is low, and handing him my two apple boxes of letters and c/copies (looks like I'll need three boxes), I'm gonna say to this selected victim, "Listen, pal, I'm in a hurry! I'm moving outa the section. You be acting SCM. Nothin' to it. Write me if you wanna know anything. All the dope is in those boxes. So long." I'm gonna beat it PDQ before he wakes up. Then I'm gonna trade this ole mill for a pair of scissors and spend the rest of my life cutting out paper dolls — or maybe collecting stamps.

WERS of the Month

Bethlehem, New York

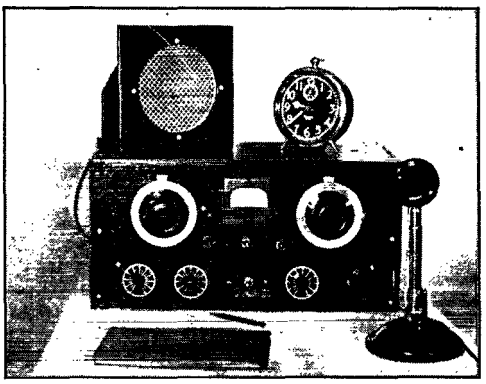
Each month under the accompanying heading we shall publish the story of an outstanding WERS organization as an item of general interest to all WERS participants. Contributions are solicited from any radio aide or WERS participant, whether he be an amateur or a WERS permittee. Descriptions of organizations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

DURING the summer of 1942, arrangements were made for a WERS system for the Town of Bethlehem, involving five suburban communities, which would have a two-fold purpose. First, to provide emergency communication in connection with the local defense program; and second, to advance a training program in the Boy Scout organization of this district. On December 9, 1942, a license was issued by the Federal Communications Commission for two composite stations under the call WJXZ.

Plans were put into operation at once to train a group of the older scouts of Troop 56 to obtain licenses. This work was ably carried forward under the direction of D. S. Dewire, engineer of special equipment with the New York Telephone Company. By early January, 1943, twelve scouts had completed their training and were granted restricted radiotelephone permits. During 1943 the license was expanded to include six stations, and in 1944 to include twelve. With the transfer of D. S. Dewire to the Bell Telephone Laboratories another source of supervision became necessary. This was found in W2LMF, W2LLU, and W8DSU, who have cooperated consistently ever since.

Late in 1943 our first operator was taken into the Navy and, of the original twelve, five are now with the armed forces. One is taking the radio technician's course at Gulfport, Miss.; another is doing the same at Treasure Island, Calif.; and a third is specializing in electrical engineering as a V-12 student at the University of Rochester. All have reported benefits from their WERS training.

During 1944, because of the wide interest, two more training classes of nine boys each were formed. Then, with so many additional operators, a plan of rotation of operation was found necessary to provide equal chances for training on the various types of equipment.



WJXZ-8, monitoring station for Bethlehem, N. Y. network, used by Radio Aide J. W. Campbell.

The equipment consists of two battery-operated walkie-talkies, four portable-mobile stations and four semi-permanently located transmitters. The latter use HY75 tubes and are adaptions of the standard ARRL *Handbook* circuits. WJXZ-8, shown in the accompanying picture, is a transmitter-receiver arrangement mounted on a standard chassis. The power supply is built in. The receiver portion of the unit comprises a 9002 detector, with two stages of audio to feed the external speaker. The transmitter section employs an HY75 oscillator modulated by a 6Y7G with a 6C5 speech amplifier. Adequate modulation is derived by use of a single-button mike with three volts of mike battery. Antenna change-over is accomplished by a telephone relay equipped with specially insulated contacts, actuated by the total plate current to the transmitter. The antenna is a "J" type mounted vertical about 40 ft. above the ground, fed with a parallel transmission line. A useful feature incorporated in the receiver is the provision for varying the antenna coupling from the front of the panel. This transmitter-receiver has proven very satisfactory and gives adequate coverage of the field of our operation.

In 1943-44 the network operated during every alert, with an average of 75 per cent of its stations being covered. During practically every test period all stations in our 10-mile-square district have been in operation, with many internetwork contacts, including tests with WKNT of Schenectady, WCZQ of Colonie, WJPD of Troy and WKHW of Pittsfield, Massachusetts, and on occasion with various CAP planes when in our district. We cover an area with an approximate population of 50,000; and of more than 500,000 when combined with the various other networks within our transmission limits.

With the termination of the civilian defense organization, classes in code, amateur radio theory, and various other related subjects are under way. Interest continues to be keen, and undoubtedly will lead to several new local amateur stations when conditions permit.

— *J. Wallace Campbell, Radio Aide, WJXZ*

BRIEF

Plans for the North Shore Radio Club of Long Island hamfest, to be held at 8:00 P.M., Friday, August 24th, at the Community Gardens Ballroom, 215-32 Jamaica Ave., Queens Village, L. I., have been progressing rapidly, according to John DiBlasi, president of the club. While the program will feature one prominent speaker on "What the Hams Have Done in the War Effort and What They Can Expect Postwar," the evening's program will be informal and will include entertainment, movies, door prizes, and an opportunity for all interested in the art to get together for exchange of ideas. George W. Bailey, president of the League, will represent the ARRL. Tickets are available for 50¢ at Greater New York radio stores dealing in amateur radio equipment, from North Shore Radio Club members, and at the door. All radio amateurs are welcome and a big time is promised to all.

The Month in Canada

QUEBEC—VE2

From Lt. L. G. Morris, VE2CO:

BILL OKE, 3AKO, has left the Naval service and returned to his old job with Canadian Pacific communications in Montreal. Rod McDonald, 2FO, has accepted a position with Lockheed Aircraft and has moved to California. Congratulations to Bob Prissick, ex-2CX, on the arrival of a junior op. — a YL this time. Bob is serving with the Army overseas. Lieut. Col. Guy Eon, 2LE, has returned to Canada after three years of foreign duty and is now located in Ottawa.

ONTARIO—VE3

From L. W. Mitchell, VE3AZ:

THE Wireless Association of Ontario held their last regular meeting of the season on May 31st in the Electrical Building, University of Toronto. The attendance was 68, of whom 50 were members. A further appeal for membership was made by Wally Hainge, 3IB. Several new members were secured through Wally's efforts, as well as six additional subscriptions to *QST*. In the absence of our worthy Art Potts, 3MT, Bill Winter, 3APA, acted as secretary-treasurer for the meeting. The president introduced the speaker of the evening, Carl Nelson, ass't. chief engineer, Addison Industries Limited, whose paper was entitled "Light Beams in Communication." The display was most convincing and after a brief question and answer period the speaker was accorded a very hearty vote of thanks on the motion of Bob Humphreys, 3ALC, seconded by Wally Hainge. The date of the first Fall meeting had not been arranged as yet, but full particulars will appear in this column at a later date.

Stan Hill, 3ARD, is in the VE4 district at Winnipeg working with the Department of Transport. 3QN, Milt Graham; 3AGT, Mike Dzendrowski; 3AZE, Eddy Warburton, and 3QO, Wally Colton, are actively engaged on 100 per cent war work in and around the motor city. 3ATS, Mel Burgess of Whitby, has been at the DIL plant at Pickering. John Elston, 3AKB, is now a senior radio navigator with the RAF Ferry Command. We regret to add that with the passing of his chum, 3AZV, Paul Zavitsky, also of the Ferry Command, Oshawa lost one of its ablest amateurs. Paul lost his life in the course of duty on May 20, 1944, in a flying accident in England. 3SZ, Lorne Doreen, is busily engaged on the overseas transport. Until recently 3ARI, Jack Warburton was acting in the capacity of wireless training instructor at the E.F.T.S., located just outside of Oshawa. Douglas Jones, 3APW, has returned after serving for five years overseas with the RCCS. Doug was stationed for a lengthy period on the east coast of England and had much experience with the enemy bombers. During a recent visit with one of the Toronto amateurs Doug proved that he has not forgotten ham radio and the code, for he copied 20 w.p.m. commercial press during the evening. During his service period Doug had the misfortune to sustain a fracture of the leg and was in the hospital for some time. He married overseas and is now the proud possessor of a 1½-year-old jr. op.

ALBERTA—VE4

From W. W. Butchart, VE4LQ:

IN ORDER to raise funds for the coming season's activity, the NARC are raffling off a Dow Standard bug, donated to the club by 4BW, Ted Sacker, of Edmonton. The draw will be made in a couple of months, and it looks as if the sale of tickets will net a tidy sum. Have you got your ticket yet? Last month we mentioned the return of Flight Lieutenant P. A. (Pete) Fair of Peace River, High River, etc., and noted that he had intentions of returning to the scenes of his crimes! He spent a couple of weeks at P. R. and he and his YF looked us up on their return to Edmonton. While overseas he managed to see quite a bit of the Old Country. Radar installations were his meat over there, so we should be able to pry a smattering of his knowledge loose after we get him back on the ham bands again.

4AQY, Cpl. Ken McLean of Edmonton, overseas with the RCAF, who at the time of writing was in England awaiting repatriation to Canada. Fifty months overseas (twenty-two of them in the Middle East) should give him a fairly high point rating for repatriation. He will bring back a YF and junior op., both acquired since leaving here. Two years ago, Ken was in Durban South Africa, for a few days and managed to get several telephone QSOs with ZS5Y. Les Peyton, of that city. 3AAA, Bill Booth of Toronto, Ont., crossed paths with him on several occasions, in fact to such an extent that Bill thought Ken was shadowing him! Of Bill, Ken has the following remarks to make: "He is a warrant officer and a really fine fellow, a real "gen" man on radio." Another chap he met up with was 1LN, B. P. McKay of Yarmouth, N. S. Jay Crandall, 4ASL of Ponoka, returned to England from the Middle East with Ken, and our correspondent says ASL should be back here by now. Thanks a million for the swell letter, Ken.

4XE, Dick Bannard of Edmonton, W.O. 1 with RCCS in this city spent most of the early part of this year in Kingston, Lacombe, Red Deer and Medicine Hat. He recently demonstrated the use of a vibrator power unit to 4LQ's hopefuls in the Signal Section of the Edmonton Fusiliers. Another letter which should have been acknowledged earlier was received from 1FQ, L. J. Fader of Halifax, N. S., now in England with the RCCS. He has been visiting some of the English and Scottish hams whenever he grabs a few days' leave, and noted particularly that he had spent time with GM8MN, Crieff, Scotland, and G5LK, Reigate, Surrey, Eng. The latter chap is blind, but Les says that that doesn't faze him one bit. He was very high in his praise of the hospitality extended him by these chaps. A visit to the RSGB was on Les's itinerary before he packs up for home, which by the way, appears to be some distance off.

4HM, Charles Harris of Edmonton and YF recently said farewell to their son, Roger. The boy was just too late to make the grade for overseas work in the RCAF, as his age held him up until the RCAF stopped sending aircrews overseas. Flying apparently has made a deep impression on him, so he is now overseas with the Royal Navy Fleet Air Arm. 4EA, Roy Usher of Edmonton, is in for a busy summer. CKUA it appears, will have new studios, etc., and in the course of a general shake-up preparatory to going commercial, Roy will have his hands full with the technical end of things. How about a few letters, gang, with some newsy bits in them?

MANITOBA—VE4

From A. W. Morley, VE4AAW:

THANKS to 4AIY we have news of some of the fellows in the Navy. Jack is at St. Hyacinthe where he is instructing in radio. He is married now. The other half of 4AIY, Fred, is a lieut. in the Armoured Corps and is now in Germany. He also got himself an XYL and they have a jr. op. 4TJ is at sea. 4ALT is doing shore operating near Halifax. Murray Prior (think call is 4AMT) is doing maintenance work in Eastern Canada. 4ABE has been on nearly every kind of ship there is. Bill Thorne is instructing with 4AIY. 4SO has his commission with the RCAF and is on radar work stationed around Ottawa.

4SS who is an S/L with the RCAF is now stationed in Penhold but seldom stays there. Alf has one of those traveling jobs. He has seen 4NT and 4APQ. A note advises that 4ZU is back in the Peg after five years on the west coast. From 4RO comes word that 4GQ is on the air (no fooling). He's working the f.m. rig for the City Hydro. 4DU is looking for a spot in the sticks to put up some sticks MIM. 4IU is rebuilding. 4ADV has gone to the West Coast. On May 5th 4RO whipped up a miniature hamfest in honor of 4MY, Bill Lomax, who is going to settle in the VE5 district. 4BG, 4ACR, 4BQ and 4RO made things interesting for Bill. 4ACR made an inquiry about condenser spacing and found himself buried in paper. Just simple (?) mathematical formulas worked out by 4MY and 4BQ. 4ACR is going back to a Ford coil MIM. (Did Bob have that much? And how about that expanding tube you had at the hamfest at Regina Beach in 1939?) 4BG thought that an old spark job would be of interest and suggested that the Wpg club get one. The host was figgety all evening. He had built up a lovely supply rack and cabinet and was het up as to how many cracks the gang would make about it. We still want to know what comes with the box fastened to the cabinet and understan l it carries power, too. MIM. 4MY passes his 73 to all in leaving the VE4s and asks that we bend an ear west now and then. From VG comes word that he has again been moved and is now back near his old stamping ground, Portage. 5AHO is the only 5th district man around there. 4ABN of Wpg is a Sgt., PZ of Barons, Alta., is a Cpl. EF of Weyburn is a Cpl. 3AXO is a Sgt. 3AFK is on leave prior to discharge. ABD of Regina is also there. 4ABP is back home after a few years in India. How about some news from some of the others? Don't depend on the next guy. 73.

ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES — The Frankford Radio Club had a fine turnout at the last meeting. 3CHH, 3ENX, and 3KT, who have been away, have returned — at least temporarily. The club has at its disposal two generators delivering 400 v.d.c. at 175 ma. for future field day and emergency use. 3IXN has moved to his new and permanent QTH. 3HFD is scouting around for a new location since the town to which he was to move has an ordinance against the erection of antenna masts for transmission and reception. 3ILK is in the rebuilding mood. 3GET has plenty of sky wire space at his new place. Rumor has it that 3JBC will be back home for a short time to inspect his new postwar transmitter. The Pennsylvania State Guard is looking for radio operators. 3HRE says Easton WERS is expanding its scope of activities. 3QP is cogitating over directive arrays already. 3HXA is working hard to break in a new ham in Westinghouse X-ray. *Jerry Mathis.*

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — SCM, Hermann E. Hobbs, W3CIZ — A very fine letter has been received from GEB. When the war first started he served part time in the Coast Guard Auxiliary as chief radio officer. During 1943–44 he worked for the War Production Training Program as vocational radio instructor in day and evening classes, and throughout the summer of 1944 worked as part time vacation relief operator for broadcast station WCAO. He then shipped out as radio officer for almost seven months but went back to teaching at Vocation School 293, Howard & Center Sts. At present he also is working as part time broadcast engineer at station WCBM. S/Sgt. IXJ, of the U. S. Marines, would like to locate IRL, INB and ILI. Write to Headquarters for his complete address. The Washington Radio Club held a very successful picnic in Rock Creek Park attended by forty persons. WERS activities have been continued with the code classes in full swing. One class has taken and passed the FCC operator's examination. 73 to all.

SOUTHERN NEW JERSEY — SCM, Ray Tomlinson, W3GCU — Asst. SCM, Ed G. Raser, W3ZI. State Radio Aide ASQ reports that various WERS organizations throughout the State are carrying on regardless of the disbandment of OCD. The WKPX organization of Hamilton Twp. reports, through ASQ, that a simulated emergency drill recently was held and very gratifying results were obtained. The regular monthly meeting of the Hamilton Twp. WERS Operators' Association was held at twp. police headquarters on June 18th, with an attendance of approximately forty. Radio Aide ASQ presented a very enlightening and interesting talk on the various components which went into the building of one of our units. Radio Aide ABS reports their walkie-talkie is being equipped with a 300-volt MG set and has been assigned to the fire chief of the Hillsboro district. Stan says the WKXQ network is all set for any emergency operation they may be called upon to participate in. A letter received at this office from the Bell Telephone Labs asks for qualified men for the position of technical engineering assistant for development in radio and u.h.f. fields. Qualifications include good basic knowledge of radio theory with appreciable experience in radio field, either as an amateur or in radio service work. Several of these positions are open at the labs located on Whale Pond Road, Deal, N. J. Anyone interested may write Mr. A. E. Valentine, Personnel Dept., Bell Tel. Labs, Murray Hill, N. J., or may 'phone him collect at Summit 6-6000, extension 228. IWF, now in Northern Italy, may be addressed: Sgt. J. W. Brimmer, APO 85, c/o Postmaster, New York, N. Y. Jack has at present, with nineteen months of overseas service, three combat stars and a Bronze Star medal but not enough points to be mustered out. He is operating an SCR-399. JOL is on the high seas with the merchant marine. JOL and IUQ shipped out together as radio operators. GRW recently returned from a trip to London, and tells us that while in port he passed the 1st-class telephone exam and now holds both 1st-class telegraph and 'phone tickets. EED recently returned from his first Atlantic crossing as radio operator; Les has re-signed for duty aboard the same ship. ISY, also in the merchant marine, was home recently but has again put to sea. Fritz is holder of both 1st-class telegraph and 'phone tickets. JAG, another merchant marine operator, was home recently and told us he had quite an extended cruise to South America via the Panama Canal. QL has been promoted to a full lieutenant in the Navy. SW is doing duty aboard a cruiser somewhere in the So. Pacific. Jimmy Hassal, SWL, informs us that he has been enjoying the warm spring climate of Northern France and has purchased a bicycle. It is with deep regret we must register FAL, of Oaklyn, among Silent Keys. Don was very active on 56 Mc., and was an engineer with RCA Aircraft Division. Lt. Comdr. W. A. Smith, ex-AN, is home from a tour of duty in the Pacific before taking up his duties at the Naval Air Station in New York. Doc says the best QSL right now is a WAR BOND! AXU is again sticking out his chest with the arrival, on June 4th, of the second jr. operator. We wish to extend our sincere sympathies to AFA on the death of his sister. Bob Crozer, who enjoyed a short leave in the U.S.A. after many months of combat overseas, has been transferred to the Air Transport Command with duties as radio operator and is stationed at Assam, India. Ted McElroy is an operator in the merchant marine. Maj. VE paid a visit to the Delaware Valley Radio Association in June. Sam is home on a thirty-day furlough after sixteen months of combat duty in the German theater of action. The ole D.V.R.A. Bond Wagon is sure greased up now, with the total earnings so far reaching the "thousand" mark. AWH has taken unto himself a bride. 73 and CUL, gang. *Ray.*

WESTERN NEW YORK — SCM, William F. Bellor, W8MC — After another successful wartime year the RARA is ending its season with an election of officers and a club picnic. We hear from AYI that the Third Regiment, NYG, has been assigned eight new combination G.I. transceivers for use on 3825 kc., bringing their total radio units to fourteen. They are in need of more operators and those interested should contact Lt. AWP Monday evenings at the Armory, Syracuse. OSH, after dodging bullets all over Africa, Italy, France, Germany, etc., has become ill with malaria and has been shipped home. His present QTH is Ward 818, Rhoads General Hospital, Utica 5, N. Y. Arch was with an S.I.A.M. Co. Buffalo, Tonawanda, Rochester, Syracuse, Rome, and Utica WERS units are working toward a statewide tie-up on 112 Mc. 73, *Bill.*

WESTERN PENNSYLVANIA — SCM, R. R. Rosenberg, W8NCJ — The Radio Association of Erie has been reorganized. Following are the new officers: MZI, pres.; QJ, vice-pres.; Harold L. Loomis, secy.; William F. Sommers, treas.; WBM, chairman of the publicity committee. UJN, who entered the Signal Corps in 1942, sends a nice card from Veterans Hospital at Oteen, N. C. UVD submitted the usual fine report from Jeannette. VNE is reported back in French Morocco, but expects to be transferred soon. TVA is pounding brass for AACS down in Brazil and is said to have learned to speak Spanish. LIG, former Warren amateur, is residing in Corry. DXN still is engaged in the lumber business at Northeast. Al Evans is Erie's latest amateur to receive an operator license since Pearl Harbor. BTY has been in the Navy for some time and is instructor at Gulfport, Miss. PDP recently visited the SCM and stated that he was getting along fine in his Naval radio work at Washington, D. C. CUN also is in the Navy and was last reported to be studying radio at Bainbridge, Md. CRJ has been working for a radio manufacturing concern at York for the past several years. RTH, presently employed by G. L. Martin Company, Baltimore, Md., announces the arrival of a new YL operator. QXF has been working in Philadelphia as guarantee engineer for his company. We are indebted to AOE for the following FB report: Ernie has heard from NDE, TVA, TTD, PER, and KWA. 1KIU, formerly of West Springfield, Mass., and well-known for his 20-meter 'phone contacts with Admiral Byrd's "Little America," is working as radio engineer for the Westinghouse Ordnance Engineering in Sharon, Pa. CBJ is reported as having a swell ham shack constructed next to his home. TTD is QRL at Camp Crowder and has not been heard from for several months. PER is active in CAP and at present QRL with house cleaning. IYQ has returned home after spending ten months in a German prison camp. Lt. Saborsky will spend sixty days at home meeting his friends and then will report to Miami, Fla. for reassignment. Mercer County WERS, WKXV, has limited its activities for the summer months, but the gang is planning a field meet with the Mahoning County boys from Ohio. Very 73, *Ray.*

(Continued on page 66)

★ ★ ★

THERE still seems to be some unfinished business relating to our series of pages on phonograph reproduction. Quite a number of readers have written asking for information on volume expanders. We have never been very enthusiastic about expanders, and for this reason we have not experimented much with them. It is our rule that these pages must be based on first-hand knowledge, so we tried out some standard circuits. The results are given below. We think these circuits could be improved considerably, but the pressure of war work here at National does not allow us to spend much time developing circuits for fun.

A volume expander is simply a device to make loud passages louder and soft passages softer, in order to compensate for the opposite compression which is done in recording and broadcasting.

The simplest expander is a variable resistance, such as a lamp, shunted across the speaker terminals. This gives only a limited range of expansion, but it is sometimes used. It wastes power, but most of the loss occurs on weak signals. This is very desirable with a Class B amplifier, for it tends to maintain the load on the output and reduces distortion on weak signals.

The expander may operate by controlling feedback. One commonly used negative feedback circuit has a voltage divider across the output circuit. The voltage at the tap on this divider is fed back to the grid of the power tube. If a lamp is substituted for the resistor between the tap and ground, the circuit has expansion characteristics without sacrificing the usual advantages of a feedback circuit. Such a circuit has very low distortion. However, the time constant of the circuit depends on the lamp and in this respect it is not very flexible.

The third method of expansion makes use of an A.V.C. circuit connected "backwards." Such a circuit is given on page 74 of the Radiotron Designers Handbook. Since this employs a variable mu tube, it does introduce distortion. If the signal level does not exceed ¼ volt at this tube, the distortion will not be serious, however.

All of the circuits described suffer from the defect that the volume does not expand until *after* the loud passage has begun. Likewise, the volume does not drop until after the loud passage is over. This is inherent in an expander circuit, for any attempt to speed up the expander action beyond a certain point will make it follow each individual cycle. This introduces serious distortion.

The best compromise is to have the volume increase very rapidly at the beginning of a loud passage and fall relatively slowly. Practically, this means that the A.V.C. circuit is designed like a peak-reading voltmeter. A condenser charges quickly from a low-impedance amplifier tube and discharges slowly through a large resistor. The voltage across this condenser provides the control bias for the variable mu tube. We have not experimented with this arrangement, but it seems like a very obvious and straightforward one. However, please do not ask us for circuit details. Maybe you would like to do your own experimenting.

Some day we shall have time really to explore schemes like this. When that time comes, we promise to give you complete dope. Right now we have a different job to do.

MARTIN OXMAN

(*Continued from page 64*)

CENTRAL DIVISION

INDIANA — SCM, Herbert S. Brier, W9EGQ — WXG is back on a ship in the Pacific. ABB, in the Marianas, wants to try 20 c.w. He and AQD, a gunnery officer, had lunch together. ZYG says he is as happy as if he had his right mind. FOS is in Washington after many months in Europe. YMV is going to write a book about the repeal of Ohm's law by ship engineers. NXU has finished radio school. EGV and FDS are experimenting with remote control gadgets. HUV is worried about the effect of his new tin roof on his antenna. DHJ copies police c.w. for code practice. EHT had a chicken dinner at the home of 7CWM. UYP is in India. SNF is in the AACS. EBB writes letters to PBS and says things about EGQ. PUB was home for a few hours while changing bases. UCT is a t/sgt. ILU is in the P. I. KMY doesn't know it, but he and ILU were in the same convoy. IUM gets more radio service work than he can handle. MJH built an audio amplifier with four A3s. YWE is working seven days a week as a b.c. engineer. CTK was home from the Pacific long enough to get married. AB spent a Sunday with EGQ. LPQ sent his EC certificate for endorsement. DUT, alias portable-mobile WKMR-10, was verbally whipped by an irate citizen, who thought he was police radio, for driving such a swell car. MVZ and WWG attended a meeting of radio aides in Chicago. JZA wishes the city was larger so he could get far enough away from control with WKMR-11 to check his coverage without going outside the city limits. IFU offers to show me a radar installation, if I promise to hold his hand during the execution. 73, *Herb.*

KENTUCKY — SCM, Darrell A. Downard, W9ARU — Members of the Amateur Radio Transmitting Society and the Louisville Photographic Society participated in a joint fish fry-WERS field day at the South Park Fishing Club June 10th which was highly successful. One of the outstanding "fishy" events of the evening was the breakdown of one of the mobile units in front of a beer joint! One of the wags told Ed Raible he blew his final. Ed took a "flash" shot. Orville Cox, reporting on WERS, says that there has been quite a bit of portable-mobile interest in his district lately. Mather has a mobile in his car which works almost the entire city. Parkhurst also is working mobile. Cox has one in the making. No. 32 at Curtis-Wright is being discontinued. Likewise No. 33 at Seagrams. O. Funk reports that on May 21st, their mobile units found that the best transmission was from a cemetery on Bardstown Road. On the same night, Jeffersontown, our lively little suburb on Taylorsville Road, was "dead as a hammer." Dave Jarrett passed his Class A amateur and 1st-class radiotelegraph exams. Lloyd King and Mike Atlas participated in a Coast Guard communications problem May 27th. District Radio Aide Gates filled the program at the last ARTS meeting talking on S.B.T.&T. Co. communications problems.

MICHIGAN — SCM, Harold C. Bird, W8DPE — 8OCC is very busy with wiring and construction work preparatory to moving to a new location. 8UGR is interested in getting the State organized for WERS. 8QQK thanks the DARA, and Ken especially, for keeping the bulletin going. 8MGQ expects to be home for two weeks soon. Harold E. Schultz, 312 W. Telegraph, Dowagiac, died Feb. 13th in the service of his country. 9GJX, who holds a corporal rating, has been busy writing books, teaching radio for AAF and for CAP, and running her beauty shop. 8BIU now is the father of a jr. operator named Keith. He is open for new ideas for the club. RM1c 8SNH, USN, says hello to the gang. 8SS sends in his sub for *QST* and states, "Had to figure out a demagnetizer coil last week and that formula for computing inductance of a multilayer coil given on page 477 of the 1942 *Handbook* gave the answer right on the nose. 8FEP, of Suttons Bay, has been radio inspector for the Signal Corps since June 2, 1942. 8KNP was home for a few days and spent the time with his brother, who has been in So. Pacific with the Marine Corps for three years. 8TVT hopes to get back on the air soon. 8VRQ states that Don is still on foreign assignment but she sends the bulletin to him regularly. 8QQN sends in his sub to *QST*. He reports the WKHA WERS net is red hot. Many stations have gone to m.o.p.a. using 815s and 6V6s for drivers and oscillators. Others are grinding crystals for crystal-control jobs. All seventeen units are licensed and are working with the police dept. since OCD folded. Arnold Thomas, a W9 from Chicago, is assistant radio aide and Wm. MacLaine operates control station. A chief engineer will be appointed shortly. The gang is changing to superhet receivers using 5 Mc. with double converters. 8RJC pops up again with a sub to *QST*. Herb is very busy with three jobs and is attending weekly meetings of CAP. 8FLA still is with RID and FCC and Polly sends in his *QST* sub. Francis Martin is back in the good old U.S.A. at Santa Ana, Calif., and writes that he expects to get a permanent station in the near future. 8FWU writes that he has a valient key but is not entirely satisfied with it. 73 to all. *Hal.*

WISCONSIN — SCM, Emil R. Felber, jr., W9RH — OXP, CRT USNR, is teaching modulation at the Naval Research Laboratory, Washington, D. C. SYT came home for good after spending six months in France and Italy. Lt. (jg) Wm. Black, USNR, is in the Philippines. Sgt. Don Hayner is in Bari, Italy. CRG is in Chicago. Lt. Louis Wollaeger, USNR, met Bill on Luzon and they were on a scavenger hunt together. T/Sgt. John Rashinsky hopes to leave Cerignola, Italy soon for home. Midshipman PCN graduated from Annapolis Naval Academy with the rank of ensign, was married the same day, and then had to report for duty on a carrier. S1c Ed Thornley is at Hugh Manley Naval Pre-Radio School at Chicago. VDY still is with Raytheon in Boston. RT3c Frederick Rahr is at Navy Pier, Chicago. Sgt. Jimmie Fischer dropped HRM an Air Mail letter from Australia. Lt. (jg) Geo. Pfister, USNR, is a river-going sailor at New Orleans. QIH, CRM USNR, still is on the same ship, according to the letter he sent GPI. Lt. KFB sent HRM the *RSGB Amateur Radio Handbook*. RT3c Ray Charney still is in Australia. Capt. FY states he's near ANA in the Philippines, and is on the lookout for him. Pfc. Orrin Loch is in Germany. Comdr. DTK, USNR, is in the Marianas as staff communications officer. Radio Aide NY, of Milwaukee County, reports that WMFI has been renewed for 1945–46. Permission was granted for twenty-four more units. That makes twenty-three fixed units, nineteen mobiles, and nine portable units. Any of the boys that are home for good are welcome to assist as operators. Contact radio engineer, Milwaukee Police Dept. 73, *Emil.*

DAKOTA DIVISION

SOUTH DAKOTA — SCM, P. H. Schultz, W9QVY — MBA was home on furlough from Camp Simpson. He is CRM now and has acquired an XYL. SOB is home on furlough from the So. Pacific and is leaving for the East Coast for a new assignment. DJM has terminated his assignment at Sioux Falls Radio School and is radioman on a ship out of San Francisco. He still is a civilian according to ZBU. JBL, 1st lieutenant in the Signal Corps, writes an interesting letter from the So. Pacific, where he has been for the past twenty-eight months doing all phases of radio work. He says Maj. USI was in Manila the last he heard. Bob would like to hear from some of the old gang. Drop me a line for his address. 73, *Phil.*

NORTHERN MINNESOTA — SCM, Armond D. Brattland, W9FUZ — For the information of the gang, since I left for the merchant marine those reports in *QST* containing a wealth of news were written by BHY. JNC had a fifteen-day furlough at his home in Minneapolis. He reports that T/Sgt. JHF, USMCR, a radar instructor at Camp Le Jeune, N. C., also was back in Minneapolis on a furlough. Likewise S/Sgt. JRI, USMCR, now back at Ft. Worth, Tex., where he is instructing radar observers and doing radar installation. NCS, a former net control station for MSN, now MR1c, USCGR, has just finished a thirty-day furlough after spending three years in Hawaii, on cutters, etc. QIN is with Honeywells Field Eng. Div. at Tulsa, Okla. His new QTH is 444 S. Columbia, Tulsa. The last report on QDE, of St. Paul, is that he still is in Italy. "Lefty" mentions having a chat with Charlie, who still is at Bonn's. JHF and JNC spoke of many who are going strong and are patiently waiting for the chance to make that first call. Among them one can hear the calls of "Zed MQ"; "Beep," now at Norfolk; "Norway Norway Oslo," now on a Pacific aircraft carrier; "The Lousy Engineer," who works as an adviser at Telex; our many faithfuls of the MSN gang, and a host of others. QCP writes from Washington, D. C. that he will trade his "RID" and all other alphabetical mixtures for an active QCP back in Northern Minnesota again. EHM, with the U. S. Immigration Service, has been transferred to the Frisco district. FUZ and family are looking forward to visiting friends in Minnesota this fall. M/Sgt. ZWW writes from somewhere south of the Equator that he thinks ARRL has done a fine job on the frequency allocations. He has observed some very interesting propagation conditions down there on 20-40

(*Continued on page 68*)

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(*Continued from page 66*)

Mc., hearing police stations with excellent signals as high as 36 Mc. He adds that YTL is flying for ATC as an operator. BBL, CRT of the Coast Guard, has been with the outfit for almost four years and wants to hear from the gang. His address is District Coast Guard Office, Ninth Naval Dist., 230 Old Customhouse, St. Louis, Mo. RPT and MTH are busy building WERS equipment for CAP. Mac and BHY have all the piping necessary for their four-element stacked concentrics and will shortly have them in operation. From all indications, the tests that have been made show that with antennas of moderate height 2½ should prove an ideal band for local contacts. With 5 watts input, a transmitter in a CAP plane puts in a terrific signal at twelve miles. Until further notice, it is suggested that you address your reports to me at Bemidji, Minnesota. 73, *Army*.

DELTA DIVISION

ARKANSAS — SCM, Ed Beck, W5GED — The following report was sent to Headquarters by S/Sgt. ENH: DZE is in Honolulu doing "hush-hush" government work. EKD and GNV are field engineers with Raytheon in Massachusetts, 1st Lt. J. J. Bailey is making with the G.I. paper work "somewhere in Louisiana." On a recent visit to wartorn Manila, S/Sgt. ENH ran into 2nd Lt. EWD in a barber shop. EKD reports GED (SCM) is with Raytheon in California. ENH has been visiting some KA fellows and has "procured" several items of Jap radio equipment. EVD sold out "Beem Radio Co." some time ago and is doing war work on a large scale in parts unknown. ENH would enjoy hearing from the Arky gang and members of the Greater Little Rock Amateur Radio Club, FDW, and will be glad to answer all letters. Write to ARRL for his complete address.

LOUISIANA — SCM, Eugene H. Treadaway W5DKR — GIA, now an old married man, says he will give ham radio his full attention after the war. JFM writes that he sure enjoys reading our section report and plans on being a W6 after the war. HSM is a busy telegrapher with Southern Pacific. IUW has had thirty-three months overseas and was kept busy installing radio equipment. CXQ is a soundman. HHT promises to send some FB reports soon. The SCM would like to hear from the old gang, and from our radio club members throughout the section. 73, *Gene*.

HUDSON DIVISION

N. Y. C. & Long Island — SCM, Charles Ham, jr., W2KDC — N. Y. C. WERS operated for the last time on June 17th. The sad news was given by BGO, who has nursed us through some trying situations. Up to 300 operators have served faithfully since October, 1942, some turning in activity of up to 4,000 hours. Nassau will continue, however, under the problem of moving their main station, necessitated by change in the War Council situation. A communications meet involving CAP planes and ground WERS stations has been reported by DKJ. 3CSW/2 is organizing communications for the Knickerbocker Group of the CAP. Maj. LFX, of Manhasset, is home after two years in the C.B.I. theater. LKC announces a hamfest, August 24th, Community Hall, Queens Village, under the auspices of the North Shore Radio Club. Sam Seml, now at N.R.L., was in to see his WERS cohorts at WNYJ-323 recently. CJY announces the arrival of a daughter, Barbara Elisabeth, a few months ago. CTO has 111 points but is "essential" and hence stays in Italy awhile. EVZ reports from Germany. DLT is developing classified material at Middletown, Pa. BKZ should have his car painted red. He answers fire calls from any part of the borough in record time. Esposito of Queens WERS is hospitalized as the result of a recent eye injury. LRL is in the Philippines. Lt. Comdr. NDQ is China-bound to push and pull the molars of the boys there. BYK reports that he and the following former Long Islanders of the Tri-Boro Radio Club are working for Army Service Forces in the vicinity of Asbury Park, N. J.: BSL, HKY, HHW. JSW is at Hudson-American. BVE still is flying for Naval Transport.

NORTHERN NEW JERSEY — SCM, Winfield G. Beck, W2CQD — Capt. NCY, AAF, c/o R.D., N. Ave., Greensboro, N. C., has been supervising the operating division for 2½ years at the AAF Tech. School at Scott Field. He now is awaiting a communications assignment in the Pacific. He writes, "As supervisor of the school I ran into many hams who were instructors and students. One of my senior civilian instructors was Tom Braidwood, brother of 3BZX. Also managed to acquire a Class A ticket as well as 1st-class radiotelephone and 2nd-class radiotelegraph tickets by taking time out from official duties. Any news from MLW or LFR?" CRT John Geisler, RMS Staff, Naval Research Lab., Washington 20, D. C., writes: "I am at present serving as instructor at the radio material school." LSX writes as follows from Noroton Heights, Conn., where he's getting some advanced base training, "Have run into a few boys up here who were on the air before the war, among them 5IED, 9NXX, and 8GHX. The ole Connecticut Brasspounders Club, CBA, is just a few houses up the street from the base. Have received some swell letters from LQR, who was right along with the V-E Day push and has been giving me the blow-by-blow description. While home one week end I got in to see ALK at the shop in Cranford. One Saturday I heard a guy giving directions on how to get to Sun Radio in N. Y. It turned out that he was NLJ from West Orange, a very ardent 10-meter 'phone man who is a radio technician up here. I was very interested to read about Cpl. EAM as he used to live right up the street from me and was always getting his antenna masts chopped down!" Bud's address is M. D. Hall, RM3c, C–2–220, USNTS, Noroton Heights, Conn. BZR writes, "Recently completed twenty-six months at Pearl Harbor as radio planning officer. Installed gear of all types on every class of ship the Navy operated. Had thirty days leave and am back in the States as officer-in-charge of Radio Radar and Sonar Repair Shop at Tompkinsville, Staten Island. Do you know anyone who will swap an SX28 or 28A for an HQ120 in excellent condition? Will pay a small cash difference plus the HQ120 if an SX28A owner is so inclined. Ask the boys to drop me a line at 174 Summit Ave., Summit, N. J. MPQ is in the Western Pacific doing radio operating in the Signal Corps, with several combat operations to his credit. He'd like to hear from MTI, MRZ, LXO, and LKO, or any of the Irvington Radio Club gang. DBY is sojourning at Lovell General Hospital, Fort Devens, Mass. After joining the 80th Division at Camp Forrest he went to Tennessee on maneuvers, detached for school at Camp Crowder, joined them again at Camp Phillips, Kans., had three months rest at Camp Dix and then went overseas to England. From England he went to France and such places as Chalons, Barle Duc, Commercy, Moselle River, Delmy Ridge and up to the German border north of Saarbrucken. He then was laid low by liver trouble and yellow jaundice. He is back in the States now. *Win*.

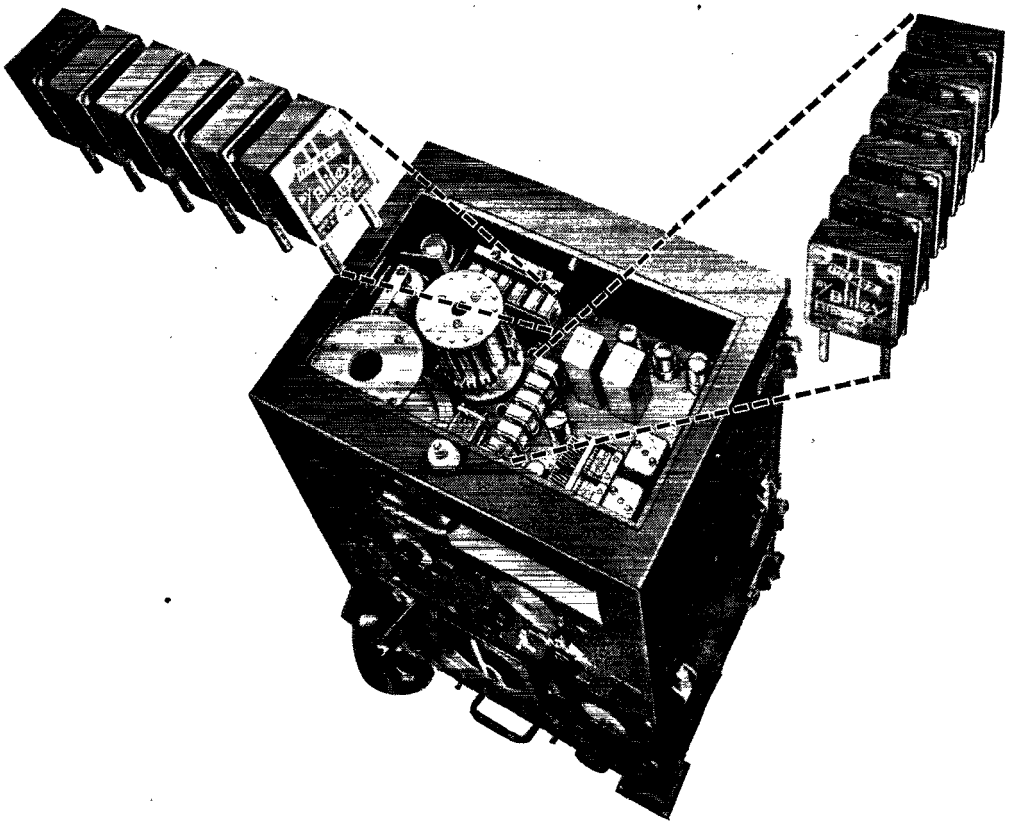
MIDWEST DIVISION

IOWA — SCM, Leslie B. Vennard, W9PJR — AHP, an operator at WOC, reports Davenport very quiet. Ex-YBA reports from overseas that *QST* is slow in arriving but always is very welcome. YBV, now in New Guinea, already is laying plans for a relay net back home. UFL reports that Sioux City WERS works out very well even on hills. GFQ reports for Council Bluffs. UOQ, FZN, IFI, PGG, UQY, YKX, YYF, JRY, and UQI are busy with essential war work and WERS. Former SCM ARE resigned from CAA and now is in Milwaukee. GWD, HIM, and WNL are at U. of I. in scientific work on radio. RM2c WMP is on Okinawa. ALC is in school in Paris. QOQ is doing radio range and radar work in the West Indies. FSH is at Mayo Hospital. CRM DVP is an instructor at Terminal Island. RZV is looking ahead; he is putting a 2½-meter job in his car. Radio Aide LAC is a grandpa and is rushing WERS. QVA built an oscillator to keep his fist in shape for 40. GKN is at KBUR, and is getting ready for a 1st-class license. 73, *Les*.

KANSAS — SCM, A. B. Unruh, W9AWP — This report is being written in Dayton, Ohio (Wright Field), where your humble servant is attending advanced radar school. The trip followed immediately upon return home from a Seattle, Washington trip to instruct airplane radar trouble-shooters at that point. At Seattle, 7NH, 7IKY, 7IUU, ex-7BOA. and others were trouble-shooting radar and upholding ham tradition. ESL has been temporarily transferred to Burchard, Nebr., from Delia and Sabetha, Kans., where he repaired 175 farmers' radios in his spare time to "keep 'em playing." He celebrated his Silver Jubilee as priest at Kinsley in May. GUJ is in Naval radio school at Corpus Christi, Tex. At Denver, your SCM found APR pounding brass at KGPX with typical ham gusto. BCY, QQI and 5HHF returned from radar school. OZN, who is in the Signal Corps overseas, has been promoted to sergeant. *Abie*.

MISSOURI — SCM, Mrs. Letha Dangerfield, W9OUD — KG has renewed his operator license and is busy with radio servicing as well as the Highway Patrol station. His brother, WOC, joined the merchant marine last November.

(*Continued on page 70*)



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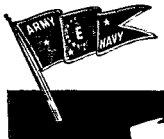

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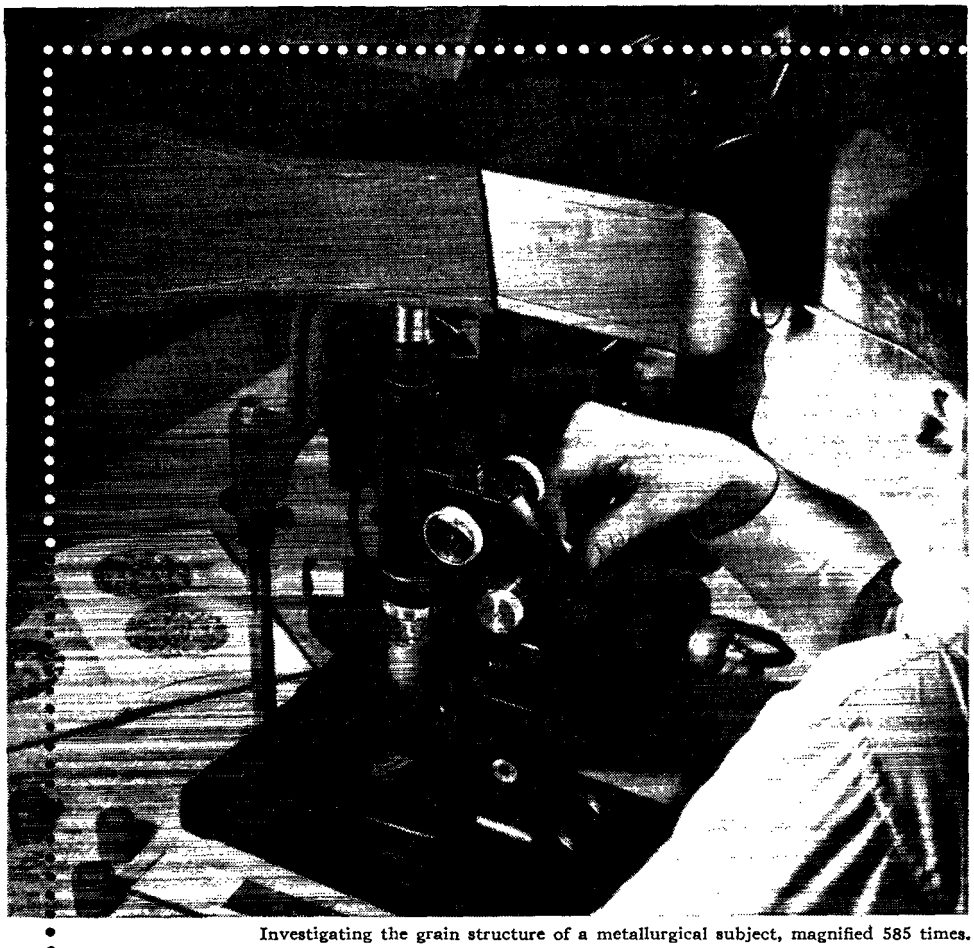
(*Continued from page 68*)

TGN has four or five radio men ready to take exams when tickets are going out again. He is CRM on a troop transport out in the Atlantic. MVE, in the So. Pacific, writes that he has a letter from JWD in St. Louis, who is active with CAP-WERS and is working on a civilian pilot license. HGB is out for one of those civilian pilot licenses also. GHD, who recently was home on leave, is in charge of communications at a small outpost in the Aleutians. KIK came through with the dope on TWP and BAA requested for FOR/FIR; these twin brothers were in the same outfit in the Signal Corps over in Germany. Addresses on request. MOZ, who is now consulting meteorologist to the Army Flight Service in Kansas City, wants some definite information about VEW of Ask Grove, who he thinks has been reported missing over Germany. HDK and TAB, formerly of Willard, are still out in California where they have new W6 calls and the OM, HDK is working in the radio section of Lockheed. OUD and BMS are here at the same old stand.

NEBRASKA — SCM, Arthur R. Gaeth, W9FQB — EKK, KHKN-2, reports WWV working at Hastings Naval Arsenal and planning WERS activity, with relay through Milford to Lincoln. Herman Hosch, Fremont, visited EKK and reports that WERS is ready to activate there. GEU, KHKN-37, returned from Dayton and is building a new receiver. Paul Russum, KHKN-15, joined the ARRL and built handie-talkie KHKN-57, and is going to summer camp in Colorado as jr. counselor. ZPZ, KHKN-62, moved to East Omaha, near Carter Lake. Cliff Allwine, KHKN-39, reports 7A4 doing the hula-hula in the receiver. UFD, KHKN-31, built field strength meter for 2½, and is prospecting for a new home on a hill. VKT, KHKN-9, reports new "J" antenna 50 feet high. Henry L. Petersen, KHKN-43, is one of our ardent code students. FUV, KHKN-64, reports the addition of r.f. stage to the receiver, and has installed unit No. 64 in his auto. VHS, KHKN-38, is active in Cub Scout work. JCK, KHKN-8, is active in the KHKN net. Max. H. Lohse has been assigned KHKN-42. Tom Jeffery, KHKN-17, left for the Navy. EXZ, KHKN-58, built an m.o.p.a. with 6J7-615 modulated with single 6V6. FQB, KHKN-10, received a new multitester as a Father's Day present from family. The Ak-Sar-Ben Radio Club is planning a picnic for July 8th at Carter Lake. YDC showed films of Italy, Sicily, and Corsica, taken by Capt. BZV and projected by Herman Hoesing, one of the gang at the Signal Depot. Capt. BZV reports from Italy that his group repairs anything, including radio and radar transmitters, teletype, cable vulcanizing and power generators, up to 50 kva. Pfc. LTL has been transferred from Sioux Falls to Pueblo, Colo., in PAAB-TAU. Pfc. ex-MUK, K6TXV, prefers Burma to India. 4GFH, operator No. 1, "Cellophane," is shooting for jr. observer in meteorology via civil service. HGV moved his 10-meter, three-element beam off the roof to the pole in the back yard, and is rarin' to go. UEW received a "through the fire lines" card for picture taking and then the city stopped having fires. VHR is dropping hints on some of the new frequency assignments. EUT is active in Boy Scout work. Capt. HTE is chasing Japs. 73, *Art.*

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Edmund R. Fraser, W1KQY — Steve Tabor, GB member, is enroute to Los Angeles for further Naval training. KKS, chief operator on a ship, writes from Calif. that he has just returned from a trip to KA1 area. VB has left the G.E. Co. and is resuming his electrical business in Newtown. CJD still is with the Middletown Press. NCL has received his Class A license. Harry Johnson, ex-8F, is now back in his outboard motor business. MEF has added four more names to GB's honor roll, Northrop, Dayton jr., Tabor, and Singer, bringing the total of club members in the services to thirty-six. FJE's XYL is quite ill in Bridgeport. AGT, MVH, and TD are studying hard for their commercial radiotelephone 2nd-class exams with KAT doing likewise for his commercial first. BW has completed his e.c.o. and reports excellent stability. LOP a 1st lt. and navigator on a B-29, writes that he has completed fifteen missions to Japan. He reports that NAT received a medical discharge from the Air Corps and is attending school in California. 4HVH, a member of the Norwalk Radio Club, CBA, writes from North Truro, Mass. that he returned to the States in Feb. 1944 after a year and a half in the Pacific. WERS news: Norwich: Eli Crumb, of WJTR-6, reports that tests have been conducted using quarter-wave rods connected directly to the units with good results, proving this method can be used with success in event the main antennas



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ARMY E NAVY

IN RADIO COMMUNICATIONS, IT'S...

COLLINS

(*Continued from page 70*)

are damaged. WKWG-70 and WKNQ-1 are being heard regularly. Five units operate during all three test periods. WJTR-1. New London: NEK, district radio aide for WKOB, spent his vacation in Danbury, where he operated portable-mobile from WKOB-15. Waterbury: Dick Tuttle, Cheshire radio aide and operator of WKWG-62 has been busy experimenting with television receivers. Carl Weyand, WKWG-70, reports a half dozen successful contacts with WJXW-8, located in Verona, N. J. WKWG-70 is using a double extended Zepp which is on a fifty-foot steel tower 950 feet above sea level. Bridgeport: Ray Preston reports that WKAO-20 and 23, while operating portable-mobile, heard units WKWG-70, WJXW-8, and WKOB-14. Middletown: DBM, district radio aide, was paid a visit by IND, KQY, and Dickerman. DBM demonstrated WKNQ-25 portable-mobile unit with very good results. This unit uses two "J" antennas, one for receiving on the front of the car and the transmitting antenna on the rear. DBM's XYL, with the assistance of another YL, operate the main control at WKNQ-1. WKNQ-12 was paid a visit. DBM, while operating portable-mobile in the center of Middletown, worked WJLH-1 and WKWG-70, a distance of twenty-five to thirty miles with excellent signal strength. New Haven: WJLH units are preparing to operate for the Red Cross with about the same set-up that was formerly used. Katharine Jackson, chief operator of WJLH-1, is spending the month of August in East Hampton, L. I. LZM has been operating portable-mobile with WJLH-24 unit. Hartford: With the closing of civilian defense activities EAO has completed his job as State radio aide after a period of three years, climaxing it with a message of appreciation sent over the State network to district radio aides in the nine warning districts, namely: KDK/WMHC, Hartford; NEK/WKOB, New London; DBM/WKNQ, Middletown; KXB-Toleski/WKJA, Torrington; EEM/WKWG, Waterbury; ALW-Crumb/WJTR, Norwich; IM-Sanchione/WKAO, Bridgeport; EER/WJQA, Stamford; and KQY-Jackson/WJLH, New Haven, as well as all associate radio aides. EAO deserves much credit for the splendid leadership throughout the three years. Some districts are remaining in operation to furnish emergency communication to their towns, while other networks are now becoming a part of the Red Cross organization. 73, *Ed.*

MAINE — SCM, G. C. Brown, W1AQL — Several squadrons of CAP will stage a joint maneuver soon with a simulated flood and forest fire. Headquarters will be in Augusta and three planes, a Stinson, a Fairchild and a Grumman will be equipped with 115.2-Mc. rigs for communications. About two hundred CAP members stationed at Dow Field, Bangor, will take a course in radio, weather, and Link training in July. IES writes that he is a t/sgt. in the 1st Tactical Air Comm. Sqdn. and wants to know if FBJ still is around. Ens. LHA/4HRN writes from the Southwest Pacific and says that they have just learned about V-E Day. He tells us that LYC, Brookline, Mass., is stationed at Camp Crowder, Mo., after a three year hitch in the Canal Zone. LHA still is asking for the QTH of CCF. QH sent in a nice letter and a picture of himself from the Philippines. Received a nice letter from Sgt. Linn Joy, of Lewiston, now overseas. He is station operator on an SCR-399. NQX is at Scott Field, Ill., and wants to be remembered to Bill Gibbs, Mac MacGown and the rest of the boys. LYK has renewed his EC ticket. BNZ was in town recently after a trip to England. AGL is at WLBZ. BGQ is a warrant officer in the Navy somewhere in the Pacific. 73, "*GC.*"

EASTERN MASSACHUSETTS — SCM, Frank L. Baker, jr., W1ALP — We are sorry to have to announce the death of BZR. 7BOG and his XYL have a new son. NOX is home for a month's leave. The South Shore Amateur Radio Club held its meeting with the following present: AKY, BNS, IS, MMU, CCL, FWS, NUP, JXU, MMH, IHA, ALP, 5JLO, and the Mugford twins. EKG is working in California. NKW received membership in the RSGB, compliments of G8UO with whom he has had FB mail QSOs. Lt. LBB is in the Southwest Pacific, civil censorship. LIO is a lt. in the Mass. State Guard Radio Officers. Newton WERS is going to continue regular Sunday drills. Until October the schedule will be the last Sunday of the month. Mass. State Guard has received and set up its new field radios, SCR-511s. MQV writes from Houlton AAF, Maine, that he is chief radio technician for an entire radio net. RM1c NNH is bound for the So. Pacific; his brother has held an equivalent rating in the Army. T/Sgt. NLP still is in the C.B.I. theater.

(*Continued on page 74*)

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Medium speed drive for keying head, zero to 400 wpm. — MSD-400	195.00
High speed drive for keying head, zero to 700 wpm. — HSD-400	295.00
Low speed drive (AC/DC), zero to 75 wpm. — LSD-400	135.00

RECORDERS

Ink recorder, speed range from zero to 700 wpm. — REC-400	195.00
Medium speed recorder driver, zero to 400 wpm. — MRD-400	195.00
High speed recorder driver push-pull amplifier, zero to 700 wpm. — HRD-400	365.00

PERFORATOR

Wheatstone code tape perforator (not keyboard) — PFR-443-A	265.00

TAPE PULLERS

Tape Puller, speed range zero to 700 wpm. — ATP-400	195.00
Tape Puller, speed range zero to 100 wpm. (AC/DC) — DTP-400	135.00

ACCESSORIES FOR CENTRAL OFFICE EQUIPMENT

Horizontal tape stand is included as part of the recorder.

Vertical tape stand (if desired) with tape warning bell (rings when new roll slip needed). — VTS-400	45.00
Horizontal tape stand (if desired separately). — HTS-400	20.00
Tape bridge, 3/8" slip one side, 1 5/16" slip other — UTB-400	45.00
Oiled slip for perforators, per roll (1/2 lb. approx.)	.30
Slip for ink recorders, either 3/8" or 1 5/16"	.20
Recorder ink, each capsule makes one quart. Per capsule	1.00
Operator's table, stain-proof, alcohol-proof, cigarette-proof	165.00
Operator's chair	35.00

Except where otherwise indicated as AC/DC, all equipment is for 110-120 volts and/or 220-230 volts 50/60 cycles.

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ARMY E NAVY

(*Continued from page 72*)

FCR is training for special duty on airborne Navy equipment in Minneapolis. NUP is T.W.X. supervisor at Boston. MQV wants to know the whereabouts of 9ANK. NPE has been very busy. LAD says they are having a tough time with WERS operators; one has gone into the Navy, and another one drowned in Maine. JFS writes that KON was home and Ray and MJE visited him. MJE had her first airplane ride. JKY bought a house on Lindall Hill. DKS built a boat and lobster traps and goes fishing when not working at G.E. LN is with Salem State Guard unit. JNK is in the Philippines. GRV joined the Masons. HWE is fattening woodchucks. AMT is living on Herbert St., Danvers. JFS would like to hear from KDC. 73, *Frank.*

NEW HAMPSHIRE — SCM, Mrs. Dorothy W. Evans, W1FTJ/4 — JSL has written his YF from some far-off island in the Pacific. He tells her that he recently ran into KHI and that Ted is married and has two youngsters! ADR had a close call in Derry while working for the local power company. However, he survived and is on the road to recovery. NAZ writes that he now has his 2nd-class telegraph and 'phone ticket. Hal says that his kid brother, Richard, will be a postwar ham. CFG has just shipped out as communications officer on a Navy hospital ship. GJH is traveling around the country for the Western Electric Co. ATE is executive officer of a Pacific Fleet radar school. LVG is the proud possessor of a Presidential Unit Citation ribbon. FTJ is in Tennessee after a hurried-up trip to New Hampshire. AVJ has bought a new house in the country in preparation for better postwar DX! ITF has been quite ill and would be glad to hear from his ham friends.

RHODE ISLAND — SCM, Clayton C. Gordon, W1HRC — An unfortunate incident occurred at the regular monthly meeting of the Providence Radio Association, which meets regularly in Conduit Hall, an annex building associated with the Providence YMCA. A ham, from Australia we believe, was carrying a letter from ARRL Headquarters and inquired at the main desk of the YMCA for the location of the radio club meeting. Because of a mistake in the information available to the YMCA they told him they did not know of any radio club meeting that night and he went away before anybody could set him right. Mr. Atherton, of the club, learned of the incident shortly after it happened and spent a futile half hour roaming the streets of Providence trying to locate the visiting ham. Needless to say, the YMCA has been advised about our club meetings, and in the future notice of the meetings will be posted on the bulletin board in the main floor lobby of the main building at the YMCA. The P.R.A. has kept up its meetings and activities all through the war period and has had a meeting at least once a month on the first Tuesday of each month, at approximately 8:30 P.M. FUB has shown visible evidence of a new v.f.o. which he has built for postwar operation. NLF has left for sunny California and willed his junk box to the club. NLF was tendered a farewell banquet at the 1025 Club before he left and was presented with a pen and pencil set. KKE took pictures of the event.

VERMONT — SCM, Burtis W. Dean, W1NLO — BD reports that the State Guard tried out their SCR-511 sets at the maneuvers at Tunbridge, June 23rd, with FB results. The SCR-511 operates in the 80-meter band and certainly runs circles around the 2½-meter rigs. Cpl. Dick Evans (LSPH) has been spending a short furlough in Vt. The Vermont gang extends sympathies to JVS and his XYL on the loss of their son. Watch for details in September *QST* on the Hamfestette to be held in Burlington this fall. NLO and his XYL are the parents of a boy, Wallace Holmes Dean, born June 28th. 73, *Burt.*

NORTHWESTERN DIVISION

MONTANA — SCM, Rex Roberts, W7CPY — CCR stopped at Great Falls airport and gave some of the boys a call. He is in Denver with the International Brotherhood of Electric Workers. ART2c HEM, USNR, is on a short leave. CC is home after two years in the Pacific area. DJR has moved to the 6th call area. WERS in Great Falls has received its license renewal. DSS has rebuilt an old battery b.c. receiver into an up-to-date communications receiver. DXR is up and around after a light attack of meningitis. 73, *Rex.*

OREGON — SCM, Carl Austin, W7GNJ — Anyone who worked 160 during the years just prior to Pearl Harbor will remember GWH, the advocate of the 160-meter rotary beam. After finishing training about four years ago, he was assigned to Africa, the Aleutians, the South Pacific, and back in the

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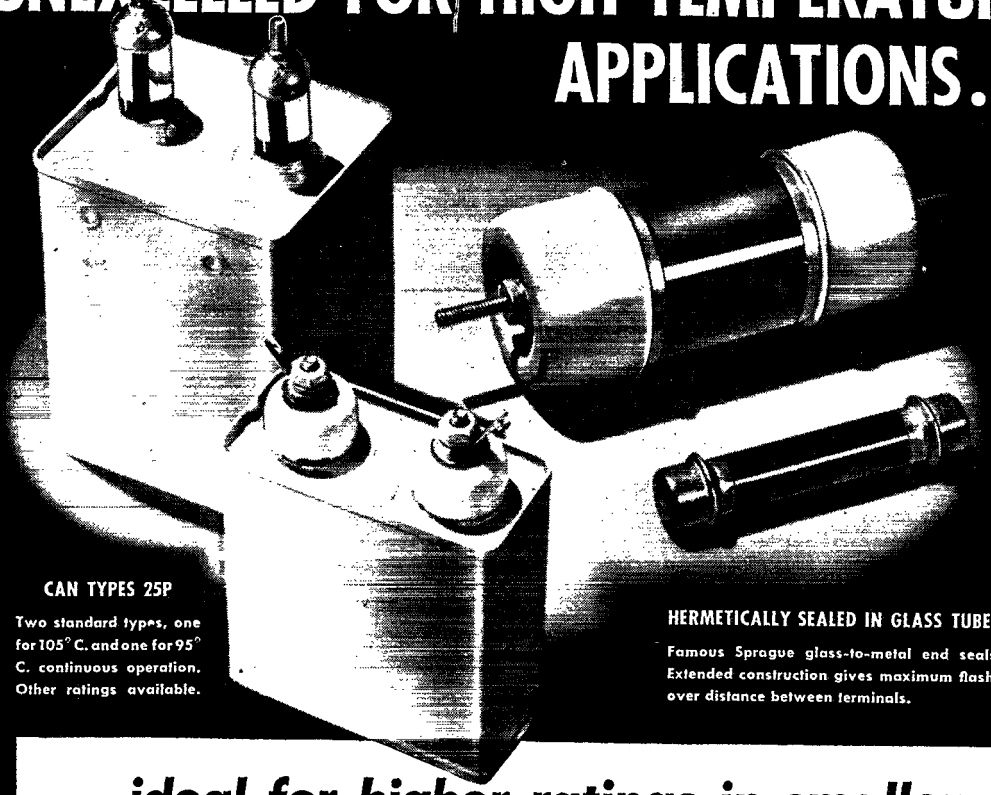

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(*Continued from page 74*)

States last Dec. He now is in San Diego, where he is in charge of repair and maintenance at amphibious training base. Jim, who is RT1c, says they work on frequency-modulated stuff as well as many types of audio amplifiers. The 5-meter gang will be interested in knowing that EO still is at Treasure Island teaching radio. Wonder what EO will be like when he gets on the air again. He seems to think in huge gobs of h.f. and u.h.f. stuff, such as measuring signals for distance covered in miles, and other dark deep things such as detecting odors and colors by u.h.f. 73, *Carl.*

WASHINGTON — SCM, O. U. Tatro, W7FWD — Members of WERS station KFEY have organized the Skagit Amateurs Radio Club, nicknamed SARCS. Officers are Jack Wittman, pres., Roy Reisland, vice-pres., Stan Johnson, secy.-treas. Anyone interested in joining the club contact Stan Johnson, 1510 S. 2nd, Mount Vernon, Wash. Members include JBH, radio aide, DQ, and FXD. HCE, EC, reports an explosion at the Naches hydro plant which left cores from 200-watt potential transformers about right for 350-watt mod. transformers. CAM officiated at the YARC dinner which honored Bill Preicy and his bride. Among those present were AMX, HRX, HV, FCZ, AYO, and HCE. AYO was home on leave from his CAA post at Paine Field. ALH has two microwave transmitters on hand. LV's son Mickey recently received his wings and the YARC is considering increased activity. IOQ, EC, reports KFNV still active and has selected Miriam Brown (LSPH), holder of a Class A ticket, as radio aide. GYO has returned from a hitch in the Navy. HVM, formerly with CAA, is at Fort Lewis. EK, bedridden for years, is very ill. IOQ is installing a new heating plant and has just finished building a freezing unit that works. A letter from JEA says he is ashore as Marine superintendent at Seattle after Army Transport service to the Aleutians, Southwest Pacific and other places since July '43. He has been OI, AC8HW, 6PPO, and now 7JEA. HUK wrote on V-E Day that he was back in the northern part of Italy. HQO writes that he has a little YL operator, 7 lbs. 10 oz., and is stationed with the Air Forces at Kearns, Utah. GGO is back at his base in China and his dad, EKT, is looking for a replacement for his storm blown antenna pole. EWW, a recent visitor from Baltimore, is married and has a YL nine months old. 73, *Tate.*

PACIFIC DIVISION

EAST BAY — SCM, Horace R. Greer, W6TI — EC, QDE; EC v.h.f., FKQ; Asst. EC v.h.f., OJU; OO v.h.f., ZM. The monthly WERS meeting was held June 21st as a special dinner meeting and a great time was had by all. TT and DUB have gone into business for themselves under the name of the "Electric Supply Co." They have opened their new headquarters on 12th St. in Greater Oakland. The many amateur friends of Elvin and Mario wish them all the success in the world. TI is remodeling his back yard in his spare time and claims it is darn hard work. He is planning to give up the good old radio shack in the back yard and build a radio room in the house for after-the-war rag chews. "Another day closer to victory." *TI.*

SAN FRANCISCO — SCM, William A. Ladley, W6RBQ — Phone Randolph 8340. ECs, DOT and KZP. OO u.h.f., NJW. BHK is interested in working other hams via wired wireless carrier-current; so is QVB, of Bakersfield, stationed here with the Army. 5KHB, of Natchez, Miss., is stationed at Mare Island as radio electrician. Miss Frances Jessen has installed a new 2½-meter rig in her car and is ready to operate for California SG-WERS. Sgt. CVP is lining up a code class at the State Guard. It is also rumored that Sam has secured a 750-volt genemotor that he will install in his car as voltage for new SG-WERS transmitter. 9EKY will return home soon after an extended stay in the Hawaiian Islands for Raytheon. Maj. ZF was entertained while home by the SARO and is now out in the Pacific with AACS. S1c NKE, USN, writes in from Pearl Harbor, where he finally caught up with his old buddie, RXV. So far Ken has run across 9PVG, 8PCS, 8POI, 8VGM, KF6PUL and K6PAS. Sudheimer is a new member of SG-WERS. A fine letter is at hand from Capt. HJP, APO 246, c/o Postmaster, San Francisco, Calif. Bill Pease, Raytheon engineer and a good W4 ham from the South, passed through here on his way East. A nice letter has been received from Radar Technician 9VND, of E.R.C., as he leaves the Admiralty Islands for U. S. A. Ozzie says Ken Hughes left there some time ago for KA-land. A letter comes from Sgt. 9ICM, husband of 9ILH. Dale is now at Pearl Harbor on his way West with the USMC. We learn that

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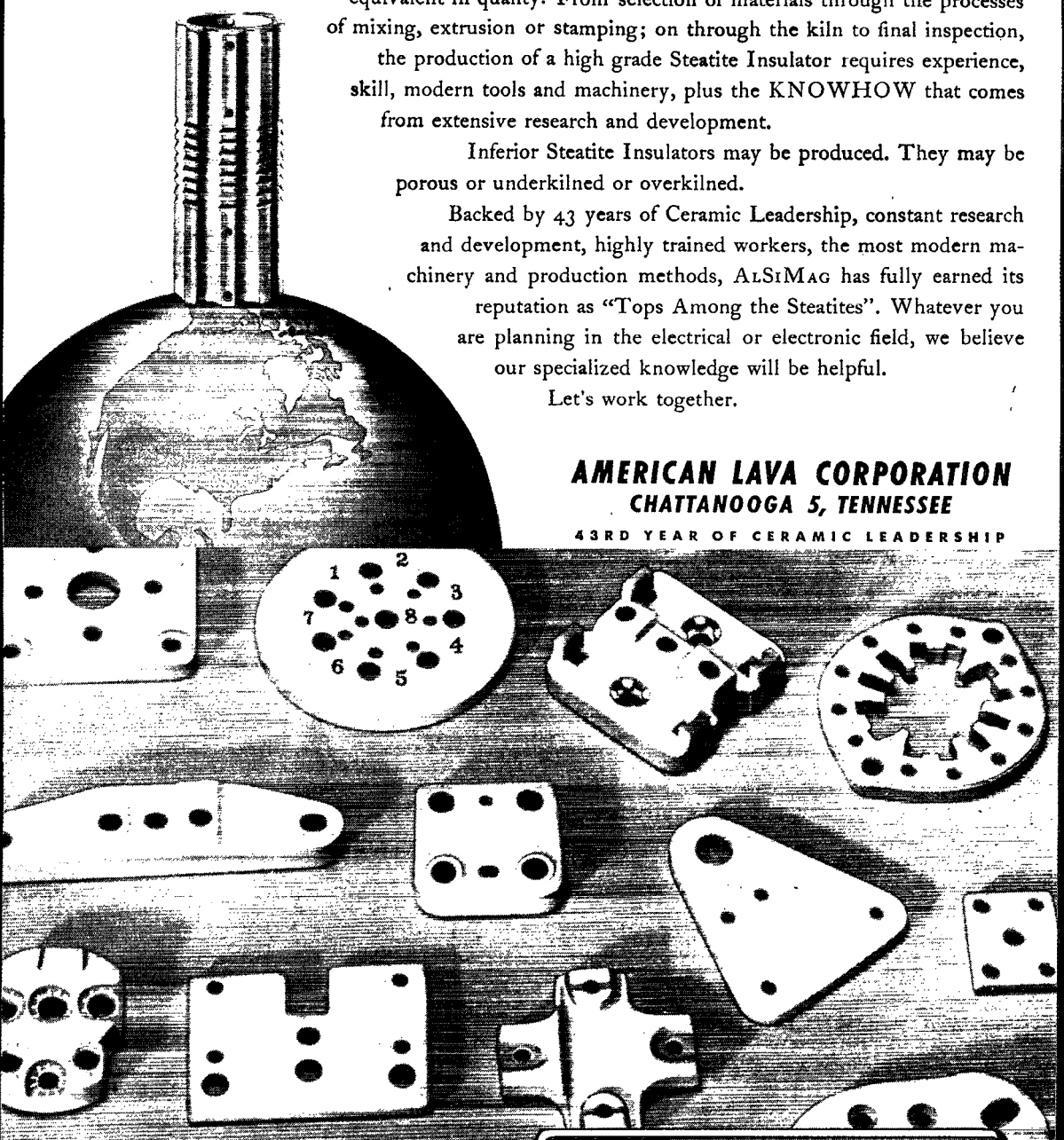

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ARMY E NAVY

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(*Continued from page 76*)

RM1c QGN still is a prisoner of the Japs. RM1c 7IBC arrived back in the States after serving six months in the Western Pacific as radio operator aboard one of our new fast armored transports. RM1c Norma Schall, WAVES, returned home after a short visit with her family near Boston, Mass. 73, *Bill*.

ROCKY MOUNTAIN DIVISION

COLORADO — SCM, H. F. Hekel, W9VGC — Carl Drumeller has been in the hospital since the middle of May with a calcified gallbladder. To make matters worse his wife's code practice went bad on account of his trip West earlier in the spring and then his "calcification." Then "Old Mother Hard Luck" came along with the news that his good friend and sidekick, who operated under the call INUK, got promoted to the rank of 1st lieutenant. YFJ is an inspector for the Air Technical Service Command and his big job is inspecting radar equipment for Western Electric Co. To keep from loafing in his spare moments he is working Sunday evenings as radio announcer at WHBI, a 2½-kw. job on 1280 kc. in Newark, N. J. YKP has his family with him now. Donna took the two babies and the ration books and expects to spend the hottest part of the summer on the East Coast, where it gets so hot they have to keep the matches and unpopped popcorn in the icebox. At the last club meeting we had the pleasure of meeting YDS, a local boy who will be making good some of these days. Bob Perske, another local boy making good in the Navy the hard way, is down at the Naval Training Station, Gulfport, Miss. He is in Co. I, 2nd Plat., as NTS radioman. Now write him a letter. The natives in the areas around Nederland, Rifle and Cliff Lake have been notified to keep the underbrush cut back from the trail as W2OEN-1, ex-WFV, ex-4CA/9, will be on his way back some of these days. Just now he is holding down the job as assistant editor of *QST* at West Hartford, Conn. He said he will be coming back here to stay but my idea is that he is coming back here to eat. I heard tell that beef steaks and roast pig "just ain't" back there in that part of the U. S. Here is the latest dope on S/Sgt. F. C. Colyar, APO 241, c/o Postmaster, San Francisco, Calif. Floyd reported on May 17th from somewhere in the So. Pacific that he had not seen a copy of *QST* for seven months. 6SSA is a real live soldier by this time. 73, by *Beck*.

UTAH-WYOMING — SCM, Victor Drabble, W6LLH — 6UOM divides his time between v.h.f. experimenting and keeping his liquid ration points up to par. 6SYD expects to move to Brigham City. 9OLL has lived in Utah for the last three years and is doing a good job at his war work. He added a new daughter to his family this spring. 9CKO, also a resident of Utah for the past three years, is undecided on whether to buy a megaphone or get new gear for the new v.h.f. band allocations. 6FRN is formulating plans for a new transmitter when the war is over. 6MDP does a good job teaching code to a class of CAP recruits. 6FYR bought a new home and is hard at work keeping the "wheels of communication" rolling. 6GQM went to New York for communication engineering work. 6GPH, a radio engineer for the Army Air Corps in civil service, went to Alliance, Nebraska with Captain Burch to install a tower h.f. transmitter. Charles Kramer (operator license) is doing a good job as a radio mechanic at Hill-Field. 9NFX, back from the China, Burma, India theater of war, is the officer in charge of the radio repair shop at Hill-Field.

SOUTHEASTERN DIVISION

EASTERN FLORIDA — SCM, Robert B. Murphy, W4IP — EYI, of St. Pete, comes through with the note that FZW is based here in Miami and IGQ is based in California and that Spence just returned from his vacation at Lake Tsala Apopka. Ellis Jones, of WKDL, is with Raytheon as a field engineer and says Alex Witherspoon has been torpedoed. IE says AXP, Western Florida SCM, is retiring as SCM in favor of MS. Oscar has really done a fine job over there the past seven years. EWX's picture was in the local Miami paper; Duffy is with the 8th Air Force in England as communications officer and has received a Bronze Star for his remarkable service. ES is a busy li'l beaver here in Miami. BRB has settled down to business in West Palm Beach. WKNW-30, control station, has made contact with a mobile rig, WKNW-14, near Jewfish Bridge, south of Homestead. GZY, please note. EFZ has a rig on and plans an antenna to work into BYF, control here in Miami. NB, IP, and Shep of the Overhaul Shop paid Dodd a visit. Sykes is planning to either build a 112-Mc. rig or go out in

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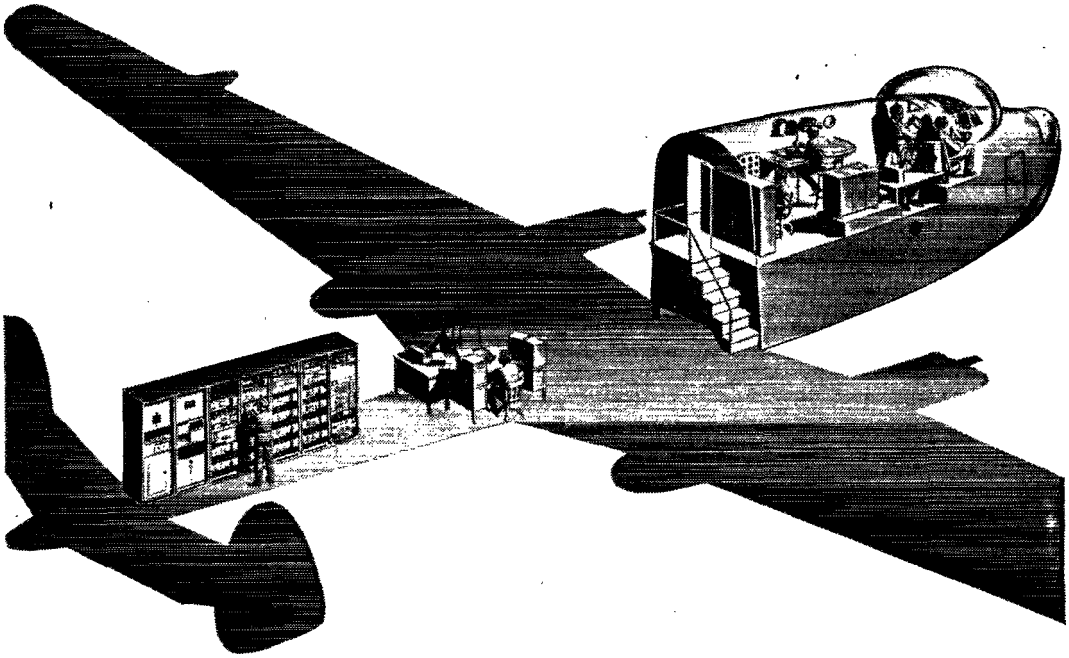

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(*Continued from page 78*)

the Pacific for the "dog days." DQW visited DVO, ALP and several others while in Tampa. BXL is sailing the Pacific on a tanker. HYQ has been an engineer on one of the tankers plying the Atlantic. ASR is plugging along with A.T. & T. Co. and his b.c. work. CPG is either in the Pacific area or on the West Coast. HXM writes from Camp Crowder, Mo. that he wants to hear from HGO and CPG. Paul says he has had a lot of experience with those plywood masts in May *QST*, page 27, and if any of the fellows, especially those on 112 Mc., are interested in getting their sky wires up they really are light and can be handled by one man. WKNW-30, control, has been heard by a mobile rig in Ft. Lauderdale. We have had several field days in Miami and vicinity with the WKNW net. No. 2 is trying to get a pole to put his antenna up high enough to get into Ft. Lauderdale; No. 3 is an FRO with A. & O. and flies the Atlantic between QSOs in the net; No. 4 is putting out a nice signal; No. 7 is having a time with his modulation and keeping the boys happy; No. 8 has been laying down a good signal with a crimp he has put in his antenna; No. 11, after a "serious" of calls, has hit into this one and is doing OK; No. 13 is having a time with his mobile rig, but will be on later; he met HEX, now with the American Airlines in Casablanca, on his last trip over the Atlantic; No. 14 is doing an excellent job on his trips south of Homestead and really has established our DX for this district; No. 16 is crooning about his contact with WKRW-36 in Ft. Lauderdale; No. 17 is a li'l upset by not making the contact Bumpus made; No. 20 is back from the PAA contacts down south on teletype; No. 31 is the real secondary station for control station; he makes consistent contact with Ft. Lauderdale; No. 32 is the portable that runs a close competition to No. 14; the rest of the gang are doing fine; No. 42 is the station to be the southern contact of the net; it will be set up by EFZ and we expect to encourage a little competition with GZY. The local radio club has had a little shake-up, and it looks like it will be a good club to which to belong. At the last meeting R. B. Murphy was elected president and Gray Russell, vice-president. It is my understanding that WERS will be sponsored by the local Red Cross. 73, *Merf.*

WESTERN FLORIDA — SCM, Oscar Cederstrom, W4AXP — A letter to BGM states that Lt. Comdr. PE is critically ill in the Navy Hospital at Bethesda, Md. RS, formerly with Block Bros., at Selma, Ala., paid a visit to MS. RS is a captain in the Army Air Corps. MS visits DAO quite often and reports DAO's swell new shack is nearly completed. MS built two of those nice looking split stator condenser jobs that look like a two leaf clover with rotor in middle and stator on each side. They were built for QK and DAO. MS heard from ACB, who is looking forward to 2½-meter activity. 6PNI and BGM hope to work U. S. from Borneo and Tokyo, postwar ham radio. CPO 7IQJ, ex-6QJN, is at the transmitter here at N. A. S. Carl Rodgers, one of our instructors, recently established a radio school at Molino for potential hams. Rodgers is getting set for both commercial and ham tickets under the wing of the OM. Another wedding this month. The two radio teachers in the code room at Bldg. 606, S1c Mary Ellen Laird and RM2c Horten E. Whaley, took the big leap June 17th. 7BWK and ex-7MX are civilian employees in the radio line at Corry Field. CNK and 5IVP are in the telephone communications department, Bldg. 47-C. 5IVP has been discharged from the Navy. He was a CPO and put in eight years in the services. Lt. ex-6BRG, stationed in Atlanta, is back on a visit. JV was presented with a brand new harmonic. A fine letter was received from EZT, now at the Navy station, Cheltenham, Md. Kirk's brother was a POW in Germany and is on the way home. Kirk says there is a fine bunch of WAVES up there as operators. A nice letter came in from Sgt. Red Flowers, who has been in Germany for several months. He is keeping up with the news about home ham doings and other boys in the services through reading our section summary in *QST*. GXL, one of the old traffic gang and an old operator at WVR, is anxious to find out where he can secure Braille radio and ham data so he can help a blind boy. What say, gang? GXL has been working for Eastern Airlines and is getting his code speed up to 40 and 50 w.p.m. He put in two years on the North Atlantic as an operator and now is at Jax. GXL sends 73 to the gang. The OM has been as busy as two hens digging in a new flower bed. 73, from *The Old Maestro.*

GEORGIA — SCM, Ernest L. Morgan, W4FDJ — GIA has recovered from a minor operation and now is teaching in Mississippi. EGT was married to Miss Ethel Swanson at East Orange, N. J., in May. Capt. Jim Huggins, Maj. AGI

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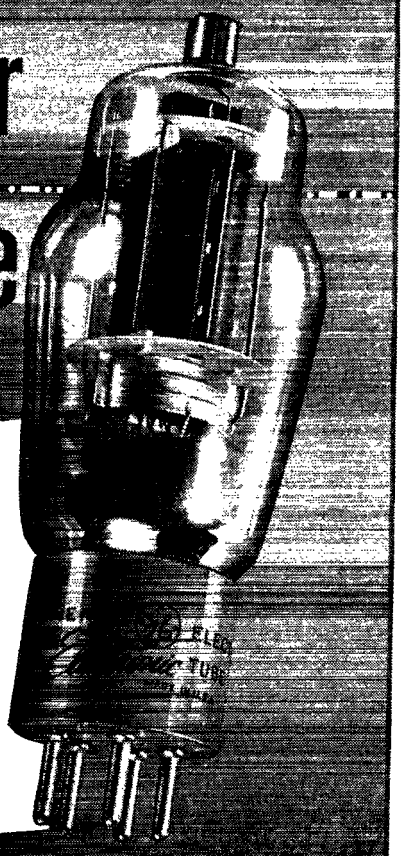

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(*Continued from page 80*)

and Lt. Comdr. AAY held a miniature hamfest in Washington. Capt. Huggins is thinking of matrimony. FCW recently received the Bronze Star in Germany. Ex-ABS/HD soon will be on his way to an assignment abroad. MA is trying to get QSLs from those of us who were too careless to send them in the old days. If you didn't QSL to Doc, do so and show him that some of you *do* read this column. 73, *Pop.*

SOUTHWESTERN DIVISION

LOS ANGELES — SCM, H. F. Wood, W6QVV — Wish all of you could have been with us at the recent hamfest staged by the most able and efficient gang in Altadena. Several of the WERS group up there put on some very clever skits and a swell time was had by all. SSU has moved his family down to Mexico City, where he has taken over the duties of superintendent of radio installation, etc. for the Aerovias Azteca, a new airline company. UQL, who thought that he was on his way out of "this man's Army," was home for a few days before reporting back to the hospital in Tacoma where, we understand, they sent him to Santa Barbara for assignment. PPW and his XYL drove out to the house the other Sunday and it was very enjoyable seeing them again. Had a mighty nice letter dated June 2nd from Cpl. THU in Bavaria and he reports that *QST* has been arriving a little late but regularly and he and all the other hams over there follow our activities with a great amount of interest. He speaks of the times he and TRD came over to my shack to talk about the work of the AEC. He says that in the drive from the Rhine to Salzburg he found that many times the Signal Corps men that weren't hams came to him and 9SZB for a lift. Stu Walmsley writes that the Inglewood Amateur Radio Club will have its old meeting place in the Veterans' Memorial Hall on Centinela in Inglewood back. Meetings will be held the first and third Friday of the month. The club has set up a new schedule of events and expects to start a new code and theory class soon. Gear and other things donated by the members have been auctioned off at recent meetings and the club has benefited considerably by the net proceeds. Stu says that ECC has left for Bishop where he has accepted a new job, and 8WLG now has a jr. operator. Have heard KGWE, Long Beach, on at every drill period I have attended for KGLV and they are carrying on in great style. The Inglewood nets, KGIC, as well as the Los Angeles County group, KGCL, are busy each period and KGLV is carrying on each period allowed. New gear and ideas are being developed by many in this area and new stuff is shown at every get-together. The old man's daughter came down from the ranch in the High Sierras and found me in the midst of building a new shop, etc., in order to have some place ready in which to overhaul the old rig so as to be in readiness for the "green light." 73, and CUL. *Ted.*

ARIZONA — SCM, Douglas Aitken, W6RWW — MLL still is reporting for Doug, who is much improved although still in the hospital. NRP is pounding brass for the Navy in the Philippines and copies press for the local news bulletin on his island. LAI, a 1st lieutenant, dropped in to visit RWW while on leave from Elgin Field, Fla. The 25 Club in Tucson held its regular meeting on May 18th with eleven hams present, including MLL, who was a guest. The WERS plan is moving forward in Tucson with a number of hams putting in applications for licenses. Most of the fellows plan to build crystal-controlled rigs and superhets or converters. The Tucson Short Wave Association is running code classes with a special class for those returning from overseas to speed up their code before going on to the Pacific area. Tucson Hi reports eighty per cent of their radar review class for the Eddy Test successful on the test. Eddie Marston (LSPH) is attending the class. RZN is in Louisiana waiting for ham radio to be revived. CMP is back in Phoenix and is doing electrical design work for the Army. CMP and RPS visited Tucson. KMM was in Phoenix on leave after two years in the So. Pacific. He is now a CPO and is in Los Gatos, Calif. Sentiment is strong in both Tucson and Phoenix for a state organization, and at CMP's suggestion mimeographed copies of dope on it may reach you soon. CMP makes a motion that all Arizona hams give a vote of appreciation to ARRL Headquarters for keeping amateur radio alive. Best of luck from all of us, Doug. 73, *G. C.*

SAN DIEGO — SCM, Ralph H. Culbertson, W6CHV — Asst. SCM, Gordon W. Brown, W6APG. I am very happy to report that WERS license KKQL has been received for the City of San Diego. Forty-two licenses have been approved, five fixed stations and the balance portable and portable-

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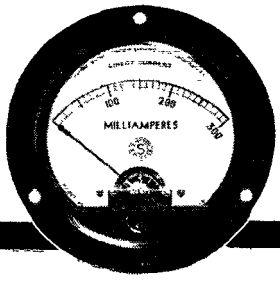

(*Continued from page 82*)

mobile. OIN is operating as main net control station. Eight to ten stations have started operation in the net. I had the pleasure of listening to the drill on June 20th and things are going FB. The following stations were active: OIN, No. 1; QKI, No. 5; OZH, No. 7; EOP, No. 17; CNB, No. 21; RGY, No. 23. No. 21 and No. 23 were operating portable-mobile. Contacts were made with KGWE-28, of Long Beach. OIN's new four-element beam is working very well. Received an FB letter from HTJ, who is in the So. Pacific and wants to be remembered to the gang. 1IRL is located at the Sound Lab., Point Loma. A meeting on WERS is scheduled for the very near future. 73, *Ralph.*

WEST GULF DIVISION

NORTHERN TEXAS — SCM, Jack T. Moore, W5ALA — Sgt. ISD, in the Signal Corps, reports from Germany. Haynes says 2KOC and 8YLZ are in his company, along with Carl Henry and Jim Luscher, who have ham tickets but no calls. ISD says that in spite of his QTH, he received a new *Handbook* recently. Haynes advises that ISS is in the Navy and AUT was working for a railroad out of Big Spring. SP says he will get the old rig percolating again as soon as the lid is off. BIN sends the following news about the Waco boys; DZ is a colonel and is stationed at Randolph Field; ATW has moved from Houston to Waco; CQQ has gone into business for himself; UF is with the U. S. Engineers in Galveston; BOB is busy repairing refrigeration units. GML reports from Kelly Field, where he is taking a communication inspector's course. JCN has acquired an SX-28. FKM has left Lockheed to go into the refrigeration repair business. HZB reports from Randolph Field, and sends the following: FAJ is a lt. (jg), somewhere on the water; HYE was last reported with the Signal Corps in Italy; FRE (HZB's father) is interested in frequency standards. ICB hears that BNQ is taking flying lessons. JJF has transferred from El Paso to Austin, according to BNQ, HPG, ACRT, is now stationed at Banana River, Fla., after twenty-eight months of overseas duty. AUJ keeps busy in the wholesale automotive parts business, but takes time off to send the following on the Abilene boys: QA is active in the radio service business while not looking for 50L6s and 12SA7s; BNS is chief radio-man in the USN and has been home for the first time in four years, after service in the Atlantic and the Pacific; AUL is a lt. comdr. out Okinawa way; Bill Green also is a lt. comdr. and has been called from Pacific duty to the West Coast for a physical checkup; AW holds down the transmitter for KBST at Big Spring. HDG is chief operator and technician for KADR, the local police station; Herschel Peake has graduated to an engineering capacity for the local utilities company. Lt. BXY has a new jr. operator. KOW reports that amateur activities are quiet in Knox County. Doc sends the following: FQT is the only other ham left in the County; Jack Pippen (LSPH) has returned home after ten months in England, with thirty missions over Germany as navigator on a B-17; FLJ is with the Signal Corps at Camp Swift near Austin; GDH is at Biggs Field; ENP is in the radio shop at Lexington, Ky. 73, *Jack.*

OKLAHOMA — SCM, Ed Oldfield, W5AYL — Headquarters is really in there batting on the old and new frequency allocations and it looks like we're going to come out in fine shape. The new 21-21.5-Mc. band should be a real "DXers delight" and a new experience. All hams, I believe, have a great obligation to the League for the solidity it has given ham radio and the manner in which it has continually plugged for us. Join the A.R.R.L. now. JOV is pfc. at AACS, Sheppard Field, Tex., and previously operated CAA station at Honolulu. Received a nice letter from Cpl. JHJ, who is radar operator in the Gulf region. Regards, *Ed.*

SOUTHERN TEXAS — SCM, James B. Rives, W5JC — AQK still is in radio service at Corpus Christi. His XYL, BKG, keeps busy with household tasks. We all mourn the passing of MS, an oldtimer, who was killed in an airplane crash in Australia. ZX is working for Eastman in Oak Ridge, Tenn. EEY and IFU are working for the Navy in Corpus Christi. IFW is in the Army, stationed in New Guinea. CHI is in England. CHN is working for Navy civil service at Austin. ZN has retired from Western Union and is spending most of his time at Port Aransas. All former members of the San Antonio Radio Club are requested to write the secretary, Henry Velte, 125 City St. Your SCM is grateful for a nice letter from Capt. EYB in Pilsen, Czechoslovakia, telling how the boys overseas appreciate reading the reports in *QST* about the fellows back home. 73, *Jim.*

Radar Techniques

(Continued from page 52)

down to a point where its velocity in the conductor compares to its free space velocity as does a pedestrian to an airplane. The energy isn't wasted, of course; the current rises correspondingly, and the tangential magnetic field is doubled in intensity.

The quantity δ is called "depth of penetration." It represents a phase shift of 180° — one-half conductor wavelength — at which point the field has practically vanished. Thus the reflection coefficient of a metal is essentially independent of the angle of incidence and differs only a negligible amount from unity even at u.h.f. Thus at an air-copper surface the ratio of the magnetic and electric field energies in the wave ranges from 5.7×10^{-8} at 3000 Mc. to 5.7×10^{-12} at 0.3 Mc. In the case of iron, which has about one-tenth the conductivity and the permeability may be of the order of 10^3, but the ratio is still exceedingly small, even at wavelengths of a few centimeters.

To summarize, this means that metallic conductors at high frequencies vigorously repel the electromagnetic field, confining it to an extremely thin layer. Moreover, the magnetic field in a good conductor everywhere obviously lags 45 degrees behind the electric field.

Dielectric Surfaces

Reflection coefficients for dissipative media are markedly altered when the medium is predominantly dielectric. For vertically polarized waves the reflected ray at grazing incidence has the same amplitude before and after reflection. As the angle of incidence is increased the coefficient of reflection becomes smaller, while the phase shift remains constant at 180 degrees. At a cer-

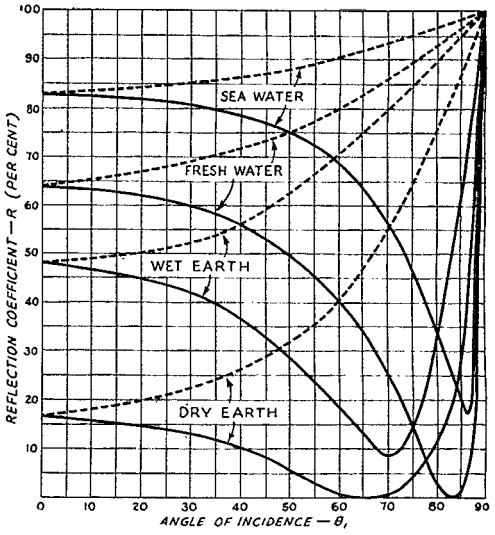

Fig. 8 — Reflection coefficients as functions of angle of incidence for plane waves reflected from typical terrestrial surfaces at frequencies at which $\sigma/\omega\kappa < 1$ (dielectric). Solid lines are for vertical polarization, components polarized in the plane of incidence, and dashed lines for horizontal polarization, in the plane of incidence.

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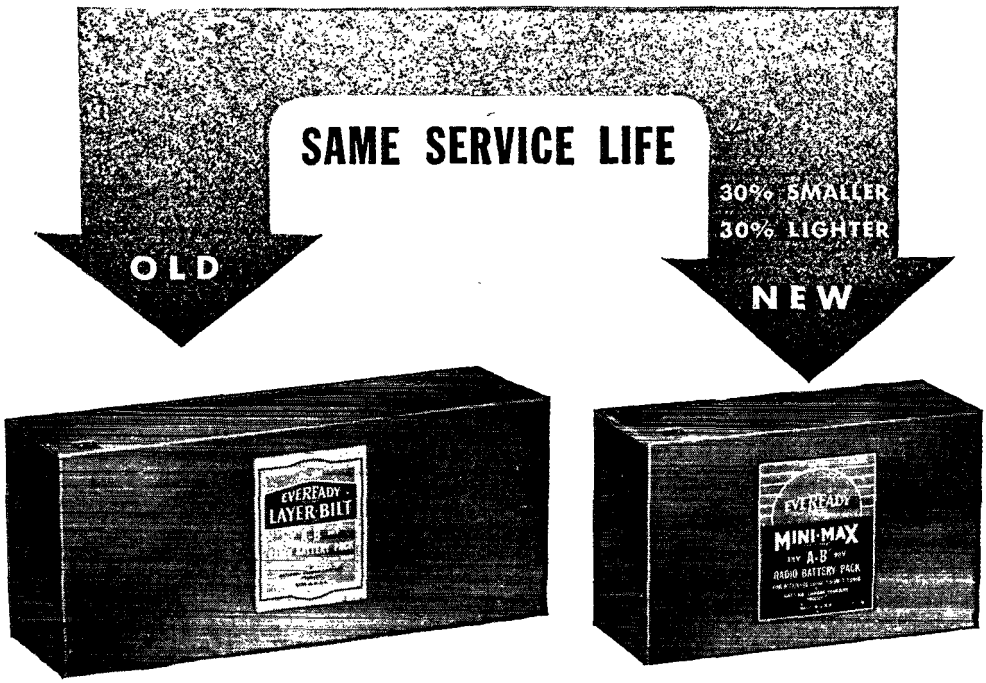

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(Continued from page 86)

tain incident angle the reflected ray disappears, and a further increase gives a sharply increasing reflected ray with constant zero phase shift. For horizontally polarized waves reflected from a dielectric medium, the phase of the reflected ray remains at 180 degrees, while the amplitude continually decreases with increasing angle of incidence.

Since frequency is a factor, it is logical that certain media which are "conductors" at low frequencies change to dielectrics at high frequencies. A striking example is average ground. At frequencies above about 1 Mc. dry earth or rock act as dielectrics in their reflecting properties. Typical reflection coefficients are plotted in Fig. 9 against angle of incidence.

Earth having a conductivity of the order of 5×10^{-4} to 5×10^{-3} (M-K-S units) is considered average. Values above 10^{-3} are high, while conductivities of the order of 10^{-5} are considered as low. Sea water, on the other hand, has a conductivity many times that of earth, and also possesses a very high dielectric constant. Thus, because of its homogeniety it is an excellent reflector. Similarly in the case of fresh water, especially small inland lakes; although the conductivity is relatively low, the dielectric constant is high and thus strong dielectric currents will be set up, particularly at v.h.f. and u.h.f. At frequencies in the audio range ordinary earth behaves like a good conductor, while at u.h.f. it acts as a good dielectric. For the typical examples in Figs. 9–10, "dry earth" may be classified as a good conductor only in the audio frequency range, becoming a reasonably good dielectric in the middle of the broadcast band, at about 750 kc. The corresponding limits for typical wet earth are approximately 15–20 kc. and 35–40 Mc. Fresh water is a good conductor only up to the middle audio range, becoming a fair dielectric at about 4 Mc. As a conductor, sea water maintains good conductivity up to about 10 Mc., but does not achieve the status of a true dielectric until having passed through a broad transition region to about 17×10^9 Mc.

In Fig. 7 typical dielectric constants and conductivities are charted for different types of soils.

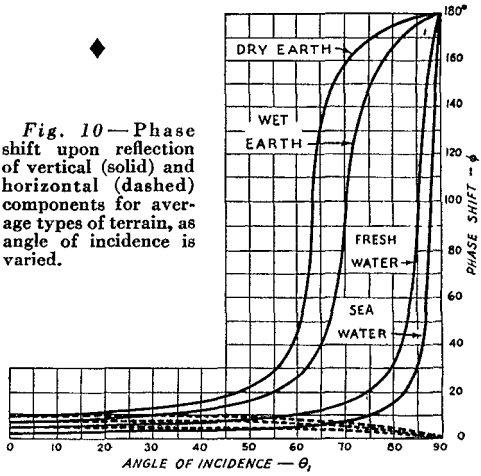

Fig. 10 — Phase shift upon reflection of vertical (solid) and horizontal (dashed) components for average types of terrain, as angle of incidence is varied.

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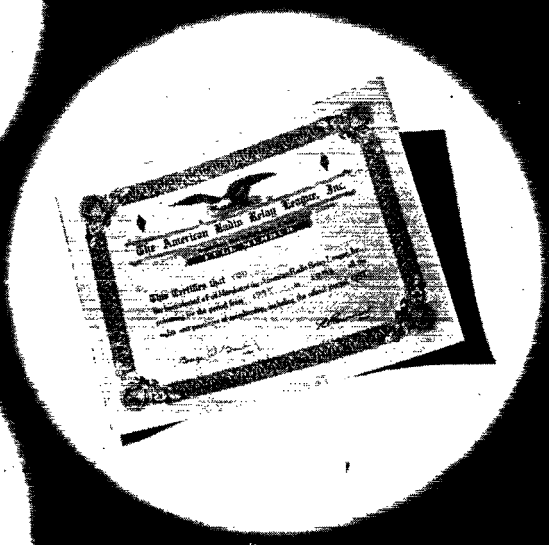

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(Continued from page 88)

Actual ground constants depend not only on the type of soil, but on stratification, depth below the surface, moisture content, temperature, and frequency. Both dielectric constant and conductivity increase with moisture content. Conductivity, in particular, shows large variations with increasing moisture content. In general, the dielectric constant decreases and the conductivity rises with frequency.

The effective values of conductivity and dielectric constant represent distance below the surface of the earth to which ground currents of appreciable amplitude penetrate. The depth of penetration is itself a function of frequency, dielectric constant and conductivity, and is commonly of the order of several feet. As a result, its effect on the earth constants can be fairly readily taken into account. Ordinarily, large values of dielectric constant tend to go with high conductivity, and vice versa. The highest conductivities occur with wet loam, while the poor conductivities and low dielectric constant are generally associated with dry, rocky, sandy soil. The effective value of σ is reduced if the surface is not level, as in the case of mountainous or hilly regions, and also with increasing altitude above sea level. The effective conductivity also tends to be low in wooded areas, and in regions containing many buildings, particularly cities with large office buildings.

It will be apparent from Fig. 7 that the regularity of the terrain also influences the conductivity. The flatness of the earth relative to the area being scanned is of particular importance. Hills, forestation, large buildings and other obstacles create shadows or blurred spotches. Such "shadow", while distinctive and in striking contrast with the low attenuation over flat terrain, are correspondingly difficult to analyze. In the wide-band receivers employed, energy arriving from multiple reflections adds at some frequencies, and subtracts at other frequencies. Such interference patterns tend to occur more frequently the higher the frequency, the minimum area of a surface that can act as an effective reflector rather than a "scatterer" being proportional to the wavelength.

In metropolitan areas where there are many buildings with steel framework, or numerous reinforced concrete structures in large-city business, industrial, and large apartment-house areas the effective conductivity is considerably less than the normal conductivity of the underlying earth because of the scattering and multiple reflection losses caused by man-made structures. Except where highly localized concentrated scanning is employed this effect is particularly pronounced in large-city business, industrial, and large apartment-house areas.

Tests made at frequencies up to 500 Mc. display an average increased attenuation over earth of poor conductivity as compared to sea water of an average of 20 db. Such factors as forestation, hills, irregularities, trees, rivers, etc., also have an important influence on the reflection coefficient.

Splatter

(Continued from page 10)

Columbia Universities. But please note — the call is the same (plus the necessary W). And that good old ham spirit hasn't changed either. W3PZ is a Sigma Xi, a technical advisor to IRAC, radio aide of the Arlington County (Virginia) WERS, and holds amateur Class A, radiotelephone first-, and radiotelegraph second-class licenses. OM Smith has seen his by-line on about a hundred articles since his first appearance in print in that January, 1925, *QST*. If he keeps up that output we can look forward to using that "By W3PZ" several times in the next two decades. . . . Although **Lt. Henry K. Weidemann, USNR, W6HKN,** is on active duty at Bowdoin College in the Navy pre-radar school, he found the opportunity to work out an effective volume expansion circuit for his phonograph amplifier. His findings are recorded in the article on page 19. Lt. Weidemann's interest in radio dates back to the early '20s but W6HKN did not go on the air until 1933. While most of Weidemann's activities embraced circuit design and operational theory, he has operated on 'phone and c.w. on the bands from 30 Mc. down. Following graduation from the University of California with a major in physics, Weidemann was for twelve years a member of the staff of the Woodland (Calif.) High School where he taught physics and chemistry. His extracurricular activities included both school administration and extending encouragement to boys interested in radio. Now we know why there are so many W6s!

Correspondence from Members

(Continued from page 59)

message, and since the enemy already knows the guns are there, we're not telling them anything. All messages are copied for possible bearing on our tactical situation, and information is immediately forwarded on our voice command net which all our local stations monitor. V.h.f. contact with air is also used for coördination at this level.

All in all it's a fast-moving job for one man, but those of us who operate these nets wouldn't trade the job for anything but a trip home. Congratulations, Mid, to you and all who had a part in producing this set for which you definitely don't "have to make excuses."

— *Cpl. W. S. Miller, LSPII*

Somewhere in Europe

Editor, *QST:*

May I first take the opportunity to express the appreciation of all of us in the radio section of this unit for the fine articles in recent issues of *QST*. Through them we have not only increased our knowledge of various phases of radio but also increased the efficiency and operation of our nets.

In particular, I extend thanks for the article on the SCR-506 in the May issue. Many of us have worked with this radio set and were overjoyed at the sight of your very complete article.

— *Henry D. Mitchell, jr.*

Silent Keys

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

W1IIK, William S. Nemetz, RT1c, East Port Chester, N. Y.

W3FAL, Donald W. Short, Westmont, N. J.

W6NWB, Herman Kuhn, San Francisco, Calif.

W8VHR, Robert S. Evarts, Pittsburgh, Pa.

W9AUF, Louis F. Lete, Effingham, Ill.

KA1JM, Alfred F. Duggleby, Manila, P. I.

KA2OV, Samuel J. Douglas, Bauang, La Union

VE4AO, W. R. Pottle, Saskatchewan, Canada

G6XO, John L. Stoddart, South Shields County, Durham, England

Electronic Key

(Continued from page 45)

screw hole and using fibre washers. The normal dot contact, No. 1 in the diagram, is adjusted so that contact is made with the key in the neutral position. This contact is broken only when the lever is swung to the dash side. In other words, the lever contacts No. 3 for dashes, No. 1 for spaces and Nos. 1 and 2 for dots. If desired, there is space enough so that the key can be built into the chassis as some constructors have done.

Adjustment

With the key open, R_5 should be increased until V_3 is cut off as determined by inserting a milliammeter in series with the plate of V_3 or by observing the relay. The circuit will oscillate with R_5 set at less than cut-off value. Once set, the value of R_5 requires no further adjustment and can be provided with a screwdriver adjustment or the correct fixed value may be inserted. With the key held closed the relay should be adjusted for equal pull-in and drop-out positions by changing the spacing of the armature in relation to the relay core and the spring adjustment. The speed can be adjusted most easily by setting R_9 for the proper space rate, setting the dot-length control for proper length and then the dash length to jibe with dot speed. Each of these adjustments is practically independent of the others.

The power supply delivers 400 volts to R_{11} and the VR-105 tube. The value of R_{11} can be changed if other than the specified voltage is used. It should be of such value that the regulator tube passes between 10 and 20 ma. to ground. If the value of R_{11} is too high, the VR-105 will break into a blocking type of oscillator. When using lower voltages the insertion of a choke in series with R_{11} may be necessary for proper filtering.

Ground-Plane Antennas

(Continued from page 29)

culated dimensions of the antennas, radials and stub sections for five radiators in the frequency range of 112–116 Mc.; these radiators will match a 72-ohm concentric transmission line.

Calculations will show that the impedance of the stub section is 41.6 ohms. This impedance was selected in order that a mechanically-rigged mount could be constructed to hold the antenna and also to insure that the adjustment of the stub section was not critical. With the combination shown, the position of the shorting stub varies only 0.4 inch over a 4-Mc. range. Obviously then, one could construct an antenna in the middle of this band for operation throughout the band; in fact, frequencies having a ratio of nearly plus or minus 2:1 as compared to the design frequency can be used with this antenna, but at reduced efficiencies as the ratio increases.

The method of feeding this antenna is illustrated in the detail photograph. The sheath of the concentric cable is bolted to the flange or ring which supports the horizontal ground-plane rods. The concentric wire of the transmission line is attached to the vertical radiator between the lower nut on the vertical rod and the hex-rod fitting supporting the vertical antenna.

The use of this antenna as compared to a center-fed vertical doublet has resulted in recording signals which were not previously heard. With this antenna it is not uncommon to have ground-to-ground communications at this frequency over distances up to 80 miles, and it is believed that the effect in constructing a really efficient antenna has been well worth while.

Happenings of the Month

(Continued from page 27)

membership of our League is now at a record high number of over thirty thousand. He, too, looks forward to the day when we can greet you direct from our headquarters station in Hartford.

Some of us, including myself, have sons who have flown over the mountains to visit your country many times in the past year, and are still doing so. They tell us of your valiant efforts in this cataclysmic war. They have learned first-hand of the important part your radiomen are playing in the successful prosecution of our gigantic struggle for freedom. It is good that your government recognizes the value of their services.

Our own government has been giving careful consideration to allocations of frequencies after the war. While the result of these deliberations has not yet been fully determined, I feel sure that the very extraordinary record of amateur radio operators in the service of their country is fully recognized by our leaders, so that when the war for freedom is won, we shall be able to talk with you on our old frequencies.

I wish that I might elaborate on that record of amateur radio service, but I must wait until the war is over, and the deeds of amateur radio operators the world over may be publicly recorded in all their glory.

At last, rays of sunshine are breaking through the dark clouds of war. It is our devout hope that before another year rolls around our swords may be raised in victory.

We hope and pray for those days when our swords are beaten into ploughshares, and peace prevails throughout the world. Then, when we are united with our families and friends, and following the pursuits of peace, we may again use our own transmitters to exchange friendly greetings with one another.

In Ordering and installing replacement parts, the short cut to satisfactory service is duplication of parts used in the original assembly. Substitution is hazardous and often costly. Where manufacturers' engineers have tested, approved and used Astatic parts, you will be playing it safe to follow their lead in making repairs or replacements. Veteran amateurs, who long have used Astatic Microphones, Phonograph Pickups, Cartridges and other products, have learned, through experience that the name "Astatic" means quality workmanship and dependable performance . . . yesterday . . . today . . . and tomorrow.

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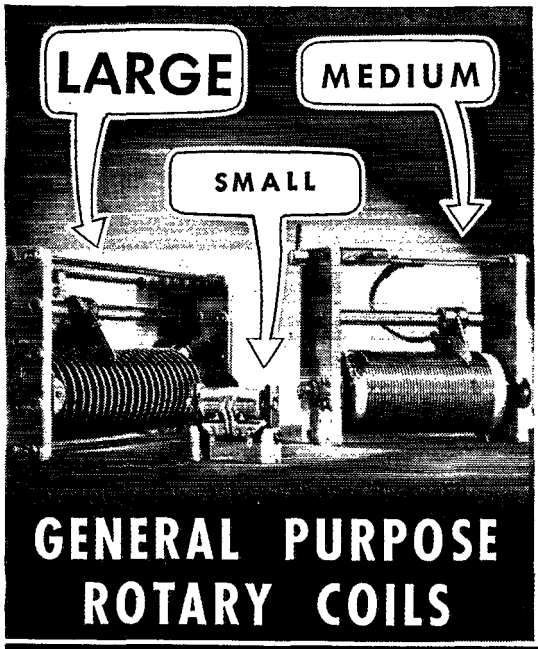

GENERAL PURPOSE ROTARY COILS

These rotary coils are typical of the many new and unique inductors rolling in tremendous quantity from the busy B&W war equipment assembly lines. They range all the way from big dielectric heating coils to midgets with dual opposed windings for continuously variable operation. And remember! Each new one designed adds to the wealth of B&W experience that will mean the finest line of Air Inductors for post war amateur radio use—bar none!

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QST Goes Voyaging

(Continued from page 18)

matériel of war to the armed forces in every part of the world. You'll see action, and plenty of it. You'll learn a lot more about radio operating and you'll be helping win the war in the way every radioman wants — as a radio operator. Doesn't all this make you want to help?!

Sign On With the USMS

Well, here's what *you* do about it! If you hold an expired or an unexpired marine radio operator's license, *wire* the Recruitment and Manning Organizations, War Shipping Administration, Washington 25, D. C., collect! Give them the details and you'll get prompt action.

If you have had no marine radio experience you should apply at once at the nearest U. S. Maritime Service enrolling office or U. S. Employment Service office. They will give you all the necessary details and assist you in every way.

The Maritime Service will make requests for selective service deferments directly to the local boards, for men between 17 and 35, after they are accepted for training.

After acceptance, you'll be sent to a training school and your training pay ($50 a month) will commence. You'll spend six weeks at a Maritime Service apprentice seaman training station learning the basic and necessary facts to fit you for a seafaring life. Upon completion of this training you will be assigned to either Hoffman Island or Gallups Island for the last twenty-one weeks of the course, during which time you'll be instructed in radio theory, operation and practice.

However, if you can immediately qualify for a temporarily limited second-class operator's license (the easiest class of commercial license to obtain) you may be sent right out to sea. This temporary license includes the usual sixteen code groups per minute, but the theory portion requires only 50 per cent passing grade on the regular second-class radiotelegraph examination. For men who have held a first- or second-class radiotelegraph license, only the code examination is required.

Your base pay starts at $180 a month, plus a bonus. Living quarters and food are furnished, so this base pay is worth a lot more to you and you can save up enough money for a new postwar rig.

I am well aware of the enormous difference between the brief four-day cruise that I had from Baltimore to Boston on a training ship and a real deep-sea voyage on a sea-going cargo ship. But basically, the idea is the same. You stand your watches, keep up the gear in tip-top shape, and, above all, you serve your country in the most critical time in its long seafaring history, by helping move the men and supplies that will shorten the war.

And don't forget, by shortening the war even a moment, you save the lives of your pals fighting the war in the Pacific.

So — join the U. S. Maritime Service as a radio operator and listen to the world on 500 kc.!

HAM-ADS

(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.
(2) No display of any character will be accepted, nor can any special typographical arrangement, such as all or part capital letters be used which would tend to make one advertisement stand out from the others.
(3) The Ham-Ad rate is 30c per word, except as noted in paragraph (6) below.
(4) Remittance in full must accompany copy. No cash or contract discount or agency commission will be allowed.
(5) Closing date for Ham-Ads is the 25th of the second month preceding publication date.
(6) A special rate of 7c per word will apply to advertising which, in our judgment, is obviously non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Thus, advertising of bona fide surplus equipment owned, used and for sale by an individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League takes the 7c rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and all advertising by him takes the 30c rate. Provisions of paragraphs (1), (2), (4) and (5), apply to all advertising in this column regardless of which rate may apply.

Having made no investigation of the advertisers in the classified columns, the publishers of *QST* are unable to vouch for their integrity or for the grade or character of the products advertised

QUARTZ — Direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Drill Carbon Co., 719 World Bldg., New York City.

COMMERCIAL radio operators examination questions and answers. One dollar per element. G. C. Waller, W5ATV, 6540 Washington Blvd., Tulsa, Okla.

WHY NOT turn your unused equipment into ready cash which may be applied towards new and better equipment after the war? Leo, W9GFQ, offers you the best cash prices for communications receivers and test equipment. Write today for large illustrated catalog. Wholesale Radio Laboratories, 744 W. Broadway, Council Bluffs, Iowa.

CRYSTALS available — all types, including 100 kc., 465 kc. and 100 kc. Broadcast and Aircraft given prompt attention. Scientific Radio Products, Council Bluffs, Iowa.

CRYSTALS: complete units or blanks. All types. Your specifications and tolerances. One or one million. Refinishing and repairing of your present units. Rex Bassett, Incorporated, Ft. Lauderdale, Fla.

RADIO TESTS — Pre-examination Tests for Radio Operators. Tests your knowledge before you appear for commercial radio operator license examinations. Avoids failures. Guides your preparation. Saves your time. Worth investigating at once. Also books for home study. Write for free circulars 5Q. Nilson Radio School, 51 E. 42 St., New York 17, N. Y.

PROMPT Repair Service on meters and electronic instruments. Braden Engineering Co., 3317 Kenmore Ave., Dayton 10, Ohio.

FRITZ for better QSLs after victory! 1213 Briargate, Joliet, Ill.

QRR de LSPH: Need Volumes 1, 2 and 3 to complete my file of *QST*. Will pay good price for bound volumes or single copies in good condition. QRU? E.D.C., 38 LaSalle Road, West Hartford 7, Conn.

BUILD radio complete with tubes, $10.95, details. Radio, 9418j Avenue "A", Brooklyn, N. Y.

WANTED: Typewriter in good condition. Prefer portable. Floyd Howard, Jonesboro, La.

WHEN amateurs are on the air again there will be a complete line of James Knights Precision Crystals for every amateur activity. The James Knights Company, Sandwich, Ill.

ASTATIC pickups and microphones in stock. Send for price-list and information. Hard-to-get tubes at ceiling prices. Also batteries. List and prices on request. Abbott Appliance & Music Co., 2101 Grand Concourse, New York City.

FABERADIO crystals will be available to amateurs immediately after hostilities cease. Faberadio, Sandwich, Ill.

WANTED: Highest cash price for Hallicrafters S-29, Sky traveler. Corp. Humphrey Propsner, U.S.M.C., B Co., 2 Pioneer Bn., 2 Marine Div., FPO, San Francisco.

FOR SALE: NC-200 with speaker, like new. 4-section 150 watt transmitter, including Meissner signal shifter and 6-ft. standard relay rack. Complete with tubes and coils for 40 meters. All for $300. Kenneth Hiers, 513 Jenkins Ave., No. Charleston, So. Carolina.

WANTED: EC-1, or similar. Overseas request. A. Weber, 2617 Knapp, Ames, Iowa.

SELL *QST* July 1926 to date, also Radio. SX-24, transmitting equipment, tubes, parts. W9DW1.

BEST offer takes 1000 volt, 300 watt plate transformer, 2 μfd. 1300 volt condenser; UTC, S-33 choke. W1BBM.

SURPLUS: (Fifteen) 75-watt modulator units with peak-limiting speech amplifier. Uses 6SJ7, 6L, 6SQ7, 6V6, 807's, Class AB2. Matches 5000-ohm load. Hand-picked by ham, guaranteed perfect. Photos on request. $25.00 each, less tubes. Electro-Mechanical Mfg. Co., 17 East 42nd St., New York City 17, N. Y.

WANTED: Westinghouse 0–25 ampere BX radiation ammeter. Hot-wire ammeter for DeForest OT3 transmitter. Early crystal receivers and early wireless gear. Also early wireless publications such as Modern Electrics, Marconigraphs, etc. Franklin Wingard, 4517 13th Ave., Rock Island, Ill.

IMMEDIATE shipment on priority: New SX28As, $223.00; SX25s, $94.50; PM23s, $15.00; S39s, $110.00; S20Rs, $60.00. In Stock Without Priority: Trimm headsets, McElroy keys, oscillators, bugs, meter rectifiers, $1.95. Instructographs for rent. Write for our parts list. Henry Radio, Butler, Mo. and Los Angeles 25, Calif.

FOR SALE: National NC-200, 12-inch p.m. speaker, like new. Francis Beecher, 801 Emerson St., Madison 5, Wis.

FOR SALE: Johnson 200FD20, 200DD35 at net price. Craven, W3ERV, 2216 South 7th St., Philadelphia, Penna.

WANT HRO Sr. ham coils, power supply, speaker. Give details. Will trade latest edition Encyclopedia Britannica, special blue levantex binding, gold-stamped. Cost $230. Includes 1945 volume, new. Jerry Gorman, W6JJU, 10317 Glory Ave., Tujunga, Calif. Phone Sunland 5889.

HERE'S something! 100/1000 Kc. dual crystals with diagram for serviceman's standards, etc., $12 mounted; no priority, quantity limited. Changing frequency? Prompt delivery of Eidson fine crystals. Low drift commercial types available throughout the 100–12500 Kc. range. Also repair and regrinding and crystals supplied to your holders. Ten years of satisfaction and fast service! Send for folder L-5, mention your needs. "Eidson's," Temple, Texas.

GET on free mailing list for monthly technical bulletin, The Electric Laboratory. Impedance Laboratories, Box 425T, Great Neck, New York.

ARMY-NAVY surplus transmitter components. Send for list. C. A. Sprague, 1002 Forest, Ft. Wayne 3, Indiana.

TRADE $150 Bacon Silver Bell, tenor banjo or 20-watt Bogen amp. for good recorder or test equipment. Write Housholder, Box 413, Beloit, Wis.

WANTED: Old theatre speakers WE-555, 713A, 596; RCA 1435; Jensen Auditorium 14" or 18". Write price, condition. R. E. Dye, 41 W. Walnut Ave., Merchantville, N. J.

WANTED: Triplett 100 ma. 2" model 221 meter. W1BB

PAIR 807s, slightly used. Swap for 300-ma. cased choke, or what have you? W5EBN, Mickle, 224 West Maple, New Orleans, La.

WILL buy SX-17 Super Skyrider receiver in good condition, at a reasonable cost. Charles W. Hobbs, 1904 Benhall Ct., Ft. Worth, Texas.

FOR SALE: McElroy streamlined speed key, transmitting variables, pair new 807 tubes, technical books. Ernest Austin, 1445 Ogden Street, Northwest, Washington 10, D. C.

SELL $35, or trade R.M.E. D.B.-20. Bill Pullen, Natural Resources Building, Urbana, Ill.

TRANSMITTER, high power T-55s, 866s, highest quality parts, standard 6-ft. rack, steel panels refinished. Mims rotary beam antenna with deluxe roto-mount. National NC-101X receiver, $840. F. L. Manfredi, 111 Quinby Avenue, White Plains, N. Y.

WANTED: Meissner high-fidelity p.a. tuner or utility p.a. tuner. Will trade Meissner f.m. receptor for above units. For sale: pole transformer 110 V/220 V, 60 cycles, 1500 k.v.a., $5.00. Francis Beecher, 801 Emerson, Madison 5, Wis.

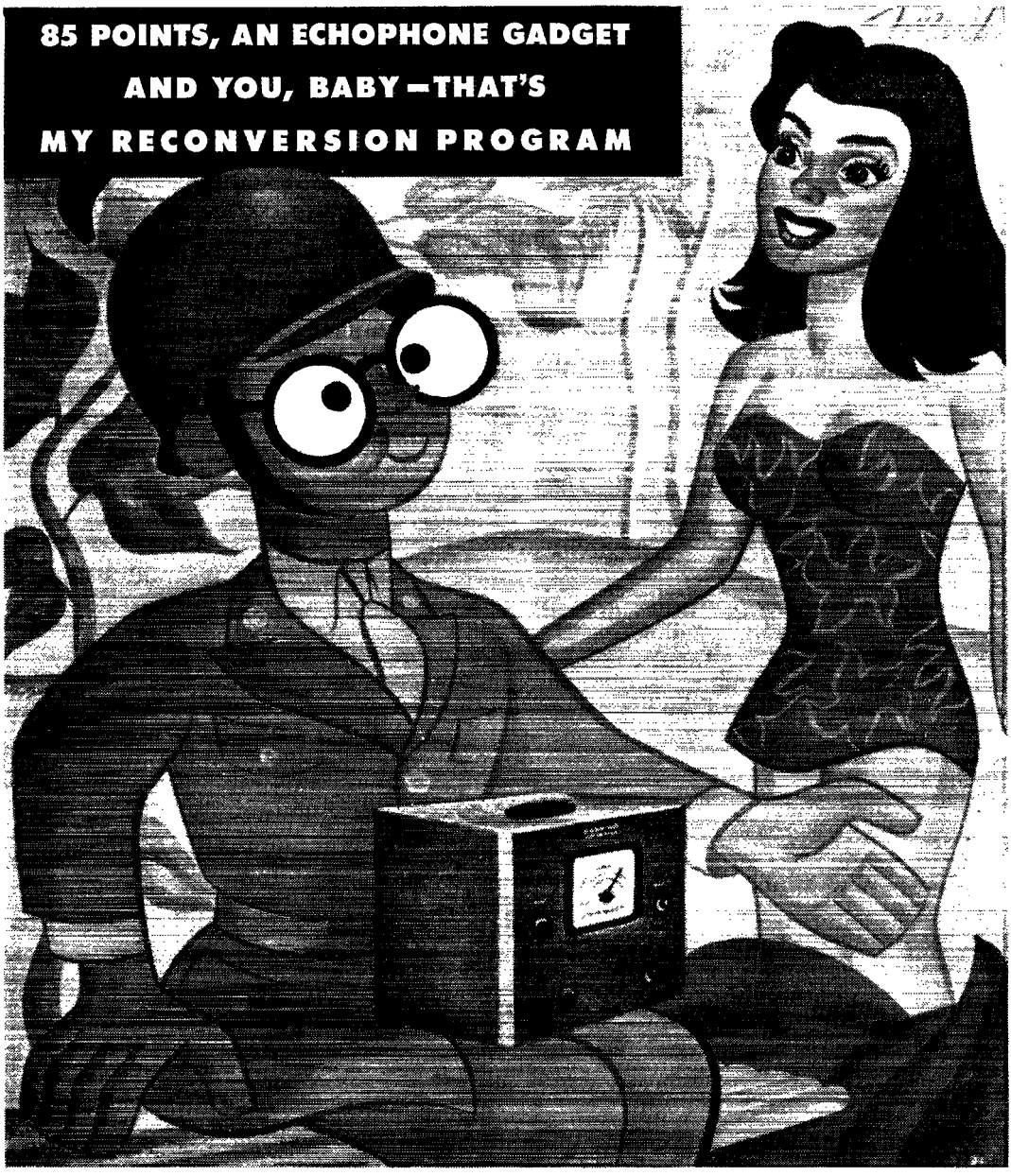
SELLING McElroy TP-890/-742 tape puller and G813–742 keyer with tapes, tubes, and phones. Perfect condition. $75. S 1/c Packard, R-19, Gallups Island, Boston, Mass.

FOR SALE: Several unused 2-in. square-case Weston or equivalent 0-20 d.c. voltmeters — $2.85 each (400 ohms) and 0-5 d.c. milliammeters, $3.65 each, postpaid. Removed from surplus war material. W. D. Montgomery, W8PNQ, 1290 Coolidge Ave., Cincinnati 30, Ohio.

HALLICRAFTERS SX-9 good condition. For sale at $35.00. W. Ulrich, W2MQH, 2707 Sedgwick Ave., Bronx 63, N. Y.

WANTED: Two 1600 *k.c, i.f.* transformers, one 1600 kc. oscillator transformer. Permeability tuned preferred. I. W. Wade, S 1/c (RT), Co. 119–411 Navy Pier, Chicago, Ill.

TEST equipment — now available with AA-5 priority! Radio City 805 tube and set tester, $89.50; Radio City 488 multimeter, $71.50; Solar CE-1-60 condenser checker, $44.90; Superior PB-100 v.o.m., $28.40; 17-watt amplifier with tubes, $30.30; Rek-O-Kut RKD-16 motor and turntable, $148.38. Scenic Radio & Electronics Co., 53 Park Place, New York 7, N. Y.



ECHOPHONE AND THE CITIZENS' RADIOPHONE BAND

Hogarth's date with the future embraces new possibilities for Echophone. There will be Echophone equipment for use on the citizens' radio communications service band. It is certain to be low in price, high in performance and completely dependable. The present EC-1 covers from 550 kc. to 30 Mc. on three bands . . . electrical bandspread on all bands . . . self-contained speaker . . . 115-125 volts AC or DC.

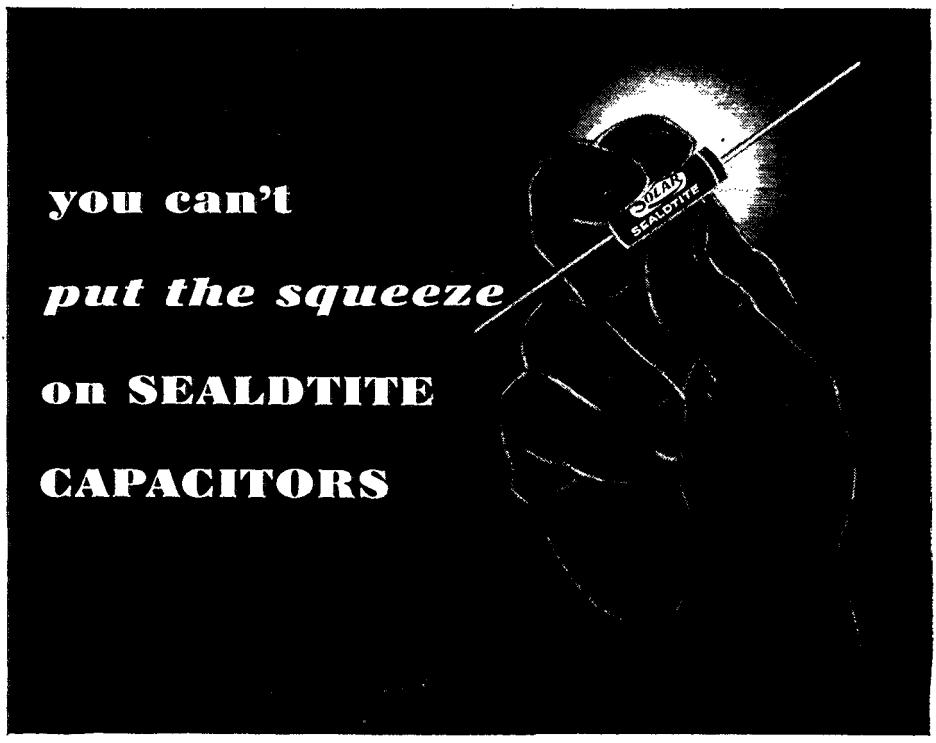
ECHOPHONE
"The Ears of the World"

ECHOPHONE RADIO CO., 540 NORTH MICHIGAN AVE., CHICAGO 11, ILLINOIS

Index to Advertisers

All of the above advertisers are cooperating with the A.R.R.L. to permit publication of an editorially adequate *QST* during this period of war-rationing of paper. Using less advertising space but at higher rates, they continue their customary support of *QST*. Some are using smaller space in each issue and some are using space only every second or third issue. Of the latter, those whose advertising does not appear in this particular issue are indicated by the **above.


FOR A JOB Well Done . . .
THIS button, soon to be worn by thirteen million men and women—honorably discharged members of the Armed Forces of the United States—is a symbol of honor, an insignia of respect.
Wherever it is worn, it eloquently proclaims a victorious fight for Country and principles. It is indeed the chevron of service—the reward for a job done well.
Jensen
SPEAKERS WITH Alnico 5
Specialists in Design and Manufacture of Acoustic Equipment
JENSEN RADIO MANUFACTURING COMPANY • 6601 SOUTH LARAMIE AVENUE, CHICAGO 38, ILLINOIS



Just try it . . . Take a genuine "Sealdtite" capacitor and try to *squeeze* it. No results. You'll find it has no soft spots, which in ordinary tubulars provide room for moisture, the capacitor's worst enemy. Because the Solar capacitor has an internal winding of high quality paper and foil, skillfully *molded* into *solid* plastic.

No moisture can penetrate this protective case and its substantial construction permits rough handling, assures long and *reliable* service.

Use "Sealdtite" capacitors. Send for your copy of Catalog V-4.

Any Climate—Any Atmosphere—
Any Service.

BAYONNE PLANT
WEST N.Y. PLANT

A TOTAL OF EIGHT ARMY-NAVY
EXCELLENCE AWARDS

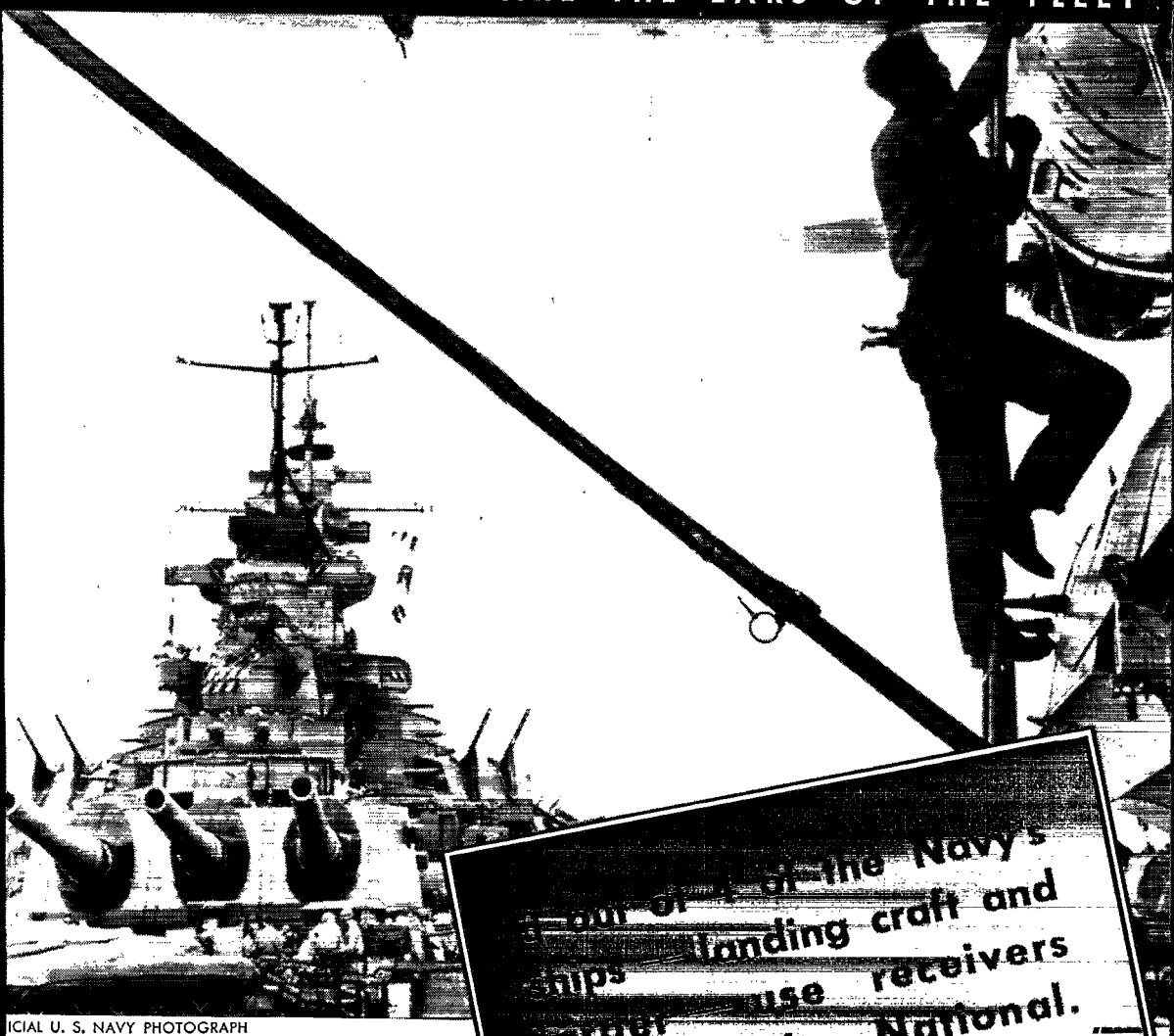
Ⓢ 7567

SOLAR

SOLAR CAPACITOR SALES CORP.
285 MADISON AVENUE, NEW YORK CITY

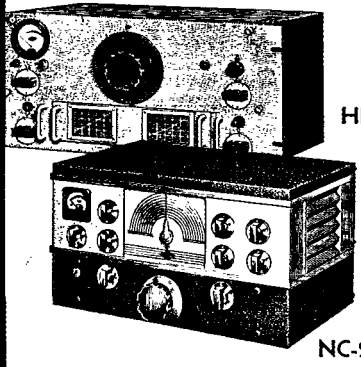
PRINTED IN U. S. A.
RUMFORD PRESS
CONCORD, N. H.

NATIONAL RECEIVERS ARE THE EARS OF THE FLEET



ICIAL U. S. NAVY PHOTOGRAPH

...out of ... of the Navy's ...ships ...landing craft and ...larger ...use receivers ...designed by National. ...the OS2U Kingfisher observation ...scouting plane provides eyes for the ...battleship's muscle. Radio provides the ...indispensable link. It has to be reliable.



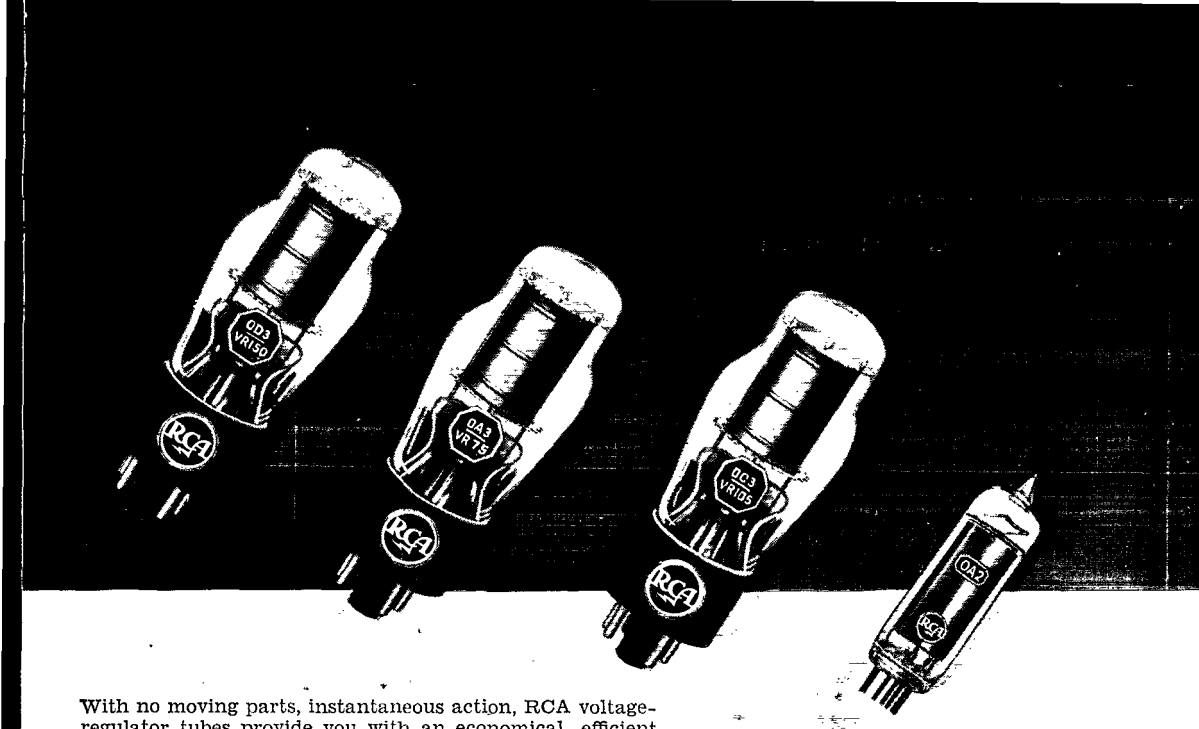
HRO

NC-200

NATIONAL COMPANY

MALDEN MASS, U. S. A.

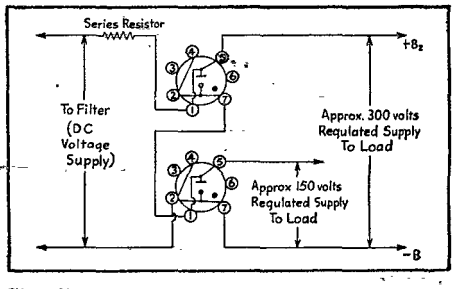
NATIONAL RECEIVERS ARE IN SERVICE THROUGHOUT THE WORLD



With no moving parts, instantaneous action, RCA voltage-regulator tubes provide you with an economical, efficient means of obtaining a regulated d-c voltage across a load. By using these tubes it is possible to maintain a stabilized voltage despite load-current and minor line-voltage fluctuations.

TYPICAL APPLICATIONS

1. Regulate voltage to frequency-controlling oscillator—either ECO or Xtal types. The Master Control VFO described in RCA Tube Guide uses an OA3/VR75 to stabilize screen voltage of oscillator.
2. Regulate oscillator power supply in superhet receivers.
3. Stabilize bias voltage.
4. Stabilize tube voltages in electron-coupled frequency meter.
5. Spark-over protection.



Circuit using two OA2's to provide regulated voltages of approximately 300 volts and 150 volts to load.

TECHNICAL DATA

	OA2	OA3/VR75	OC3/VR105	OD3/VR150
Max. Overall Length, Inches	$2\frac{5}{8}$	$4\frac{1}{8}$	$4\frac{1}{8}$	$4\frac{1}{8}$
Max. Seated Height, Inches	$2\frac{3}{8}$	$3\frac{9}{16}$	$3\frac{9}{16}$	$3\frac{9}{16}$
Max. Diameter, Inches	$\frac{3}{4}$	$1\frac{9}{16}$	$1\frac{9}{16}$	$1\frac{9}{16}$
Bulb	T-$5\frac{1}{2}$	ST-12	ST-12	ST-12
Base	Miniature Button 7-pin	Small Shell Octal 6-pin	Small Shell Octal 6-pin	Small Shell Octal 6-pin
Mounting Position	Any	Any	Any	Any
DC Anode Supply, Min., Volts*	185	105	133	185
DC Operating Current				
Continuous, Max., Ma.	30	40	40	40
Continuous, Min., Ma.	5	5	5	5
Ambient Temp. Range, Deg., C	−55 to +90	−55 to +90	−55 to +90	−55 to +90
DC Starting Volts, Approx.	155	100	115	160
DC Operating Volts, Approx.	150	75	105	150
Regulation, Volts	2 (5 to 30 ma)	3 (5 to 30 ma) 5 (5 to 40 ma)	1 (5 to 30 ma) 2 (5 to 40 ma)	2 (5 to 30 ma) 4 (5 to 40 ma)

*Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

The Fountainhead of Modern Tube Development is RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

62-6238-76