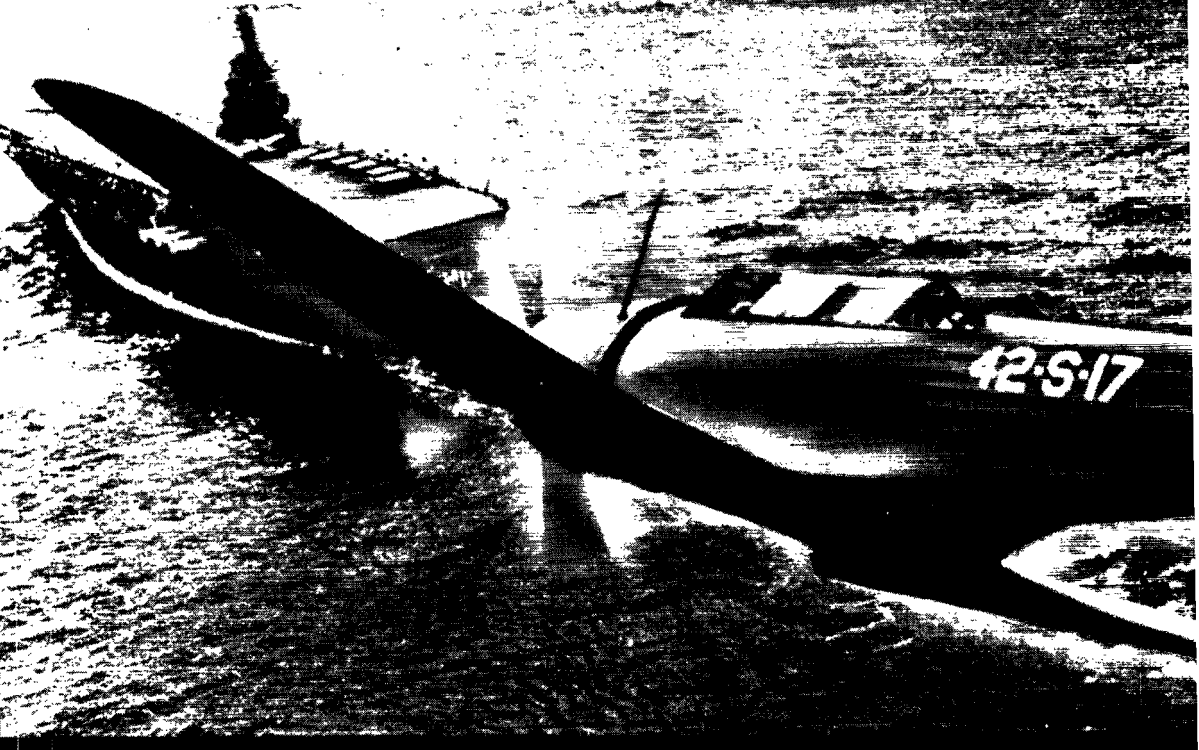
QST

devoted entirely to

amateur radio

...tober, 1942
25 cents
35c in Canada



DESIGNED FOR SPECIFIC APPLICATIONS

U. S. NAVY OFFICIAL PHOTO

The bulk of U.T.C. production is on special units constructed to precise customers' requirements. It is naturally impossible to describe all of these thousands of designs as they become available. Many of them are unique.

In most cases, today, a major design factor is the conservation of material, or provision of substitutes for critical materials. All in all, it is significant that many former jobs find their way to U.T.C.

MAY WE ASSIST YOU IN YOUR PROBLEM?

UNITED TRANSFORMER CO.

150 VARICK STREET ★ NEW YORK, N. Y.


ARMY
E
NAVY
hallicrafters
Battle Flags!

Battle Flags!

All of us at the Hallicrafters are both proud and humble to have important assignments in defeating America's enemies.

That our efforts have justified the award of the famous Army-Navy "E" flag is a great honor. We shall keep it proudly flying.

all of the hallicrafters

OCTOBER 1942

VOLUME XXVI

NUMBER 10

★

★

OFFICES

38 La Salle Road
West Hartford, Connecticut

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

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

QST *devoted entirely to*

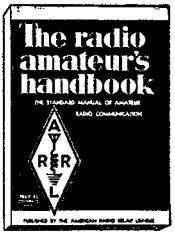
AMATEUR RADIO

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

CONTENTS

BOOKS FOR RADIO TRAINING COURSES

The Radio Amateur's Handbook



★ ★ ★

REGULAR EDITION — The *Handbook* tells the things which are needed for a comprehensive understanding of Amateur Radio. From the story of how Amateur Radio started through an outline of its wide scope of the present — from suggestions on how to learn the code through explanations of traffic-handling procedure and good operating practices — from electrical and radio fundamentals through the design, construction, and operation of amateur equipment — this book covers the subject thoroughly. It includes the latest and the best information on everything in Amateur Radio. *Price $1.00*

Buckram bound — $2.50

($1.50 Outside Continental U. S. A.)

Spanish Edition — $1.50

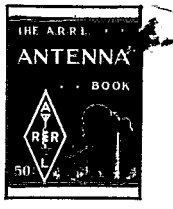
SPECIAL DEFENSE EDITION — This new edition of the Handbook is designed especially for use in radio training courses. It eliminates those portions of the regular edition which are not useful for instruction purposes and has added chapters on mathematics, measuring equipment and code instruction. Brand new is the first chapter covering the elementary mathematics necessary for the solution of all formulas and interpretation of graphs appearing throughout the text. This includes a review of decimals, method of extracting square root, algebraic notation and manipulation of formulas, laws of exponents, logarithms, a discussion of linear, power and exponential functions and their application to graphs, and the use of coordinates. Supplementing this chapter, a four-place log table is included in the Appendix. *Price $1.00*

Learning the Radiotelegraph Code

Designed to train students to handle code skillfully and with precision, both in sending and in receiving, this booklet takes first rank among the League's publications which meet today's special training needs. Employing a novel system of code-learning based on the accepted method of *sound* conception, it is particularly excellent for the student who does not have the continuous help of an experienced operator or access to a code machine. It is similarly helpful home-study material for members of code classes. Adequate practice material is included for classwork as well as for home-study. There are also helpful data on high-speed operation, typewriter copy, general operating information — and an entire chapter on tone sources for code practice, including the description of a complete code instruction table with practice oscillator.

Price 25 cents

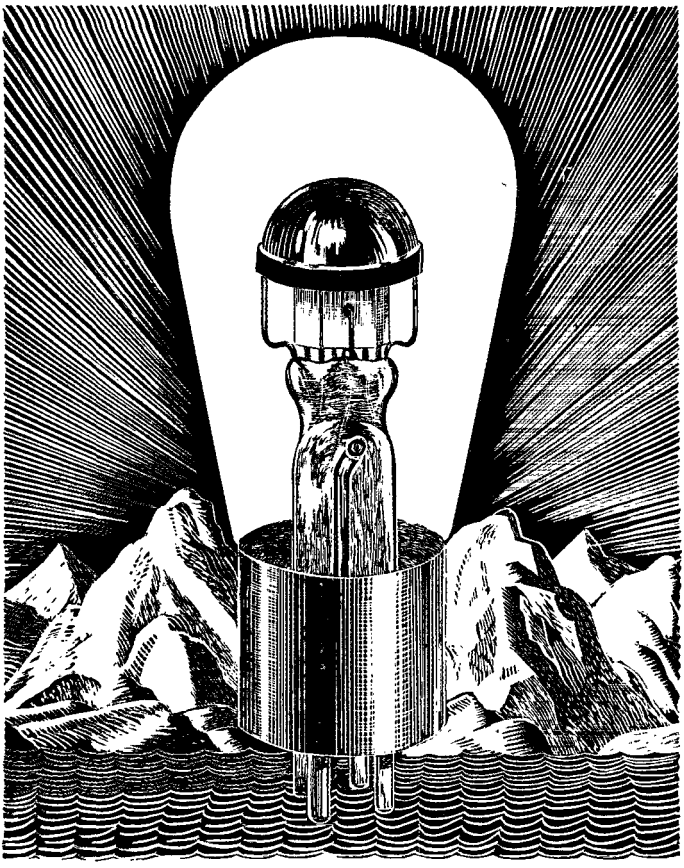
The A.R.R.L. Antenna Book



A comprehensive manual of amateur antenna design and construction, by the headquarters staff of the American Radio Relay League. Sixteen chapters, profusely illustrated. Both the theory and the practice of all types of antennas used by the amateur, from simple doublets to multi-element rotaries, including long wires, rhomboids, vees, phased systems u.h.f. systems, etc. Feed systems and their adjustment. Construction of masts, lines and rotating mechanisms. The most comprehensive and reliable information ever published on the subject. Over 100 pages. *Price 50 cents*

ABOVE PRICES ARE POST-PAID • PLEASE DO NOT REMIT IN STAMPS

AMERICAN RADIO RELAY LEAGUE, INC., West Hartford, Connecticut



For military reasons, the tube shown is not a new development

Today, Raytheon Research Engineers are experiencing an unusual opportunity to further new tube developments. The design and production of special tubes, engineered and built for today's highly important electronic devices, is our part in a constantly increasing war production schedule.

In the past years we have produced popular types of tubes, and the maintenance of increased production without sacrificing quality occupied a great deal of our energies. Today, with civilian radio production curtailed, the mass output of popular receiving type tubes is no longer a factor.

Raytheon is meeting the new challenge . . . the demand for new tubes of intricate design to properly function in special electronic devices which are producing amazing results. When peace comes we will be in an impregnable position to produce advance designs with the latest improvements gained from our present experience.

Raytheon's engineers and scientists are vitally important factors in this new program.

Raytheon Manufacturing Company

Waltham, Massachusetts

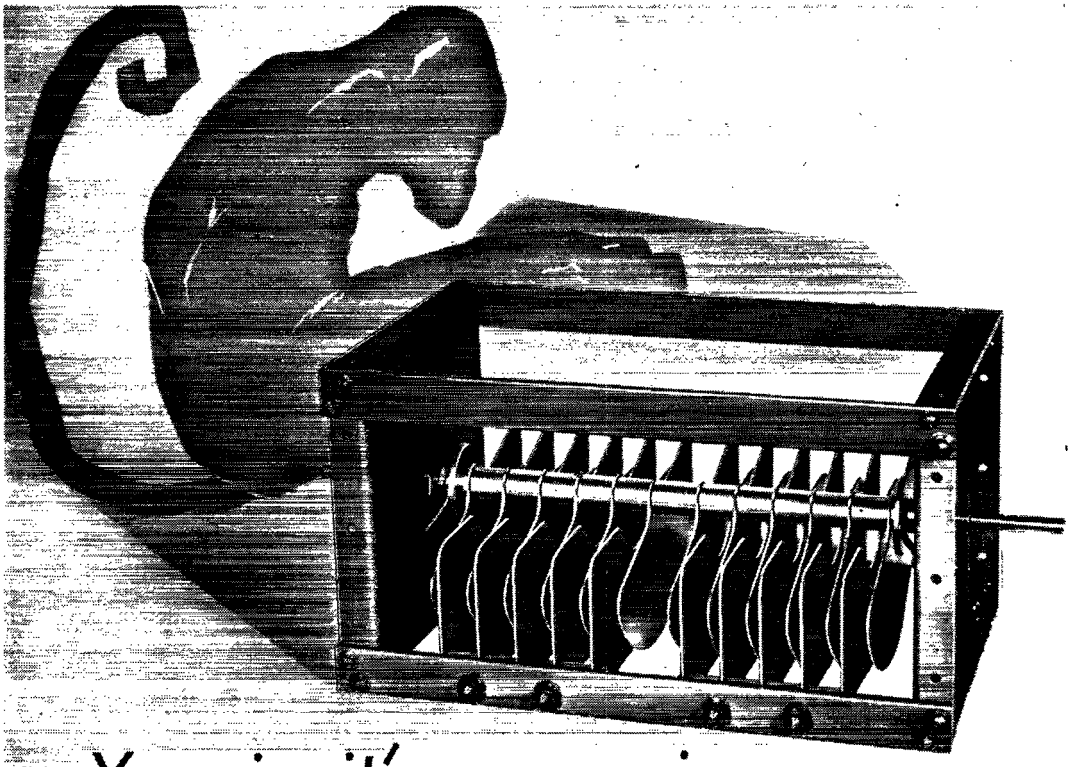
DEVOTED TO RESEARCH AND THE MANUFACTURE OF
TUBES FOR THE NEW ERA OF ELECTRONICS

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

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

ATLANTIC DIVISION				
Eastern Pennsylvania	W3BES	Jerry Mathis	6208 Master St. 9701 Monroe St.	Philadelphia
Maryland-Delaware-District of Columbia	W3CIZ	Hermann E. Hobbs	Silver Spring P. O.	Linden, Maryland
Southern New Jersey	W3CCO	Lester H. Allen	704 Quinton Ave.	Trenton
Western New York	W8PLA	Fred Chichester		Sonyea
Western Pennsylvania	W8CKO	E. A. Krall	703 Broadway	East McKeesport
CENTRAL DIVISION				
Illinois	W9ILH	Mrs. Carrie Jones	2407 Central Ave.	Alton
Indiana	W9YMV	LeRoy T. Waggoner	1721 Winton St.	Indianapolis
Kentucky	W9ARU	Darrell A. Downard	116 N. Longworth Ave.	Louisville
Michigan	W8DPE	Harold C. Bird	R.F.D. 2	Pontiac
Ohio	W8CBI	D. C. McCoy	Normandy Lane, R. R. 7	Dayton
Wisconsin	W9RH	Emil Felber, Jr.	1625 N. 18th St.	Milwaukee
DAKOTA DIVISION				
North Dakota	W9YVF	John W. McBride		Lidgerwood
South Dakota	W9QVV	P. H. Schultz	118 N. Yankton Ave.	Pierre
Northern Minnesota	W9FUZ	Armond D. Brattland	Birchmont Rd.	Bemidji
Southern Minnesota	W9YNQ	Millard L. Bender	608 N. Huron Ave.	Spring Valley
DELTA DIVISION				
Arkansas	W5GED	Ed Beck	2503 Bishop St.	Little Rock
Louisiana	W5DWW	W. J. Wilkinson, Jr.	Room 313, Jefferson Hotel	Shreveport
Mississippi	W5EGE	S. Benton Cain	221 E. Monticello	Brookhaven
Tennessee	W4DDJ	M. G. Hooper	4908 Georgia Ave.	Nashville
HUDSON DIVISION				
Eastern New York	W2LU	Robert E. Haight	356 West 34 St.	New York City
N. Y. C. & Long Island	W2AZV	E. L. Baunach	102 Central Ave.	Massapequa, L. I.
Northern New Jersey	W2LMN	Edward Gursky, Jr.	367 Van Winkle Ave.	Hawthorne
MIDWEST DIVISION				
Iowa	W9ALD	Arthur E. Rydberg		Mitchellville
Kansas	W9AWP	A. B. Unruh	1617 S. Seneca St.	Wichita
Missouri*	W9OUD	Letha E. Allendorf	1015 West Third St.	Joplin
Nebraska*	W9DXY	Lt. Comdr. P. H. Quinby	1425 S. 11th St., Apt. 4	Lincoln
NEW ENGLAND DIVISION				
Connecticut	W1KQV	Edmund R. Fraser	48 Willow St.	West Haven
Maine	W1BAV	Ames R. Millett	37 Morning St.	Portland
Eastern Massachusetts	W1ALP	Frank L. Baker, Jr.	91 Atlantic St.	North Quincy
Western Massachusetts	W1JAH	William J. Barrett	239 Columbia St.	Adams
New Hampshire	W1FTJ	Mrs. Dorothy W. Evans	P. O. Box 312	Concord
Rhode Island	W1HRC	Clayton C. Gordon	70 Columbia Ave., Gaspee	Plateau, Warwick
Vermont	W1KJG	Clifton G. Parker	Box 537	Morrisville
NORTHWESTERN DIVISION				
Alaska	K7GNN	James G. Sherry		Homer
Idaho	W7AVP	Don D. Oberbillig	P. O. Box 486	Boise
Montana	W7CPY	Rex Roberts	Box 1088	Glendive
Oregon	W7GNJ	Carl Austin	1137 Federal	Bend
Washington	W7EPB	Carl F. Hofmann	6906 So. Mason	Tacoma
PACIFIC DIVISION				
Hawaii	K6ETF	Francis T. Blatt	837 16th Ave.	Honolulu
Nevada	W6BIC	Edward W. Heim	509 Claremont St.	Reno
Santa Clara Valley	W6IUZ	Earl F. Sanderson	101 Claremont Ave.	San Jose
East Bay	W6TI	Horace R. Greer	414 Fairmount Ave.	Oakland
San Francisco	W6CIS	Kenneth E. Hughes	590 35th Ave.	San Francisco
Sacramento Valley	W6MDI	Vincent N. Feldhausen	113 South Quincy St.	McCloud
Philippines	KA1GR	George L. Rickard	Box 849	Manila
San Joaquin Valley	W6QDT	Antone J. Silva	Route 5	Modesto
ROANOKE DIVISION				
North Carolina	W4CVB	W. J. Wortman	P. O. Box 566	Morganton
South Carolina	W4BQE/ANG	Ted Ferguson	1213 College St.	Columbia
Virginia*	W3BZE	Thomas S. Jones	2918 Montrose Ave.	Richmond
West Virginia	W8JRL	Kenneth M. Zinn	P. O. Box 132	Clarksburg
ROCKY MOUNTAIN DIVISION				
Colorado	W9CNL	Stephen L. Fitzpatrick	25 Emerson St.	Denver
Utah-Wyoming	W7GZG	Henry L. Schroeder	P. O. Box 731	Laramie, Wyoming
SOUTHEASTERN DIVISION				
Alabama	W4GBV	Lawrence J. Smyth	808 Winona Ave.	Montgomery
Eastern Florida	W4PEI	Carl G. Schaal	Lakeview Hotel	Clermont
Western Florida	W4AXP	Oscar Cederstrom	Second St. & Bruce Ave.	De Funiak Springs
Georgia	W4AOB	William U. Hanks	4 Hunter St., S.E.	Atlanta
West Indies (Cuba)	CM2OP	Mario de la Torre	Escobar 110 (Altos)	Habana, Cuba
(Puerto Rico-Virgin Islands)	K4KD	Everett Mayer	24 Lindberg St.	Santurce, P. R.
SOUTHWESTERN DIVISION				
Los Angeles	W6QVV	H. F. Wood	723 No. Las Palmas Ave.	Hollywood
Arizona	W6RWW	Douglas Aitken	341 S. Mt. Vernon Ave.	Prescott
San Diego	W6BZE	Richard Shanks	4033 S. Hempstead Circle	San Diego
WEST GULF DIVISION				
Northern Texas*	W5CY	Gordon Ash	111 So. Ravinna Drive	Dallas
Oklahoma	W5GFT	Russell W. Battern	Box 290	Enid
Southern Texas	W5MN	Horace E. Biddy	1746 Schley Ave.	San Antonio
New Mexico*	W5HJF	J. G. Hancock	110 S.E. Nevada St.	Portales
MARITIME DIVISION				
Maritime	VE1DQ	A. M. Crowell	69 Dublin St.	Halifax, N. S.
ONTARIO DIVISION				
Ontario	VE3EF	Flying Officer Donald R. Gunn	c/o Canadian Bank of Commerce	New Toronto, Ont.
QUEBEC DIVISION				
Quebec	VE2CO	Lindsey G. Morris	Apt. 6, 4510 Girouard Ave., N.D.G.	Montreal, P. Q.
VANALTA DIVISION				
Alberta	VE4GE	C. S. Jamieson	581 W. Riverside Drive	Drumheller, Alta.
British Columbia	VE5DD	C. O. I. Sawyer	2634 West 31st Ave.	Vancouver
PRAIRIE DIVISION				
Manitoba	VE4AAW	A. W. Morley	82 Carlton St.	Winnipeg
Saskatchewan	VE4SY	Arthur Chesworth	1071 4th Ave., N.W.	Moose Jaw

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



Yes sir, it's a genuine

CARDWELL CONDENSER

Time was, when a CARDWELL easily could be recognized by the very design and construction features that now are accepted as standard for the industry.

Naturally, we are flattered by the fact that our original developments are so universally acknowledged and, shall we say, utilized in an effort to simulate outstanding CARDWELL QUALITY.

"STANDARD OF COMPARISON"

CARDWELL CONDENSERS

THE ALLEN D. CARDWELL MANUFACTURING CORPORATION BROOKLYN, NEW YORK

THE AMERICAN RADIO RELAY LEAGUE

Directors

President
GEORGE W. BAILEY.....W1KH
2101 Constitution Ave., N. W., Washington

Vice-President
CHARLES E. BLALACK.....W6GG
Box 108, Yuma, Ariz.

Canadian General Manager
ALEX REID.....VE2BE
240 Logan Ave., St. Lambert, P. Q.

Atlantic Division
WALTER BRADLEY MARTIN.....W3QV
Address correspondence to the Acting Director:
HERBERT M. WALLEZE.....W8BQ
42 No. Rockburn St., York, Pa.

Central Division
GOODWIN L. DOSLAND.....W9TSN
11831 Longwood Drive, Chicago

Dakota Division
TOM E. DAVIS.....W9VVA
915 W. Becker Ave., Willmar, Minn.

Delta Division
E. RAY ARLEDGE.....W5SI
Villa D'Este Hotel, Miami, Fla.

Hudson Division
ROBERT AKERIDGE KIRKMAN....W2DSY
250 Albert Place, Elberon, N. J.

Midwest Division
FLOYD E. NORWINE, JR.....W9EFC
7405 Hiawatha Ave., Richmond Heights, Mo.

New England Division
PERCY C. NOBLE.....W1BYR
37 Broad St., Westfield, Mass.

Northwestern Division
KARL W. WEINGARTEN.....W7BG
3219 N. 24th St., Tacoma, Wash.

Pacific Division
J. L. McCARGAR.....W6EY
66 Hamilton Pl., Oakland, Calif.

Roanoke Division
H. L. CAVENESS.....W4DW
2607 Vanderbilt Ave., Raleigh, N. C.

Rocky Mountain Division
C. RAYMOND STEDMAN.....W9CAA
925 So. Gaylord St., Denver

Southeastern Division
WILLIAM C. SHELTON.....W4ASR
945 Hurt Bldg., Atlanta

Southwestern Division
JOHN E. BICKEL.....W6BKY
1834 E. Whittier Blvd., Whittier, Calif.

West Gulf Division
WAYLAND M. GROVES.....W5NW
Route 1, Overton, Texas

THE AMERICAN RADIO RELAY LEAGUE, INC., is a non-commercial 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 non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its board.

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

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

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

Past Presidents

HIRAM PERCY MAXIM, W1AW, 1914–1936
EUGENE C. WOODRUFF, W8CMP, 1936–1940

Officers

President.....GEORGE W. BAILEY, W1KH
Washington, D. C.

Vice-President.....CHARLES E. BLALACK, W6GG
Yuma, Ariz.

Secretary.....KENNETH B. WARNER, W1EH
West Hartford, Connecticut

*Acting Communications Manager**.....JOHN HUNTOON, W1LVQ
West Hartford, Connecticut

Treasurer.....DAVID H. HOUGHTON
West Hartford, Connecticut

General Counsel.....PAUL M. SEGAL
1026 Woodward Building, Washington, D. C.

The Communications Manager, F. Edward Handy, W1BDI, is on leave of absence.

"IT SEEMS TO US—"

LEARNING RADIO

AN UNTOLD number of thousands of people in this country have set out to learn something about radio as their way of preparing themselves to serve the country in its present effort. There is no question of the urgency of the need for more and more radio people.

Probably the best way to learn radio from scratch is to enroll as a resident student in a good radio school. One way to accomplish this is to enlist in the Army or Navy. For civilians, it means having the leisure and finances to promote some months of schooling at one's own expense, which not many of us can do. The next best thing would seem to be registration in a free local evening radio course, such as the ESMWT one or a course put on by a local amateur club. But most of us have no such activity in our home town. What then, supposing we're serious in this determination to learn radio?

It can still be done, by the most time-honored method of all, the one most amateurs have used: home study and experimentation. It is for the very purpose of assisting in that method of doing the job that George Grammer's "A Course in Radio Fundamentals," based on *The Radio Amateur's Handbook*, is now appearing in *QST*. We'll now confess that we started that course primarily for the already-licensed radio amateur, who has an amazing ability to get practical results out of his equipment but who all too frequently does not understand clearly what is taking place. We figured that, with amateur transmission prohibited, this would be a good time to study up and do a little self-improvement. We're somewhat surprised but no end delighted to find that the course is equally useful for and popular with people who've had no previous exposure to radio. Both groups are writing us enthusiastic letters. If we may judge by those letters, we can say that nothing *QST* has ever done has been hailed as half so valuable as Grammer's series.

This gives us a grand glow, not because we've accomplished something but from its proof that we're helping others to accomplish their objectives. Because, believe us, we know that's the way to learn radio: by getting right in there and demonstrating each fundamental fact to one's own satisfaction. One of the best-known amateurs of this country, with a dozen or so radio patents to his credit, learned his electricity and radio just that way. If we mentioned his name you'd know him and be surprised, because you probably think that he was born knowing radio. He wasn't. But this chap wouldn't believe anything he read in the book — not until he'd proved it to himself. The book says that if you plunge a magnet into a coil hitched to a galvanometer, the needle will kick over, going and coming. After you understand it you see why it does. Most of us are sufficiently lazy to be willing to believe the book without investigating. Not this lad. He tried out for himself everything shown in the texts, worked at them until he made them an unforgettable part of his own knowledge. It's on that kind of background that contributions are made to this art. The stork doesn't bring them.

So we say that it is a wholesome thing for radio that there is this evidence that amateur and neophyte alike are seeking a sound and enduring basis for their future radio work. That is certainly the way to learn radio. It's not "the hard way," either; it's entertaining. The hard way is to be superficial in knowledge and pay for it later in bungles, blown-up gear and helplessness. Real knowledge has always repaid the effort of learning. No person can follow the course now being published in *QST*, faithfully and honestly performing the experiments and studying the text to the point where he knows the answers to the examination questions, without really *knowing* radio.

You who are taking this course may already be licensed amateurs, going back over your early trails to plug the gaps in your knowledge. Or you may be men and women preparing yourselves for military or civilian-defense service with no thought of amateur radio. Nonetheless, if you're in these latter categories, we'd like to suggest that you aim for an FCC amateur operator license. It won't cost you a thing and it will be the real proof of what you have accomplished, a sort of final examination. The holders of this license are recognized by

both Army and Navy as possessing a very useful amount of radio knowledge and special provisions are made for them, a very helpful thing if you go into the service. And when this war is over, you'll be all set to have your own amateur station and join in the fun.

KEEP UP YOUR LICENSES

WHEN do your ham tickets expire? . . . No, no — we mean without looking it up. . . .

So you don't know! We thought so. Most of us are finding it pretty hard to remember during this period of inactivity just when our licenses are up for renewal. An unhappily great number of amateurs are forgetting until it is too late, then awakening with dismay to the realization that they are no longer licensed. Then, no matter how long they were under ticket prior to the lapse, they must journey to the FCC office and go up for examination again, just like any newcomer. Moreover, although existing station licenses may be renewed or modified in the traditional manner, no new ones are being issued during the war, and once you let yours lapse you may hold only an operator license. Not that it's of much practical good to us now to have station licenses but it is definitely a matter of pride, and it does leave us on the mark, ready to go, when FCC blows the whistle after the war. And the operator license, of course, is a precious thing to keep in force, because it is accepted everywhere as an attestation of our skill: in Army and Navy, in certain commercial work, and particularly as the basis for a WERS certificate; in instructorships and other wartime jobs — and who can tell where this business will go before it ends?

If you've slipped by the expiration date just a little, and can still get an application into FCC within three months after expiration, we'd recommend that you start moving at once and pop the papers to Washington (together with your old license), and frankly explain that you slipped up on the date. If it's older than that, we're afraid your luck has run out on you.

The proper date for applying for renewal is sixty days before expiration. You ought to allow enough extra time to write the Inspector for blanks. Figure out when that ought to be. If you keep an engagement pad, make a date with yourself right now, or put a red circle on your calendar. If you can't remember any other way, write a note to yourself and thumbtack it to the wall some place where you're sure to see it frequently. Men in the armed forces should remember that it is much easier for them, if only they can remember as the time approaches. No forms needed. Just write a letter to FCC asking renewal, and get your CO to endorse the statement that you are in the service.

Don't let the dates get away from you — keep those licenses going!

K. B. W.

★ SPLATTER ★

OUR COVER

NO WELL-INFORMED HAM should need to be told what this month's cover is all about — not, at any rate, after he spots the title of the booklet "The Control System of the Citizen's Defense Corps." That means WERS, of course. Equally obvious is that the transceiver is the one especially developed by George Grammer for WERS, described in this issue. The operator? None other than John Huntoon, W1LVQ, currently acting communications manager of ARRL and a kingpin in WERS planning.

• • • —

GET IN THE SCRAP

DON'T forget that the scrap salvage program editorialized about in the September issue is still going on. In fact, it will go on — from now on. You've heard all about the need and the method of coöperating with your community WPB Industrial Salvage Committee from local newspapers and broadcasting stations, of course; all we want to do is repeat that the scrap around our ham shacks is the very kind most needed in waging — and winning — the war.

• • • —

"OBSERVE FIRE PREVENTION WEEK — OCT. 4TH-10TH"

THAT'S the message we bring you from Director James M. Landis of the Office of Civilian Defense. At first glance it may not seem to have very much to do with either OCD or ARRL — but that's only until it is understood that fire is as effective a weapon of war as the blitzkrieg. And helping in every way possible to fight the war is our business, and OCD's — and yours. Fire works as effectively for the enemy if we let it occur through carelessness as if he started it through incendiary bombs. Fight on our side — not that of the Axis. Do all you can to aid in preventing fires and eliminating hazards.

(Continued on page 88)

IF YOU CHANGE YOUR ADDRESS—

Please give us as much advance *direct* notice as is possible — also *be sure* to put both your *new* and your *old* address on the letter or card (not the envelope).

A Transceiver for WERS

Building a Simple 2½-Meter Outfit From Junk-Box Components

BY GEORGE GRAMMER,* WIDF

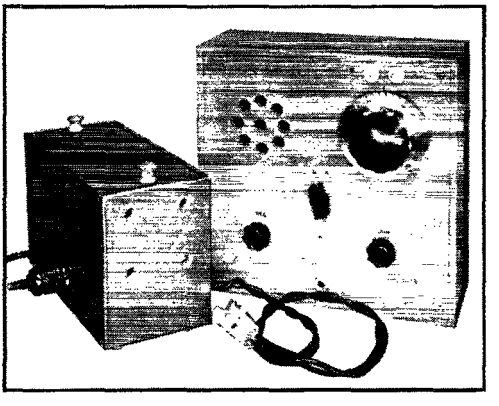
CONSIDERATION of the regulations of the War Emergency Radio Service, as well as the communications plan recommended by the OCD, indicates that some modification of our early thinking on civilian defense equipment is in order. It may be recalled that last winter, in setting up probable technical requirements for equipment, all signs pointed to a wholly amateur-operated system, with organization and operating conducted as purely local functions. It seemed to us then that the best plan would be to work as far as possible toward stabilized transmitters — stabilized, that is, in the direction of minimum frequency modulation — and to use separate transmitters and receivers in preference to transceivers. Not that transceivers were to be discouraged altogether — it was realized that without any doubt all the equipment available, whatever the type, would have to be used — but simply that when apparatus was being built the separate transmitter and receiver should be the choice. This was a logical attitude in view of amateur experience with QRM from wobbulated signals, and assumed that the operation would be governed by ordinary amateur regulations.

The actual situation is a good deal different than that we pictured last winter. We have an entirely new set of governing regulations, one important feature of which is the fact that only the simplest kind of license is required for operators. Without this provision WERS could not begin to be a success; even in pre-war days it would have been a mighty exceptional community which had enough hams to provide the needed operating personnel. Now, with at least half the licensed amateurs either in the services or away from home in other capacities, it becomes a job which licensed hams alone could not accomplish even with all the good will in the world. The amateur's rôle now is that of providing equipment, technical advice and assistance, aid in organizing, and training of new operators for WERS — as well as the nucleus of the operating staff. The new WERS operators will not have the amateur's skill in operating 112-Mc. apparatus; most of them, in fact, will have had no previous radio experience at all.

Under the OCD recommendations the lower half of the band, 112–114 Mc., will be for the exclusive use of control stations.[1] In the typical case of a subcontrol center, one frequency will be assigned for communication with the district warning center and a second for transmitting one-way dispatches. Because of the stability requirements and also because the control station must be capable of listening on several frequencies if not the whole band, separate transmitters and receivers are dictated for these stations. The sector wardens' stations — we use the term here to indicate any of the local stations reporting to a subcontrol center — are to work in the 114–116-Mc. part of the band, using one frequency to talk to the subcontrol center and a second to contact mobile stations. With "green" operating personnel it is obvious that there must be no complications in the use of the equipment. Let us say, for instance, that these "local" stations actually will be called upon to use two frequencies. It is hardly likely that a separate transmitter will be available for each, nor a separate receiver. The possibilities for confusion should the operator happen to set the transmitter on one frequency and do his listening on the other are only too apparent. There is also the problem of providing separate antennas, or the alternative of an automatic changeover system such as a relay. Either method is likely to run

* Technical Editor, *QST*.

[1] Huntoon, "Planning WERS for Your Community," *QST*, August, 1942.



The low-power transceiver and vibrator power supply in this photograph can be built from receiver components which nearly every amateur can salvage from old equipment. The addition of an antenna and storage battery makes a complete emergency set-up.

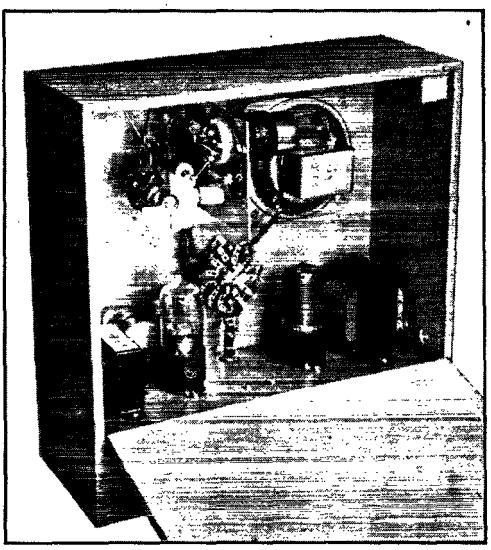
into operating complications or require extra equipment which may be badly needed elsewhere.

Under such circumstances the transceiver, with its simple "send-receive" switch, requiring no antenna changeover, begins to look rather attractive. The fact that the receiver and transmitter always are tuned to the same frequency now becomes a definite asset, since the OCD plan contemplates only spot-frequency operation for these stations. The operating simplicity more than outweighs the technical disadvantages which caused the transceiver to be frowned upon in ordinary amateur operation. In fact, these disadvantages are of little consequence for WERS work, with the single exception of the radiation problem.

As a final factor, the transceiver requires fewer parts than a separate-unit outfit, and as things are to-day this may well be the consideration which tips the scales in its favor. OCD has made it plain that no priority rating will be assigned for the purchase of either complete equipment or components for WERS. By one means or another it may be possible to get some of the commoner replacement parts new, but definitely out of the picture are such things as variable condensers and special tubes. This puts it squarely up to the junk box — and robbing needed parts from apparatus built for other frequencies. We think most of the needed components can be found.

A Transceiver for WERS

The transceiver shown in the accompanying illustrations is built from parts such as the average amateur is likely to have, or can find if he looks hard enough. As with the emergency gear described previously, it is built around the more numerous types of standard receiving tubes and parts. The circuit is more or less the conventional transceiver arrangement, as will be recognized from an inspection of Fig. 1. The oscillator circuit is the ultraudion, using a 6J5GT or a 6V6GT, depending upon the plate voltage available. The metal or G types — or any pentodes or triodes having octal sockets and the standard basing arrangement — may be used instead, with some variation in results. In reception, the smaller triodes are somewhat smoother in operation and have less tendency toward "squawks" and fringe howl than the 6V6; also the efficiency in transmission is better. However, they are a little lightly constructed for transmitting if a 300-volt supply is used, but since transmission periods undoubtedly will constitute a very small percentage of the total time the unit is in operation, it may be possible to run such a tube overloaded in the transmit position without harming it particularly. Nevertheless, the 6J5 (GT type preferred) is more particularly recommended for operation at 200 volts or below. An easily-constructed power supply for this purpose is described later, or the unit can be used with a supply taken from a car radio receiver.



A rear view of the transceiver installed in the case. The oscillator-detector is constructed as a unit on a projecting metal piece. The antenna coil is mounted on the feed-through terminals and coupling can be varied by bending the leads.

One section of the switch makes the customary change of grid leaks in the oscillator circuit. The receiving grid leak, R_1, is returned to the positive "B" lead rather than to ground, because the operation of the tube as a superregenerative detector is much smoother this way.

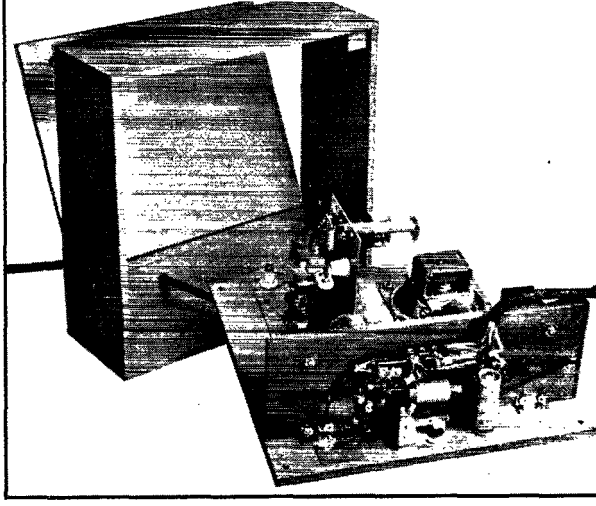
The audio system consists of a triode first stage (6J5 or 6C5) followed by another 6V6 (or 6F6) in any of the varieties of glass or metal. The pentode is used as a modulator in transmitting and to drive the loud-speaker in reception. The loud speaker is a matter of choice; the chances are that it will be preferred to headphones by the operators, and the tube is there so it might as well be used in reception as in transmission. We made no provision for headset reception in this unit, but if it is wanted a jack easily can be connected in the 6J5 plate circuit. An additional switch section should be provided to cut the 'phone circuit when transmitting. As a matter of economy when operating from emergency power, the "B" drain could be cut to a very low value in reception if headphones only are used, since the changeover switch could be arranged to cut the "B" lead to the plate and screen of the audio power tube. Again this is a matter of choice, but in the event that the speaker is not wanted or a suitable unit is not available, it would be a worthwhile modification. We found that we were still able to purchase 3-inch permanent-magnet speakers, and also had no trouble in getting a four-position two-circuit switch wafer. This may not be true in all sections of the country

— or even in any section by the time this gets into print.

In the event that a single switch wafer of the desired number of poles and circuits cannot be obtained, any 4-pole double-throw switch can of course be used. Generally some sort of wafer switch can be salvaged from old equipment; if it is necessary to use more than one gang the only result is that the switch is more bulky.

Output transformers, T_2, usually can be taken from some discarded receiver, if not available new. Transceiver transformers are not to be had at this writing, but it is not difficult to manufacture a satisfactory substitute. The transformer actually used in this unit is an ordinary interstage audio (about 3:1 ratio) with a microphone primary added. There is usually enough space between the core and the windings to get in at least one layer of fairly fine wire, such as No. 30. It is necessary to take the core apart and possibly to remove some of the paper already around the windings. This was done with the transformer in the unit shown; the microphone primary is one layer of No. 30 s.c.c. (about 50 turns) wound over the existing windings. It was given a coat of shellac to hold it in place, then covered with paper to prevent short-circuits to the core, after which the core was reassembled. The number of turns may not be optimum, but it is easily possible to modulate the transmitter fully.

The regeneration control circuit, consisting of R_9 and R_{10} in series, permits operating the detector at the lowest plate voltage consistent with good superregeneration, and thus holds receiver



The below-shelf wiring and the construction of the plywood box are shown in this photograph. The unit can be removed completely from the box for servicing.

radiation to a minimum. The fixed resistor makes the setting of the control less critical, and also keeps the voltage across the variable resistor to a safe value. No by-pass condenser is used across the control; if there is any contact noise it has not been especially noticeable.

The microphone current is obtained from the cathode circuit of the modulator tube, by tapping the microphone across part of the cathode resistor. The single by-pass condenser from cathode to ground is sufficient to prevent feed-back between the modulator and microphone circuits. No cathode by-pass condenser is used in the first audio stage; while its omission introduces a small amount of negative feed-back, the reduction in

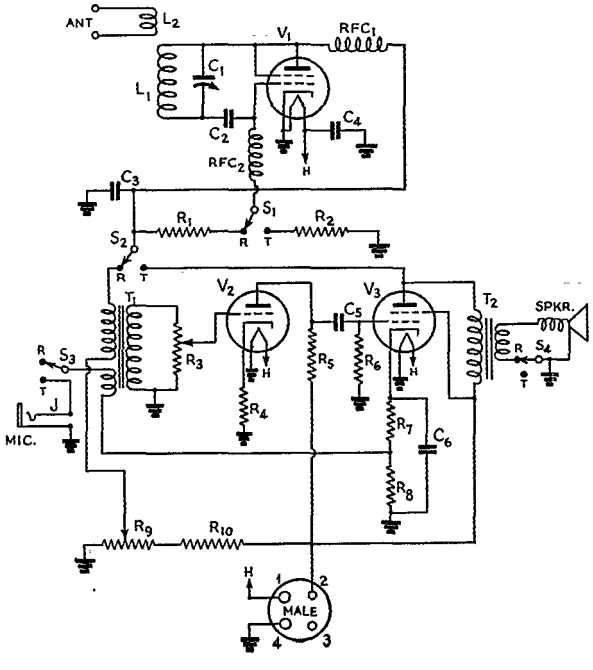


Fig. 1 — Circuit diagram of the transceiver. If a triode is used at V_1, the screen connection shown may be ignored.

C_1 — Midget variable, 10–15 $\mu\mu$fd. max.
C_2 — 50-$\mu\mu$fd. mica.
C_3 — 0.005-μfd. mica.
C_4 — 250-$\mu\mu$fd. mica.
C_5 — 0.1-μfd. paper, 400 volts.
C_6 — 25 to 50 μfd., electrolytic, 50 volts.
R_1 — 5 megohms, ½ watt.
R_2 — 5000 ohms, 1 watt (6J5, 6C5); 10,000 ohms, 1 watt (6V6, etc.).
R_3 — 0.5-megohm volume control.
R_4 — 1000 ohms, ½ watt.
R_5 — 0.1 megohm, 1 watt.
R_6 — 0.5 megohm, ½ watt.
R_7 — 250 ohms, 1 watt.
R_8 — 200 ohms, 1 watt.
R_9 — 50,000-ohm volume control.
R_{10} — 50,000 ohms, 1 watt.
L_1 — 3 turns No. 12, 9/16-inch inside diameter, ½ inch long.
L_2 — 1 turn No. 12 or No. 14.
RFC_1, RFC_2 — 55 turns No. 30 d.c.c., close-wound on ¼-inch diameter rod.
T_1 — Transceiver transformer (see text).
T_2 — Output transformer, pentode to voice coil.
S_{1-4} — 4-pole double-throw switch.
J — Open-circuit jack.
Spkr — 3-inch permanent magnet dynamic speaker.
V_1 — 6J5, 6C5, 6V6, 6F6, etc. (GT types preferred).
V_2 — 6J5, 6C5. V_3 — 6V6, 6F6.

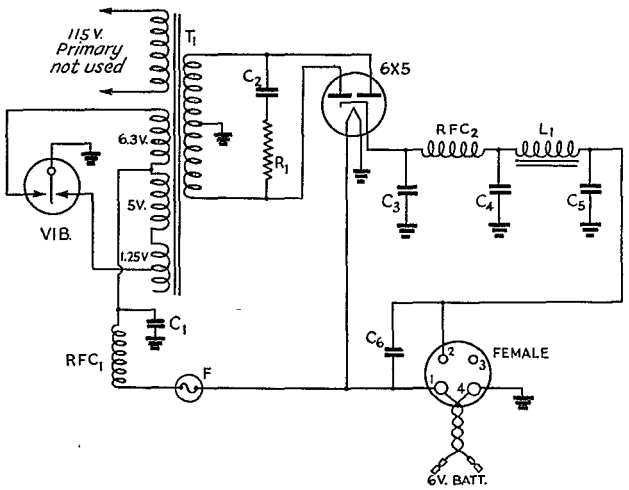


Fig. 2 — Power supply circuit diagram.
C_1 — 0.5-μfd. paper.
C_2 — 0.008-μfd. paper, 1600 volts.
C_3 — 0.01-μfd. paper, 600 volts.
C_4 — 8-μfd. electrolytic.
C_5 — 16- to 32-μfd. electrolytic.
C_6 — 100-μμfd. mica.
R_1 — 5000 ohms, 1 watt.
L_1 — Approx. 10 henrys at 60 ma.
RFC_1 — 52 turns No. 12, close-wound on 1-inch form.
RFC_2 — 2.5-mh. r.f. choke.
T_1 — Power transformer, approx. 300 volts each side c.t., 60 to 70 ma.; with 6.3-, 5- and 2.5-volt windings. 115-volt primary not used.
F — 10-ampere fuse.
Vib — Vibrator (Mallory Type 294 or equivalent).

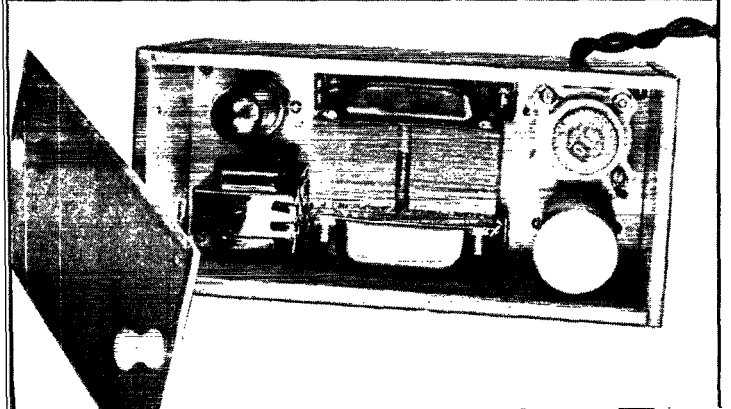
gain is of no consequence and an extra component is eliminated. On reception the microphone circuit is opened by the switch, with the result that the bias on the output tube rises and the plate current is reduced. This has no particular effect on the operation of the tube, particularly since the full power output is not needed in receiving.

Construction

The chances that suitable metal chassis and cabinets are obtainable are very slim indeed, so in the present case we didn't even try to find any. The panel in this unit is a 10 × 10-inch piece of quarter-inch tempered Presdwood, while the shelf which holds the audio circuits is a 3½ × 10-inch piece of the same material. Plywood could be used instead, but being soft is not quite so satisfactory. Some gray enamel brightened up the panel and base considerably. The photographs show the simplicity of the arrangement. The shelf is mounted 1½ inches above the bottom of the panel, leaving ample room for the resistors and condensers which go underneath. No attempt was made to make the unit ultra-compact; in fact, extra space was allowed so that the G types of tubes would fit in, even though the GT models are preferable from the standpoint of performance — at least in the oscillator — and availability.

The box in which the transceiver is housed is made of ¼-inch plywood, with inside dimensions 10 × 10 × 3½ inches. At each corner the sides are glued to ¾ × ¾ × 3½ inch pieces of wood. A strip of plywood 1¾ inches high runs along the back, and a piece 1½ inches high is glued to it inside so that the rear edge of the shelf rests on it when the assembly is placed in the cabinet. The remainder of the back is a door, hinged at the bottom, through which access can be obtained to the tubes and r.f. section. At the top it is held to the case by hooks. The panel is fastened to the corner blocks with wood screws.

The oscillator is all one unit, built on a 3 × 4-inch scrap of aluminum with a half inch of one end bent over to form a mounting lip. The metal base projects 3½ inches behind the panel, the same depth as the shelf for the audio section. In general, the oscillator circuit has been arranged to make the leads between the tube and tuned circuit as short as possible. The mechanical layout may have to be varied with tuning condensers of different construction, of course. A condenser having a maximum capacity of 10 to 15 μμfd. is required; this means two plates, for the midget condenser of ordinary size and plate spacing. The one used in the unit shown is a Hammarlund MC-20-S, originally having a maximum of 20 μμfd., with one plate removed. To reduce capacity to ground, the rear bearing assembly was taken off by sawing the rotor shaft and the side rods holding the stator plate. Removing this excess material noticeably increased the efficiency of the



A top view inside the power-supply. The rectifier tube is at the upper left with the filter choke just below. The fuse socket and vibrator are at the right. A synchronous vibrator can be substituted for the interrupter-type used in this unit, to eliminate the rectifier tube.

circuit as compared to its operation when the condenser was tried with the original construction.

The tuned circuit coil, L_1, is wound of No. 12 wire, one end being mounted under the condenser panel-mounting nut and the other being soldered to the end of the side rod holding the stator plate. Since both sides of the condenser must be insulated from ground, the condenser is mounted on a midget stand-off insulator. An insulated coupling and extension shaft connect the rotor to the tuning dial on the front panel.

The plate and grid chokes are mounted from insulated lugs at the "cold" ends, the hot ends being placed as close as possible to the points in the circuit where they connect. The power leads from the r.f. section are cabled and brought down to the switch.

The speaker is mounted on the panel to balance the tuning dial. To protect the cone from damage the holes for letting out the sound are backed by a piece of window screen material, held in place by the bolts which fasten the speaker to the panel.

The metal strip running from top to bottom of the panel serves as a shield to prevent body capacity and also as a low-inductance ground connection between the oscillator and the audio section. Its use proved to be highly beneficial in preventing "hot spots" along the power-supply connection cable. It makes direct contact with the oscillator support, the rotor arm of the volume control, R_3, the metal frame of the switch, and the frame of the microphone jack. It is approximately $4 \times 9\frac{1}{2}$ inches, and was cut from an ordinary tin can, about pint size. A similar piece of tin could be used to cover the audio shelf, but does not seem to be essential.

In the rear view, the transformer at the left is T_1, the revamped audio transformer. The audio gain control, R_3, is on the panel between R_1 and the 6J5 first audio. The modulator tube and speaker transformer are at the right with the regeneration control, R_9, behind them on the panel. All leads from the switch are cabled and pass through a hole in the shelf near the panel. The two grid leaks, R_1 and R_2, are mounted directly on the switch contacts, but all other resistors are below the shelf. The below-shelf arrangement is of no particular consequence, since there are no r.f. circuits — except, of course, that the grid leads to both tubes should be kept short so that hum pickup will be minimized. The dropping resistor, R_{10}, for the regeneration control circuit is mounted on the lug strip at the rear; the other two resistors which connect together at this strip are the two sections of the modulator cathode resistor. Spare terminals on the tube sockets are used as tie points wherever necessary.

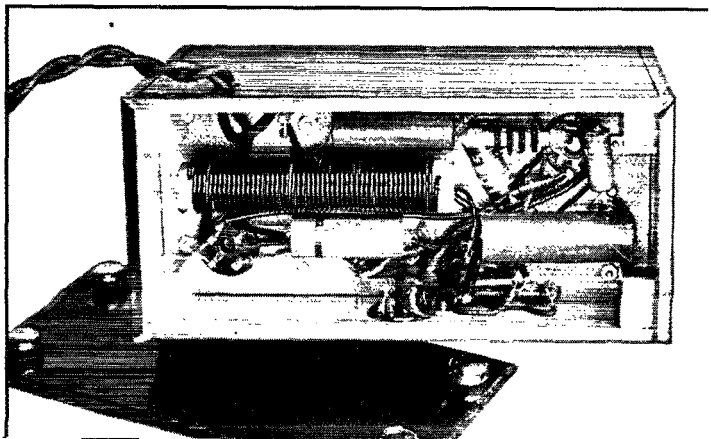
Circuit Adjustment

Although the audio system should give no trouble, it may be necessary to spend some time pruning the r.f. components. It is possible that in a particular layout the proper choke specifications will differ from those given. The grid choke is the more critical. In both cases the number of turns should be adjusted so that the cold end can be touched with the finger without disturbing the operation of the oscillator. This condition is more easily checked by operating in the "receive" position. Actually touching the cold terminal of the grid choke probably will cause considerable hum pickup which tends to obscure the results, but it is not particularly difficult to tell when the choke is working properly. Effective superregeneration depends considerably on this choke and on the capacity of the plate by-pass condenser, C_3. The circuit may not superregenerate at all with less than 0.002 μfd. at C_3, while values higher than 0.005 tend to cut down the audio output because of the rather heavy by-pass effect across the primary of the audio transformer, T_1. The value recommended is a good compromise. It may be made of two or more condensers in parallel or series in case the exact capacity is not obtainable in one unit.

The only work to be done on the tuned circuit is to adjust the coil inductance to bring the band on the dial. This is simply a matter of spreading the turns apart or squeezing them together until the proper frequency range is secured. Since the oscillator works more efficiently with a reasonable amount of capacity in the circuit, it is best to adjust the coil inductance to bring 112 Mc. near the maximum capacity of the tuning condenser.

The size of the antenna coupling coil will depend upon the antenna system with which the transceiver is to work. Usually a turn or two of wire is sufficient, the coupling being adjusted by

(Continued on page 84)



Hash and smoothing filter components are mounted below in the bottom, as shown in this view of the power supply. The four-prong outlet socket is mounted on the side of the box. The metal cover should be connected electrically to the grounded side of the wiring.

Frequency Allocations in the WERS

A State-Wide Plan for Clear-Channel Operation Without Mutual Interference

BY ROBERT G. LING,* W1IBF

THE Federal Communications Commission has directed that stations operating in the War Emergency Radio Service shall be coördinated so as to minimize interference and make the most effective use of the frequencies available. It would be a relatively simple matter for the radio aide of any given warning district to so assign frequencies to the stations under his jurisdiction. However, most such districts are contiguous to three or four others, and 2½ meters recognizes no district bounds. It seems in order, therefore, that a master plan of frequency allocation for an entire state be made up prior to the actual operation of the ARP networks. This has been done in Massachusetts[1] in such a way as to provide each link of the proposed networks with a relatively clear channel, not used by any stations in the immediate vicinity.

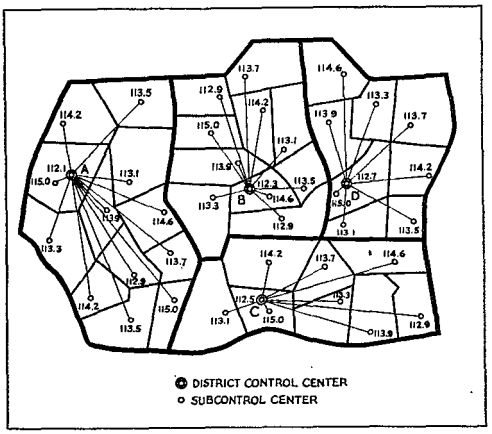
The band has been divided into channels that are consistent with the tolerances set forth by the FCC. The 112–114-Mc. range is divided into channels 200 kilocycles wide. This allows a considerable deviation either side of the middle frequency before a station would cause serious interference in the next channel. The 114-116-Mc. range is divided into channels twice as wide, or 400 kilocycles. These channels were chosen for best economy of the frequencies available and appear to be adequate in view of practical experience with various types of 2½-meter equipment and the tests made by George Grammer.[2]

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

As this service is open both to State Guard and Civilian Defense stations, a working agreement has been made in Massachusetts between the two interested parties which provides that the two channels at the high-frequency end of the band, as shown in the table of allocations, will be used exclusively by the State Guard.

In making individual assignments, first consideration was given to the district control center[3] stations which have to cover considerable areas and therefore require clear channels. It was felt that four was the minimum number of channels that would eliminate interference between districts. They were chosen at the low-frequency end of the band in order to minimize adjacent channel interference from subcontrol centers and their local units, which might result if the district control center channels were staggered through the band.

The remaining nine ARP channels are allocated to the various subcontrol centers. It will be noted that six of these frequencies are in the high-stability 112–114-Mc. range and only three in the low-stability range. Cities or towns having equipment that will not maintain the 0.1 per cent tolerance are given assignments in this latter range. Cities wherein district control centers are located also have subcontrol centers, of course, and in many cases the latter are located in the same buildings as the control center. Such sub-



* Regional Radio Representative, Massachusetts Region No. 4, 166 Locust Street, Danvers, Mass.

[1] Doremus, "Massachusetts Civilian Defense Radio," *QST*, September, 1942.

[2] Grammer, "Technical Aspects of the WERS Regulations," *QST*, August, 1942.

[3] Formerly called "main control center."

control centers have been assigned frequencies in the low-stability range (usually 115.0 Mc.) even though their equipment will maintain the 0.1 per cent tolerance, in order to have them well removed from the d.c.c. frequency and give every possible opportunity for the simultaneous operation of both stations.

The assignments for the other subcontrol centers are simply made by a cut-and-try process, taking care to have good geographical separation between towns on the same frequency, and to have wherever possible at least a two-channel separation between adjacent communities. At times it is helpful to consult geodetic maps to see what natural barriers are available, and maps showing centers of population to determine where the bulk of the stations in a given community might be located.

Let us consider the operation of this plan in the four fictitious districts shown. District control center station A has an assignment of 112.1 Mc., B has 112.3 Mc., C has 112.5 Mc. and D has 112.7 Mc. The subcontrol center frequency assignments should result in a minimum of interference between those stations, not only within each district, but also between the stations of adjacent districts. Note that the subcontrol centers where d.c.c. stations are located are all on 115.0 Mc. with one exception: B and D are fairly close together and the subcontrol center at B was therefore assigned 114.6 Mc.

Each subcontrol center communicates with its district control center on the latter's assigned frequency, and communicates with its subordinate units and handles all dispatching on its own assigned frequency. Subcontrol center transmitters must therefore be able to operate on two frequencies. Some groups plan to use two separate stations; others to have two receivers to cover the two frequencies, but to use a single transmitter and change its frequency. If the transmitter is crystal-controlled this can be accomplished without retuning if the frequencies of the two crystals are reasonably close together. On self-excited oscillators using coil-and-condenser tanks, adjustable stops on the dial or condenser will permit accurate resetting to either of the desired frequencies. In transmitters using resonant lines, two separate oscillators can be used and the modulator and power supply switched from one to the other. It is obvious that when communicating with the district control center, the subcontrol center must use equipment capable of maintaining the 0.1 per cent tolerance.

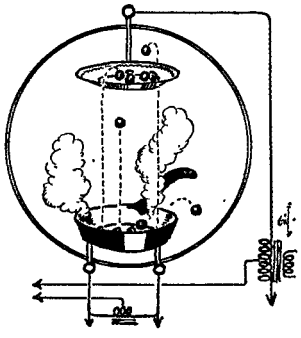
Two receivers are needed at each subcontrol center in order that one may always be tuned to the district control center frequency to receive air-raid warning or other calls from the d.c.c. and to quickly effect "radio silence" if necessary.

(EDITOR'S NOTE: Mr. Ling's plan makes no specified provision for frequency allocations to networks subordinate to the sector wardens, which obviously cannot operate on the same frequency their community utilizes for control purposes. It may be well to point out here that an appreciable amount of simultaneous use of one "low-stability" frequency by lower nets in separated communities is quite practicable. For example, a sector warden's sub-net of mobile pack transceivers on a single frequency will furnish adequate signals for the one-mile distance or less involved without any disturbing amount of mutual interference with a similar net on the identical frequency in a town eight or ten miles distant.)

Diodes

BY EILEEN V. CORRIDAN*

This is a sketch of a Diode Tube.
I'll tell you how it should work.
I'll show you where the current goes
And how the electrons perk.



"So what does 'diode' mean?" you ask.
Just what it indicates.
Two elements only have these tubes —
Their filaments and plates.

"What is the purpose of diode tubes?"
They're mostly for power supply.
To "direct pulsations" they change a.c.
And therefore rectify.

Of course the action of tubes depends
On making electrons move.
You must have heat to pep them up
And get them in the groove.

That's "Thermionic Conduction" —
A two-bit name, no doubt,
For saying the heater's electrons
Get a hot-foot to rout them out.

But now that we have them jivin',
Where are they goin' to go?
If you remember "unlikes attract,"
You'll soon be in the know.

Because of their very nature,
These tubes are one-way workers.
In the plus half-cycle they're busy as bees.
On the minus half, they're shirkers.

(*Continued on page 94*)

* 979 Summit Ave., New York City.

The Neon-Tube Parts Checker

A Simple Means of Measuring Resistors, Condensers and Voltage Without a Meter

BY WALTER E. BRADLEY,* W1FWH

PRIORITIES, priorities, priorities! "Where may I buy this?" and "Where may I buy that?" is the cry. Too often there just isn't any answer, but many of us have old receivers, accumulated from friends or neighbors, laid aside against the possibility that an extra resistor, condenser or what not could some day be salvaged to fill a need. That "some day" has arrived!

With luck, values may be found labeled on some parts, but frequently the markings will have faded in the course of time or the marking which does exist may simply be the manufacturer's part number. A means of measuring such values obviously is needed. For a few dollars — at this writing — a checker of extremely simple design and surprising versatility can be built. Its heart is the neon or argon tube.

By making use of the fact that the extinction voltage of such a tube is constant within reasonably close limits, it is possible by a simple circuit arrangement to measure voltage, resistance and capacity over a useful range of values. The lamp is shunted across the variable portion of a voltage divider, and under different conditions of use the divider must be adjusted to bring the neon lamp voltage just to the extinction point. The values to be checked can be read directly from a calibrated scale associated with the voltage divider.

With the insulation and resistances used, d.c. voltages between 70 and 1500 and a.c. voltages between 50 and 800 may be measured fairly accurately and with safety. Resistances from 0 to 500,000 ohms and capacities between 0.0025 μfd. and 4 μfd. may also be measured. The limitations cited are determined by the voltage supplied at the input and the amount of resistance used in the voltage divider system. The instrument's range could be extended indefinitely, but the values given should be sufficient to cover the more frequently used capacities, resistances and voltages.

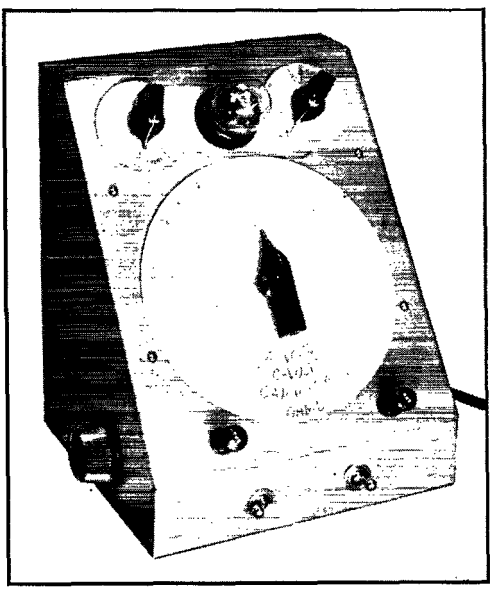
The circuit diagram of the checker is given in Fig. 1. In addition to the parts listed under the diagram, three pointer-type knobs or dials, one ordinary round knob and two binding posts or pin jacks to which the test leads may be attached will be needed. The antenna and ground binding posts of an old receiver serve this purpose in the model illustrated.

And so out of one neon lamp, six resistors and one ordinary bell-ringing transformer comes a neat little gadget that effectively laughs at priorities and gives us a combination voltmeter, ohmmeter, capacity and continuity meter.

Characteristics of Neon Lamps

The basic principle upon which this device operates, and without which separate calibrations for each individual neon lamp would have to be made, is the observation that the extinction potential of practically all 1-watt neon lamps does not vary more than 1½ volts when a.c. is the power source. With d.c. the variation can be as much as 4 volts, although with rectified a.c. (pulsating d.c.) there seems to be practically no variation. However, this type of power source was eliminated because it not only added to the cost and complicated the circuit but did not effect enough increase in accuracy as compared to a.c.

*Technical Information Service, ARRL.



Front view of the parts checker shows the calibration spread of the 0-5,000-ohm resistance scale, upper left, and the 0-50,000-ohm scale, upper right. The small knob on the left-hand side is the line voltage compensator control.

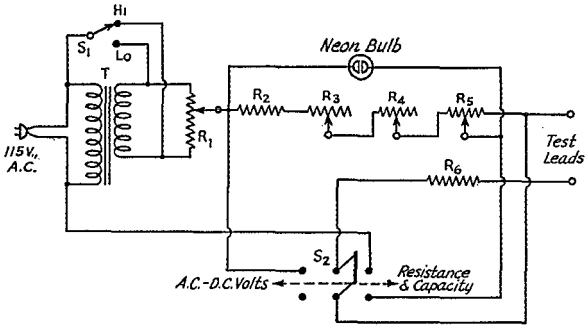


Fig. 1 — Circuit diagram of the neon-tube checker.
R_1 — 300-ohm potentiometer, wire-wound (Centralab V125).
R_2, R_6 — 2,000 ohms, 2 watts.
R_3 — 5,000-ohm potentiometer (Centralab 72–110).
R_4 — 50,000-ohm potentiometer (Electrad 205).
R_5 — 500,000-ohm potentiometer (Centralab 72–106 or N118).
S_1 — S.p.d.t. toggle switch.
S_2 — D.p.d.t. toggle switch.
T — Ordinary bell-ringing transformer.

to justify its use. Laboratory experiments also showed that a 2-watt argon lamp (the type that glows with a purple hue) has substantially the same characteristics and may be substituted for the 1-watt neon. Because the d.c. ignition voltage required is at least 62 and the a.c. required is a minimum of 48, measurements below these figures cannot be made.

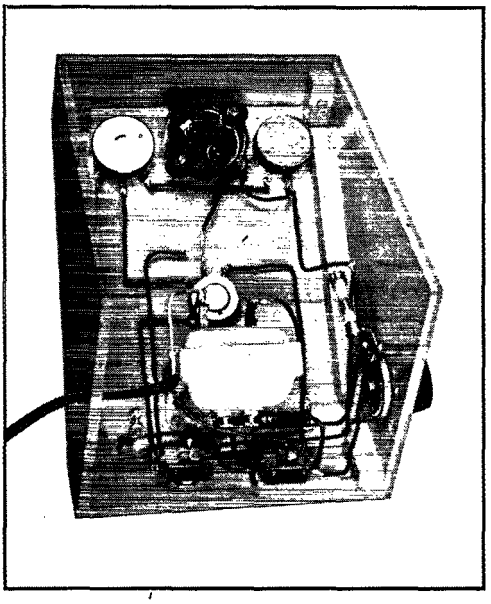
It is possible to take advantage of one additional characteristic of neon tubes if the polarity of an unknown voltage source must be determined. When positive voltage is applied to one side of the lamp and negative to the other, only one plate glows. In this model it is desirable to have a neon lamp of the type that has a solid cylindrical center plate surrounded by a spring-like coil as the other plate, and to mark that binding post which, with a known positive potential applied for initial calibration, makes the center plate glow. From then on the ability to check polarities is an additional function of the meter.

Circuit Details

The transformer, T, with its associated switch, S_1, and potentiometer, R_1, provides a means of adjusting the voltage across the voltage divider, R_2 to R_6 (including the unknown resistance or capacitive reactance to be measured), to approximately the 96 volts required, regardless of the line voltage. Since our line voltage was 120 volts, the secondary voltage of the bell-ringing transformer in our case had to be increased to 24 volts (the nominal secondary voltage is 10) in order to reduce the voltage to 96. This required the addition of some 240 turns of No. 28 enameled wire to the secondary, which meant that 10 turns per volt was about right for these transformers. Actually the secondary voltage must equal the difference between 96 volts and the highest voltage encountered on the a.c. line. In practice this means that, with S_1 in the "low" position, R_3, R_4 and R_6 at minimum and the test leads shorted, adjustment of R_1 should permit the neon lamp to be extinguished.

R_2 and R_6 are current-limiting resistors which permit measuring low-wattage resistors safely. R_6, being in series with one side of the a.c. power line, protects the line against a short circuit in case of accidental contact via a test lead to a grounded chassis. The terminal to which R_6 is connected should be marked "ground." To insure that this terminal is on the "cold" side of the line, reverse the power plug until the neon lamp glows when a test lead from the terminal connected to R_5 is touched to an actual ground connection such as a radiator or water pipe.

R_3, R_4 and R_5 are the adjustable part of the voltage-divider system and, when adjusted to the point where the neon lamp is just extinguished, will equal the resistance being measured. The resistance necessary at R_3, R_4 or R_5 to develop the required voltage drop depends on the current, which in turn is dependent upon the external resistance or reactance, so that the internal resistors readily can be calibrated in terms of resistance or capacity.



Circuit simplicity is apparent in this inner view which shows the general arrangement of the few parts the "meterless meter" requires. The method of assembling the plywood cabinet is also shown. Location of the square dowels is important in the cabinet construction.

Since, in voltage measurements, the value of applied voltage requires a different voltage-divider ratio to give the fixed output voltage characterized by the glow extinction point, the variable resistors can be calibrated in terms of applied voltage. Voltages below the value required to make the lamp glow — in general somewhat higher than the extinction voltage — cannot, of course, be measured, but for a.c. voltages from about 50 and d.c. voltages from 70 upward the method is quite satisfactory.

S_2, when thrown to the right-hand side, connects the voltage-divider system to the a.c. power source and at the same time connects the rotary arm of R_5 to the upper test lead. These connections are necessary for making resistance or capacity measurements. For voltage measurements, S_2 is thrown to the left, disconnecting the internal power source, breaking the connection of the rotary arm of R_5 to the upper test lead, and connecting R_6 to R_2. We now have all the resistors except R_1 presenting a voltage-divider system to any externally applied power source. It should be noticed that, so far as the external voltage is concerned, this resistance does not change, so for all voltage measurements below 500 this checker draws less current than the common 1000-ohms-per-volt meter.

Calibrations

For easiest reading it is desirable to use potentiometers (R_3, R_4 and R_5) having a useful rotational arc as great as possible. The degrees of shaft rotation available on several makes was found to be as follows: Electrad, 256 degrees; Yaxley, 270; Clarostat, 298, and Centralab, 308. Then, in order for the resistor calibrations to be linear, linear potentiometers were required. Actually no manufacturer makes a resistor of this type which is absolutely linear for every degree of dial rotation. Linear resistors are, however, linear from approximately 25 to 87 per cent of their total rotation. The actual mid-point of the resistance is, therefore, approximately 56 per cent of the total rotation (clockwise), or the mid-point between 56 and 87 per cent; 36 per cent of total rotation is required to give one-quarter total resistance, while three fourths of the resistance is covered by 78 per cent of the total rotation.

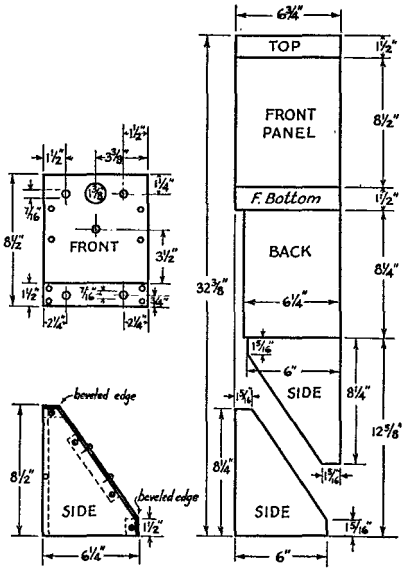


Fig. 2 — Working drawing of the mounting.

Four initial calibration points are thus obtained. Additional calibrations can be made from here on by further division of each quarter section taken as a separate resistor to be divided. For instance, suppose we were to use a 500,000-ohm Centralab resistor having 308 degrees of rotation and wanted to locate the 250,000-ohm mark. From the above we find that 50 per cent of the total resistance in the potentiometer is not reached until 56 per cent of the total degrees of rotation are reached, or almost 172½ degrees. Therefore a line should be drawn on the circular chart for this potentiometer 172½ degrees to the right of the minimum or zero-resistance position to indicate the 250,000-ohm calibration point. Similarly the 375,000-ohm mark should be made at 78 per cent of 308 degrees, or the 239½-degree point to the right of the zero resistance point. Follow this same procedure in calibrating the other two potentiometers. A protractor, by the way, is the thing to have for marking off degrees.

If one is lucky enough to have a radio serviceman permit him the use of his ohmmeter, accurate calibrations of individual potentiometers, whether linear or tapered, can be made. Also, the use of a voltmeter for about ten minutes will give a set of voltage calibrations that will be as accurate as the original meter from which they were copied. For a group of capacity calibrations readings can be taken on a couple of 1-μfd., 0.5-μfd., 0.25-μfd., 0.1-μfd., 0.01-μfd., etc., condensers.

If a voltmeter is not available for voltage calibrations, the scale easily can be calculated. Remember that the total resistance across the external voltage is always 500,000 ohms (within the limits of resistor accuracy) and for d.c. the extinction voltage across the neon lamp must be dropped to 62 volts, while for a.c. it has to go down to 48 volts. This is why the a.c. and d.c. scales do not correspond. The amount of resistance needed across the neon lamp to reduce the external voltage to the extinction point of the lamp is obtained from the following formulas: For a.c., the resistance across the lamp equals 48 times 500,000 divided by the external voltage;

(*Continued on page 90*)

U.S.A. CALLING!

INSTRUCTORS NEEDED

THE most urgent need for radio personnel in the country to-day is that for civilian radio instructors. There are several very large training programs under way. An unbelievable number of men and women all over the country are to receive instruction in various branches of radio, and the need for instructors runs well into the thousands. Several items on this subject appeared in this department last month and should be consulted by the amateur who is available for this duty.

Typical of these programs is that of the Army Air Forces which is engaged in giving radio training to some tens of thousands of enlisted men and which has announced that it alone will require some thousands of instructors. While we fellows know the importance of radio to the modern army, especially the air arm, these figures are eye-openers. Much urgency is put behind the appeal to amateurs to come and help in this job. Civil Service openings exist in the states of Illinois, Wisconsin, North Dakota and Florida, where the Air Forces training is centralized. The men chosen for these positions *will themselves be given special training.* Positions are open for what are called Student Instructors at $1620 per annum who, upon successful completion of the training course, are eligible to promotion to Junior Instructor at $2000. The training course for instructors is usually three months, may be less for skilled amateurs, as to qualify it is necessary only to have either one year of technical radio experience or two years of college study which included a certain amount of mathematics and physics. Amateurs who are available should communicate at once with the Chicago district office of the Civil Service, Room 1115, New Post Office Building, Mr. S. H. Kaplan.

Many amateurs will be particularly interested in the great Air Forces effort which is being concentrated in Chicago, where several huge hotels have been taken over for the housing and teaching of enlisted students — mechanics and the operators of combat crews. It is reported that as many as 15,000 Air Forces men will be in simultaneous training there and that 1200 instructors are required for Chicago alone. At the present time the greater portion of the instructors are enlisted men, and the War Department wants to replace them with civilians so that the soldiers may go on combat duty. Many civilians who are well qualified to instruct in radio and who desire to aid the cause of Democracy, but who have been unable to because of some physical or age disqualification, now have an excellent chance to impress their personality on the Axis powers. Your ability to instruct our men of war can be your own "secret weapon." There are several pay grades: $3200 a year, $2600 and $2000; and student instructors at $1620 for the first three months while receiving instruction in teaching, to be followed by promotion if qualified to the $2000 rating of junior instructor. Qualifications for a junior instructor are either a year's experience in technical radio work, six months' schooling in a recognized radio school, a year's engineering study including a course in radio, a defense course in radio work such as the ESMWT one, or *possession of an amateur operator license.* (Tell us that license doesn't help!) Hams particularly interested in joining the Chicago school as teachers should write for further information and application blanks to Captain John T. Gilmore, Secretary, Army Air Forces Technical School, Room 430A, Stevens Hotel, Chicago.

RADAR OFFICERS WANTED

IN TERMS of valuable education, action and an opportunity for real service, possibly the best place in this whole show for a technically-trained ham is as a radiolocator officer. In the Army this means appointment as a second lieutenant in the Electronics Training Group of the Signal Corps, the selection of the personnel for which is the chief duty of ARRL President George Bailey in his capacity of secretary of the Committee on Scientific Personnel of the OSRD. Applicants for this duty must be electrical engineers (preferably with communications) or science graduates with specialization on electronics physics, from an accredited college; and must be in prime physical shape, between the ages of 16 and 46. After commissioning as second lieutenants they are given very specialized instruction which includes all the details of this highly confidential microwave technique, and not only classroom work but field experience under combat conditions. Frequently some of the training and experience is in England. The eventual duty of these officers is concerned with radar stations, their installation, maintenance and operation, in a service which is of course of immense importance. Many of the amateurs best qualified from the technical standpoint are to be found in this service. While there are many hundreds of them,

the need only increases and there is a call for many hundreds more.

If you're qualified, you're badly wanted. Write with full particulars on yourself, to George W. Bailey, 2101 Constitution Ave., N. W., Washington, D. C.

YLs FOR ARMY AIR FORCES

YLs WITH an amateur radio license, or those who have attended a six months' technical radio course, take notice! Also, women who have had six months' full-time or one year night-school experience teaching radio, or six months' technical experience as a professional radio operator or engineer, or who have a bachelor's degree in electrical engineering, take notice!

The Army Air Forces will accept you as a student instructor at $1620 a year, and give you three months' intensive training. If you can prove that you are already trained you will be hired at $2000 a year. You will be sent to one of four schools at Scott Field, Illinois; Chicago; Sioux Falls, S. D.; or Madison, Wis. You will teach radio at these schools.

Five thousand women are needed, so there is plenty of chance for everyone. The job will be under Civil Service, but you must apply to the Commanding General, Air Forces Technical Training Command, Knollwood Field, North Carolina, even if you live in one of the four cities above mentioned. You will receive a prompt answer with instructions on how to proceed further.

These women will replace men already teaching, and will fill new posts at the rapidly expanding Air Forces schools. If you are in doubt as to your qualifications, write to Mr. George W. Bailey, 2101 Constitution Ave., N. W., Washington.

ARMY VOLUNTEERS

SO MUCH has been said in *QST* about the closing-off of volunteer enlistments in the Army that we think we'd better record the fact that in August direct enlistment was reopened in the Air Forces, Signal Corps, Ordnance Department, Engineer Amphibian Command and the Parachute and Glider Troops — provided the applicant possesses one of 135 needed mechanical trades or skills, included in which are radio mechanics and operators. Such enlistment is open only to citizens between the ages of 18 and 45, either not yet called in the Selective Service or having a release from the local board. If under 21, parents' consent in writing is required. Further dope from any local Army recruiting station.

Many men who thus volunteer are appointed to Officer-Candidate Schools. For instance, the Signal Corps is currently training at Fort Monmouth a class of several thousand officers, all of whom came from the ranks. Any general officer is authorized to direct in orders that, as a reward for demonstrated fitness or meritorious service and provided he meets the physical requirements, an enlisted man of his command (especially selected for his qualifications) will be detailed as a student to the Officer-Candidate School of the enlisted man's choice within the quota allotted to the command without the necessity of having to appear before the usual Board of Officers for acceptance. Such order will serve the purpose of the report of the usual examining board.

WOMEN FOR MECHANICS

THE Signal Corps General Development Laboratory at Ft. Monmouth advises us that it will start another class for women mechanics on December 1st and is now soliciting correspondence from applicants between the ages of 16 and 50. Those accepted are given a six months' course in the overhaul, maintenance, repair and inspection of Army communications equipment, and are paid $120 a month during this period of instruction. The women are then full-fledged radio repairmen and mechanics and are given employment in the development labs at Monmouth, assisting engineers in research and development, at $135 a month. This is not only valuable training but permits one to make a most useful contribution to the national effort.

Prospective applicants should write for blanks as soon as possible to Lt. John T. Freeman, Assistant Personnel Officer, General Development Laboratory, Signal Corps, Fort Monmouth, Red Bank, N. J.

MARINE CORPS RADAR

THE leathernecks continue the quest for skilled radio amateurs who would prefer service with the Marines. Commissions, noncommissioned ratings and ordinary enlistment, depending upon qualifications.

College graduates with degrees in electrical or communication engineering or electronic physics are wanted as officers in the Aircraft Warning Service, but two years of college engineering and satisfactory practical experience will qualify many. Appointments range from second lieutenant to major, depending upon age and experience.

High-school graduates who are minus the college degree may qualify as noncommissioned officers starting with the rank of staff sergeant, with pay ranging from $96 to $145 per month including allowances, in addition to everything found. The course of instruction in maintenance duties constitutes an important education in this newest of radio fields. Amateurs who did not graduate from high school but are otherwise qualified may be accepted as privates with the assurance of general communications duty.

Candidates for commission should communicate with The Commandant, U. S. Marine Corps, Washington. For appointment in enlisted ratings,

apply either to The Commandant or to the nearest Marine Corps recruiting officer. In any event, if advice is needed write to G. W. Bailey, 2101 Constitution Ave., N. W., Washington.

RADIO OPERATORS WANTED

THERE is still a shortage of civilian radio operators in many of the government agencies supplied with personnel by the Civil Service Commission. We refer you to several previous mentions of these positions in this column. The essential data are to be found in Civil Service Announcement No. 203, at any first- or second-class post office except in 15 major cities where the Civil Service itself has district offices. There are two ratings, at $1620 and $2000 a year. Applicants must be citizens between 18 and 55, must be able to transmit and receive at a sustained speed of not less than 20 w.p.m.; and for some positions must be able to typewrite at 40 and copy on the typewriter at 20, and operate a teletypewriter at 35. Duty is to stand regular watch in a station and, when required, to be responsible for its maintenance. Applicants must be in sound physical health and capable of performing arduous duty. No written examination, candidates being rated upon their sworn statements and corroborative evidence. See particulars at your post office.

TECHNICAL WRITERS

THE Civil Service is looking for men with first-class experience of editing, writing and publicity, plus a knowledge of radio, aviation, the iron and steel industry, engineering, machinery, or allied fields. Appointees will write and edit technical articles or popularize such material for the general public, working in various government agencies. Salaries range from $2300 to $4600. Application can be made on the CS's Standard Form No. 57 or you may correspond direct with the Administrative Examining Unit, U. S. Civil Service Commission, Washington.

ARMY SPECIALIST CORPS

THE ASC is still looking for men with important technical training in radio, telegraph and telephone, particularly those with experience in u.h.f., television, teletype, and speech recording and amplifying equipment. The Specialist Corps is made up of men who by reason of age or physical disqualifications were not qualified for Army commissions. They relieve troop-age officers for combat duty. They wear uniforms identical to that of the Army with the exception of a distinctive armband, and observe the same military courtesies and customs. Physical disabilities are usually no bar to service. The Signal Corps, for example, has adopted a policy whereunder former officers now disqualified for physical disabilities, but technically qualified for Signal Corps duty, will be offered commissions in the ASC. For many, this will be the real chance.

Write to Headquarters, Army Specialist Corps, War Department, Washington; or to George Bailey for advice.

AIRWAYS COMMUNICATORS

AN EXCELLENT opportunity for radio amateurs to make a career for themselves and at the same time do an important war job is open. The Civil Aeronautics Administration has issued a call for Aircraft Communicator trainees, announcing that it would give preference to men and women who have the following qualifications: (1) a first- or second-class radiotelegraph or radiotelephone license, a restricted radiotelegraph permit, or a Class A or B amateur radio operator license; or (2) the successful completion of a radio course in any resident school giving instruction in code or on communication equipment.

Ability to type 40 words a minute is required, and the age limits are 17 to 40. Minor physical defects are not disqualifying, provided they would not impair efficiency, endanger fellow employees, or constitute a retirement hazard. Vision may be 20/200 without glasses, correctible to 20/30 in each eye. The applicant must be able to speak distinctly, and hear conversation at 15 feet with one ear. Trainees are paid $1440 and after completing a six months' course will be promoted to positions paying $1620. They may progress to jobs as Chief Aircraft Communicator, $3200.

They will learn to take and report weather observations, and to operate and maintain radiotelegraph, radiotelephone, and teletype equipment. You all know what goes on on the airways to-day. About 240 trainees are now on the job, and as many more are expected to be taken on by the end of next June. Approximately 75 per cent of the present trainees are women.

Training centers have been established at each of the CAA regional offices. The instructors attempt not only to give technical training but to make the student realize the vital importance of his work, which has been described as follows:

> He maintains vigilance at his earthbound station and through the magical medium of modern communication, serves those who traverse the sky by day and night—through weather fair and foul; with messengers at his command that span the world in an instant.
>
> His duties are exacting — responsibilities great. Safety of life and property often depend solely upon the proper performance of routine assignments; sometimes only individual initiative and resourcefulness will avert disaster.
>
> His loyalty must be constant — his mission never ends. Into his hands are placed tools fabricated through years of research and development. He must contribute the final and most vital link — intelligent human endeavor to the end that those who fly the airways do so with maximum safety.

Amateurs who are interested should file a Civil Service application for the position of Trainee Junior Aircraft Communicator. At any first- or second-class post office or Civil Service district office you may see the Civil Service announcement, which gives complete details, and obtain application forms.

OFFICER-CANDIDATE SCHOOLS

THE Army makes most of its officers nowadays, by selecting enlisted men and sending them to Officer-Candidate Schools. In addition to those thus selected by examining boards, any general officer is authorized to direct in orders that, as a reward for demonstrated fitness or meritorious service, an enlisted man of his command may be detailed as a student to an OCS of the enlisted man's choice, without the necessity of appearing before the usual board of officers for acceptance.

There is another angle on this that may interest some of you fellows. A Selective Service memo to state directors in March last, No. I-394, provided that a man in Class III (either A or B) may arrange for certain papers from his draft board that permit him to enlist voluntarily, ahead of time, with the understanding that after receiving the basic three months' military training as a draftee he may be accepted for an Officer-Candidate School. Under this arrangement, if he is not so accepted at the end of his three months he is released, permitted to return home, and reverts to his old draft status of III-A or III-B and awaits his call. If he is accepted for OCS but does not demonstrate proper qualifications for an officer, he is similarly released and returns home and awaits his regular call. In neither event is he held ahead of his regular order unless he becomes an officer and is given active duty. The arrangement possibly involves interviews to insure in advance the acceptability of the candidate as an officer. The arrangement must be promoted individually in each case between the man and his draft board. As there are many regulations surrounding it, it can't be counted on too strongly, but it has worked successfully in many cases. If you're a Class III and interested, take it up with your local board, referring to Memorandum I-394 to all state directors.

FLIGHT RADIO OFFICERS

IT HAS been announced in the press that most of the major airlines of the country have been given contracts by the Army Air Forces to expand their airways overseas so as to carry cargo and personnel for the Army. This is an undertaking of the greatest magnitude and importance. It will involve the training of both flight and ground personnel of all sorts. In the communications field it means engineers, mechanics and both ground and air operators — particularly the latter, known as Flight Radio Officers. All will be in civilian contract status. Perhaps a score of radio schools around the country have contracts with the airlines for the training of radio personnel. The candidates most sought are those with amateur experience. Operators become employees of the airline, go on the company payroll, attend one of these radio schools and obtain free instruction in a course of some months' duration, then receive substantial increases when they go on active duty. The training is good, employing actual airways apparatus and navigation aids. The salary paid while receiving free schooling is generally $150 a month plus some allowance for expenses, or is sometimes $200. When assigned to flight duty the salary is about double, plus a bonus while in foreign service or an allowance for expenses while away from a home base in the United States, so that all-in-all it is very good money. Information on these openings may be had by correspondence with the communications department of most of the major airlines; some of the schools should be able to refer you to the airline for which they train; and in numerous cases the local office of the United States Employment Service will have data for the interested amateur.

Strays

No subject is more full of surprises than magnetism. An alloy of 75 per cent iron and 25 per cent nickel is practically nonmagnetic, while permalloy, which is composed of approximately 80 per cent nickel and 20 per cent iron, has a permeability of 20 or 30 times that of pure iron. An alloy consisting of manganese, copper and aluminum has been found to be strongly magnetic, although none of its components alone is magnetic.

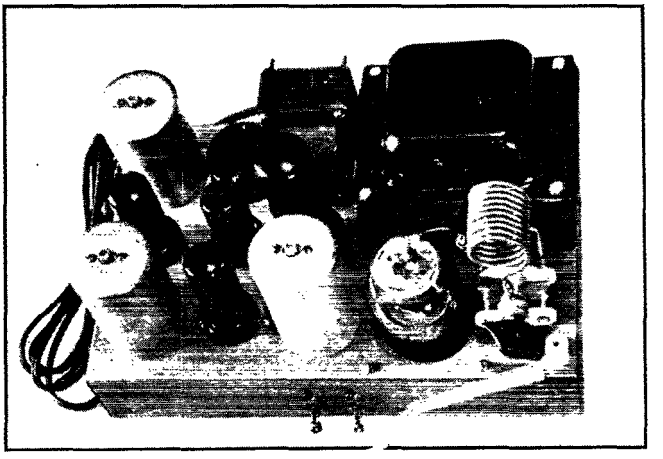
— • • • —

RCA announces new editions of their popular Receiving Tube Chart and Transmitting Tube Guide. Both have been completely revised. The Receiving Tube Chart is a booklet of 16 pages which contains characteristics and base connections for 329 receiving types. A copy may be obtained upon request from RCA or your local dealer.

The Transmitting Guide, following the pattern of previous editions, contains helpful information on the design, construction, adjustment and operation of transmitters in addition to transmitting-tube data. This book of 72 pages is priced at 35 cents and copies may be obtained from dealers or direct from RCA.

— • • • —

Remember "The Shadow" back in early 1936? The wandering signal that gave all the DX men the willies and which the Navy finally ran down only to find it to be a combination of three or four diathermy machines, then just beginning to become popular with physicians? Well, the recent FCC registration discloses that there are now in use nearly 75,000 of these machines in the city of New York alone. Better save the crystal filter!



The f.m. exciter unit, complete with power supply, is built on a chassis 11 inches long, 7 inches wide and 2 inches deep. Components are identified in the text.

A Crystal-Controlled F.M. Exciter

A Narrow-Band System for Amateur Use

BY W. P. BOLLINGER,* W3JDF

THE possibility of the use of frequency modulation interchangeably with amplitude modulation in the same amateur bands has been recently suggested.[1] The band width required for f.m. under certain conditions of reception is no more than that required for amplitude modulation, and the same band can easily be shared by both systems.

* RCA Manufacturing Co., Inc., Camden, N. J.

[1] Norton, "Why Not Narrow-Band F.M. for General Amateur Use," *Radio*, January, 1941, page 88.

Grammer, "Some Thoughts on Amateur F.M. Reception," *QST*, March, 1941, page 9.

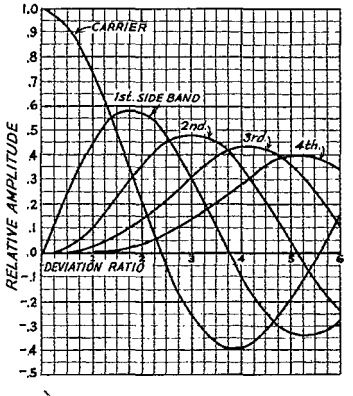


Fig. 1 — Graph showing distribution of the components of an f.m. signal. For a deviation ratio of 1, the first sideband is the only one of appreciable magnitude.

Fig. 1 shows the comparative magnitudes of the carrier and sidebands of an f.m. signal. The deviation ratio is the ratio of the frequency deviation to the modulation frequency. If we choose a deviation ratio of one or less, it is evident that the magnitude of all the sidebands, other than the first, will be negligible and will cause no interference. This first sideband is displaced from the carrier by an amount equal to the modulation frequency. For deviation ratios of one or less, then, the f.m. signal will occupy no more space than will an a.m. signal.

F.m. has several important advantages over a.m. One of these is the simplicity and economy in transmitter construction. Modulation takes place in the low-power stages and so the high-power modulator, representing about half of an a.m. transmitter, is eliminated. Of equal importance in the advantages of f.m. is the high efficiency that may be obtained.

Transmitting tubes are usually rated at about 40 per cent more power output when used for c.w. than when used for 'phone. Since the r.f. amplifiers are not amplitude modulated in f.m. systems the ratings given for c.w. may be applied. The overall efficiency of an f.m. transmitter is further increased by the absence of the modulator drain.

F.m. employing small deviation has an advantage of considerable importance in amateur use over the wide-band f.m. applied to commercial broadcasting. Since most hams are not equipped with f.m. receivers designed for swings

of 75 kilocycles, it is desirable to use a system which may be received on their present receivers. F.m. signals which deviate a maximum of about 3 kilocycles can be received satisfactorily on the ordinary a.m. receiver by detuning it to either side of the center frequency. The selectivity characteristic of the receiver then acts as a slope filter, converting the f.m. to a.m. so that it can be detected in the usual manner. This, of course, is not the best way of obtaining detection, since the noise-reduction properties of f.m. are not then realized and because distortion will be produced if the deviations are too large. It is, however, an entirely satisfactory experimental measure and very good results have been obtained using it.

Transmitter Design

There are many methods of producing f.m. signals, but for amateur purposes the system should not involve too elaborate a circuit. One simple method is to use a self-excited oscillator modulated by a reactance tube. With this system large deviation may be obtained with little distortion. This arrangement does have the disadvantage, however, that the center frequency is not sufficiently stable without complicated control circuits. This is particularly true in f.m. for amateur channels. The ideal situation would be to have the center frequency directly controlled by a crystal but circuits for doing this are also too complicated. A satisfactory compromise can be made by using a circuit which is fundamentally a self-excited oscillator but is locked in by a crystal. Some circuits of this type are sufficiently variable in frequency so that they may be frequency modulated over small deviation ranges.

The Oscillator-Modulator

In Fig. 2 is shown the circuit diagram of the oscillator and modulator used in this exciter. The oscillator is fundamentally a self-excited, electron-coupled circuit using a 6F6. However, the screen is left floating so far as radio frequency is concerned and between it and the control grid is connected the crystal. Fig. 3 shows how the frequency and plate current of the oscillator vary when the oscillator is tuned in the region near the crystal frequency. Throughout a considerable portion of the range of C_6, the frequency is controlled almost entirely by the crystal. This control is not so tight, however, that the oscillator cannot be modulated over a devia-

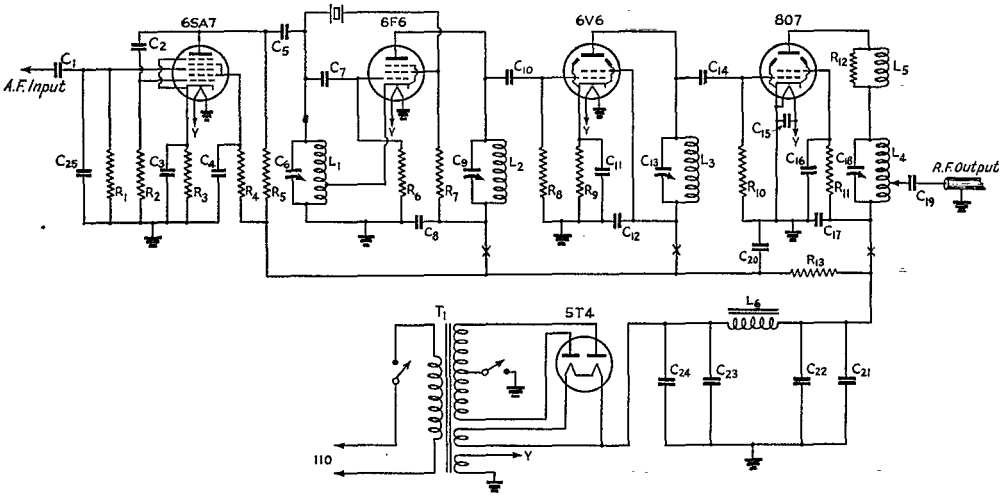


Fig. 2 — Circuit diagram of the crystal-controlled f.m. exciter unit.

C_1 — 0.05 μfd.
C_2 — 10 μμfd.
C_3, C_4, C_5, C_8, C_{10}, C_{11}, C_{12}, C_{14}, C_{15}, C_{16}, C_{17}, C_{19} — 0.0015 μfd.
C_6 — 50 μμfd.
C_7 — 100 μμfd.
C_9 — 50 μμfd.
C_{13} — 25 μμfd.
C_{18} — 20 μμfd.
C_{20}, C_{21}, C_{22}, C_{23}, C_{24} — 4 μfd.
C_{25} — 100 μμfd.
L_1 — 34½ turns No. 22 close-wound on ⅝-inch form, tapped at 10 turns from ground end.
L_2 — 15 turns No. 22 close-wound on ⅝-inch form.
L_3 — 6 turns No. 22 close-wound on ⅝-inch form.
L_4 — For 28-Mc. output: 10 turns No. 10 wire 1⅛-inch diameter, 1½ inch long.
L_5 — 10 turns No. 22 wound around R_{12}.
L_6 — 8 hy., 150-ma.
R_1 — 0.2 meg., ½-watt.
R_2 — 100 ohms, ½-watt.
R_3 — 1500 ohms, ½-watt.
R_4 — 0.2 meg., ½-watt.
R_5 — 0.1 meg., ½-watt.
R_6 — 60,000 ohms, ½-watt.
R_7 — 0.2 meg., ½-watt.
R_8 — 0.1 meg., ½-watt.
R_9 — 250 ohms, ½-watt.
R_{10} — 25,000 ohms, ½-watt.
R_{11} — 10,000 ohms, 1-watt.
R_{12} — 100 ohms, ½-watt.
R_{13} — 1500 ohms, 10-watt.
T_1 — 370-370 volts, 150 ma.; 5 volts, 3 amp.; 6.3 volts, 4.5 amp.
X indicates points where meters may be inserted.

In the better days to come, we predict that f.m. will play an important part not only in broadcasting but in amateur work. With the surface barely scratched at this date, the use of f.m. in broadcasting will increase because of its adaptability to noise-suppression measures, while hams will welcome it also as a least-expensive and most-efficient means of obtaining voice transmissions which need occupy no greater channel space than the more familiar a.m. Here we have the description of a simple method of applying crystal control to an f.m. exciter for the 28- and 56-Mc. bands.

tion of a few hundred cycles. When the output frequency is multiplied in the following doublers, a deviation of 3 kc. can be easily obtained. The plate circuit of the oscillator is tuned to the second harmonic of the crystal. It may be necessary to detune this circuit slightly to permit the oscillator to come back to mid-frequency every time. A 7-Mc. crystal is used in this exciter to give 14-Mc. output from the oscillator. The modulator is a conventional reactance tube employing a 6SA7. This tube was chosen in order that the audio and r.f. voltages might be applied to separate grids.

Doubler Stage

A 6V6 is used as a doubler giving 28-Mc. output. Through the use of cathode bias, this tube cannot be overloaded in the absence of excitation. The doubler may also be utilized as a limiter of the conventional grid-leak type, eliminating any amplitude modulation which may have been produced.

Output Stage

In the output stage is an 807 operating as a straight amplifier for 28-Mc. output, or as a doubler for 56-Mc. output. About 15 watts may be obtained with 325 volts on the plate. Although output up to 50 watts may be obtained with increased plate voltage, the lower output was used in order to simplify the power supply.

Construction

The entire exciter including power supply was constructed on an 11 × 7 × 2 chassis as shown in the photograph. All tank circuits, other than that of the output stage, were placed in shield cans. The oscillator grid tank, crystal, 6F6 oscillator tube and 6SA7 modulator tube are grouped in the upper left-hand corner. Across the front of the chassis are the oscillator plate tank, the 6V6 doubler and its plate tank circuit, the 807 and the output tank. The power transformer, filter choke and 5T4 rectifier occupy the upper right-hand corner. Two switches are mounted in front for power-line and high-voltage circuits. On the rear of the chassis is a terminal strip for audio input. No provisions were made for permanent meter circuits since the exciter requires no further attention once it has been adjusted.

Adjustment

The best way to adjust the oscillator is by using a temporary plate meter and at the same time listening to the 7-Mc. signal on a receiver with a beat oscillator. Once the oscillator is locked in, C_6 may be varied and the curve shown in Fig. 3 checked. The best point of operation is near the locking-in point indicated in Fig. 3. The oscillator-plate tank is tuned near maximum output. If the oscillator will not come back readily, it may be necessary to detune this circuit slightly. About 3 volts of audio are needed at the grid of the 6SA7 to produce a 3-kc. deviation at 28 Mc. and a correspondingly lower voltage for the same deviation at 56 Mc. Final tests can be made by listening to the signal on an a.m. receiver. If too much modulation is used, the signal will be distorted because of the non-linearity of the receiver selectivity curve. It should also be possible to tune directly on the signal and hear nothing but the distortion components produced because the receiver selectivity curve is not flat on top.

Tests have indicated that this type of transmission is entirely satisfactory for amateur purposes, even when an a.m. receiver is used in reception. The unquestionable advantages such a system possesses will undoubtedly make it attractive to many.

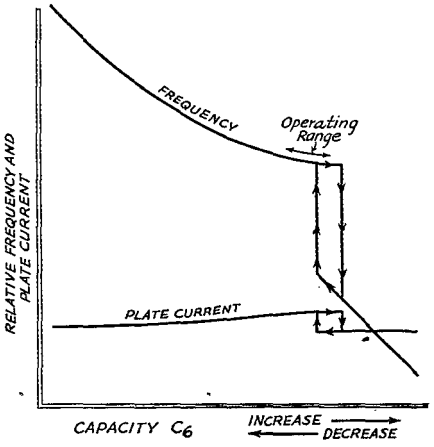
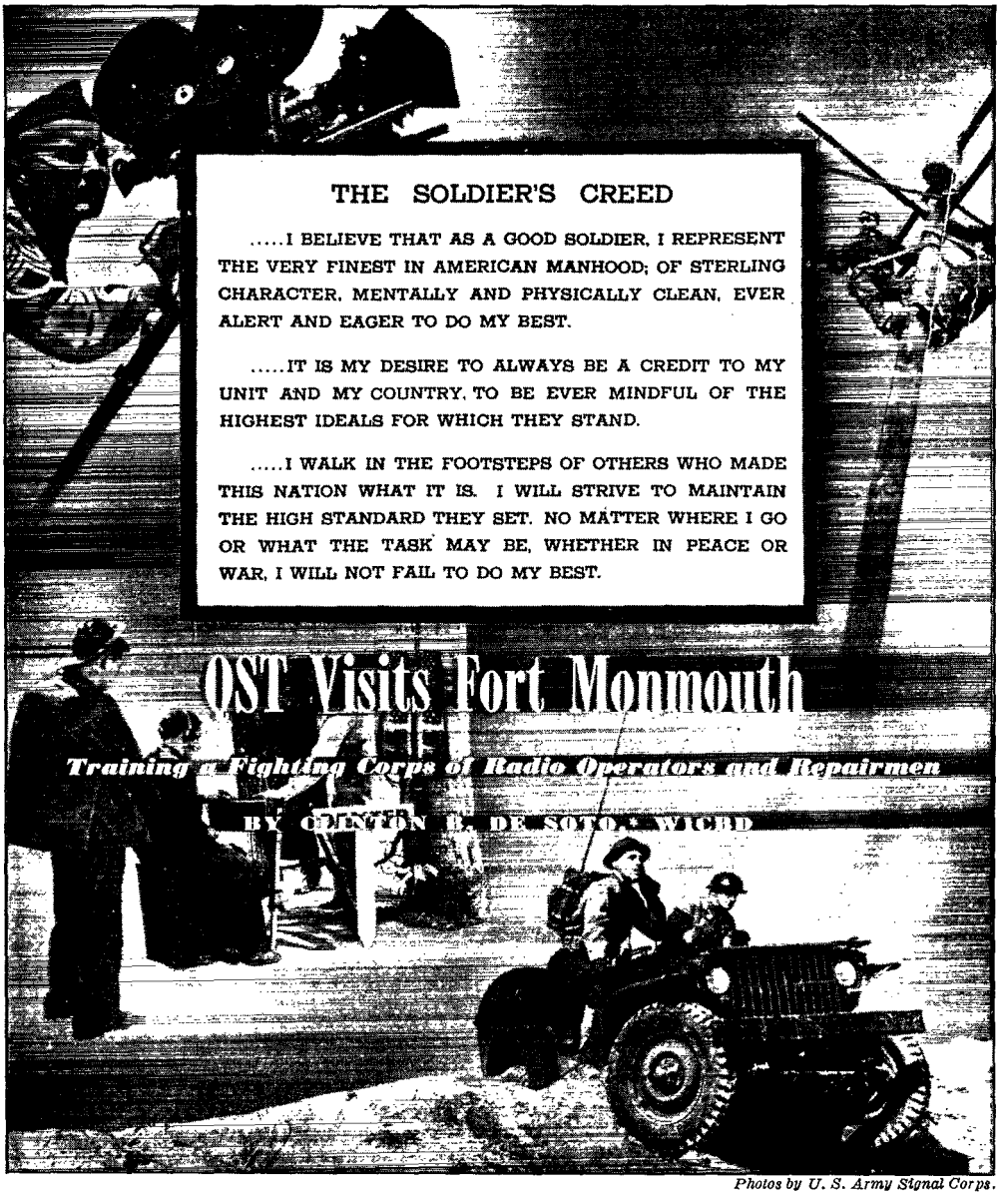


Fig. 3 — Tuning characteristics of the locked oscillator. The vertical line at the end of the frequency curve indicates an abrupt change in frequency when the capacity of C_6 is increased to the point where the crystal loses control. A similar abrupt change occurs when decreasing capacity, the crystal again locking in.



QST Visits Fort Monmouth

Training a Fighting Corps of Radio Operators and Repairmen

BY CLINTON B. DESOTO,* W1CBD

Photos by U. S. Army Signal Corps.

THERE are one or two soldiers in this new army of ours who are going to be sadly disillusioned. Not many, you understand — just a few. These are the fellows who enlisted in the Signal Corps with the notion that thereby they were getting themselves safe and soft jobs in which to sit out this war. Handling radio messages behind the lines, stringing telephone wires back where the brass hats bask in relative security — that was the soft spot they thought they were getting.

If they haven't found it out yet, it's going to be a rude shock to these lads to discover that, instead of spending his time in a comparative sinecure, the Signal Corps man is just about the fightin'est soldier there is. Right in the thick of the battle is where you'll find him, usually ranging far ahead of the main units of the ground forces, more often in hand-to-hand combat with the enemy than not.

There won't be many Signal Corps men who are thus disillusioned, though. By and large they

* Executive Editor, *QST*.

are as fighting an outfit as ever put on a uniform.

Even in World War I the men of the Signal Corps fought themselves into a distinguished record of heroism and bravery — though they had nothing more to fight with in 1917 than a puny .45 and a few extra clips of cartridges.

But in this war they have their own rifles and submachine guns — deadly Garand semiautomatics and vicious rapid-firing Tommy guns — to put them on better than even terms with the enemy. And currently they are being issued the lethal carbine — that new prized side-arm of the American forces, short, handy, its stubby snout full of quick-firing death.

"The Signal Corps is its own infantry," the saying goes. It does its own fighting and asks for aid from no one. Piercing into the battleground-to-be, it sets up its communications posts well ahead of the main advance. Often the Signal Corps is first to contact the enemy — and that's when the shooting starts.

Yes, the Signal Corps man is a soldier — a real soldier, who pits his strength and his fighting skill against the enemy as often as he uses the superior communications knowledge drilled into his brain.

That's why the communications officers trained at the Eastern Signal Corps School at Fort Monmouth are given as much instruction in shooting and military tactics as they are in communications. When they get toe-to-toe with the Axis they'll be matching more than wits and radio knowledge — they'll be matching their fighting hearts and disciplined bodies and lightning-keen minds, as well.

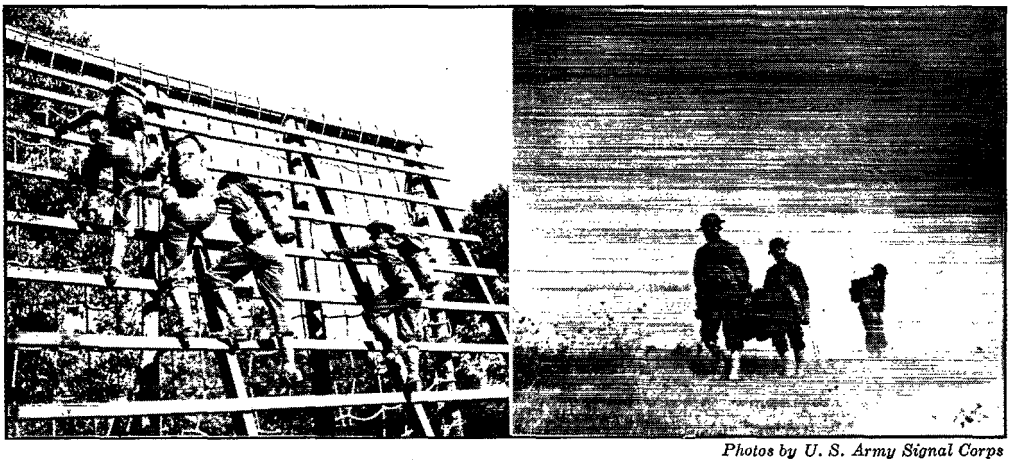
We found that out when we visited Fort Monmouth recently — found it out in a way we'll never forget. We learned, too, about the finely-balanced training that the officer-candidates, and the enlisted men as well — every department of the school, in fact — receive. Training designed to give them the maximum of useful practical knowledge in a minimum of time. Training stripped of every lost motion, of all superfluous minutiae, designed to equip them with every item of useful knowledge within their sphere — but with not a moment wasted on cumbersome details that would slow up the time required to turn them into the efficient, competent fighting force America needs so desperately and so soon.

The Eastern Signal Corps School

It won't be possible to tell you the full story of all that we saw and heard at Fort Monmouth. For one thing there are some things that shouldn't be told — yet — for, while the information certainly would not give comfort to the enemy, it might give him aid. And for another, it would never be possible in a few brief pages to show all the magnificent spectacle of tens of thousands of husky, intelligent American youths straining minds and hearts to do their individual best in the greatest effort the nation has ever made.

But we can give you an outline.

First of all, the main headings. For those who did not see the story on the "Signal Corps Radio School" in the August, 1941, issue of *QST*, the training at Fort Monmouth is divided under the following heads: (1) the Officer-Candidate Department, where selected enlisted men, chosen from the ranks because of exceptional ability, are trained as communications officers for all branches of the service; (2) the Enlisted Men's Department, where the thousands of operators and repairmen needed to man and service the vast flood of communications equipment used by the armed forces are trained; (3) the Replacement Training Center, where specialists of all kinds are given basic training; and (4) the Signal Corps Laboratories, where — but our story doesn't take us that far, for *both* of the reasons set forth above.



Photos by U. S. Army Signal Corps

The Signal Corps must fight as well as supply communications. *Left* — Signal Corps soldiers are toughened by training over an arduous obstacle course with full pack and equipment. *Right* — Communications detail advancing through gas barrage lays telephone line from a portable reel, keeps in contact with the base by walkie-talkie.

In fact, this account will be concerned chiefly with the two departments first mentioned — for there is where the cream of the radio personnel is being trained. And — since hams naturally almost always turn up with the cream, and since *QST* is concerned chiefly with the hams — that is where our interest lies.

Even that segment of the vast, almost incomprehensible spectacle that is Fort Monmouth will be difficult to visualize in its entirety. Let us, therefore, attempt to reduce it to a least common denominator — to the experience of a single rookie who (with permissible literary license) follows through the various phases of the training given at various places on the flat Jersey coastal plain surrounding what was once Camp Alfred Vail and is now named Fort Monmouth after the famous Revolutionary battleground.

From Rookie to Specialist

First of all, we'll assume that this typical rookie is a ham — not because all of the men trained at Monmouth are hams, but because many of those who reach the top are — and this fellow is going to the top.

His story starts with an Army recruiting office in a dust-mantled town in Nebraska, we'll say — or it might be a bustling metropolis in Oregon or a somnolent New England village. His origin doesn't really matter; not once he's in the Signal Corps, anyway.

And it's Signal Corps work he elects when he signs his name to the enlistment papers, of course. Not that it's a matter of election, either; his amateur ticket alone establishes that that's where he's to go. Almost before he knows it he's on the train along with a few dozen other recruits bound for the reception center.

The next few weeks pass quickly for a rookie busy with the business of learning a new life. From the reception center, where he is examined, inducted and classified, he travels to the Replacement Training Center at Fort Monmouth, one of a lot of nearly a thousand new recruits. There he is given an intelligence test and the Signal Corps Aptitude Test and is classified as to his ability to receive and absorb specialist training. Then he begins what is supposed to be a three-month basic training period as a communications specialist.

His ham experience soon displays itself, however, and in a month he has covered the allotted 90-day course and is transferred to the Enlisted Men's Department, commanded by Lt.-Col. M. W. Wallington. There he is one of several thousand picked men, half of them from the RTC along with himself, the others selected from various Signal Corps units all over the country on the basis of their special aptitudes. A third of these men are to be trained in the Wire Division as telephone specialists; the remaining two-thirds are assigned to the Radio Division and grouped under four major specialties: radio repairmen, field radio operators, fixed station radio operators and telegraph printer operators.

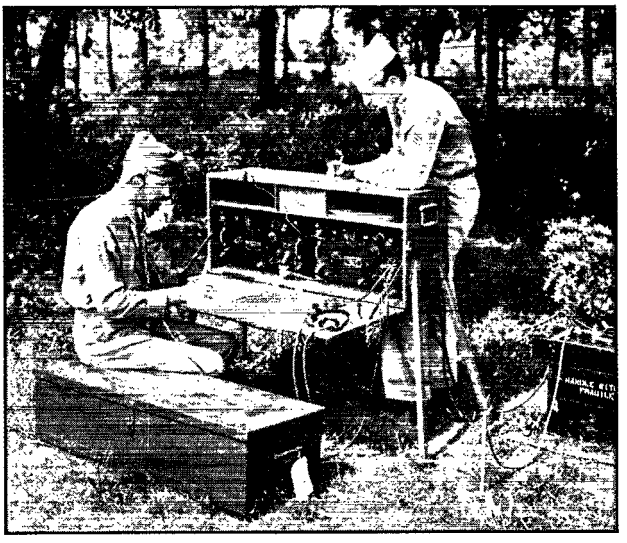
Our ham's technical ability brings him into the first category. He is one of a motley crew, some with little or no preliminary knowledge of radio, others as skilled as himself. All start at the same point — but what happens from there on depends on each individual's ability. He can progress as fast or as slow as his native ability and his industry dictate. There are no lectures, no formal study periods. All classes are handled as shop groups, groups of three students of mutually equal ability working with actual equipment. Information sheets are furnished containing all the essential theory; from there on it is all "self-instruction" under the alert eyes of especially-trained noncoms who are always at hand to give patient, consid-

Left — Radio-equipped reconnaissance car. The famous "peep" is the eyes of the reconnaissance unit. Note the trolley-type adjustable vertical antenna. *Right* — Close-up of operating position, showing let-down operating shelf and communications-type superhet receiver. Both 'phone and c.w. are used. *Photos by U. S. Army Signal Corps.*

erate help. The Signal Corps calls it the "applicatory method."

After completing the review quiz attached to each instruction sheet and the assigned laboratory exercise, the student is given a "PT" — a progress test, the successful completion of which advances him to the next stage.

With his amateur background our rookie moves rapidly through "P of E" — Principles of Electricity, taken in common by both radio and wire men, closely paralleling the electrical fundamentals section of the *Handbook* — and on into shop practice. Had he failed to display the necessary qualifications by this time he would have been interviewed by the officer-in-charge and either his release from the school recommended or his transfer effected to a course more suitable to his aptitude.



Two-channel mobile field station with duplicate operating positions, either c.w. or 'phone. Transmitters are several hundred yards away for break-in. A heavy-duty storage battery is the power source. Receivers are BC-312-C and BC-314-C. *Photo by U. S. Army Signal Corps.*

Students Build Actual Transmitters and Receivers

But our hero has what it takes, and he moves quickly from the basic training on to "E of R" — the Elements of Radio course, comprising twenty-nine lessons supplemented with comprehensive laboratory experiments. This is the intermediate stage of the training. Here he builds up breadboard layouts using familiar amateur parts illustrating basic radio principles — detectors, r.f., i.f. and audio amplifiers, even an m.o.p.a. transmitter. He learns to align a receiver using approved signal tracing methods, and how to use an oscilloscope. There's plenty of equipment, and ample shop space in which to use it.

All of which, of course, is right up a ham's alley. Soon he is well ahead of his group — so far ahead, in fact, that he puts in a little extracurricular work in a special shop in the back room, building new lab equipment for the expanding needs of the school. He may even be ordered to put in some time helping his fellows — by shop coöperation, or even by lecturing on a specialty.

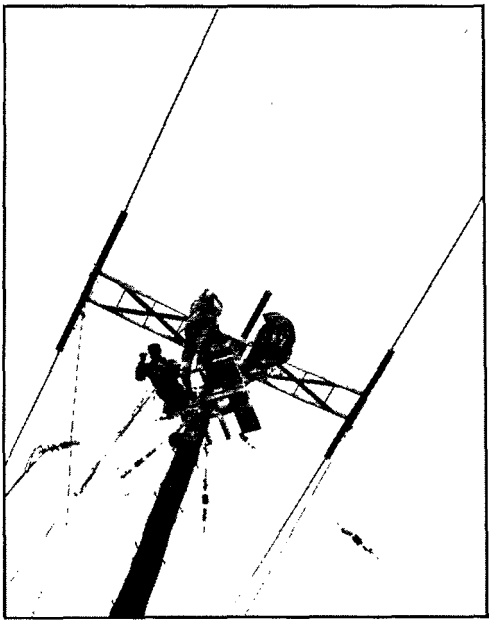
In a very few weeks he progresses on to the advanced course on Test and Repair. There he first comes into contact with actual Signal Corps equipment — the sets used in the field by the modern army, ranging from semi-obsolete t.r.f. receivers and small transmitters selected for their straightforward design and accessibility of construction to the elaborate superheterodynes and multi-stage transmitters found in the armored vehicles and in the big bombers.

Always his rate of progress is limited only by his own ability. "No one is held up — if they've got the stuff they sail right through," we were assured by Major Frederic C. Shidel, W9CIU, the competent and conscientious officer in charge of advanced training in the EMD.

And our ham does just that. Not that he doesn't have to work hard; he does. He finds many flaws in his background of fundamentals, plenty of things he never fully understood. He has to learn all the circuits and layouts of the unfamiliar Signal Corps equipment, has to know every set frontwards and backwards, all its little idiosyncrasies, where to look for trouble and how to fix it — quickly, accurately, infallibly.

But he learns all that, in time. Finally he emerges from Test and Repair — and then a road with many forks stretches out before him. His instructors, who have kept detailed records on his progress, classify him along with the rest of his classmates. If he is near the very top of the list, he may be assigned to VHF to receive three months' additional training in one of the most specialized activities of the Signal Corps. Only the men with the highest ratings go there. If he ends up in a slightly lower category he goes to the Air Corps Maintenance group for a supplementary two-month course, receiving post-graduate instruction on the specialized apparatus of the Air Forces. If he has shown the proper personal qualifications he may be ordered to duty as instructor in one of the sections.

The remainder of the class go out into active service as field radio repairmen. That means *all* of those who are left, regardless of their relative standings. No one flunks out of the course at this stage; they are simply assigned to work compatible with the ability they have shown. The more expert are classified as "journeymen," those of



Looks like a ham-band 20-meter rotary beam — and that's just what it is! Formerly used at W2OEC, the Signal Corps amateur station at Fort Monmouth, this view shows the antenna being installed atop a new 65-foot mast. *Photo by U. S. Army Signal Corps.*

intermediate ability as "apprentices" and the remainder as "helpers."

Five Echelons of Repair

At this stage you, too, may require a word of explanation concerning how Signal Corps radio repairmen function, as we did. It seems that the Signal Corps has what are called "five echelons of repair." The demands placed upon the first echelon are the simplest; they are required mainly to replace non-functioning units — transmitters and receivers — with good ones, to make tube replacements and correct minor defects of an obvious nature. The more obscure troubles move progressively back through the system. Each superseding echelon has more elaborate equipment and can correct more basic faults than those before it. The final echelon is just about capable of building up and adjusting a complete new set, if necessary.

It sounds complicated, but it enables the army to service its equipment with a minimum of lost *operating* time and a maximum of efficiency and economy of elaborate test and shop equipment. Obviously a man who only replaces a defective tube doesn't require a whole laboratory; all he needs to do is see if a tube lights or feel if it heats. And if the unit goes out in the stress of action the urgent thing is to replace it instantly with one that is working right — not to fool around in the front-line trenches trying to isolate an obstreperous bug. That's for the boys in back of the lines who can carry the tools and equipment with them to do the job right.

The Officer-Candidate School

It's time we got back to our ex-rookie, however. Let us — just to complete the cycle of Fort Monmouth training — assume that, instead of getting any of the prescribed assignments outlined above, he has displayed certain special qualities of initiative and leadership and has been recommended for the Officer-Candidate School.

Here he is one of a selected group of our very best soldiers, carefully picked from all branches of the service upon recommendation by their commanding officers — men who have displayed exceptional ability and personal qualities, far beyond the average, who possess certain minimum educational and other qualifications. He is one of a class of more than five thousand officer-candidates — that figure being in itself an indication of the size of our vast prospective army — who are being trained as communications officers.

That statement about the exceptional quality of these officer candidates is no idle flinging-about of adjectives, either. You'd agree if you, too, had seen as we did their smart precision on the parade ground — making even the best of ordinary troops look like a ragged squad of rookies, the determined vigor and snap with which they salute any officer near enough to make his shoulder straps visible, the grim concentration with which they follow classroom lectures and demonstrations. You'd be overwhelmingly gratified, too, at the sound democracy of an army that selects the vast body of its future officers from the best of the men in the ranks rather than from the politically influential or the registers of the social and academic elite. We'll say it again — the Officer-Candidate School at Forth Monmouth is an inspiring example of the American tradition at its best.

And now here is our Signal Corps ham proudly marching among them, the bright orange armband designating his new status jauntily decorating his left arm. With him are men from all other arms of the service, the vari-colored piping on their overseas caps — red, blue, green, orange — indicating their own particular branch.

Entering the OCD — Officer-Candidate Department, commanded by Lt. Col. G. L. Richon — was almost like joining the Army all over again. First our ham had to make proper application, accompanied by proper indorsement by his commanding officer. Then he was given a rigid physical examination. On being transferred to the OC school he was "processed" — an operation resulting in the extraction of every pertinent detail of his past history, including the filling out of a detailed questionnaire covering all his abilities, vocations and avocations. Then he was assigned

(*Continued on page 96*)

Easy Lessons in Cryptanalysis: No. 4

BY JOHN HUNTOON,* WILVQ

"'S'MATTA, pal — girl trouble?"

It was the dejected face of his protégé, Jim Bremer, framed in the door to the Wilson domicile, that brought from Ed Wilson this none-too-helpful greeting.

"Not me. Cipher busting's got me down. Here I am — what do I do: I take these lessons from you, go home and copy a lot of foreign stations sending code — and then I can't bust any of it. How'm I going to win the war if I can't decipher the stuff?"

They descended the stairs, Ed grinning. "All that scrap wire you collected for Uncle at Thursday's club meeting ought to cause at least a little trouble for Adolph and his gang. But as an expert cryptanalyst you won't bother him much for a little while, I'm afraid. What sort of material did you copy?"

"Five-letter code groups, mostly. I tried everything on 'em."

"You mean 'everything you've learned so far.' We've got a corps of specialists in Washington who probably can't break it all down right away themselves; after all, that's the idea! Maybe you're trying to bite off too much. Most of the stuff you can copy over the air is far too complicated for us to solve, since it requires the work of dozens of trained persons even for one message."

"What you mean is that I should stick to fundamentals for a while?"

"Exactly," Ed confirmed. "And that — as the b.c. announcers say — brings us to tonight's session, since I'm going to try to show you how you can distinguish general classes of cipher from each other, so far as we've learned them. Actually, the toughest problem of the cryptanalyst working with a new unknown cipher is to determine what class it is; once that is done, he knows he has the biggest part of the problem licked and actual solution is simply a question of time.

"Incidentally, you should remember that there also are commercial and government codes, making use mostly of words or at least pronounceable combinations of letters. Such a message, since it is not prepared by mechanical cipher methods, will resist our mathematical analyses because cipher letters bear no direct relation to plain text letters. For instance, the code word **ADORE** might mean, 'Advise date your division will be ready to march.' A portion of code text heard over the air might be, '. . . **ADORE MARIN LEDEL REFAT POTER TENET** . . .,' which might contain the same English text as a full-page letter. If this were actual cipher, the groups would not be pronounceable. There are also number codes, particularly used in weather reporting. My object is simply to warn you not to try what analytical systems we've learned on this kind of text, for they just won't work. And you'll hear lots of this sort of thing on the air, the length of groups varying anywhere from four to ten or fifteen letters."

"I guess that's my trouble," Jim lamented. "Jeepers — when I think of how much time and paper I've wasted! But lookit, Ed: If they can make such tough systems, do they ever use the simpler ones we can bust easily?"

Ed explained. "You see, in secret communication between fixed points such as large cities, such as between a government's foreign embassy and its home office, time is not quite so important. They can make use of complex systems. If the staff of cryptographic clerks takes half an hour to decode a message it probably won't lose the war; and the voluminous code books can be securely locked in vaults and constantly kept under guard.

"But in actual military operations, time is a most important factor. The commanding officer can't wait a half-hour for deciphering of messages from his scouts and spies concerning movement of his and the enemy's troops. Cipher systems can be made very complex, such as double transposition or double substitution or a combination of several methods, but they then become too slow to be of any use. You can imagine, too, what would happen if a spy or scout were captured by the enemy while in possession of a code book! The point is that for military operations work, a cipher must be translated at high-speed and have an easily-remembered key which means simplicity; the commander is content to let the enemy break it down eventually (he'll just keep changing its key) if he can get his information swiftly and, temporarily at least, in secret."

"I get it," Jim acknowledged. "But you were going to tell me how to distinguish one elementary cipher from another. I suppose you make a frequency count?"

"That's the opener. You remember that English text in any large amount follows certain percentages for its letters. As we've said, certain of these fall into definite groups used by the cryptanalyst. Here," and Ed wrote rapidly.

Group	*Percentage*	*Usual Limits*
aeiou	38	35–45
lnrst	33	25–35
jkqxz	2	0–5

* Assistant Secretary, ARRL.

"Suppose we take three cipher texts, each of the same plain text but prepared by a different system, and compare them. Thus:

(a) **SOIGC EUTIH HNRIA ALTTE ELDLG USOSR WYIDE TISAE AANEA IGEYI SBADB FHESN**

(b) **ITWEA IMNPC AXSJX SNAUS PXWXY AUWAZ WAGHS VGPIS UTHHM IWWSH IACIT WJWSN**

(c) **OHPOH KKNWQ HTERO AUSCI WVLVY ARWHT AZFLP XQLDA NZPTZ KLWET DSFKD ECWPF**

and make a frequency count of all three . . . thus," after a moment pushing the paper over to Jim.

	(a)	(b)	(c)
A	𝍸 II	𝍸 II	IIII
B	II		
C	I	II	II
D	III		III
E	𝍸 III	I	III
F	I		III
G	III	II	
H	III	IIII	IIII
I	𝍸 II	𝍸 I	I
J		II	
K			IIII
L	III		IIII
M		II	
N	III	III	II
O	II		III
P		III	IIII
Q			II
R	II		II
S	𝍸 I	𝍸 II	II
T	IIII	III	IIII
U	II	III	I
V		II	II
W	I	𝍸 II	𝍸
X		III	I
Y	II	I	I
Z		II	III

"Let me try the first one" Jim offered. "The **AEIOU** count is 26 in a total of 60 for a percentage of about 43 — good. **LNRST** totals 18 or 30 per cent — better. And **JKQXZ** is zero — peachy. That spells "transposition" in any language."

"Right, m'lad," confirmed Ed. "Another notable characteristic of transposition is that it nearly always breaks up word sequences and even frequent digrams and trigrams, so you won't find very many in a transposition. But go ahead with the next."

"Okay, professor: Cipher (b) totals 17 or 28 per cent for **AEIOU** — not good; **LNRST** is 13 or 22 per cent — worse; and there's 7 of the **JKQXZ** group. All that means no transposition. But . . . don't tell me, now . . . I total the five highest letters, in this case **ASWIII,** and get 31 or a percentage of 52. Is that good for simple substitution?"

"It's a bit high," Ed advised, "but the better test is to see if the first ten letters total comfortably over 70 per cent. The second high five, **NPTUX,** total 25 per cent, which plus 52 gives 77 per cent. Since **BDFKL** total zero, and are therefore good substitutes for **jkqxz** we may assume a simple substitution.

"There is one trick to watch for here, though. The encipherer might have chosen vowels for vowel-equivalents; for example, **A** might be **e, O** might be **a, I** might be **o,** and so on, so that a count of vowels would appear to be normal and the analyst might decide it was transposition, particularly if the consonants **lnrst** were similarly substituted for each other. The check on this is simply to see if there are any repeated sequences, which would normally be present in simple substitution as equivalents of repeated words or frequent digrams, whereas transposition would break them up. I find **ITW, WA, AU, SN, ZA** — all of which confirm our assumption of simple substitution. And now for number three."

"Coming up," Jim sang out. "Cipher (c) totals . . . less than 20 per cent for **AEIOU** and **LNRST,** nearly 17 for **JKQXZ.** So somebody has tampered with it! The highest five, **WAHKL,** total 21 or 35 per cent. That's low, huh?"

"Yes, but possible. The next five total 17 or 28 per cent, however, which shows that more than one alphabet has been used in substitution. Note that all but four letters of the alphabet have been used, too — something almost impossible in an English text this short unless multialphabet substitution were used. And while we may find an occasional repeated digram, there certainly are no longer repeated sequences. So our conclusion is a key-word system such as Vigenere or Beaufort."

"Hey! What're those?"

"Vigenere is the system we discussed last time," Ed explained, "wherein multialphabetic substitution is used, the alphabets being standard and their settings changing each letter in accordance with a keyword. Beaufort is substantially the same, except the alphabets used are a standard against a reversed — our "reciprocal" alphabet."

"I get it."

"Here's some data you can make good use of,

Jimmy," Ed offered. "Tables of letter-frequencies, digrams, trigrams, short words and the like. They're extremely helpful in all cipher work — the tools of the cryptanalyst. Always keep them handy while you're working on a new cipher, no matter what the type. And now it's past my bedtime, so I'll see you Monday. And don't forget your homework."

—...—

STHRL NPLEE HXMRU ATFOE MOHIE LEDSI AFSES ENAYD WG

MROES WOTUP EINBA RRSTA FYSEA SGYTA EEORF TAOSF HXEDP NUDIH NPAYO XAUIR TPSFO DLTIB

AYLMZ URWVR MGVIV HGRMZ NZGVF IZWRL RHGSV LMOSV HHVMG RZOJF ZORUR XZGRL MULIN VNYVI HSRKR MGSVO V ZTFV

Solutions to the cipher problems in the August issue are given on page 108.

ENGLISH TRIGRAMS

Below are shown the number of occurrences of the sixty most frequent trigrams appearing in the English language, according to a count of 25,000 three-letter sequences. This list, and others below, is part of the appendix material prepared by Frank R. Fraprie for use in the textbook "Elementary Cryptanalysis" (American Photographic Publishing Co., Boston), and is reproduced here through the courtesy of the publisher and Mr. Fraprie.

THE	1182	THA	155	ITH	111	AVE	84	STA	75
ING	356	ATI	148	TED	110	PER	84	INE	73
AND	284	HAT	138	AIN	108	ECT	83	WHI	71
ION	252	ERS	135	EST	106	ONE	83	OVE	71
ENT	246	HIS	130	MAN	101	UND	83	TIN	71
FOR	191	RES	125	RED	101	INT	80	AST	70
TIO	188	ILL	118	THI	100	ANT	79	DER	70
ERE	173	ARE	117	IVE	96	HOU	77	OUS	70
HER	170	CON	114	REA	95	MEN	76	ROM	70
ATE	165	NCE	113	WIT	93	WAS	76	VEN	70
VER	159	ALL	111	ONS	92	OUN	75	ARD	69
TER	157	EVE	111	ESS	90	PRO	75	EAR	69

ENGLISH DIGRAMS

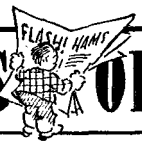
TH	1582	OU	361	LI	273	TA	225	TR	183	PA	165	NA	141	IL	118
IN	784	IT	356	RI	271	EL	216	BE	181	US	165	OL	141	OS	117
ER	667	ES	343	IO	270	ME	216	CE	177	MO	164	EV	131	UL	115
RE	625	ST	340	LE	263	EC	214	WH	177	OM	163	IE	129	EM	114
AN	542	OR	339	ND	263	IS	211	LL	176	AI	162	MI	128	NS	113
HE	542	NT	337	MA	260	DI	210	FI	175	PR	161	NG	128	OT	113
AR	511	HI	330	SE	259	SI	210	NO	175	WE	158	PL	128	GE	112
EN	511	EA	321	AL	246	CA	202	TO	175	AC	152	IV	127	IR	112
TI	510	VE	321	IC	244	UN	201	PE	174	EE	148	PO	125	AV	111
TE	492	CO	296	FO	239	UT	189	AS	172	ET	146	CH	122	CT	111
AT	440	DE	275	IL	232	NC	188	WA	171	SA	146	EI	122	TU	108
ON	420	RA	275	NE	232	WI	188	UR	169	NI	142	AD	120	DA	107
HA	420	RO	275	LA	229	HO	184	LO	166	RT	142	SS	120	AM	104

COMMON ENGLISH WORDS

Below are shown the number of occurrences of the one hundred words appearing most frequently in the English language, according to a compilation by Mr. Fraprie on 242,432 words of text.

THE	15568	HAVE	1344	BEEN	720	ITS	425	CAN	285
OF	9767	YOU	1336	HIM	708	OUT	387	MADE	284
AND	7638	WHICH	1291	ONE	700	INTO	387	WELL	283
TO	5739	ARE	1222	SO	696	OUR	386	OLD	282
A	5074	ON	1155	IF	684	THESE	385	MUST	280
IN	4312	OR	1101	WILL	680	MAN	383	US	279
THAT	3017	HER	1093	THERE	668	UP	369	SAID	276
IS	2509	HAD	1062	WHO	664	DO	360	TIME	273
I	2292	AT	1053	NO	658	LIKE	354	EVEN	272
IT	2255	FROM	1039	WE	638	SHALL	351	NEW	265
FOR	1869	THIS	1021	WHEN	603	GREAT	340	COULD	264
AS	1853	MY	963	WHAT	570	NOW	331	VERY	259
WITH	1849	THEY	959	YOUR	533	SUCH	328	MUCH	252
WAS	1761	ALL	881	MORE	523	SHOULD	327	OWN	251
HIS	1732	THEIR	824	WOULD	516	OTHER	320	MOST	251
HE	1727	AN	789	THEM	498	ONLY	309	MIGHT	250
BE	1535	SHE	775	SOME	478	ANY	302	FIRST	249
NOT	1496	HAS	753	THAN	445	THEN	298	AFTER	247
BY	1392	WERE	752	MAY	441	ABOUT	294	YET	247
BUT	1379	ME	745	UPON	430	THOSE	288	TWO	244

HAPPENINGS OF THE MONTH



ARE YOU AVAILABLE?

IN ADDITION to the calls for radio men and women published for your information in "U.S.A. Calling!", ARRL Headquarters daily receives appeals from government and commercial agencies for the names of amateurs qualified for various kinds of wartime radio jobs. There is work of every description: operating, maintenance, administrative — in shop, laboratory, factory, repair depot, offices, military units. Although right now there is a particularly urgent appeal for theory instructors, the available jobs run the gamut from solderer to physicist, from operator to top-drawer executive.

The ARRL Personnel Bureau can help any amateur, man or woman, to a radio job with better pay and more interesting work and, most important, an opportunity to make a more important contribution toward the winning of this war. Thousands of names have flowed through this bureau. We need more. We have little material now with which to work. We don't need to tell you that the need is urgent. It certainly is. If you have radio talents, they belong in the war effort.

If you are possibly available for a radio job, regardless of limiting circumstances, we want your registration on the adjoining blank (or a reasonable facsimile if you don't want to cut your copy of *QST* — or write us for a loose form). We'll pass along your name to all the agencies interested in persons of your qualifications. You will hear from them direct and can take or leave their offers as you wish. But *register* with us, and do it to-day!

XMTR REGISTERED?

ORDERS of the FCC require the possessor of every transmitter belonging to an amateur to apply for a certificate of registration. Full information will be found on page 29 of August *QST*, with more on page 29 of the September issue. If your transmitter is not yet registered, you should take care of the matter immediately in the method described, stating that you have just learned of the requirement.

FINANCIAL STATEMENT

AT THE instructions of the ARRL Board of Directors, the League's operating statement for the second quarter of this year is here published for the information of members. Lessened amateur activities made a reduction in operating expenses, while League publications enjoyed an increased sale, resulting in a tidy net addition to League funds.

STATEMENT OF REVENUE AND EXPENSES, EXCLUSIVE OF EXPENDITURES CHARGED TO APPROPRIATIONS, FOR THE THREE MONTHS ENDED JUNE 30, 1942

REVENUES		
Membership dues	$10,544.60	
Advertising sales, *QST*	17,977.37	
Advertising sales, Handbook	5,350.50	
Advertising sales, booklets	920.00	
Newsdealer sales, *QST*	9,567.34	
Handbook sales	32,513.45	
Spanish edition Handbook revenues	16.25	
Booklet sales	3,836.02	
Calculator sales	431.01	
Membership supplies sales	1,279.22	
Interest earned	280.18	
Cash discounts received	557.07	$83,273.01
Deduct:		
Returns and allowances	$3,321.96	
Cash discounts allowed	320.57	
Exchange and collection charges	92.20	
	$3,734.73	
Less: decrease in reserve for newsdealer returns of *QST*	183.66	3,551.07
Net Revenues		$79,721.94
EXPENSES		
Publication expenses, *QST*	$14,220.70	
Publication expenses, Handbook	15,153.83	
Publication expenses, booklets	1,506.80	
Publication expenses, calculators	148.40	
Spanish edition Handbook expenses	0.78	
Salaries	21,200.02	
Membership supplies expenses	797.69	
Postage	1,027.73	
Office supplies and printing	1,278.46	
Travel expenses, business	1,234.60	
Travel expenses, contact	25.65	
QST forwarding expenses	1,317.88	
Telephone and telegraph	736.63	
General expenses	1,416.77	
Insurance	205.16	
Employees' group insurance	35.20	
Rent, light and heat	1,117.90	
General Counsel expenses	260.01	
President's defense expenses	9.15	
Communications Dept. field expenses	68.50	
Headquarters Station expenses	128.94	
Loss on sale of capital asset	75.00	
Bad debts charged off	177.00	
Provision for depreciation of:		
Furniture and equipment	230.86	
Headquarters Station	108.97	
Truck	22.92	
Total Expenses		62,505.55
Net Gain before expenditures against appropriations		$17,216.39

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.

BEING DRAFTED?

Now that induction under the Selective Service is speeding up, it is well to repeat here that any amateur called into service should make certain to take along his amateur license and any of the following he possesses: Code Proficiency Certificate, commercial licenses, certificate of graduation from radio school, credits obtained in college engineering training. Early in the induction period each selectee is called before an examining board or officer, or given aptitude examinations or otherwise tested, to determine in what branch of the Army he will be most useful. It is at this point that the amateur needs to show evidence of his radio ability. When queried, orally or by questionnaires, he should state that his main interest in life has been amateur radio, that he has held a government license so-many years, built so-many receivers and transmitters. Any commercial experience will just about cinch the matter.

You can almost be assured of a communications assignment if you make the proper impression personally and on paper. Put all your steam into this first effort to get a radio assignment, since ARRL Hq. can no longer promote transfers to radio after the initial assignment. Most of the past cases handled through Hq. indicate that the selectee himself made the mistake of not having his license along during the examination period, or something of the sort.

ATLANTIC DIVISION NOTES

LIEUT. WALTER BRADLEY MARTIN, USNR, W3QV, the director of the Atlantic Division, is off to the wars, after many months of duty as communications officer at an eastern base. Being now quite a considerable distance from his home division and unable to look after its affairs, he tendered his resignation to President Bailey. The President has declined to accept it, feeling that it is an honor to the League to have a director serving his country, and that those who are in the armed forces should be permitted to serve out their term of office with such assistance in the meanwhile as is necessary from the alternate director. Everybody's good wishes are with Brad. In the meanwhile the reins are taken over by the alternate director, Herbert M. Walleze, W8BQ, whose new address is 42 North Rockburn Street, York, Pa.

ELECTION NOTICE

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

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

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

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

Executive Committee

The American Radio Relay League
West Hartford, Conn.

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

(Signatures and addresses)

The signers must be Full Members in good

(Continued on page 112)

Registration of Personnel Availability

If interested, file this form immediately with ARRL, West Hartford, Conn. Typewrite if possible. If you don't want to mutilate your copy of *QST*, make out your own form on letter-paper following this same style.

This registration replaces the one of last winter. If you registered then and are still interested in a new position, please register again on this form.

Keep our Personnel Bureau advised of any change of address, and do this separately from any notifications to our circulation department.

Let us know if your situation changes so that you are no longer interested in changing employment.

Your story is told chiefly by your report of education and experience, so give complete details thereon.

Name.....Call.....

Address.....

Age..... Married?..... Dependents?..... Draft Classification.....

Physical disability?.....

Present occupation.....

Education.....

.....

.....

.....

.....

.....

.....

Radio experience.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Licenses held.....

.....

For what kind of position do you wish to be considered:

☐ Code instructing	☐ Manufacturing executive	☐ Production superintendent
☐ Design and development	☐ Mechanics instructing	☐ Radio mechanic or repairman
☐ Drafting	☐ Operating supervision	☐ Research
☐ Engineering administration	☐ Operator, automatic	☐ Theory instructing
☐ Engineering testing	☐ Operator, manual	☐ .....

Other specialty:.....

Preference for location?.....Necessary salary $.....

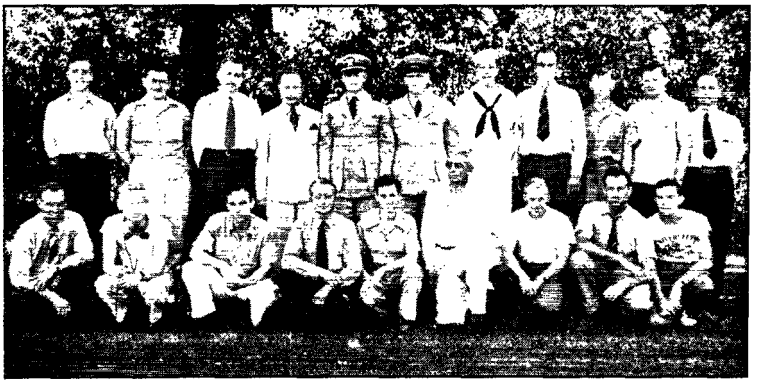
IN THE SERVICES

AT THE suggestion of a good amateur in the service, this month sees a change in form of this column and a call for an expression of opinion from its readers. The new arrangement allows us to list more names per month, by grouping them by services, districts and alphabetically by call letters. The object is twofold: to list more names, and to make them easier to find.

Compare this with past issues, decide which you like and write us your opinion. Whether we continue this form or revert to the former system will depend entirely on your reaction, so it is up to you. Drop a card to "In the Services" and say, "I like the new form," or, "I like the old form," and we will let public opinion decide.

SIGNAL CORPS

1AJY, Raulins, 2nd Lt., APO 887, New York.
1BIW, Clarkin, 1st Lt., Houlton, Maine.
1ERH, Wise, 2nd Lt., Ft. Monmouth, N. J.
1FVR, Gale, 2nd Lt., Ft. Monmouth, N. J.
1IOB, Rockwood, 2nd Lt., Ft. Monmouth, N. J.
1IBS, Rigney, 2nd Lt., Ft. Monmouth, N. J.
1IMP, Maceieski, Pvt., Ft. Monmouth, N. J.
1KJT, Bibisi, Pvt., Ft. Monmouth, N. J.
1KKG, Skilton, Pvt., Ft. Monmouth, N. J.
1LNR, Joyce, Major, foreign service.
1MID, Stuart, Pvt., Ft. Monmouth, N. J.
1MKF, Turner, Pvt., Ft. Monmouth, N. J.
1MVT, Warner, 2nd Lt., Ft. Monmouth, N. J.
1NJB, Dowd, Pvt., Ft. Monmouth, N. J.
1NRV, Wicke, Pvt., Ft. Jay, N. Y.
1NUF, Olsen, 2nd Lt., Ft. Monmouth, N. J.
2CHZ, Eitelbach, 2nd Lt., Ft. Monmouth, N. J.
2DQV, Abrams, Pvt., Ft. Monmouth, N. J.
2DUR, Munzer, Lt., OCSigO., Washington, D. C.
2HAP, Gardner, Lt., Ft. Dix, N. J.
2HFC, Hutchinson, 1st Lt., OCSigO., Wash.
ex-2JKS, Emanatian, Pvt., Moorehead City, N. C.
2KWC, Grishin, Camp Crowder, Mo.
2LJQ, Potter, 2nd Lt., Ft. Monmouth, N. J.
2LRG, Jeffries, Ft. Monmouth, N. J.
2MCD, Koralko, Pvt., Ft. Monmouth, N. J.
2MDJ, Althoff, Corp., Ft. Monmouth, N. J.
2MHB, Althoff, Pvt., Camp Crowder, Mo.
2MOW, Morgan, 2nd Lt., Ft. Monmouth, N. J.
2NCY, Spillner, Lt., Ft. Dix, N. J.
2OKB, Rabinowitz, Pvt., Ft. Monmouth, N. J.
2PF, Talley, Major, foreign duty.
3AGH, Terry, Pvt., Ft. Monmouth, N. J.
3AKR, Holt, 1st Lt., OCSigO., Washington.
3CJS, Lathe, Sgt., Westport Station, Baltimore.
3CYT, Pyle, Capt., Lexington Signal Depot, Ky.
3ETL, Lownsbury, Pvt., Ft. Monmouth, N. J.
3ILU, Robertson, Pvt., Ft. Monmouth, N. J.
3IWF, Brimmer, Pvt., Camp Shelby, Miss.
3IYN, Ryscuck, 1st Lt., Canal Zone.
4EV, Adams, Capt., Temple, Texas.
4FCY, Hill, Lt., Schenectady, N. Y.
4FPG, Mayer, 1st Lt., Wright Field, Dayton.
4FWO, Branch, 1st Lt., Ft. Jackson, S. C.
4HRP, Bodine, Capt., Ft. Monmouth, N. J.
4ICL, Carlisle, Pvt., Washington, D. C.
4VK, Rice, 2nd Lt., Purdue Univ., Lafayette.
5APM, Serur, Technical Sgt., Pearl Harbor.
5EIJ, Woosley, Pvt., Ft. Monmouth, N. J.
5ERJ, Lipson, Major, OCSigO., Washington.
5GWD, Hall, 2nd Lt., India.
5HJC, Powell, 2nd Lt., Ft. Monmouth, N. J.
5HOL, Woodman, Capt., Ft. Monmouth, N. J.
5HUB, Luckie, 2nd Lt., Camp Bowie, Texas.
5JRQ, Bennight, Pvt., Rice Institute, Houston.
5KGV, Auten, Tech. Sgt., Camp Bowie, Tex.
6BZU, Peterson, Pvt., Camp Crowder, Mo.



Staff of the Naval Training School (Radio), U. of Wisconsin, Madison. *Front row* — L. to r.: Smith, 9NAK; Lytle, 9GOC/9WEO; Kennedy, 9UFX; Zindars, 9HCR; Chernikoff, 9HVM; Grove, 9MFR; Christenson, 9WET; Humphrey, 9AVM; Jensen, 9JEK. *Back row*—L. to r.: Gehrke, 9WJD; Hayes, 9DBI; Oakley, 9KTM/9KTN; J. L. Miller, Dir.; Lt. Cmdr. Schubert, 8ALW/8NC, Commanding Officer; D. M. Cozzens, CRM; Werderman, RM3c; Hull, 9PCX; Olson, 9IJV; J. J. Binder; Glen Bock.

6EEN, Kimball, 2nd Lt., Hill Field, Ogden, U.
6EOU, Borgia, Sgt., Ft. Mason, San Francisco.
6GVU/ex-KA3AA, Elser, Capt., Ft. Monmouth.
6IFP, Maryatt, 2nd. Lt., San Diego, Calif.
6IUF, Daily, Pvt., Camp Crowder, Mo.
6JVK, Lowe, Pvt., Camp Crowder, Mo.
6KUT, Andress, 2nd Lt., foreign duty.
6KWP, Comyns, Capt., Washington, D. C.
6MWF, Davis, Pvt., Camp Crowder, Mo.
6NBA, Libby, Pvt., Camp Crowder, Mo.
6NOJ, Ivey, 1st Lt., Camp Crowder, Mo.
6OSM, Stern, Corp., Ft. Monmouth, N. J.
6PMA, Magida, 2nd Lt., Ft. Monmouth, N. J.
6PT, Langrick, 1st Lt., Wright Field, Dayton.
K6RBC, Morgan, Lt., Honolulu, Hawaii.
6SGZ, Dockendorf, Pvt., Ft. Monmouth, N. J.
6SYP, Farnsworth, Ft. Monmouth, N. J.
6TEY, Hotchkiss, Lt., Wright Field, Dayton.
6TJE, Sullivan, Corp., Camp Crowder, Mo.
6TNN, Matthew, Sgt., Montgomery, Ala.
6TRB, Weeks, Pvt., Camp Crowder, Mo.
6UOO, Young, Dodge Radio School, Valparaiso.
7DRF, Lindberg, 2nd Lt., Ft. Monmouth, N. J.
7FNS, Cowen, 1st Lt., Lexington, Ky.
7HEL, McClain, Camp Crowder, Mo.
8AUA, Bonnet, Pvt., Camp Crowder, Mo.
8CAB, Schlemmer, Capt., Washington, D. C.
8DNE, North, 2nd Lt., Ft. Monmouth, N. J.
8EKC, Davis, Pvt., Camp Claiborne, La.
8EPL, Montgomery, Capt., foreign duty.
8FTW, Zunich, Staff Sgt., Ft. Wayne, Mich.
8GOF, Spann, Pvt., Ft. Monmouth, N. J.
8LHB, Pvt., Camp Crowder, Mo.
8NEM, Touranjoe, Pvt., Camp Crowder, Mo.
8NUT, Quashnock, 1st Lt., Camp Crowder, Mo.
8NXF, Myers, Pvt., Camp Forrest, Tenn.
8ODZ, Rosenstein, Pvt., Camp Crowder, Mo.
8PQQ, Hix, 2nd Lt., Ft. Monmouth, N. J.
8QIJ, Mulhern, 2nd Lt., Ft. Monmouth, N. J.
8REI, Harris, Master Sgt., Pendleton Field, Ore.
8RTN, Tippett, Ft. Monmouth, N. J.
8TJK, Schmidt, Pvt., Camp Crowder, Mo.
8TUD, Schmidt, Pvt., Ft. Monmouth, N. J.
8UFP, Heim, Pvt., Ft. Monmouth, N. J.
8VLB, Markley, Pvt., Ft. Monmouth, N. J.
8WGT, Wine, 2nd Lt., Ft. Monmouth, N. J.
9BYO, Foerster, Pvt., Ft. Monmouth, N. J.
9BZV, Williams, Staff Sgt., Ft. Monmouth, N. J.
9CGV, Kunzman, Pvt., Camp Crowder, Mo.
9DOO, Gibbons, Lt., Camp Claiborne, La.
9DTF, Simms, Capt., Camp Crowder, Mo.
9EGG, Rogness, Coyne Elec. School, Chicago.
9EHC, Drumeller, 2nd Lt., Wright Field, Dayton, Ohio.
9FVJ, Turner, Pvt., Camp Crowder, Mo.
9HNH, Moline, Ft. Monmouth, N. J.
9JAU, Burt, Pvt., Ft. Monmouth, N. J.
9KTU, Austin, Pvt., Ft. Monmouth, N. J.
9KUI, Tabor, Sgt., Ft. Leonard Wood, Mo.
9KWR, Reeves, Pvt., Camp Crowder, Mo.
9LCQ, Michalenko, Pvt., Camp Crowder, Mo.

Pvt. Sperry Skilton, 1KKG, Signal Corps, enlisted in the Army, April 10th, went to Ft. Monmouth for the radio repair course and managed to track down and bag a three-day pass long enough to get married two months later. From then on he started working to be a Technical Sergeant as well as a husband. Congrats, OM!

9LQD, Nettesheim, 2nd Lt., Camp Murphy, Fla.
9MEP, Lawrence, Pvt., Ft. Monmouth, N. J.
9OCG, Minnich, Corp., APO 813, New York.
9OUQ, Houchin, Staff Sgt., Ft. Monmouth, N. J.
9PYS, Turner, 1st Lt., Ft. Monmouth, N. J.
9RMU, Soden, Staff Sgt., Ft. Monmouth, N. J.
9RQZ, Maki, 2nd Lt., Ill. Inst. of Tech., Chicago.
9SDP, Holcomb, Lt., address unknown.
9SHB, Seanor, Pvt., Camp Crowder, Mo.
9SQO, Klippel, 2nd Lt., Ft. Monmouth, N. J.
9SVJ, Gregorowicz, Pvt., Camp Crowder, Mo.
9SZJ, Claggett, Pvt., Ft. Monmouth, N. J.
9TCP, Dale, Pvt., Ft. Monmouth, N. J.
9TGL, Keyte, Lt., Middletown Air Depot, Pa.
9TKV, Richie, address unknown.
9TRK, Grenseman, Pvt., Camp Crowder, Mo.
9UCT, Kientz, Pvt., Ft. Knox, Ky.
9WHO, Lain, Ft. Monmouth, N. J.
9WUX, Tice, Pvt., Ft. Monmouth, N. J.
9YQE, Rippeon, 2nd Lt., Ft. Monmouth, N. J.
9ZBP, Geier, 2nd Lt., Ft. Monmouth, N. J.
9ZDS, Buck, Pfc., Ft. Omaha, Omaha, Neb.
9ZEU, Drawbaugh, Pvt., Camp Crowder, Mo.
9ZUT, Hoehne, Pvt., Ft. Monmouth, N. J.

NAVY—GENERAL

NY1AA, Lockwood, Lt. Cmdr., Noroton, Conn.
1GEH, Newman, Ens., Portsmouth, N. H.
1HPH, Rose, MM2c, Newport, R. I.
1NKO, Rich, RM2c, Anacostia, Washington.

2AOS, Biele, Lt., Canal Zone.
2BAF, Taber, Lt., Cambridge, Mass.
3FI, Mousley, Lt. Cmdr., Canal Zone.
3GTA, Nygren, Lt., Philadelphia, Pa.
3IEX, Schroeder, Lt., Dam Neck, Va.
3IWD, Sharpe, Lt., Washington, D. C.
3IXZ, Kerr, RM2c, Corpus Christi, Texas.
K4FAY, Haley, sea duty.
5FDR, Hollis, ACRM, Pensacola, Fla.
5IT, Shook, Lt., Cambridge, Mass.
6EQD, Stewart, Ens., Cambridge, Mass.
6LEF, Hilton, Chicago, Ill.
6MGL, Ruggles, RM2c, Treasure Island, Calif.
6QNX, Freeman, RM2c, address unknown.
6QVS, Collins, Sea1c, San Diego, Calif.
6RNQ, Forestal, RM2c, San Francisco, Calif.
6RNY, Sarno, ACRM, Quonset Point, R. I.
6UAI, Lindsay, RT2c, Okla. A & M, Stillwater.
8ALW, Schubert, Lt. Cmdr., U. of Wis., Madison.
8INF, Brooker, Alameda, Calif.
8LKP, Sears, Lt., Sunnydale, Calif.
9BTO, Becker, Boulder, Colo.
9FA, Glasscock, Lt., San Francisco, Calif.
9FQK, Johnson, Boulder, Colo.
9FYY, Juza, Boulder, Colo.
9GHY, Pawley, Washington, D. C.
9HIR, Anderson, Boulder, Colo.
9HXZ, Lewis, Boulder, Colo.
9IVT, Andrew, Washington, D. C.
9JBI, Latchford, RM2c, San Diego, Calif.
9NBK, Propst, RM1c, Treasure Island, Calif.
9PGS, Mallory, Washington, D. C.
9SZH, Wyman, Lt. Cmdr., Portsmouth, Va.
9WMP, Kuhlmeier, RM2c, sea duty.

AIR FORCES

1BYN, Dillingham, Technical Sgt., Bolling Field.
1JXE, Rice, 1st Lt., Kellogg Field, Mich.
1KKN, Ballou, 2nd Lt., Scott Field, Ill.
1KRW, Thayer, Capt., Dir. Comm., Washington.
1LGC, Daly, Pvt., Bradley Field, Conn.
2EOT, Wallenstein, Cpl., foreign duty.
2BMK, Thomas, Dir. Comm., Washington.
2HMY, Lieberman, Lt., address unknown.
2HPZ, Kleihans, Lt., address unknown.
2HVN, Ritter, Ft. Dix, N. J.
2IAQ, Gluss, 2nd Lt., Scott Field, Ill.
2IUM, Mahoney, Corp., Ft. Dix, N. J.

To ARRL Members in the Services:

This is to request you to notify us *well in advance* of any change of address.

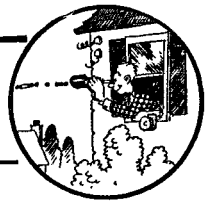
Many copies of *QST* are undelivered each month because notification was not received in time.

If it is impracticable to advise us of changes of address *at least 30 days in advance*, please cooperate by having *QST*, your ARRL bulletins, etc., delivered to your home, arranging to have them forwarded from there if desired.

— David Houghton, Circulation Manager

2LEE, Watson, address unknown.
2OFD, Bellavia, 1st Lt., Ft. Dix, N. J.
3DPU, Pemberton, Capt., Dir. Comm., Wash.
3DQ, Wilson, Capt., Dir. Comm., Washington.
3ELA, Marsh, 2nd Lt., Scott Field, Ill.
3JNV, McClelland, 1st Lt., Dir. Comm., Wash.
K4HNI, Friend, Sgt., foreign duty.
ex-5CDC, Hower, WO, Randolph Field, Texas.
5DAF, McReynolds, 2nd Lt., Scott Field, Ill.
5HPB, Brougher, 2nd Lt., Randolph Field, Tex.
5IQH, Olivier, Technical Sgt., foreign duty.
5KDA, Brewer, Lt., Randolph Field, Texas.
5KLY, Winchell, 1st Lt., Randolph Field, Texas.
6CAH, Nagle, 1st Lt., Dir. Comm., Washington.
6IIG, Boring, 2nd Lt., Scott Field, Ill.
6KZG, Rhines, address unknown.
6LJE, Rosellini, 2nd Lt., somewhere in Florida.
6MHZ, Abbett, 1st Lt., Hammer Field, Calif.
6MLC, Gibbs, 2nd Lt., Scott Field, Ill.
6MZD, Donkin, Lt., somewhere in Utah.
6QEU, Onigan, foreign duty.
6RIC, Bray, 1st Lt., Miami, Fla.
7BZS, Gerking, 2nd Lt., Scott Field, Ill.
8AET, Love, 1st Lt., Dir. Comm., Washington.
8CJT, Duckwitz, Capt., Ft. Knox, Ky.
8CS, Scripps, 1st Lt., Direc. Comm., Washington.
8GFJ, Gallier, Major, address unknown.
8IBH, Pratt, Cadet, Chickasha, Okla.
8JE, Hertzberg, 1st Lt., Dir. Comm., Washington.
8LWN, Seccomb, 2nd Lt., address unknown.
8NOB, Pidhayny, Sgt., Scott Field, Ill.
8RDM, Baer, address unknown.
8RYX, Holloway, address unknown.
8RZO, Fry, address unknown.
8SMN, Buehler, address unknown.
8THM, Geng, 2nd Lt., Scott Field, Ill.
8TZE, Lee, Sgt., foreign duty.
8UJB, Bailey, 1st Lt., Miami Beach, Fla.
8VEG, Sheerer, Lt., address unknown.
ex-9ATC, Barnes, 1st Lt., Dir. Comm., Wash.
9BBB, Corrigan, Lt., Ft. Myers, Fla.
9CCY, Nelson, Cpl., Maxwell Field, Ala.
9CWI, Collier, Lt., Direc. Comm., Washington.
9EVG, Turner, 1st Lt., Santa Ana, Calif.
9FJB, DeMuth, 2nd Lt., Scott Field, Ill.
9FLW, Gray, Lt., San Antonio, Texas.
9GOI, Stiglich, 2nd Lt., Scott Field, Ill.
9IIW, Hasty, 2nd Lt., Scott Field, Ill.
9LHF, Linn, Lt., Hendricks Field, Sebring, Fla.
9NEV, Willis, Lt., address unknown.
9NZA, Amick, Lt., Farmingdale, L. I.
9ODS, Strait, 2nd Lt., Scott Field, Ill.
9OWD, Griffiths, Capt., Dir. Comm., Wash.
9PID, McCurdy, 2nd Lt., Scott Field, Ill.
9RE, Monigan, 1st Lt., foreign duty.
9RRS, Heiderstadt, address unknown.
9TGC, Heizer, Corp., Scott Field, Ill.
9THB, Adamson, address unknown.
9TQB, Frizen, Capt., foreign duty.
9ULZ, Chambers, Master Sgt., address unknown.
9UWY, Fisher, Capt., Dir. Comm., Washington.
9ZDP, Barrow, Lt., Randolph Field, Texas.

EXPERIMENTER'S SECTION



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

PROJECT A

Carrier Current

REPORTS on work with carrier-current systems continue to outnumber those received on any of the other projects of the Experimenter's Section. This is probably only natural, since the gear involved is of a type with which most of us are best acquainted. Many of the gang are finding it a swell means of keeping the fist in shape and as an outlet for local rag chewing. In the more populated areas, local groups are beginning to expand to the point where they could well be of practical importance in an emergency. Any of these groups (mentioned in previous issues of *QST*) would be glad to have others join their nets. From the reports of results obtained thus far, it would seem to be only a matter of time before activity grows to the point where intercity relaying will be possible. While it is often found that the range which can be covered in urban locations is limited, the communities are close together, often merging. In the rural areas, open power wiring often makes up for the greater distances between towns.

Derwin King, RFD 4, Box 253, West Monroe, La., has built a transmitter and converter similar to those described in March *QST* chiefly from salvaged broadcast-receiver parts. With this equipment, he has been able to pick up his signal at a point 4 miles air line (7½ miles by wire) from the transmitter. He would like to hear from anyone in his vicinity interested in c.c.

Clifford Paterno, 104–44 108th St., Ozone Park, N. Y., has a transmitter and receiver under construction and would like to get in touch with others interested in establishing communication.

W9FHS has a rig running about 40 watts to a 75T and a converter with a stage of r.f. working into his 101X. He would like to contact others in the Chicago area.

Robert Stephenson, jr., 283 Bowman Ave., Merion, Penna. has worked 3 miles with gear built from the March *QST* article and is anxious to make other contacts.

Reg Tibbetts, W6ITH, reports having worked up to 12 miles on an open-wire line in the country. The line itself was a 2300 volter but the transmitter was fed into a 120-volt secondary line.

Robert Meagher, 157 Boston St., Salem, Mass., has been working his friend Thomas Reid a half-mile away ever since March, but they would like to contact others in the Salem area. Meagher has now replaced the 6L6 in his transmitter with a 10 and is running 45 watts input.

W9TWW, 736 Buena Ave., Chicago is interested in contacting anyone in his vicinity with c.c. He is also working on a light-beam system.

W8VWX is all set to go with transmitter and receiver and wishes to contact others in Cleveland. He gets a good signal six blocks from the transmitter on test.

W3JGJ, 1116 Staples St., N. E., Washington, D. C., is anxious to find someone to communicate with in the District. He can be reached by telephone at LI-2035.

W6SLF reports that a sizeable group in the Burbank area, consisting of W6SYT, W6UBB, W6QQX, W6UCW, W6LGP, W6UFH, W6UTZ, W9TAB/6 and several others, are busy building equipment for carrier current.

W6ULE has rigged up a power plug, 0.1-μfd. condenser and a 60-ma. dial bulb or neon bulb in series. He uses this arrangement plugged into a wall socket as an indicator for transmitter output. Different appliances in the house can be turned on and the brilliance of the bulb noted. Those which by-pass most of the current can be determined in this manner. Strange though it seems, the electrical fixtures which have the highest wattage rating do not always seem to by-pass the most r.f.

PROJECTS C & G

Audio-Frequency Induction & Earth-Current Communication

I NOTICED in the latest issue of *QST* that you are reviving experimental work on audio-frequency or induction transmission during the wartime radio ban. At one time I was interested in this method of communication and made several enlightening but unfruitful experiments in this field, and I thought that you might find an account of them of interest. At the time, I was attempting to develop a method of communication requiring no license and one which could be installed cheaply in any car.

Both electrostatic and electromagnetic methods were tried with approximately the same results. In the electrostatic system, a microphone and battery were connected in series with the primary of a high-ratio transformer. One terminal of the secondary was connected to ground, while the other was connected to a large metal plate. For receiving, the metal plate was connected to ground through a pair of high-resistance headphones. Step-up transformers of all types, including neon-sign transformers, mike transformers and even Ford spark coils were tried in an attempt to increase the receiver sensitivity. Under the best conditions, however, the greatest DX possible was about 12 feet, which was hardly worth the effort.

In the electromagnetic system, two coils, square in shape and about 10 feet on a side, wound with 100 turns of bell wire, were constructed. In series with one of the coils the mike and battery were connected, while a step-up transformer, with the high-resistance 'phones across the secondary, was connected in series with the second coil. Again, the maximum range worked out to be about 12 feet with the coils in the same axial plane.

A high-frequency buzzer was substituted for the mike in both cases with a slight increase in range. It was interesting to note that in both cases an increase of power does not increase the range but merely the intensity of the signal within the aforementioned range. The signal strength remains constant out to a given distance and then drops off suddenly, as contrasted to the smooth variation of radiated signals with distance.

Perhaps if a vacuum-tube amplifier were used in the receiver and more effective systems for emitting the field were devised, more distance might be obtained. However, at the present stage of the game, it would seem that audio-frequency transmission is decidedly impractical. — *C. F. Rockey, W9SCH.*

During the early days of World War I when "wireless stations" were shut down, the writer and a friend accidentally set up an audio-induction system that worked satisfactorily over a distance of about a mile. The inductance was a wire (all the scraps of magnet wire we could find) which ran about half a block at a height of ten to fifteen feet and was grounded at the end. The station end of the loop and a water-pipe ground were connected to the center of a d.p.d.t. switch. One side of the switch went to a pair of headphones, while the other went to a key, buzzer and battery in series. The signals in both directions were entirely satisfactory and, of course, at that time there were no b.c.l.s. to bother.

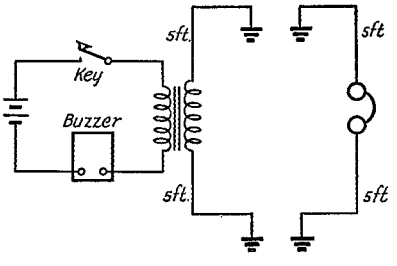


Fig. 1 — With this simple arrangement and a pipe separation of only 10 feet, W9TWW has been able to work a distance of 75 yards without difficulty.

With the high-gain amplifiers and fairly-powerful audio oscillators available now, I see no reason why such a system could not be made to work over similar distances with much smaller loops, or over much greater distances with the same size loops. Interference with telephone circuits is a possibility, but with care in the placement of the loop, it seems unlikely. I am following *QST* reports of results of experiments with such systems with much interest. — *Harry B. Miller, W9AB.*

I have been able to work up to a distance of 75 yards with the simple system shown in Fig. 1. The grounds were only 10 feet apart at both transmitter and receiver.

In the last war, the French and English used a similar system in scout work for distances up to 5000 feet. In this case, only a headset was used between the grounds at each station. Each headset was used both as microphone and receiver without supplementary power. Using that system, I have been able to cover a distance of 50 yards and it worked fine with short distance between grounds. Longer ground bases would doubtless be required for working longer distance. In my tests, I found that a low-impedance 'phone, such as an old Bell Telephone receiver, is the only type which would work. — *E. R. Perl, W9TWW.*

In the earth-current field, I have done a little experimenting as to the directive effects in transmission. I used an old Ford spark coil for a transmitter and a pair of grounded headphones for a receiver. When the ground connections of both transmitter and receiver are in the same axis, maximum DX results; when the axes are parallel, a drop in DX is noticed; when the axes are at right angles, minimum DX results. I would like to know of anyone else in this neck of the woods who is interested in this project. — *Robert Stephenson, jr., Merion, Pa.*

PROJECT D

R.F. Induction Fields

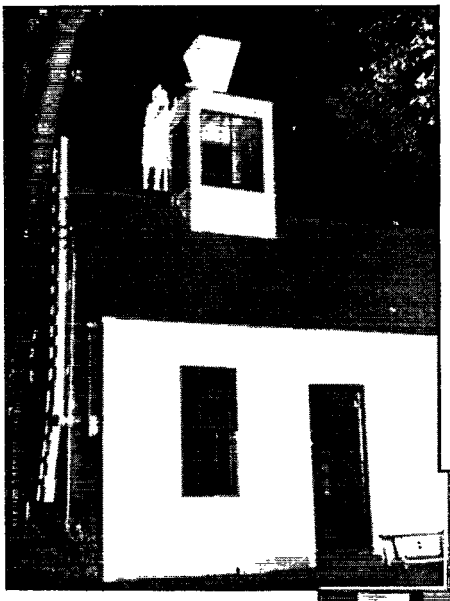
I HAVE just completed the construction of an induction transmitter along the general lines of that given in *QST* for March, and work regular schedules with Thomas Keefe, a block up the

street. Tom is using a 6V6 e.c.o. modulated with a code-practice oscillator, since I have no b.f.o. in my receiver. The rig here is a 59 e.c.o. which puts out a nice signal with no antenna. We are still very busy trying to set frequencies so as not to cause interference to b.c.l.s. and also trying to make sure that our field strength is within the limits specified by the FCC — *Francis P. Hanes, W5IIQ.*

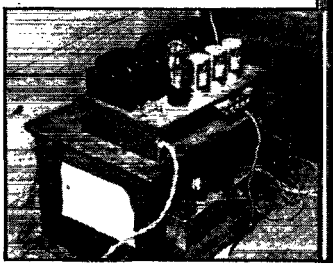
PROJECT E

Acoustic Aircraft Detection

INSTEAD of additional technical information on acoustic aircraft detectors this month, we are giving a complete description of a working installation in Newburyport, Mass., forty miles north of Boston.



The American Legion Aircraft Warning Post at Newburyport, Mass. The acoustic detector permits observations to continue from indoors during bad weather. W1IIN's XYL is shown in a downpour of rain at midnight. The amplifier may be made up chiefly of b.c. replacement parts.



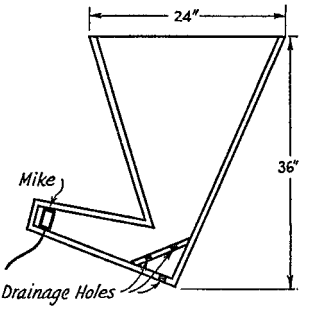


Fig. 2 — Cutaway sketch showing construction of the horn used in the AAD installation in Newburyport. The mike is protected from the weather by the drain holes in the baffle and bottom of the horn.

Mr. Henry Mack, W2MQV, accosted the operators of a local American Legion Aircraft Listening Station and suggested the use of an AAD amplifier system to enable the men to keep out of bad weather and to increase their effective aural range. His offer was accepted, and last March such a system was installed. All the observers agree that their effectiveness has been greatly increased by the use of this apparatus and enthusiastically recommend its adoption by other such groups.

The observation post is ideally located on a hill on the outskirts of the town and occupies a small building, originally a tool shed in a local cemetery. The tower was added for the convenience of the observers before the AAD was installed. This provided a convenient base for the horn, as may be seen in the photograph. The amplifier is mounted in the loft directly under the tower, protected from the weather yet allowing short leads to the speaker.

The horn, a rough sketch of which is shown in Fig. 2, is mounted about 25 feet above the ground, while the crystal microphone therein feeds directly into a pre-amplifier using a 57-type tube which is conventional, except for the use of a larger-than-usual coupling condenser to the following stage and a 5-meghom shunt resistor across the mike. This seems to give the best low-frequency response for airplane engines and is less sensitive to high-pitched whistles, auto horns and the like. This stage is then resistance-coupled to a 56

(*Continued on page 108*)

Training Auxiliary Operators for WERS

Typical Questions and Answers for Radiotelephone Third Class Exam

BY JOHN HUNTOON,* W1LVQ

SINCE tens of thousands of amateurs are in military or other government communications service, it may safely be said that no community planning a WERS unit has a sufficient number of already-licensed persons to man the stations necessary to provide enough two-way emergency channels. It therefore falls the duty of each radio aide and his assistants to select desirable personnel for rapid training to secure an FCC operator license and then a WERS permit.

A third-class radiotelephone operator permit is the most easily obtained operating authorization available from FCC, requiring simply the passing of examination Element One covering commercial rules and regulations. The certificate obtained is sufficient "technical" qualification to secure a WERS operator permit, however, and radio aides wishing to produce a sizeable number of operators in a minimum of time should direct their training efforts toward this certificate.

Selection of class personnel should be discussed with local CDC officials. Probably it will be desired to give the course to the present staff of telephone operators at the control center, and perhaps to some air-raid wardens as well. A majority of the class, however, should come from other sources to provide a separate trained group of radio operators which, if necessary, can function separately and simultaneously with normal telephone communication. Personnel should be selected on the bases of nearness to CDC or sector warden WERS installations, availability on short notice (don't count heavily on war plant workers, for example!), ability to speak clearly and write neatly and legibly, and any personal qualifications your committee may set up.

Any commercial operator after a brief review of the material, or any amateur after intensive "boning up," will be able to serve as an instructor. A short, intensive course could be set up covering six hours, divided into two-hour periods. It might be laid out as follows:

First hour: The instructor may well spend the preliminary part of this period in briefly describing the background of radio operating, regulations, and the need for licensing and control; the remainder should be used in a general exposition by the instructor of the more important commercial rules and regulations.

Second and third hours: With the background specified, students and instructor may take up individual typical questions and answers in examination Element One, including a detailed discussion of each and a description of a practical example which will illustrate the regulation applicable in each case. Home study required.

Fourth and fifth hours: Though not legally required for the license itself, probably most important of all to produce results will be these two hours devoted to simulated operating, radiotelephone procedure exercises, gaining skill in phonetic word lists, practising calls and signoffs, handling dummy messages in CDC form, and the like. Have 2½-meter equipment on hand in the classroom for demonstration purposes — with reasonable care to prevent stray radiation you can give students practice in two-way message handling between adjacent rooms with antennaless transceivers. Familiarize students with converted Minilog forms, or whatever log system you choose. Remember the objective is to make operators, not merely licensees.

Sixth hour: Review of typical examination questions as a "refresher" period.

The instructor will find the appendix material on commercial radio regulations appearing in "Study Guide and Reference Material for Commercial Radio Operator Examinations" quite helpful in preparing his preliminary talks and general expositions of the regulations. This booklet may be secured (if not out of stock) from the Superintendent of Documents in Washington, D. C., for 15¢ (no stamps). Students may use the question-and-answer material at the end of this article for home and class study.

The selective answer type of examination is not used in Element One; the applicant must write out his individual answers in longhand. There are ten questions, each counting ten percent; three are on material in the Communications Act of 1934, two on the general Radio Regulations (Cairo revision), and five on FCC rules and regulations. The subsequent study material will be found divided into those classifications.

Remember that the FCC has extended to WERS trainee groups the privilege of "resident" examinations for the third-class radiotelephone operator permit. The municipality/licensee should communicate with the district radio inspector, furnishing the names of the applicants and the person designated to supervise the examination — who might well be the radio aide. Before the examination can be taken it will be necessary that each applicant furnish birth certificate or other

* Acting Communications Manager, ARRL.

proof of citizenship, and two full-face head-and-shoulder pictures 2½ × 2½ inches; point this out to your class at its initial meeting so they may begin immediately to procure these needed items. Fingerprint cards are also necessary, and the coöperation of the local police department should be requested for this work. FCC will not authorize such resident examinations, however, until application for station license has been submitted; such application may have to be bare of WERS operator permit requests, at first!

—•••—

On the following pages we reproduce typical examination questions as published by the FCC in its study guide, together with appropriate answers as they might appear on a correct test paper. Parenthetically added to each question is an index reference to the pertinent section of the particular document involved. Knowing this material thoroughly, an applicant should not have the slightest difficulty in passing Element One.

On the Communications Act of 1934:

***Q.* State five grounds on any one of which the Federal Communications Commission has authority to suspend a radio operator's license or permit (Sec. 303 (m)).**

A. 1) Willful damage to radio apparatus.

2) Violation of international radio laws or FCC regulations.

3) Transmission of superfluous signals, or profane or obscene language.

4) Willful or malicious interference to other stations.

5) Transmission of false call letters.

6) Transmission of false SOS.

7) Insubordination to master of ship or aircraft on which employed.

***Q.* Is an operator subject to the penal provisions of the act if he violates the terms of a radio treaty to which the United States is a party? (Sec. 303 (m)).**

A. Yes.

***Q.* State at least two provisions made in the Communications Act to ensure the priority of communications or signals relating to ships in distress (Sec. 321 (b)).**

A. 1) All radio stations shall give absolute priority to radio communications or signals relating to ships in distress.

2) All radio stations shall cease sending on all frequencies which will interfere with hearing a radio communication or signal of distress.

***Q.* In what class of radio station and under what conditions is an operator permitted to adjust the transmitter for a maximum of radiation without regard to the interference produced? (Sec. 321 (a)).**

A. When sending a distress message from a ship station.

***Q.* In what cases may a transmitter on shipboard be adjusted to produce a maximum of radiation irrespective of the interference which may be caused? (Sec. 321).**

A. When sending a distress message.

***Q.* What communications, if any, are not subject to the secrecy provisions of the Communications Act? (Sec. 605).**

A. Any radio communications broadcast for the use of the general public, or relating to ships in distress.

***Q.* State in your own words the prohibition, if any, against the transmission of false calls and communications relating to distress (Sec. 325 (a)).**

A. No person shall knowingly transmit any false or fraudulent signal of distress or communications relating thereto.

***Q.* State in your own words the law regarding the transmission of false or fraudulent signals of distress or communications relating thereto (Sec. 325 (a)).**

A. Same as previous question.

***Q.* State in your own words the substance of the Communications Act that is provided to ensure the secrecy of radiograms (Sec. 605).**

A. No person receiving or assisting in receiving, or transmitting or assisting in transmitting, any communication by wire or radio shall divulge or publish the message to any person other than the addressee, except on demand of lawful authority. No person may use the text of any radio transmission not specifically addressed to him for his own benefit or that of anyone else not entitled to the information.

***Q.* Does the Communications Act of 1934, as amended, contain any provision that prohibits the interception, use, and publication of radio communications? (Sec. 605).**

A. Yes.

***Q.* What form of language if transmitted by an operator or other person makes him subject to the penal provisions of the Communications Act? (Sec. 326).**

A. Obscene, indecent, or profane language.

***Q.* What provisions are made in the Communications Act to ensure intercommunication between stations in the mobile service? (Sec. 322).**

A. Every station open to general public service shall be bound to exchange radio communications with any other general public service station including ships at sea and aircraft.

***Q.* Does the Federal Communications Commission have authority to issue a radio operator's license or permit to a citizen of a country other than the United States? (Sec. 303 (l)).**

A. No.

***Q.* Has the master of a ship radiotelephone station the authority to forbid the**

transmission of a message by anyone on board? (Sec. 358).

A. Yes.

***Q.* Has the master of a ship station the authority to regulate the transmissions and reception of messages on shipboard? (Sec. 358).**

A. Yes.

***Q.* Under what conditions is the utterance or transmission of a false or fraudulent signal of distress or communications relating thereto permissible? (Sec. 325 (a)).**

A. Under no conditions.

***Q.* Under what conditions is the utterance of obscene, indecent, or profane language by means of radio communication permissible? (Sec. 326 (m)).**

A. Under no conditions.

On the General Radio Regulations (Cairo):

***Q.* What is the radiotelephony safety signal? (Art. 24–26).**

A. "SECURITY," repeated three times.

***Q.* Under what conditions may a mobile station, if necessary, disregard the General Radio Regulations (Cairo)? (Art. 24–1).**

A. When sending a distress message.

***Q.* What is the radiotelephony urgent signal? (Art. 24–22).**

A. "PAN," repeated three times.

***Q.* What signals and messages are forbidden by international agreement? (Art. 22–1).**

A. Superfluous signals, false distress messages, fraudulent call letters.

***Q.* What precaution must an operator observe before proceeding with a transmission? (Art. 17–2).**

A. He must check the channel to be used to make certain he will not interfere with another station.

***Q.* What does the receipt of the signal "PAN" transmitted by radiotelephony indicate? (Art. 24–22).**

A. "PAN" is the urgent signal, indicates that a transmitting station is in imminent trouble.

***Q.* What should an operator do if he intercepts the word "SECURITY" repeated three times? (Art. 24–28).**

A. He should listen closely, copying down any immediate subsequent transmission since it will probably contain important weather or other information; meanwhile, of course, not doing any transmitting.

***Q.* Under what circumstances may the signal "SECURITY" be transmitted in radiotelephony? (Art. 24–26).**

A. When the transmitting station has an important message concerning the safety of ships or aircraft, such as important weather information.

***Q.* The urgent signal sent by an aircraft and not followed by a message indicates what? (Art. 24–22).**

A. That the aircraft is in trouble and is being forced to land.

***Q.* What obligation rests on an operator intercepting the signal "PAN?" (Art. 24–22).**

A. He should keep his own transmitter silent, monitoring the channel until the urgent message is completed.

***Q.* What procedure must be followed by a radio station receiving a distress call from a mobile station which is unquestionably in its vicinity? (Art. 24–11).**

A. The station must acknowledge receipt at once, standing by for traffic from the ship in distress.

***Q.* What essential information should be transmitted in a distress message? (Art. 24–6).**

A. The name of the ship or aircraft in distress, location as closely as possible, nature of the distress, nature of the help desired, and any further information which will facilitate assistance.

***Q.* By what authority may the operator of a ship or aircraft station transmit a distress call or message? (Art. 24–4).**

A. By the authority of the master.

***Q.* What is the international distress signal to be used in radiotelephony? (Art. 24–4).**

A. MAYDAY.

***Q.* What does the interception of the word "MAYDAY" transmitted by telephony announce? (Art. 24–4).**

A. That the transmitting station is in distress.

***Q.* What radio waves may be used under the provisions of the treaty in transmitting distress messages in case of an emergency by: (a) Aircraft stations? (Art. 24–3).**

A. Any channel being monitored by land or mobile stations capable of helping them.

***Q.* State the priority of radio communications in the mobile service (Art. 26).**

A. 1) Distress calls and communications relating thereto.

2) Communications preceded by an urgent signal (PAN).

3) Communications preceded by a safety signal (SECURITY).

4) Communications relating to radio direction-finding bearings.

5) Government radio telegrams.

6) All other communications.

***Q.* What information must be contained in a distress message transmitted in an emergency, from a radio station aboard aircraft flying over land? (Art. 24–7).**

A. The aircraft should signal its position by

the name of its nearest locality and its approximate distance and direction from that point.

Q. What information must be contained in a distress message? (Art. 24–6).

A. Name of the ship or aircraft in distress, location as closely as possible, nature of the distress, nature of the help desired, and any further information which will facilitate assistance.

Q. When after having sent its distress message an aircraft station is unable to signal its position, what procedure shall be followed to assist others in determining its approximate location? (Art. 24–6).

A. It should transmit its call letters for some time so that radio direction-finding stations might determine its position.

On FCC Rules and Regulations:

Q. State at least two classes of stations which cannot be operated by the holder of a restricted radiotelephone operator permit (13.61).

A. 1) Standard broadcast stations.
2) Ship stations.
or
3) Television stations.
4) Any station employing A-1 emission.

Q. Under what conditions may the holder of a restricted radiotelephone operator's permit operate a station for which the permit is valid? (13.61).

A. Provided he does not make adjustments to the transmitter, as they must be made by a first- or second-class licensee; and the equipment is so designed that normal service cannot cause off-frequency operation or unauthorized radiation.

Q. State at least two classes of ship stations which the holder of a restricted radiotelegraph operator permit is prohibited from operating (13.61).

A. 1) Any ship telegraph, coastal telegraph or marine relay station open to public correspondence.
2) Any ship station licensed to use radiotelephony.
3) Any radiotelegraph station on a ship compulsorily-equipped with radio.

Q. Who is permitted to make adjustments or tests in the presence of the licensed operator responsible for the maintenance of the transmitter and under his responsibility for the proper operation of the equipment? (13.63).

A. Any person.

Q. Within what period of time must any person receiving official notice of a violation of the terms of the Communications Act of 1934, as amended, Treaty or Rules and Regulations of the Commission be answered? (1.391).

A. Within three days.

Q. What is the obligation of an operator whose license or permit has been lost, mutilated, or destroyed? (13.71).

A. He must immediately notify the Commission; and he may submit an application for duplicate.

Q. How may the holder of a radiotelegraph or radiotelephone first- or second-class license indicate to representatives of the Commission that he is legally qualified to adjust equipment operated by holders of restricted radiotelephone operator permits? (13.75).

A. By the posting of his license.

Q. How may an operator show proof of his legal qualifications to operate a radio transmitter? (2.52).

A. By the posting or presentation of his license.

Q. What is an operator of a radio station, who has submitted his license for renewal or applied for a duplicate license required to exhibit as his authority to continue operation of the station pending receipt of the license? (13.72).

A. A signed copy of the application or duplicate or renewal.

Q. What is the holder of a radiotelegraph or radiotelephone first- or second-class license, who is employed as a service and maintenance operator at stations operated by holders of restricted operator permits, obligated to post at the stations? (13.75).

A. His license or a verification card thereof.

Q. How may corrections be made in a log? (2.57).

A. By striking out the incorrect entry and inserting the new one; the correction must be initialed by the person making it.

Q. Is it lawful to erase an entry made in a station log? (2.57).

A. No.

Q. What are the Commission's requirements with regard to the retention of a radio station log? (2.54).

A. The log must be kept on file for one year. If distress communications are involved, however, the log must be kept until the Commission gives specific authorization to destroy it.

Q. How long must the licensee retain a station log which involves communications incident to a disaster? (2.54).

A. Until the Commission gives specific authorization to destroy it.

Q. What is the Commission's rule with regard to rough logs? (2.53).

A. Rough logs may be transcribed into desired form, but the rough logs must be preserved and made a part of the complete log.

Q. What procedure should one follow if he desires to resist an order of suspension of

his operator's license or permit? (1.411, 1.412).

A. He may make written application to the Commission within fifteen days of receiving the suspension order.

***Q.* What is the responsibility of a licensee of a radio station with respect to permitting it to be inspected by representatives of the Commission? (2.48).**

A. The station must be available for inspection by the representatives of the Commission at any reasonable time.

***Q.* Who is responsible for the control of distress traffic? (2.60).**

A. The station transmitting the message, unless it delegates that authority to some other station.

***Q.* Are logs subject to inspection by representatives of the Commission? (2.55).**

A. Yes.

***Q.* By whom may the log of a radio station be kept? (2.55).**

A. By the operator on duty, having actual knowledge of the facts required.

***Q.* Under what conditions may a distress message be retransmitted? (2.61).**

A. When the station in distress is not itself in a position to transmit the message; when the master of the second ship or aircraft believes that further help is necessary; or when the second station is directed to do so by the station transmitting the distress message originally.

***Q.* What tolerance in operating power is permissible under normal circumstances? (2.80).**

A. When the maximum power only is specified, the operating power should not be greater than necessary to carry on the service and in no event more than five percent above the power specified. When an exact power is specified, the operating power should not be more than five percent above or less than ten percent below such power.

***Q.* Under what conditions may a station be operated in a manner other than that specified in the station license? (2.63).**

A. During a period of emergency when normal communications facilities are disrupted.

***Q.* What is the Commission's rule with respect to measurement of the radio station frequency? (2.75).**

A. Measurement of the radio station's frequency must be provided by the licensee through a means independent of the frequency control of the transmitter.

***Q.* When may operation be resumed after a station has been notified to cease transmission because of interference to distress traffic? (2.62).**

A. When notified by the station issuing the original notice that no interference will exist, or upon the receipt of a general notice that the need for handling distress traffic no longer exists.

"Invasion"

BY WHITNEY S. GARDNER,* W3IBX

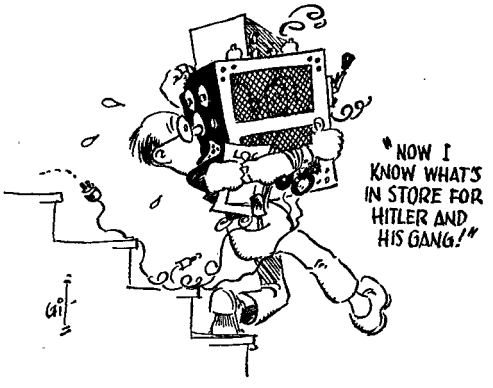
You have advanced to the point where a more appropriate setting should be provided for the rig. The cellar may be all right and you don't have to be particular about its appearance, but somehow it lacks dignity. So you decide on a little reconnaissance.

There's plenty of room in the attic but it's too hot in the summer and too cold in the winter. The kitchen, dining room and living room offer no possibilities. The master bedroom is not to be thought of and Janet's room is gradually changing from a nursery to a boudoir. The guest room is obviously the choice. It is rarely used and it seems a shame for all that space to go to waste. But to convince the XYL — there's the rub.

You are resourceful. Also, you have studied the technique of A. Hitler and, whatever else may be said of him, you grudgingly admit he gets results.

Trial Balloon. This is released by a casual remark to the effect that your receiver is acting up and you suspect dampness has got into it. She says to put a lighted bulb inside it for a few hours. You reply that you guess you'll bring it upstairs for a few days. She goes on reading.

Spearhead. You take the receiver up to the guest room, meeting practically no resistance, and set it on the dresser and establish liaison with a wall receptacle. After turning on the b.f.o. you



ask her to note the raspy tone. She replies that that station always has a raspy tone.

Appeasement. You ask whether she's given any further thought to tinting the kitchen wall, adding that you believe the weather is about right for painting.

Subversive Activities. You fill a shoe box with

(*Continued on page 51*)

* 4627 Briarclift Rd., Baltimore, Md.

ON THE ULTRAHIGHS

CONDUCTED BY E. P. TILTON,* W1HDQ

SOME months back, in suggesting a study of aerology as a likely substitute for amateur operating activity, we posed a series of questions the answers to which are available to anyone who is willing to devote a little time to reading up on the subject, and to observation of weather signs and their associated variations in u.h.f. wave propagation. Considerable response from amateurs who had, in times past, little interest in the ultrahighs, said, in effect, "You've started something — how about giving us the answers?" So, with news concerning things amateur reaching a new low, last month seemed a good time to present an outline of the various points whereon the amateurs in both radio and aerology meet on common ground. Our column for last month was to have been devoted to consideration of the fundamentals of temperature-inversion bending of u.h.f. signals; the first of a series of articles on which we've been doing spade work since December 7th. But the man with the blue pencil said it contained information vital to national interest and security — so no more on aerology until the unpleasant business at hand is successfully completed!

In the two months since this column last appeared a considerable number of reports have been received covering the openings of the f.m. band for sporadic-*E* skip. Contrary to our expectations, however, there has been very little evidence of multiple-hop reception. This is probably due to the fact that strength of certain stations well scattered through the band has prevented reception of weaker signals which might have been transcontinental in nature. Openings, in general, seem to have occurred at just about the same intervals as might have been expected had we been working the DX on Five, and the distance over which the strongest signals were received was similar to our 56-Mc. experience. F.m. DX came through at just about the same time of day, in every instance, as we were accustomed to expect the five-meter skip; which seems to rule out the frequently-expounded theory that time of day has nothing to do with band openings. The first f.m. DX reported broke through on April 16th and the last reported opening was on the evening of August 13th. Thus the "middle of April to middle of August" tradition has been maintained. The doings of the f.m. band will bear watching through the fall and winter months as well, in order that we may learn of any new evidence of aurora effect. Reports of any unusual reception on the f.m. band are always welcome.

*329 Central St., Springfield, Mass.

In what was to have been our column for last month we acknowledged DX reports from W1DLY/9, Prairie du Sac, Wis.; A. L. Caldwell, Jr., Brockton, Mass.; W1IKS, Worcester, Mass.; W9EIQ, Eldorado, Ill.; W5AJG, Dallas, Texas (a broadcast station operator, Leroy finds DX listening on the f.m. band rather weak stuff!); Bill Scott, Johnson City, Tenn.; W1IJ, Madison, Conn.; D. P. Cameron, Racine, Wis.; Robert S. Coe, Manchester, Conn., and W9YHZ, St. Louis, Mo.

C. S. Moore, Trenton, N. J., reports reception of what was apparently skip of some sort on a frequency between 70 and 80 Mc. on the night of July 21st. A Philadelphia television station, WPTZ, near 70 Mc., is the only signal normally heard near this frequency. The signal broke in about 9:50 and was gone by 10 P.M.

W8QHA writes that he is now an operator for the Illinois State Police. One of his duties is the monitoring of the u.h.f. police band, though his operating frequency is 1615 kc. On the morning of May 20th, between 1:45 and 2:15 A.M., he heard some cars working one another near the frequency of the Ottawa Police, 33940. Contacting Ottawa, cross-band, Steve had them call the cars and contact was established. Instead of being local mobile units it turned out that they were cars of the Carlisle Police Department, testing on the highway about 30 and 40 miles west of Carlisle, Pa.! Airline distance between Ottawa in north-central Illinois to Carlisle in south-central Pennsylvania is about 625 miles. This is not only a probable record for two-way f.m. work, but is almost certainly the only skip-DX QSO known to have taken place in this year of darkness, 1942!

Other reports of skip DX include the following: W9LTS, Moline, Ill., heard the Boston Police on August 5th between 7:15 and 8 P.M., and W2XMN, Alpine, N. J., on August 12th, coming in very strong from 5 to 10 P.M. W3QP, Blue Bell, Pa., reports W47NV, Nashville, Tenn., very strong from 9 to 9:45 P.M. on the 12th. W3AGV, Philadelphia, lists f.m. DX heard on June 10th, 11th, 21st, and July 5th. August 12th produced the strongest signals ever heard via skip, with W45V, Evansville, Ind., W47NV, and W55M, Milwaukee, at close to local strength between 7:30 and 8:30 P.M. W45BR, Baton Rouge, La., was heard on the 13th. W1DCH, Baldwinsville, Mass., lists W59C, W75C and W51C, all Chicago, heard on August 2nd; W51C on the 8th; and W59C, W55M, W51C, W47NV and W67C, on August 12th. He reports reception of stations as far away as W53PH, Philadelphia, on the 12th, indicating

that this was quite a night for atmospheric bending as well as skip.

Vernon Wintroub of Hollywood, Calif., reports reception of a station on 127 Mc., using the call SL-1, on the evening of July 7th around 8:30 P.M. He would like information on this one. Who knows anything about it?

The letter of W6BHM, quoted in full two months back, has brought a response from the other end of the transcontinental 56-Mc. reception reported therein. Alexander McKenzie, W1BPI, was the operator at W1FEX, situated on the summit of Mt. Washington, at the time the station was heard in California. Mac has the W1FEX log in his possession and it contains entries showing activity at the time the signal was reported by W6BHM. The date, March 18, 1933, suggests that this may have been one of those rare instances of F_2 layer reflection of 56-Mc. signals, rather than multiple-hop sporadic-*E*. Mac concludes: ". . . I am sure that we all give Wally Bowles credit for being there when the signal was. Doubtless we now all agree, in the light of accumulated knowledge since those happy old days, that 'to work 'em you have to hear 'em,' and to hear them the receiver must be turned on at the right time, at least!"

Our correspondence for the last two months furnishes a few new items for our "Who Is Where Department." Frank Grey, W9LLM/6, formerly of Downers Grove, Ill., writes that he is now doing telephone maintenance work in La Mesa, Calif. Frank is in a hurry for the war to be over — "This is the DX country, and I have a swell QTH!" His permanent address is 5141 Randlett Drive, La Mesa, Calif.

W3CUD writes that he is now a traveling supervisor of radio schools for the Signal Corps, with headquarters in Washington. His partner in those 4-hour Saturday-night QSOs, W3HDJ, is also in Washington, doing radio matériel expediting for the Signal Corps.

W1MEP, who probably has missed his u.h.f. activity as much as any ham in the country, writes that he is moving his gear down to Bennington from the shack on Glastenbury Mountain, Vt., in anticipation of a call from Uncle Sam. A slow-mending broken leg put Chet in 4-F on the first round, but he's Class 1 now, and may be on the way by the time this appears in print. Chet has a substitute for his amateur activity which is unique: after three months of infinite patience, he now has the wild rabbits coming up to his doorstep to eat out of his hand!

And here's a letter that had us guessing! Written on the stationery of a hotel in St. Louis, it was started in Sarasota, Fla., and concluded "somewhere in England." It is from Lt. Ansel E. Gridley, 341st Bomb. Squadron. If you fail to catch the name, perhaps the call will help — W4GJO — who used to make lots of noise on 28, 56, and 112 Mc., in Winter Park, Fla., and New Salem, Mass. As Communications Officer, Grid is having plenty of u.h.f. experience, though he can't say much about it right now. He sends his best to all the u.h.f. gang and is looking forward to the time when he can get back to the States and indulge in a little rag-chewing. He may be addressed as follows: Lt. Ansel E. Gridley, 341st Bomb. Squadron, A. P. O. No. 875, c/o Postmaster, New York City.

And here's this department's DX to date: From India comes a note from Sgt. Frank Platner, W8FGV, one of our most consistent 56-Mc. DX men. Frank says that things over there are not so bad, but he "kind of misses the old days on Five and Ten." The mail service from VU-land was very good, incidentally, so don't let distance keep you from dropping Frank a line now and then. Address: Sgt. Frank Platner, 910th Signal Co., Depot Aviation A.P.O. 1061, c/o Postmaster, New York City.

"Invasion"

(*Continued from page 49*)

choice tools and place it under the bed in the guest room.

Assault. Antenna and ground connections are established. Receiver is advanced from dresser to the table in the corner. You are tempted to test defensive power with a couple of holes in the wall but settle for a one-inch opening above the upper sash.

The All-Out. You take advantage of her absence and bring up the rig. You consolidate your gains by attaching feeders and key. Log and call books, notepaper and pencils are neatly arranged on the table.

Peace Offensive. You remark that W3XYZ was asking about her last night and that Jane had a new ivy clipping she was bringing over. You add that you were looking at some color charts and that pale green might look nice on the kitchen wall.

Occupation. You are elated over your quick victory and reflect that the only time you were in any real danger was the night you left the soldering iron on the candlewick bedspread. However, it wasn't hot — merely dirty — and left scarcely any mark. You reflect that it just takes careful planning, attention to detail and forceful execution.

Counter Attack. She greets you with a telegram. "Isn't it grand? Bob and Dorothy are coming Thursday and might stay a week. You'll have to get all that junk out of the guest room right away."

Retreat. As you stagger down the cellar stairs with the rig you mumble: "Now I know what's in store for Hitler and his gang!"

Operating Procedure for the WERS

BY JOHN HUNTOON,* WILVQ

FCC RULES and regulations governing the War Emergency Radio Service contain no instructions concerning operating procedure to be used other than to require that stations identify themselves at the beginning and end of each complete exchange of communications. It thereby becomes the obligation of the licensee, who doubtless will leave the matter to his radio aide, to specify tactical procedure to be followed in opening and closing net drills and tests, handling practice messages and alert signals, methods of keeping log, and similar policy. Since one of the causes for failure of amateur reactivation plans last year-end was a laxity on the part of some groups concerning operating procedure, and some do-as-you-please, haphazard ragchewing under the guise of civilian-defense communication, it is extremely important that our present plans of operation be foolproof in this respect.

What system of procedure is used is the choice of the radio aide. After a conference with his communications officer and other interested and qualified parties to determine any unusual or particular communications needs his community might have under its civilian defense set-up, he should specify custom-built procedure based generally on amateur radiotelephone practice.[1] This basis is logical; first, because it is the standard method of two-way radiotelephone communication in emergency work, and second, because it will be already familiar to much of the personnel administering and operating in the system. The following discussion and the adjacent tabulated information are here presented to assist radio aides in the preparation of their material. In addition, radio aides who have not had active network organizing and operating experience previously can gain much help by conferring with a nearby SCM, RM or PAM of the League's field organization concerning the practical problems often encountered.

It seems a foregone conclusion that, except for dispatching and special services, all general organization should be in the form of networks. Each station unit should at all times be under instructions from its immediate superior net control station. The radio aide should issue policy statements designating which stations may begin transmissions at which stages of an impending air raid. Unless there is a disruption of telephone communication, a subordinate unit should not transmit to its net control until called.

In calling a net together, a control station needs to give the complete letters of the called station as well as his own, not only because it is legally required but also because that information is necessary for other members of the net. After contact has once been established, a transmission burst should begin with, for example, "control to seventeen," or "seventeen from control," obviously being the station in charge of the net transmitting to unit No. 17. Identifying titles such as the name of a schoolhouse in which the unit is located might be used for sub-stations, so that after communication is once established the opening words of a subsequent transmission might begin with "control to Hawthorne . . ." Names of individuals or wardens should not be used for station identification at any time.

A standard form of message is specified by OCD for its telephone communication of incident reports from wardens and similar traffic, and the same form should be utilized for radio work so that staff officials will have identically the same information and in the same sequence whether radio or landwire is used. Also, by the use of such forms the receiving operator knows the general type of code group that is coming next and is able to copy rapidly.

Much ARP communication is coded and employs unusual letter and numeral combinations. For example, to report that "three incendiary bombs hit house in area 17, sector 4, at 8.37 P.M.; fire under control, no assistance needed," the coded message for radio transmission might be "A17 S4 3IB Report 21, 8.37 P.M." It is therefore important that operators be thoroughly versed in phonetic word lists. The following page carries the Western Union word list, plus other voice equivalents for radiotelegraph procedure. The phonetic "Robert" for "R" or "received" will be extensively useful.

As a sample of possible operating procedure, let us assume that of stations WQRR-42 through WQRR-49 making up the WERS unit for Glenview, Oregon, 42 is the transmitter used for dispatch work and contact with the main control center, 43 the Glenview net control station, and 44 through 49 the sector warden stations. Comes an air-raid alarm or the time for a regular test. Listening on the net frequency, we might hear something like this:

WQRR-43: Calling Glenview War Emergency Radio Service, calling Glenview War Emer-

* Acting Communications Manager, ARRL.

[1] A copy of the ARRL Communications Department publication containing these principles, *Operating an Amateur Radio Station*, is available at no charge to any member; at 10¢ to non-members.

gency Radio Service. WQRR-43 calling WQRR-44.

WQRR-44: WQRR-43 from WQRR-44. Okay here.

WQRR-43: Robert. WQRR-45 from WQRR-43.

WQRR-45: WQRR-43 from WQRR-45. Okay here.

WQRR-43: Robert. WQRR-46 from WQRR-43.

(No answer; control waits several seconds.)

WQRR-43: WQRR-47 from WQRR-43.

WQRR-47: WQRR-43 from WQRR-47. Okay here.

(This continues until all stations have been called. From then on, silence is kept until the breakdown or overloading of normal telephone circuits, which status should be determined by the air-raid warden in charge. This might then transpire:)

WQRR-48: Forty-eight to control. Telephone circuit is lost. I have traffic for you.

WQRR-43: Control to forty-eight. Robert. Go ahead.

(WQRR-48 then transmits the traffic he has, and the control station, WQRR-43, acknowledges or asks for fills.)

Before allowing his units, once they are licensed, to engage in test drills and participate in practice blackouts, the radio aide should school his operating personnel thoroughly in the system of procedure he and his communications officer select, whether dissemination of the information be by written memoranda or delivered in person at an evening meeting or two. Simulated emergency drills and tests should take place by voice *across an instructor's table* before any person is allowed to put a WERS unit on the air, particularly the mass-production type of operator it will be necessary to turn out of civilian raw material in many cases.

A — Adams	N — New York
B — Boston	O — Ocean
C — Chicago	P — Peter
D — Denver	Q — Queen
E — Edward	R — Robert
F — Frank	S — Sugar
G — George	T — Thomas
H — Henry	U — Union
I — Ida	V — Victor
J — John	W — William
K — King	X — X-ray
L — Lincoln	Y — Young
M — Mary	Z — Zero
Ø — Zē′-rō	5 — Fī′-yiv
1 — Wun	6 — Siks
2 — Too	7 — Sev′-ven
3 — Thuh-rēē′	8 — Ate
4 — Fō′-wer	9 — Nī′-yun

Example: WQRR-49 . . . William Queen Robert Robert Fō′-wer Nī′-yun.

In the organization and execution of any WERS unit, there will not be a great amount of time devoted to actual operating; we hope not, at least, realizing that only one thing can cause extensive operation. But even our test periods should be marked mostly by silence and standby status for most stations; necessary transmissions should restrict themselves to essential information, be escorted by snappy calls and signoffs. Since we amateurs will be present in the picture to a great extent as administrators and technicians and to a lesser extent as operators, we should not find it hard to resist the urge to "chew the fat" that was often our peacetime stimulus.

Strays

In all the textbooks and the popular handbooks you'll find it laid down categorically that all kinds of horrible things will inevitably happen to secondary cells if anything but distilled water is used for mixing the electrolyte in the first place and for topping up the cells subsequently. I wonder how many writers of the aforesaid books have founded their heavy warnings against the use of tap water on the results of practical experiments. Most of them, I'll wager, have been content to bank on what others have written before them. Personally, I don't think it matters two hoots whether you draw your water just as it comes from the tap or buy it distilled from the chemist. I think I'm right in saying that for years the G.P.O. people have used tap water widely for their secondary cells without noticing any ill effects. I, personally, never hesitate to use tap water, unless it's of the very hard variety. Even then, all seems to be well if you boil it first and allow it to cool and settle before putting it into the cells. — "Diallist" in *Wireless World.*

—···—

Silent Keys

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

William A. Camp, jr., W1MXL, Laconia, N. H.

Jules Cohn, W6JT, Oakland, Calif.

Ernest M. Crenshaw, W4DAV, La-Grange, Ga.

Cmdr. Malcolm P. Hansen, W9XM, WFA, Washington, D. C.

James Edgar Miller, W6NPL, Lynwood, Calif.

Guy D. Newland, W6BSA, Oakland, Calif.

John J. Watters, W2DZ, Port Richmond, N. Y.

How Recordings Are Made

No. 4—Playback

BY CLINTON B. DE SOTO,* W1CBD

THE best record ever made is just so much plastic and metal unless there is some way to re-convert into audible sound waves the message it imprisons.

And so we come to the topic of playback. That topic largely reduces itself to a consideration of pickups and their associated components. Good performance in the remaining elements of the reproducer system — the turntable and motor drive — is based in the main on the same considerations as those for good recording.[1] And, apart from equalization, in the matter of amplifiers and speakers the qualified amateur should require little further instruction.

Types of Pickups

The pickup is a device for translating into electrical voltage the mechanical motion of a finely-pointed stylus or needle riding in the record groove. There are two basic kinds of pickups — magnetic and crystal. Both are widely used, but the crystal type is now by long odds the most popular. This is chiefly because it is simpler — and therefore cheaper — to manufacture.

First to be considered is the magnetic pickup. There are two basic categories: (a) moving armature, and (b) moving coil. These are broad classifications, there being several special varieties which go by other names. For purposes of analysis, however, it is convenient to consider any reproducer whose electrical output is generated in a coil in a fixed magnetic field as a "magnetic" pickup.

The armature type in some instances is made with the winding on the armature proper and in others with a diaphragm-type armature and the winding on the poles. Other variations include the manner of suspending the coil or armature; i.e., full-rotating center-pivoted coil or armature with U-fields, or the half-rocker type with end suspension.

A typical magnetic pickup for lateral reproduction is shown in Fig. 1-A. With the movement of the armature, as it is vibrated by the needle in its groove, through the steady flux provided by the permanent magnet, a flux flows through the armature which induces a voltage in the coil. This voltage is purely a magnetic product and is independent of frequency so long as the velocity of the armature is independent of frequency. Thus a constant-velocity characteristic is reproduced. In practical designs the damping is made such that the needle swing is progressively limited for

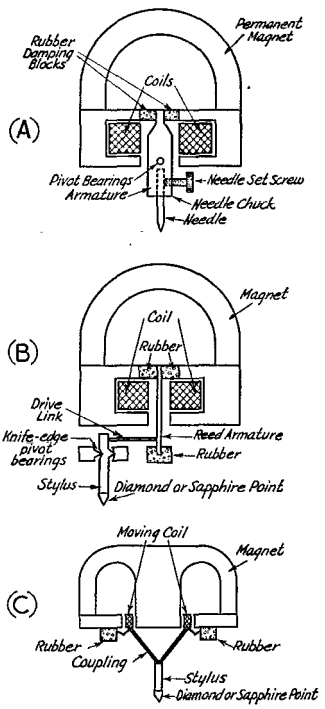


Fig. 1 — Typical magnetic pickups.

(A) Conventional moving-armature pickup as used in phonographs and home-recording playback systems, with replaceable steel or alloy needle. When the balanced armature is stationary in a central position there is no flux through it. When deflected by lateral motion of the needle a flux flows which induces a voltage in the coil. The armature works against the resistance of the rubber damping blocks.

(B) Transcription-type reproducer with reduced mass and stiffness, resulting in lowered needle pressure. The armature is a thin leaf of magnetic material clamped tightly at the top between non-magnetic spacers, actuated by the permanent jewel stylus through a pivoted linkage having a high leverage ratio. The light aluminum-alloy pivot arm is held in laterally-rigid knife-edge bearings, spring-mounted to accommodate vertical displacements. The rubber blocks provide damping.

(C) Dynamic (moving-coil) pickup for vertical reproduction. Motion imparted to the coil by the needle induces in it an alternating flux corresponding to the groove modulation. The moving coil is held in rubber-mounted flexible suspension springs.

*Executive Editor, *QST*.

[1] See p. 58, etc., August, 1942, *QST*.

the high-amplitude constant-velocity low-frequency swings, and therefore the response below 1000 cycles or so becomes modified constant-velocity as in the magnetic cutter.

Because of the necessary mass of the armature and the high damping required, a pickup of this type exerts considerable pressure upon the record groove. A more satisfactory type in this respect is that of Fig. 1-B. Here the armature is a clamped reed, actuated by a mechanical "step-down" transformer. Because of the great reduction in both mass and stiffness, as seen by the record, the effective pressure on the groove is substantially reduced.

Another commercially-popular development in this direction is the "relayed-flux" type, in which the reproducer stylus is made integral with a tiny vibrating reed. As in the example of Fig. 1-B, the air-gap is very small, requiring only about 0.00015-inch displacement for the highest amplitudes. The combination of small mass and slight displacement results in low needle "impedance" from the standpoint of the record.

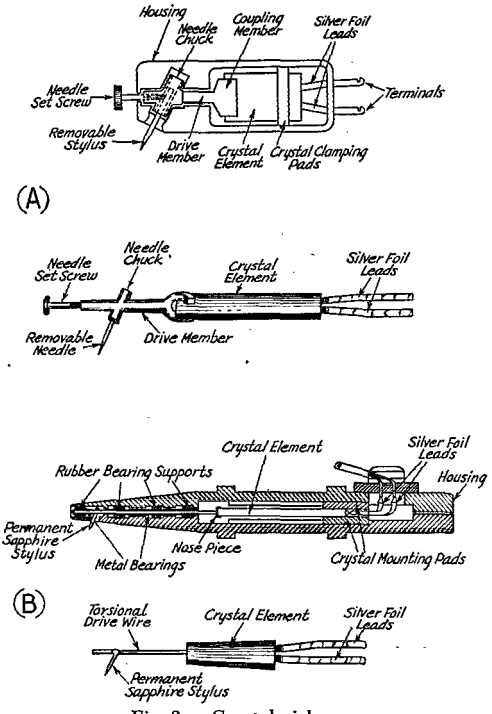


Fig. 2 — Crystal pickups.

(A) Typical inexpensive type of pickup now used in 80 per cent of all record players. The pickup head as a whole is shown in cross-section at top, the removable crystal cartridge, coupling shaft and needle chuck below.

(B) Transcription-type low-needle-pressure crystal pickup capable of high fidelity, wide frequency range and low harmonic distortion. Needle and chuck are replaced by a small permanent jewel stylus, coupling shaft by a thin torsional drive wire an inch long and 0.024 inch in diameter.

The moving-coil or dynamic pickup of Fig. 1-C is a magnetic pickup similar to a permanent-magnet dynamic speaker, wherein the output results from the motion of the coil in a steady magnetic field. This type is used chiefly in vertical reproducers, as in the example illustrated. Generally speaking, the smaller and lighter the coil and the fewer its turns (with resulting smaller mass) and the less the stiffness of the suspension system, the lower the needle impedance. On the other hand, reducing the number of turns means either reduced output or increased displacement.

The coils in magnetic pickups are wound to have impedances of from a fraction of an ohm to as high as 18,000 ohms or more. Typical moving coil units have about one ohm impedance, while standard armature-type pickups range from 8 to 10,000 ohms, with at least one special type of 18,000 ohms. Generally speaking, low impedance means reduced mass and inertia but also reduced output. By proper design, a coil of almost any impedance can be made to function satisfactorily.

Crystal pickups differ from their magnetic counterparts much as does the crystal cutter from the magnetic cutter. The needle, driven from the record by a suitable coupling, applies pressure to one end of the crystal, the other being securely clamped. The resulting displacement produces a voltage in the crystal by piezoelectric effect.

The amplitude of this voltage is proportional to the *displacement* — in contrast to the magnetic type, where it is proportional to the velocity. Thus the amplitude is greater at low frequencies than at high. That's from the mechanical standpoint. From the electrical standpoint, the crystal may be considered a voltage source in series with a low resistance and a capacitance equal to that of the crystal. Thus it is equivalent to a coupling capacitance, and the transfer efficiency at various frequencies can be closely regulated by varying the load resistance. Lowering the load resistance reduces the low-frequency response — the opposite of the mechanical effect. By balancing the electrical and mechanical characteristics of the crystal pickup, therefore, a flat overall constant-amplitude characteristic may be achieved.

The nominal impedance (not the rated load resistance) of typical crystal pickup elements ranges from 80,000 to 200,000 ohms. The internal capacity of the element varies widely with the type of construction and with temperature, but normally lies within the range 0.001–0.005 μfd.

Typical examples of crystal pickup construction are shown in Fig. 2. The inexpensive unit at (A) has a minimum of parts and is designed to be simple of construction. The needle chuck, holding a replaceable steel or alloy needle, is attached to the free end of the crystal element by a suitable coupling shaft suspended in trunnion bearings.

At the point of coupling to the crystal pads of rubber or other mechanical resistance material are inserted to provide the necessary damping.

At the other end of the scale is the professional type of pickup shown at (B). Here the mass and stiffness of the relatively bulky assembly described above are eliminated by using a tiny sapphire permanent stylus mounted in a short length of nickel tubing, attached to a torsional drive wire. The beryllium-copper drive wire twists in metal bearings held in rubber bearing supports. Slightly yielding pads connect to the crystal cartridge. The crystal element itself is well damped, being mounted on pads having a high damping coefficient and surrounded by oil having a high viscosity.

The output voltage from the pickup necessarily varies with its quality. High fidelity — extended frequency range and low harmonic distortion — means low amplitude and high damping, and therefore low output. The cheaper and therefore less precise the construction, on the other hand, the greater the amplitude and therefore the output voltage. Typical medium-priced crystal pickups deliver about 1.5 volts peak with a standard maximum groove amplitude of 0.002 inch. Some, particularly the cheaper units, give as much as 2.5 to 3 volts, while transcription-quality pickups deliver from 0.25 to 1 volt or more.

The output of high-impedance magnetic pickups is at the same general level — 1 to 1.5 volts for those from 5000 ohms up, proportionately less for lower impedance units. Since low-impedance pickups are designed to work into a step-up transformer, the effective signal at the first amplifier-tube grid is also of about the same order — a volt or so for peak modulation swing.

Frequency Response

As with the cutting head, the frequency response characteristic of a pickup is usually made to correspond as closely as possible with either a constant-amplitude curve (for crystal types) or modified constant-velocity (for magnetic types). The permissible deviation from a true curve varies with the service to be performed. For high-quality professional work it must be held to less than 2 db., while in home record players a 5 db. variation is usually not objectionable. Gradual slopes are not as troublesome as sharp peaks; these are to be avoided at all costs, since they result in "rattling" and a particularly unpleasant species of distortion.

Broadly speaking, the cost of a pickup is an index to the maximum frequency range it will reproduce. Units listing for under five dollars seldom reproduce more than a 70 to 4500-cycle band; they do a fair job on shellac pressings and the "home-recorder" type of instantaneous recordings. In those costing between five and ten dollars the high-frequency response is usually extended to about 7000 cycles, which is adequate for most non-professional work. For high-quality transcription work, however, the cost of a good pickup runs from fifteen to seventy-five dollars, with a 50-8000 cycle range at the lower end of that price scale and 30-10,000 or even 15,000 cycles for the most expensive types.

The response characteristic of any magnetic pickup, whether of the armature or moving-coil type, resembles that of the magnetic cutting heads described previously in this series.[1] The bass response drops off below 1000 cycles or so at a rate of about 6 db. per octave, which must be compensated for in the amplifier. This is because the output is proportional to the velocity of the moving armature or coil. If modified constant-velocity recordings are being played the rate of equalization must be doubled, to compensate both for the record and the pickup.

Usually two small bumps will be observed in the response curve of a magnetic pickup, one at the low-frequency end and the other at the high. The low-frequency peak is due to the mechanical resonance of the total mass of the pickup and arm, constituting inductance, with the capacity represented by the compliances of the suspension and damping elements. The pickup is designed to take advantage of this resonant condition to extend the low-frequency limit. Similarly, electrical resonance is often introduced to extend the high-frequency range, making use of the inductance of the coil. In properly designed pickups the amplitudes of these peaks is small, and the response drops off sharply at either end.

The response curve of an unloaded crystal pickup is more or less the inverse of the magnetic type, as has been stated. However, the desired flat constant-amplitude characteristic can be obtained simply by shunting the element with an appropriate load resistance. Commercial crystal pickups are usually designed to give flat response with a load of 0.25 to 0.5 megohms. (The correct value of load resistance is not the same as the rated impedance of the crystal, in contrast to magnetic types. It is usually made at least two or three times as high, not only to give correct compensation but also to reduce the effect of impedance variations resulting from changes in the internal element capacity due to temperature effects.) In this connection, the following rule should be remembered: Increasing the load resistance increases the low-frequency response, decreasing the resistance lowers it.

As with the magnetic pickup, two resonance peaks are usually observed in the response curve, one at very low frequencies resulting from resonance of the mounting and one at a high frequency produced by the natural resonant period of the crystal element itself. In designing the pickup the latter is usually placed to coincide with the limit of the high-frequency range, being followed by a sharp cut-off. In the less expensive types this may be 7000 cycles (as low as 4500 cycles for

the very cheap models), while in the costly professional types it may be placed as high as 20,000 cycles to extend the useful playing range out to 15,000 cycles or so.

Needle Force

One of the most important characteristics of the pickup is the needle pressure or, more correctly, needle force. This represents the effective weight of the pickup as it rests upon the record. In old-style magnetic pickups this may be as much as 5 or 6 ounces, and even in modern lightweight units of the less expensive variety it averages 2½ to 3 ounces. This may not seem much until it is realized that, because the actual area of contact between needle point and record is very small, the final pressure for even a 3-ounce pickup against the groove may exceed 10 tons per square inch!

Recent design has been directed strongly toward reducing this pressure, until now good pickups with a needle force of 2 ounces or less are available at reasonable cost and transcription-type pickups are made that exert a force of only 15 grams (half an ounce).

There are practical limits to the reduction in stylus force, however. A pickup with too little pressure may wear the record even more than a heavier one, particularly if it has appreciable tracking error and horizontal inertia (both of which will be discussed in detail later). The needle then tends to climb or "skate" the wall of the groove, resulting in poor tracking, rattling and distortion. Low-pressure pickups may also have high vibratory momentum due to the high velocity of the moving mass. Fluctuation in output resulting from these defects may raise the surface noise level several db., in addition to increased harmonic distortion and record wear. Recent studies indicate that a minimum force of about 12 grams is required to prevent skating with the 0.002-inch maximum amplitude and 90° groove now accepted as standard practice.

Actually, the record groove is capable of absorbing a surprising amount of pressure if the needle point is correctly shaped and carefully polished to reduce friction and tearing. The coating of instantaneous records has an elastic property which enables it to recover from the deformation of the groove caused by the stylus pressure as it moves along much like a piece of sponge rubber across which a stick is dragged. Of course, if the force is sufficient to break the surface, particularly if the point is sharp, permanent damage will be done. However, with a properly-ground needle and a good record coating a needle force up to 2 ounces may be used for several hundred playings. Shellac pressings will stand even more, while the softer nitrate and vinylite coatings may begin to wear after a few playings with 1-ounce pressure. NAB recommended standard practice for broadcast transcription work is to limit the maximum vertical force to 1½ ounces.

As to the preferred type in this respect, both magnetic and crystal pickups have been designed to give low needle force. It is somewhat more difficult to build a magnetic pickup with light needle pressure than a crystal pickup of the same performance. During the reproduction of high frequencies, the vibratory system of a pickup is inertia controlled, and the forces required to move the stylus point depend upon the moment of inertia of the vibratory system. In a magnetic pickup the stylus has to move either a small armature or a coil to generate a voltage. The crystal element, on the other hand, generates a voltage depending upon the pressure exerted on the crystal element, requiring relatively little motion. By properly designing a crystal pickup only the stylus point itself and its mounting represent the inertia of the vibratory system, while in a magnetic pickup other parts must also be moved. Only by employing a mechanical "impedance stepdown" transformer (as in Fig. 1-B) can the greater mass and inertia of these larger parts be handled effectively.

"Needle" or "Stylus"?

The terms "needle" and "stylus" have been used more or less interchangeably in this discussion, as they are throughout the literature and in conversations on the subject. There is no ac-

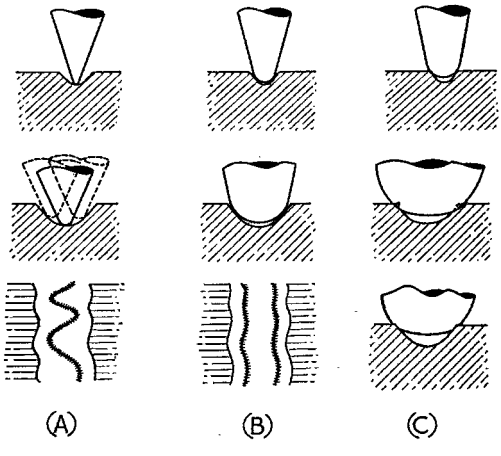


Fig. 3 — Importance of playback needle tip shape.

(A) Sharp-pointed needle does not track well in groove, resulting in "groove skating" (riding of the sidewalls), which causes distortion and rapid and irregular wear of the groove.

(B) Correctly-shaped needle rests on sidewalls of groove, with sufficient pressure compressing coating slightly to make groove conform exactly with tip radius. Maximum area of needle and groove should be in contact for good tracking and minimum distortion.

(C) Blunt needle with too-large tip radius rides top of groove, compressing lips and resulting in poor tracking and tendency to jump groove. Repeated playings wear either groove or needle (bottom), depending on abrasive content of record material. Either way friction results, increasing distortion.

cepted distinction, but commonly a "needle" is a replaceable point, usually of steel or alloy (or, less desirably, of fibre, thorn or cactus), while a "stylus" is a "permanent" jewel point assembled integral with the pickup.

In either case the use of a playback point that is correctly designed and manufactured is often the difference between good and indifferent results. This is particularly true in reproducing instantaneous recordings.

The common phonograph-type steel needle is virtually useless for that purpose. The point of such a needle is merely sharpened — not ground to a tip corresponding to the groove conformation, as is essential. Usually the tip is rough and jagged, scoring the grooves and even tearing through to the base material. Even if smooth, a sharply-pointed tip will not track properly, resulting in "groove-skating" as shown in Fig. 5. Such needles are useful only in playing commercial pressings which, because of their high abrasive content, grind the point to the proper shape before it wears the record — and then only if high-frequency response is sharply restricted by a scratch filter, because the grinding process results in high surface noise.

Carefully-made highly-polished steel needles with "shadowgraphed" or "microspected" ground points are found reasonably satisfactory when frequently changed. Even better are some of the special alloys, which not only wear longer, and can be gound more accurately, but also have a lower initial coefficient of friction and therefore lower surface noise or hiss.

Most "permanent" needles use jewel tips — diamond or sapphire, or synthetic equivalents thereof. The term "permanent" is placed in quotes because they are not really that; if used to play abrasive-type records they will wear after a few hundred playings, and in any event they are subject to chipping, breakage and even overheating. The cleavage characteristics due to the crystalline structure of the material occasionally result in microscopic fissures which wear the groove. Once the scratch level with a particular permanent stylus begins to increase it should immediately be replaced or reground.

Composition needles of the type described as "quiet" when used with commercial pressings should never be used on instantaneous recordings. The reason they are "quiet" is because they are not worn in the same manner by the abrasive action. They cannot be given a high polish, however, and the consequent increase in friction not only raises the noise level on instantaneous recordings but wears the groove.

Pickup Arm

Hardly less complex than the mechanical design of the pickup head itself is that of the arm which supports it. This arm — often misnamed the "tone arm" from its original function in the days of the old mechanical phonograph — must be designed so that it supports the pickup without adding pressure on the groove. Its vertical inertia must be low so that it can follow an uneven (warped or bumpy) record surface. Its horizontal inertia must be sufficiently low to minimize pressure on the groove sidewall and avoid groove jumping, but not so low as to allow low-frequency vibrations to be set up.

Typical pickup arms are provided with two pivoting points. In the horizontal plane the arm rotates on a smooth frictionless bearing — cone-type ball bearings, in the better units — and in the vertical plane it is hinged either at the mounting or near the head. In the latter case the arm itself is made heavy, to provide the required hori-

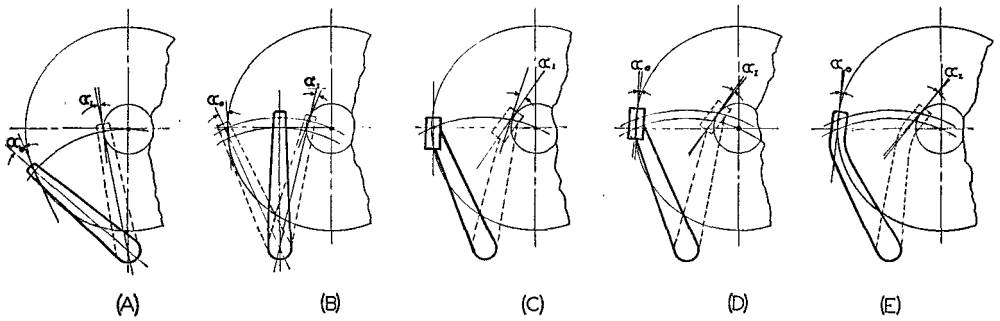


Fig. 4 — Tracking error with various types of pickup arms.

(A) Straight arm aligned with record spindle. As arm moves across record tracking angle of needle (tangent to groove at needle point) increases. At outside of playing area it is worse than at inside, but at no point is it zero.

(B) Moving the arm so needle is correctly aligned at one-half record diameter improves things, but appreciable error still exists at outside and inside. Only near center does zero tracking error occur.

(C) Offsetting pickup on arm so zero error occurs at outside helps, but there is still appreciable error at inside.

(D) Extending radius of arm helps still more, making overall tracking error negligible for ordinary work. Zero error now occurs at two points on record.

(E) Slight further improvement is achieved by using curved arm instead of offset head. Either (D) or (E) are suitable for highest transcription-quality work with extended frequency range.

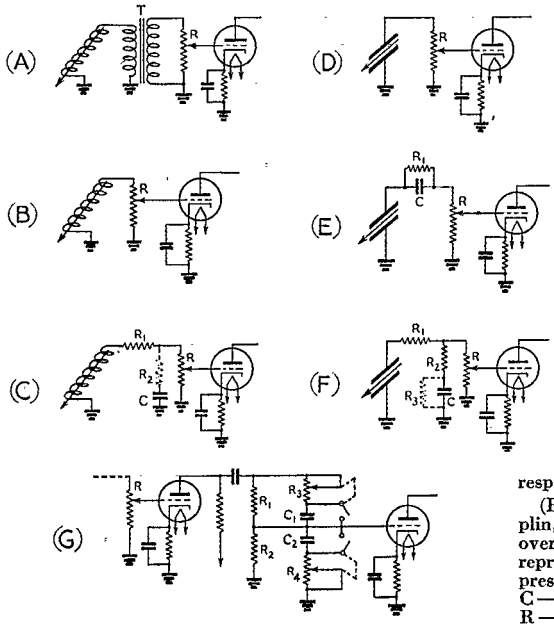


Fig. 6 — Typical pickup input coupling and/or equalizer circuits.

(A) Step-up transformer coupling for low-impedance magnetic pickup (8 to 500 ohms). Transformer is designed to give maximum voltage step-up consistent with flat frequency response and minimum phase-shift over the required range. *R* is volume control (0.5 megohm).

(B) Direct coupling for high-resistance magnetic pickups (2000–20,000 ohms), or for low-resistance units with high following amplifier gain. *R* is equal to rated load impedance of pickup.

(C) Simple equalizer circuit for bass-boosting of constant-velocity magnetic pickup when playing linear-characteristic recordings.
R, R_1 — Equal to ½ rated pickup load impedance.
R_2 — Adjust experimentally to give desired high-frequency residual response.
C — Selected to have reactance equal to 1/10 rated pickup load impedance at turnover frequency.

(D) Simplest coupling circuit for crystal pickup. *R* is equal to load resistance specified by manufacturer for linear (constant amplitude) response (usually 0.5 megohm).

(E) Treble-boosting crystal pickup equalizer and coupling circuit of type supplied by manufacturers to match overall response curve to specific applications, i.e., for reproducing constant-velocity recordings (commercial pressings, etc.).
C — 0.001–0.05 μfd. R_1 — 0.1–2 megohm.
R — 0.5 megohm.

(F) Bass-boosting equalizer and coupling circuit for crystal pickup. By adding parallel resistance across C (R_3), degree of attenuation may be controlled. Frequency where attenuation begins is determined by values of R_1, R_2, C.
For 6 db. per octave compensation:
C — 0.01 μfd. R_2 — 50,000 ohms.
R — 1.0 megohm. R_3 — 0.1–0.5 megohm.
R_1 — 0.5 megohm.
For 3 db. per octave compensation:
C — 0.005 μfd. R_2 — 0.15 megohm.
R — 1.0 megohm. R_3 — 0.1–2.0 megohm.
R_1 — 0.35 megohm.
For correcting constant-amplitude response error of typical commercial crystal pickup:
C — 0.002 μfd. R_2 — 0.1 megohm.
R — 1.0 megohm. R_3 — 0.5–2.0 megohm.
R_1 — 50,000 ohms.

(G) Interstage amplifier equalizer circuit for bass or treble attenuation, for use with either magnetic or crystal pickups (input circuits A or D). R_3 and C_1 comprise treble boost circuit, R_4 and C_2 bass boost. Integral on-off switches on each potentiometer short out capacity when full resistance is in circuit, for "off" or normal response condition. Input amplifier is a triode such as 6J5 or 6C5, with 50,000–100,000 ohm plate load.
R_1, R_2 — 0.1 megohm.
R_3, R_4 — 50,000 ohms.
C_1, C_2 — 0.002–0.02 μfd. (depending on desired turnover frequency).

zontal damping, while the hinged portion is counterbalanced either with a weight or a spring. A spring counterbalance is considered to have less undesirable vertical inertia than a weighted arm.

One of the most important requirements of the arm is that it cause the needle to "track" or meet

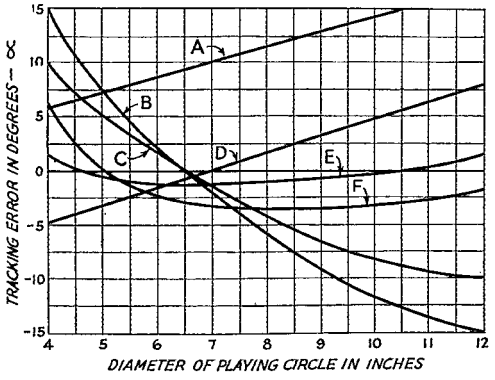


Fig. 5 — Graphical representation of tracking characteristics of different pickup arms, showing tracking error in degrees for various recording diameters.

Curves (A), (B) and (C) relate to straight arms. Curve (A) shows error for 10-inch arm corresponding to Fig. 4-A. Curves (B) and (C) show error for 8- and 12-inch arms respectively when needle is aligned to track correctly near center of record, as in Fig. 4-B; these curves illustrate advantage of long pickup arm.

Curves (D), (E) and (F) are based on a 10-inch arm with head offset at angles of 10, 23 and 30 degrees respectively. Optimum offset angle is seen to be 23 degrees with error equal to zero at two points and maximum error about 2 degrees.

the oncoming groove tangent to its radius. Since the pickup traverses the record not in a straight line but on a radius, an appreciable variation in the angle between the tangent of the groove radius and the plane in which the needle vibrates may occur. If the angle is appreciable, the needle tends to push against the wall of the groove, resulting in distortion and increased groove wear.

Fig. 4 illustrates how this error arises, and also how it may be minimized, first by properly plac-

(*Continued on page 114*)

A Course in Radio Fundamentals

Lessons in Radio Theory for the Amateur

BY GEORGE GRAMMER,* WIDF

No. 5 — Radio-Frequency Power Generation

THE experiments in this installment do not require any equipment additional to that already used in the preceding work. In fact, there are not a great many experiments to be performed. Much of the useful practical knowledge of the operation of the various parts of transmitters comes from actual construction and use, and the average amateur, for whom this course is intended, usually has acquired a fair fund of such knowledge. Chiefly for the benefit of beginners, an exercise in neutralization is included as an experiment. Supplementary to the experiments, the raw beginner can get a great deal of practical benefit from building up various basic circuits shown in the Handbook and observing their operation — always provided, in these times, that he has access to the necessary materials. This additional work also is recommended as part of a classroom program. The experiments devised for this installment have for their purpose the focussing of attention on points which ordinarily are somewhat obscure to the practicing amateur and which, because of their basic nature, form a good background for understanding otherwise puzzling phenomena which arise occasionally in the course of adjusting a transmitter.

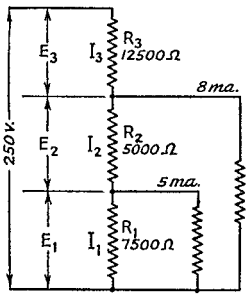


Fig. 1

Ohm's Law Problem

A number of readers have written in to confess themselves unable to attack problem 18 in Assignment 4, July *QST*. For the benefit of others who may have been equally at a loss but more reticent, we show here a solution. It is necessary to solve problem 17 first, of course, but that is a simple matter. The three resistances involved are 7500, 5000 and 12,500 ohms, labeled respectively R_1, R_2 and R_3 in Fig. 1 herewith. Question 17, in essentials, asks for the voltage drops indicated as E_1, E_2 and E_3 on the diagram across these three resistors. I_1 is the current through R_1, I_2 is the current through R_2, and I_3 is the current through R_3. The current through I_1 is not known, but we do know something about the other two currents. Thus I_2 is equal to the sum of I_1 and the 5-ma. load current taken from the tap between R_1 and R_2, while R_3 is the sum of I_2 and the 8-ma. load current taken from the tap between R_2 and R_3. In equation form,

$$I_2 = I_1 + 0.005$$
$$I_3 = I_2 + 0.008 = (I_1 + 0.005) + 0.008 = I_1 + 0.013$$

and

$$E_1 = I_1 R_1$$
$$E_2 = I_2 R_2 = (I_1 + 0.005)R_2$$
$$E_3 = I_3 R_3 = (I_1 + 0.013)R_3$$

Also,

$$E_1 + E_2 + E_3 = 250 \text{ volts}$$

so that

$$I_1 R_1 + (I_1 + 0.005)R_2 + (I_1 + 0.013)R_3 = 250$$

Substituting the proper values for R_1, R_2, R_3, and expanding, we have

$$7500I_1 + 5000I_1 + 25 + 12{,}500I_1 + 162.5 = 250$$

Collecting gives

$$25{,}000I_1 = 250 - 187.5 = 62.5$$
$$I_1 = 0.0025$$

Then

$$E_1 = I_1 R_1 = 0.0025 \times 7500 = 18.75 \text{ volts}$$
$$E_2 = I_2 R_2 = 0.0075 \times 5000 = 37.5 \text{ volts}$$
$$E_3 = I_3 R_3 = 0.0155 \times 12{,}500 = 193.75 \text{ volts}$$

The last is needed only to check the work; the three voltages should add up to 250. The two voltages actually asked for in the problem are E_1 and $E_1 + E_2$. E_1 is given above and $E_1 + E_2$ is, of course, 56.25 volts.

Circuit Note

It has been called to our attention that in circuit (E), Fig. 410, page 65, in the *Handbook*, the driver plate-supply lead should be tapped on the center of the driver tank coil. The connection actually shown would necessitate operating the cathode of the amplifier above ground for r.f.,

*Technical Editor, *QST*.

which is undesirable. The driver and amplifier cathodes in both this and circuit (F) should be assumed grounded.

ASSIGNMENT 16

Study *Handbook* Sections 4–1 to 4–5, inc., beginning page 58. Perform Exp. 27.

Questions

1) Why is it general practice, on frequencies below 60 megacycles, to use multi-stage transmitters in preference to the much simpler arrangement of an oscillator coupled to an antenna?

2) What is a buffer amplifier?

3) What are the advantages and disadvantages of a self-controlled oscillator as compared to the crystal-controlled type?

4) Describe the electron-coupled oscillator. What features make it preferable to simpler self-controlled oscillator circuits?

5) What requirement must be met by the oscillator tank circuit to give the highest frequency stability? How can this be accomplished in practice?

6) How should an oscillator be adjusted and operated to secure a high order of frequency stability? What constructional precautions should be observed?

7) Draw an electron-coupled oscillator circuit, using a tube having an indirectly-heated cathode, with tuned output.

8) Draw a crystal oscillator circuit using a pentode tube.

9) If a crystal oscillator refuses to function, what are some of the possible causes?

10) Compare the triode with a tetrode or pentode as a crystal oscillator tube.

11) What determines the frequency at which a crystal will oscillate?

12) Name four factors which can cause the frequency of a crystal to shift from its calibrated value.

13) Show a crystal oscillator circuit which will give output at a harmonic of the crystal frequency.

14) Describe the behavior of the plate current of a crystal oscillator as the plate tank circuit is tuned through resonance.

15) What is the correct method of adjusting a Tri-tet oscillator?

16) What determines the safe power input to a crystal oscillator circuit?

17) What are the distinguishing characteristics of some of the better known crystal cuts, such as the *X*, *Y* and *AT*?

18) What is a "harmonic" crystal?

19) Why is frequency multiplication generally necessary in transmitters operating above about 7 megacycles?

20) What precautionary measures can be taken to prevent fracturing a crystal from excessive r.f. voltage?

ASSIGNMENT 17

Study *Handbook* Sections 4–6 and 4–7, beginning page 66. Perform Exps. 28 and 29.

Questions

1) Draw a circuit diagram showing link coupling between a single-ended driver stage and a push-pull amplifier. Indicate series-fed plate supply for the driver and series-fed bias supply for the amplifier.

2) When is it desirable to use link coupling between driver and amplifier stages?

3) If the effect of shunting capacities can be neglected, as at low frequencies, would you expect the same coupling efficiency to be obtained with capacity and with link coupling, assuming optimum adjustments in each case?

4) Draw a circuit diagram showing capacity coupling between a single-ended driver and single-ended amplifier. Indicate a method for obtaining optimum energy transfer ("impedance matching").

5) To what part of the tank coil should a link winding be coupled in order to minimize capacity coupling?

6) Why is neutralization necessary in a triode r.f. amplifier?

7) If, when adjusting a link-coupled driver-amplifier circuit, it is found that the amplifier excitation is insufficient even though the driver power output capability is known to be ample, what is the probable cause? How may the condition be remedied?

8) What precautions must be taken to prevent self-oscillation in screen-grid r.f. amplifiers?

9) Draw a circuit of a plate-neutralized single-tube triode amplifier using a split-stator plate tank condenser. Show a driver stage with capacity coupling to the amplifier.

10) Draw a cross-neutralized push-pull triode amplifier circuit, with a link-coupled single-ended screen-grid driver. Use split-stator or balanced condensers in the amplifier plate and grid tank circuits.

11) Why is it possible, as a general rule, to obtain more complete neutralization of a push-pull than a single-ended amplifier?

12) Draw a circuit of a grid-neutralized amplifier using a single-ended or unbalanced grid tank condenser. Show link coupling to a plate-neutralized driver stage.

13) Describe the procedure used in neutralizing an amplifier, using a milliammeter in the grid circuit as an indicator.

14) If it is found impossible to neutralize an amplifier completely, how would you test for coupling (external to the tube) between the input and output circuits?

15) What is the principle of inductive neutralization?

16) If the impedance in the plate circuit of a 3.5-Mc. amplifier is 2000 ohms, what value of by-pass capacity will be suitable in the plate circuit if series feed is used?

17) A certain amplifier exhibits a grid impedance of 4000 ohms under normal operating conditions. If the driver stage requires a load of 6000 ohms for optimum efficiency, what means can be used to secure optimum power transfer with capacity coupling? If the operating frequency is 7 Mc., what values of coupling capacity will be satisfactory?

18) If the amplifier of Question 17 is link-coupled to the driver stage, and a *Q* of 10 is necessary in both the driver plate tank circuit and amplifier grid tank circuit to assure sufficient coupling, what values of inductance and capacity should be used in each circuit?

ASSIGNMENT 18

Study *Handbook* Sections 4–8 and 4–9, beginning page 71. Perform Exp. 30.

Questions

1) What is the minimum permissible *Q* (with load) in a plate tank circuit constructed in accordance with good design principles? Why is it necessary to set such a lower limit for *Q*?

2) Given a fixed value of load resistance, how may the *Q* of a tank circuit be adjusted to the proper value?

3) Of what order is the plate efficiency of a properly-operated r.f. amplifier? Is this the same as the ratio of actual useful power output to d.c. input?

4) Define operating angle. What is the usual range of values of operating angle for a Class-C amplifier?

5) How may the load on a Class-C amplifier be adjusted?

6) A certain power tube requires a negative bias of 70 volts to cut off plate current at the recommended value of d.c. plate voltage. If the peak grid voltage for full output under a given set of operating conditions is +120 volts and the operating angle is to be 150 degrees, what operating grid bias is required and what is the r.m.s. value of r.f. grid voltage which must be applied to the tube?

7) What operating bias and what value of r.f. grid voltage (peak) would be required with the tube of Question 6 if the operating angle were changed to 120 degrees, other conditions remaining the same?

8) The grid loss in the tube of Question 6 is 4 watts. What is the approximate value of d.c. grid current?

9) A Class-C amplifier is operating on 3600 kc. with a plate input of 120 milliamperes at 750 volts. What tank capacity should be used if the plate circuit is that shown at (B), Fig. 420, in the *Handbook*? What capacity is necessary if the circuit is that shown at (E) in Fig. 420?

10) A push-pull amplifier operating on 7200 kc. is loaded so that the plate current is 250 ma. The applied plate voltage is 1500. What value of inductance should be used in the tank circuit if the *Q* of the circuit is to be 12?

11) Describe the behavior of plate current with plate tank tuning of a Class-C amplifier.

12) Why is the plate current of a Class-C amplifier least when the plate tank circuit is tuned to resonance with the frequency of the r.f. grid voltage? Why is the plate dissipation also minimum at this point?

13) On coupling an antenna circuit to a Class-C amplifier it is found that it is necessary to retune the plate tank circuit. What is the cause?

14) Why is it necessary to supply more driving power to a Class-C amplifier than that actually consumed in heating the grid? What effect does the operating frequency have upon the relative amount of additional power which must be supplied?

15) What is the purpose of a dummy antenna? Describe a circuit arrangement suitable for the purpose.

16) Why should an r.f. power amplifier initially be tuned up with low plate voltage?

17) If the plate current of a Class-C stage rises continually after a period of steady operation, what is the likely cause?

18) Describe the construction and use of a Faraday screen (electrostatic shield). What is the purpose of such a device?

ASSIGNMENT 19

Study *Handbook* Sections 4–10 to 4–12, inc., beginning page 77.

Questions

1) In what way does a frequency multiplier differ from a straight-through amplifier?

2) Why is frequency multiplication necessary in high-frequency transmitters?

3) Why is the frequency doubler the most common type of frequency multiplier?

4) Can a push-pull circuit be used satisfactorily for frequency doubling? Explain.

5) How do the operating conditions for frequency doubling compare with those for straight amplification? Is it possible to obtain as high plate efficiency with a doubler as with a straight amplifier? If so, how can it be accomplished?

6) What is a parasitic oscillation? Why is such an oscillation undesirable?

7) Describe three forms of parasitic oscillations and the means for suppressing each type.

8) Explain how you would go about testing an amplifier for parasitic oscillations. How could a parasitic be distinguished from oscillation resulting from improper neutralization of a triode amplifier or insufficient screening in the case of a screen-grid amplifier?

9) What is a linear tank circuit?

10) Why are linear tank circuits preferable at ultrahigh frequencies to ordinary circuits consisting of coils and condensers?

11) Draw an oscillator circuit using a single tube working into a quarter-wave parallel-line tank circuit.

12) What is the advantage of increasing the length, in terms of quarter wavelengths, of a resonant line used as a tank circuit?

13) Why is it frequently necessary to use inductances in the cathode leads of u.h.f. oscillators?

14) What are the advantages of a concentric line over the parallel-conductor line? Name some mechanical disadvantages.

15) Draw a circuit of a single-tube oscillator using a quarter-wave concentric line. Indicate a method of coupling to the output circuit.

16) What is the customary method of adjusting the resonant frequency of a linear circuit?

17) A parallel-conductor line is to be used as a tank circuit in a 112-Mc. oscillator. What should its approximate length be if it is to resonate to the operating frequency without the tube connected? When the tube is connected, would you expect the actual frequency to be higher or lower than the frequency of the line alone? How may the effect of the tube on the frequency be reduced?

18) Why is it desirable to "tap down" on a line used for frequency control in an oscillator circuit?

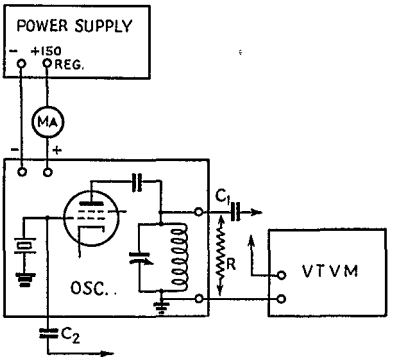


Fig. 2

EXPERIMENT 27

Crystal Oscillator Operation

Apparatus: The power supply, vacuum-tube voltmeter, test instrument and crystal oscillator are used in this experiment. The circuit arrangement is shown in Fig. 2. The plate voltage for both oscillator and v.t.v.m. is taken from the 150-volt regulated tap in the power supply. The push-button on the tube board can be used to close the plate-supply circuit of the oscillator when the milliammeter is used with the v.t.v.m., in case the test set is used for all current measurements.

The v.t. voltmeter is coupled to the output circuit of the oscillator through a small condenser, C_1, as shown in Fig. 2 or to the grid of the oscillator tube through a second condenser, C_2. (Complete oscillator connections are not shown; only the parts of the circuit to which the v.t.v.m. should be coupled are indicated.) These condensers must be adjusted so that the v.t.v.m. reads half to full scale on the medium range. It will be convenient to use a 30-$\mu\mu$fd. trimmer for C_1. The same type of condenser can also be used at C_2, although a fixed condenser of about 5 $\mu\mu$fd. can be substituted.

Procedure: The object of this experiment is to determine the operating characteristics of a crystal oscillator with respect to plate current, r.f. grid voltage and r.f. output voltage. While the actual r.f. voltages cannot be determined accurately with the simple equipment available, the relative voltage in either the plate or grid circuit of the oscillator can be determined with sufficient accuracy for the purpose. The d.c. calibration of the v.t.v.m. may be used. The setting of the plate tank condenser of the oscillator is used as an arbitrary reference in the experiment. If the oscillator does not already have a tuning dial which can be read to a division or so on a 100-division scale, such a dial or scale should be provided.

Using the 6F6 in the oscillator, connect the v.t.v.m. to the plate circuit and set the oscillator in operation. Adjust C_1 to give a suitable reading near full scale on the medium range of the voltmeter. Starting at maximum capacity on the oscillator tank condenser, reduce the capacity until the oscillator just starts, as indicated by a reading on the v.t.v.m. (a receiver may be used for monitoring the oscillator signal) and take voltmeter readings as the capacity is decreased to minimum. In the region immediately after oscillations begin it will be necessary to take readings at quite small capacity intervals in order to get enough points to plot a smooth curve. Take care not to disturb the leads to the v.t.v.m. once the run is started, because variable stray pickup will make the readings inconsistent. If a second milliammeter is available, take simultaneous readings of plate current; if not, the procedure may be repeated for the

plate-current readings, leaving the v.t.v.m. connected to the plate circuit.

When these data have been taken, the v.t.v.m. should be connected to the grid of the oscillator and C_2 adjusted, if necessary, to give a maximum reading between half and full scale. Observe the dial setting at which oscillations start, and if it differs from that noted previously, connect C_1 across the tank circuit and adjust it to make oscillations begin at the same tank condenser setting. This compensates for the capacity of the v.t.v.m. tube which was shunted across the circuit in the first run. Repeat the run, taking readings of the r.f. grid voltage. When this is completed, connect a 5000-ohm 1-watt resistor across the tank circuit, as shown at R in Fig. 2, and repeat the whole procedure. It may be necessary to readjust C_1 and C_2 to get suitable readings, or to shift to the low-voltage scale on the v.t.v.m. when reading the r.f. grid voltage.

To get a proper comparison between the no-load and load conditions, the following procedure is advisable: With no load on the oscillator, connect the v.t.v.m. to the grid and adjust C_2 to give a reading of half to full scale on the medium voltage range. Adjust the oscillator tuning for maximum r.f. grid voltage and note the value. Then, without moving the connecting wires, connect the load resistor to the plate tank and retune the oscillator condenser for maximum r.f. grid voltage. The latter figure divided by the former gives the ratio of load voltage to no-load voltage. Similar readings should be taken of the r.f. plate voltage with and without load to determine the load/no-load ratio in the plate circuit.

In plotting the data the form shown in Fig. 3 is recommended. The r.f. grid voltage is plotted in terms of percentage of the maximum grid voltage observed in the no-load condition; the load data are also in terms of percentage of the maximum voltage observed, but reduced by the ratio of load to no-load voltage found as described above. The same method is used in plotting the r.f. plate voltage. The plate current values shown are the actual values measured.

The curves of Fig. 3 give the results of experimental measurements on a 6F6 oscillator. As additional information, the vertical broken lines indicate the frequency to which the tuned circuit is resonant at that setting of the tuning condenser. The line just to the left of the 3.5-Mc. line is the frequency of the crystal used, 3550 kc. As the tuning capacity is decreased from maximum, oscillation starts at approximately the capacity which represents resonance

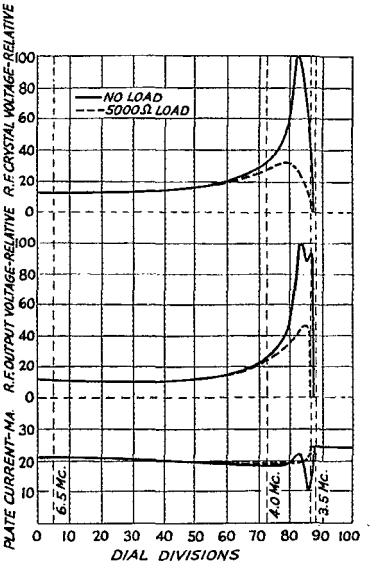


Fig. 3

with crystal. The plate current immediately drops to about half its non-oscillating value, goes through a minimum and then rises again to a maximum. This is followed by a relatively small decrease to a broad minimum and then a

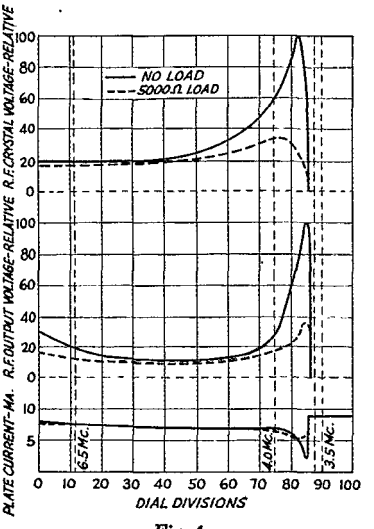


Fig. 4

slow rise. Oscillation continues throughout the remainder of the condenser range, so that the non-oscillating value of plate current does not recur on the low-capacity side of resonance. The r.f. plate voltage rises rather abruptly once oscillations start, and goes through a maximum at a condenser setting somewhat below actual resonance in the plate circuit. The r.f. grid voltage curve is similar, but reaches its maximum at a still lower setting of the condenser.

This behavior is the result of the necessity for adjusting the tank circuit tuning to maintain the proper phase relationship between the fed-back voltage in the grid circuit and the generated r.f. voltage in the plate circuit. This requires that the plate circuit show inductive reactance; that is, the plate circuit must be tuned slightly to the high-frequency side of resonance with the crystal frequency. The tank circuit impedance decreases as the circuit is detuned. The plate current is lowest near resonance, where the tank impedance is highest, and there is also a small maximum in the r.f. plate voltage at this point. However, this tuning condition is not that which gives strongest oscillation. With slightly lower capacity the r.f. plate voltage reaches a peak, but the tank is detuned and its impedance decreases, hence the plate current rises. Further detuning gives the phase relationship which results in maximum feed-back, as shown by the peak of r.f. grid voltage, but there is some decrease in actual output at this point because the tank circuit is now detuned still farther from resonance. The peak of r.f. grid voltage is accompanied by a maximum in the d.c. plate current, corresponding to high grid excitation with a detuned tank circuit. With further detuning the feed-back decreases, causing the plate current to drop once more, while the r.f. output (plate) voltage drops rapidly because the tank circuit is no longer near resonance. There is relatively little change in the three quantities when the tank circuit is considerably off resonance and the oscillations are weak. The net operation is thus the result of several conflicting factors, since there is no one setting of the tank condenser which will give, simultaneously, maximum output, maximum feed-back voltage, and minimum plate current.

When the oscillator is loaded, oscillations commence at a slightly lower capacity setting than in the unloaded case; that is, more feed-back is needed to cause oscillations to begin. Since the impedance of the loaded tank is lower than in the case without load, the minimum plate current is considerably higher than without load. Thus the d.c. plate input

to the tube rises as the power consumption in the tank and load increases. For the same reason the r.f. plate and grid voltages are lower than in the unloaded case, and the maxima are fairly broad as compared to the solid curves. This shows the result of lowering the *Q* of the tank circuit by loading; the selectivity of the tank is decreased to such an extent that the sharp humps are smoothed down, and the double-hump effects observed in the case of the plate current and the r.f. plate voltage disappear completely. With these modifications, the operation is similar to that without load.

To compare the operation of a triode with that of the pentode, substitute a 6J5 for the 6F6 (the 6J5 will fit in the same socket and no circuit changes are necessary) and repeat the procedure described above for the pentode. Plot a second set of curves in the same manner. A typical set for a 6J5 is shown in Fig. 4. Note that the double-hump effects are not present with this tube in the unloaded case; this is because the effective *Q* of the tank circuit is lower since it is shunted by the comparatively low plate resistance of the triode, whereas the plate resistance of the pentode is so high that the selectivity of the tank circuit is affected very little. The no-load curves for the triode resemble in shape, although not in amplitude, the load curves for the pentode. The effect of loading is similar in both cases. Once the oscillator tuning is well on the high frequency side of resonance the voltages and currents are about the same with or without load, illustrating that the effect of loading a tuned circuit is largely confined to the region near resonance.

Near minimum capacity on the tuning condenser the r.f. output voltage rises, although neither the plate current nor r.f. grid voltage show any particular change. The reason for this is that the plate circuit is nearing resonance at the second harmonic of the crystal frequency, with the result that the impedance for the second-harmonic component of the plate current is increasing, hence a larger voltage appears across the tank circuit. The effect is also present, although not so marked, in the pentode curve for r.f. plate voltage.

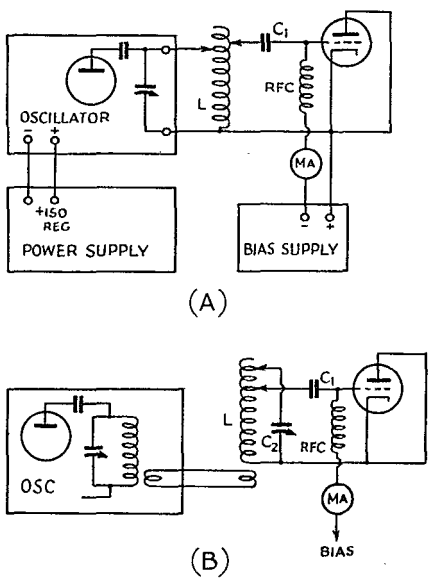


Fig. 5

EXPERIMENT 28

Interstage Coupling

Apparatus: This experiment requires the crystal oscillator, power supply, bias supply, tube board and test instrument. The circuit arrangement is shown in Fig. 5. Power for the oscillator is taken from the 150-volt regulated tap on the power supply so that the plate voltage will stay constant as the r.f. power taken from the oscillator is varied. (Should the regulator tube cease to glow at any time during the experiment, the dropping resistor in the power supply in series with the VR-150-30 should be decreased in value until the tube glows under all conditions. The 10,000-ohm resistor recommended in Fig. 4, page 65, August *QST*, may be shunted by a 15,000-ohm unit to accomplish this.)

The coil *L* is the movable coil from the circuit board. C_1 is a small fixed mica condenser; a capacity of 100 $\mu\mu$fd. is satisfactory, but larger values may be used without affecting the results of the experiment. *RFC* is a 2.5-millihenry choke coil and C_2 is one of the tuning condensers (250 $\mu\mu$fd.) on the circuit board. The tube used in the experiment should be a 6J5 or 6C5.

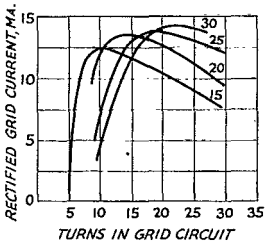


Fig. 6

Procedure: Capacity coupling may be checked by means of the set-up shown in Fig. 5-A. The plug-in tank coil is removed from the oscillator and the coil *L* is connected across the tank condenser in its place, using a clip connection at the ungrounded end so that the number of turns can be varied. The coil is set up on the tube board near the tube socket and connected to the tube as shown. The plate of the tube is connected to the cathode to prevent its acquiring a charge by collecting stray electrons. The bias should be adjusted to about 50 volts.

Connect the two clips to the end of the coil, putting all 35 turns in circuit, and rotate the oscillator tank condenser to obtain oscillation. It will be helpful to monitor the oscillator by a receiver set to the crystal frequency. The shunting capacity of the tube, together with the large inductance, may make it impossible to set the circuit to resonance with the crystal, so if oscillation does not take place move the taps down to 30 turns and try again. Using the equipment previously described, 30 turns was the maximum number permissible with this circuit and a crystal having a frequency of about 3550 kc. When the largest usable value of inductance has been found, leave the oscillator plate tap set and take grid current readings as the grid clip is moved down one tap at a time. Each time the tap is changed, readjust the oscillator plate condenser to obtain maximum grid current. Then move the oscillator plate clip down one tap (5 turns) toward the ground or cathode end of the coil and repeat, starting at the end of the coil with the grid tap. Move the plate tap down another 5 turns and repeat, continuing in this way until the plate tap is carried down at least to the 15th turn from the bottom end of the coil. The data so obtained may then be plotted in the form of curves showing the relationship between rectified grid current and number of turns included in the grid circuit of the tube.

A typical set of such curves, taken with a 6J5, is shown in Fig. 6. The number on each curve indicates the number of turns in use in the oscillator plate circuit.

Note that maximum output (maximum rectified grid current) is obtained when the grid tap includes fewer turns than are in use in the oscillator plate circuit. If the curves are inspected carefully it will be found that maximum current occurs when the grid circuit has approximately 70 per cent as many turns as the oscillator plate circuit, in each case. This indicates that the load represented by the grid-cathode circuit of the 6J5 has a lower value of resistance than the value required by the oscillator tube for maximum output. The tapped coil is thus used as an autotransformer for the purpose of transforming the actual load resistance into the

value required by the tube. Since practically the same turns ratio is required in each case the operation is evidently quite independent of the constants of the tuned circuit. Actually, the maximum rectified current obtainable decreases as the

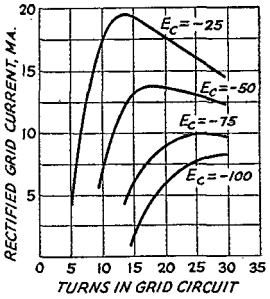


Fig. 7

number of turns in the plate circuit of the oscillator is made smaller. This is because the decreasing L/C ratio is accompanied by an increase in the r.f. current circulating in the tank (the Q of the loaded circuit is raised) causing the internal losses of the tank circuit to increase. Hence a somewhat smaller proportion of the power developed by the oscillator tube is available for the load. If the L/C ratio could be decreased without increasing the tank losses the output current would be the same in each case. In the experimental set-up some of the loss undoubtedly is "dead-end" loss in the unused turns of the coil, caused by current circulating through the distributed capacity of the unused turns.

The effect of a change in load impedance can be observed by changing the bias on the tube and following the experimental procedure just described. As the bias is increased the impedance of the grid-cathode circuit increases, since a considerably larger r.f. grid voltage must be applied to overcome the bias and cause the same or less grid current to flow. The curves of Fig. 7 show the results of such a run, using four different values of negative grid bias, 25, 50, 75 and 100 volts. In all four cases the oscillator plate was tapped on the coil at the 25th turn. At the highest bias, 100 volts, the grid current is just reaching maximum with 30 turns in the grid circuit; that is, a step-up impedance ratio is required, showing that the grid impedance is higher than the value required by the oscillator tube for maximum output. With 75 volts bias the maximum current is secured with the same number of turns in the grid circuit as in the plate circuit. The curve for $E_c = -50$ is simply a repetition of the corresponding curve in Fig. 6. With -25 volts bias the grid circuit must be tapped across approximately half the number of turns used in the plate circuit, indicating that the impedance has decreased very considerably. The resistance (or impedance) of the grid circuit therefore depends not only on the characteristics of the tube but also on the conditions under which it is operated. If the tube had been actually operating as an amplifier, still different conditions would obtain and the curves would show maximum points at different turn ratios than those indicated. In such a case the effect of the plate voltage would be to attract some of the electrons which in the experimental set-up are drawn to the grid, and this would tend to reduce the grid current and thus raise the grid impedance, since less current would flow for the same applied r.f. grid voltage.

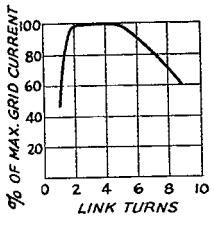


Fig. 8

In the second part of the experiment link coupling is investigated. The circuit arrangement is shown in Fig. 5-B. The regular plug-in tank coil is returned to the oscillator circuit, and is provided with an output link winding of three turns or so wound close to the "ground" end of the coil. The coil L is connected to C_2, one of the variable condensers on the circuit board, as shown. As a preliminary experiment, wind about 10 turns at the ground end of L, and connect C_2 and the grid tap to the other end of the coil so that the full 35 turns are used. Using about 50 volts bias, adjust C_2 and the oscillator tank condenser for maximum rectified grid current. There may be some interaction between the two condensers, so "rock" C_2 back and forth while adjusting the oscillator tank condenser until it is certain that maximum output is secured. Take one turn off the link and again adjust for maximum grid current; continue in this way until only one link turn is left. The result of such an experimental procedure is shown in Fig. 8, where the number of link turns on L is plotted against grid current in terms of percentage of the maximum current obtainable. Note that there is a broad maximum to the curve, the output showing negligible variation with links having from 2 to 5 turns. The value for one turn is probably low, since the turn was not held very tightly to the coil form. Obviously the number of turns is not critical. The maximum output is in the region where the link has enough turns to give a sufficiently-high coefficient of coupling without having enough reactance to limit the flow of r.f. current in the link circuit.

Using a link of about three turns on L, set the tap from C_2 at the end of the coil (35 turns) and tap the grid on the same spot. Adjust C_2 and the oscillator plate condenser for maximum grid current, then move the grid clip down one tap (30 turns) and again adjust the two condensers for

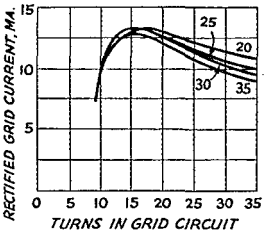


Fig. 9

maximum grid current. Continue moving the grid clip down the coil. As the tap approaches the bottom end the loading on the oscillator increases and may cause the oscillator to stop. The best procedure is to keep the oscillator tank condenser well on the low-capacity side of resonance, then rock C_2 back and forth through resonance while carefully increasing the oscillator condenser capacity until it is set just below the point where oscillation ceases when C_2 goes through resonance. (Monitoring the oscillator in a receiver will be helpful.) This point usually will result in maximum output. When the run is completed, move the clip from C_2 down one tap and repeat. Continue until the tap from C_2 has been moved down to the 15th or 20th turn. Plot the data in the same way as in the case of capacity coupling.

A set of experimental data so obtained is shown graphically in Fig. 9. The tube and grid bias were the same as in Fig. 6. There is quite a marked difference between these curves and those of Fig. 6, showing that more than simple autotransformer action is involved. Maximum grid current is secured with approximately the same number of turns between grid and cathode in all four cases shown (the numbers on the curves indicate the number of turns across which C_2 is connected). This is because in the link-coupled case — link coupling is equivalent to inductive coupling — the coupling depends very largely on the effective Q of the secondary circuit, the constants of the primary circuit being fixed. With a fixed value of load resistance, represented by the grid circuit of the tube, the Q of the circuit depends on the L/C ratio and/or the ratio of turns in the tuned circuit to turns in the load (grid-cathode) circuit. Using 35 turns in the tuned circuit, maximum output is secured with about 15 turns in the grid or load circuit, illustrating the increase in

effective Q — and hence increase in coupling to the primary — afforded by tapping the load down on the coil. A similar effect is observed with smaller numbers of turns in the tuned circuit, until with C_2 across 20 turns maximum output also is secured with 20 turns in the grid circuit. In this case the Q has been raised to the value required for optimum coupling solely by reducing the L/C ratio, whereas in the 35-turn case the same effect was secured by tapping down. With 35 turns across C_2 and 35 turns also in the grid circuit, the maximum grid current is about 9 milliamperes. This is the value represented by "100%" in Fig. 8, and is the maximum obtainable with *any* number of link turns with this circuit and loading. Hence adjustment of the link turns alone cannot result in maximum energy transfer unless the effective Q of the circuit is high enough to provide optimum coupling. If the Q is too low, it must be increased either by tapping the load down on the coil or by decreasing the L/C ratio; unless this is done, maximum output cannot be secured.

Note that the maximum grid current obtainable with link coupling is less than with capacity coupling. The difference is attributable to the additional losses in the second tuned circuit used in link coupling. Other considerations, such as the effect of too-high shunt capacity, may result in a reversal of this situation at higher frequencies, but at the frequency used in this experiment (3550 kc.) these effects are negligible.

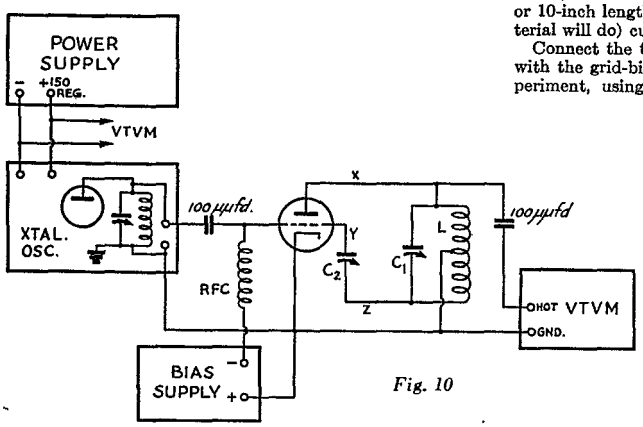


Fig. 10

EXPERIMENT 29

Neutralizing an Amplifier

Apparatus: The set-up for this experiment is shown in Fig. 10. Equipment required includes the power supply, bias supply, crystal oscillator, vacuum-tube voltmeter, tube board, circuit board, and test instrument. The tube used is a 6J5 or similar small triode. The coil L is the fixed coil on the circuit board and condenser C_1 is the variable condenser associated with that coil. C_1 should be connected across 30 turns of L, with the tap to ground placed at the 15th turn on the coil. C_2 is the small condenser (25 to 50 $\mu\mu$fd. maximum capacity) on the circuit board. The 100-$\mu\mu$fd. condensers are small fixed mica units. *RFC* is a 2.5-millihenry r.f. choke.

The connections X, Y and Z preferably should be flexible leads with clips at both ends so that they can be connected and disconnected conveniently. The crystal oscillator plate voltage can be taken from the 150-volt regulated tap on the plate power supply. The bias on the tube under test should be set to about 75 volts.

Procedure: This experiment is an exercise in neutralizing an r.f. amplifier. Connect the circuit as shown, omitting for the moment the leads X, Y and Z. Set the crystal oscillator in operation and, with the tuned circuit LC_1 in about the position it will occupy (near the tube), tune C_1 for maximum deflection on the v.t. voltmeter. If the deflection is more than a flicker on the low range, move the tuned circuit as far as possible from the oscillator, while still keeping within reasonable distance of the tube so that long connecting leads will not be necessary. It should be possible to get the v.t.v.m. reading down to less than 1 volt without much difficulty. When this has been done, connect the leads X, Y and Z, set C_2 to minimum capacity, put the v.t.v.m. on the high range, and adjust C_1 for maximum v.t.v.m. deflection. Increase the capacity of C_2 slightly and again tune C_1 for maximum deflection. Continue this process, observing that the deflection decreases as the capacity of C_2 increases, until a point is reached where an increase in capacity causes the deflection to increase again. The setting of C_2 which gives minimum output voltage is that at which the tube is neutralized as well as the circuit conditions will permit. In most cases it will not be possible to adjust the circuit so that the r.f. voltage disappears completely from the plate circuit, but it should be possible to get it down to around half scale on the low range of the v.t.v.m.

It will be observed that hand-capacity effects are quite evident in adjusting both condensers. This is partly because the hand adds a small amount of capacity which detunes the circuit, since the shafts of both condensers are above ground for r.f., and partly because the body picks up some r.f. voltage from the oscillator and couples it to the circuit when the hand is brought near either condenser. This effect can be eliminated by dispensing with the ordinary tuning knobs and, instead, sawing slots in the ends of the condenser shafts, the condensers then being turned by means of an 8- or 10-inch length of wooden rod (any other insulating material will do) cut at one end to fit the slots.

Connect the test instrument as a milliammeter in series with the grid-bias lead to the amplifier and repeat the experiment, using grid-current as a neutralizing indicator. Disconnect the v.t.v.m. in this case. Adjust the neutralizing condenser, C_2, so that there is least change in rectified grid current as C_1 is tuned through resonance. It should be possible to neutralize well enough so that there is the barest flicker, or none at all, in grid current. How does this method compare in sensitivity with the v.t.v.m. method?

EXPERIMENT 30

Class-C Amplifier Operation

Apparatus: This experiment uses the apparatus set-up shown in Fig. 11. It resembles quite closely the circuit used in the preceding experiment except that provision is made for applying plate voltage to the amplifier tube and for connecting a load resistance in the plate circuit. The 0.001-μfd. blocking condenser in the plate circuit replaces the direct ground used in Exp. 29; this is necessary to prevent short-circuiting the plate-supply voltage. The crystal oscillator again gets its plate power from the 150-volt regulated tap on the power supply.

Procedure: The object of this experiment is to observe the behavior of a Class-C amplifier under different load conditions. A small tube such as a 6J5 will be suitable. Set the variable resistor on the power supply so that only the bleeder current flows through it (arm to the left end in Fig. 4, page 65, August *QST*) since the current drawn will exceed a safe value for this resistor. The plate voltage for the amplifier may be adjusted to a suitable value by tapping the output clip on the divider at a point which gives 250 to 300 volts.

With the amplifier plate voltage tap disconnected, neutralize the amplifier by the grid-current method described in the preceding experiment. Set the bias at 30 volts so that the tube is biased well beyond the cut-off point for that plate voltage. With the 6J5 cut-off bias is approximately 15 volts, neglecting the "tailing-off" effect associated with the change in amplification factor near the cut-off point (see Exp. 22). Although the plate current may not actually reach zero until the bias is 20 volts or more, the plate current in the region between the cut-off bias calculated on the assumption that the amplification factor is constant (E_b/μ, in this case 300/20) and the actual cut-off point is so small that its influence on the operation of the tube as a Class-C amplifier is

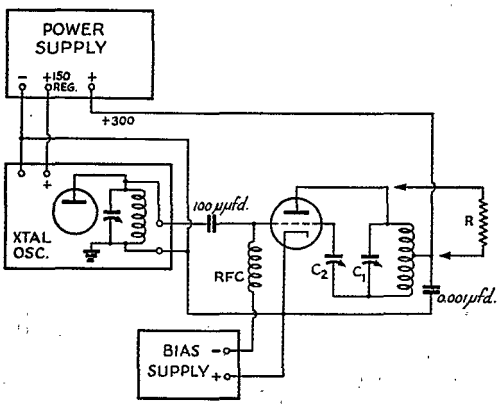


Fig. 11

practically negligible. Adjust the oscillator tuning so that the grid current is approximately 10 milliamperes with no plate voltage on the amplifier.

After neutralization, apply plate voltage and measure the amplifier plate current. If the tank circuit is not set at resonance with the crystal oscillator frequency the plate current probably will be in the vicinity of 30 milliamperes. Carefully tune the amplifier tank circuit, observing that at resonance the plate current drops to a comparatively low value — well below 10 milliamperes. The resonance point should be quite sharp. The plate current is minimum at resonance because at this point the impedance of the tank circuit is highest to r.f. current of the frequency generated by the crystal oscillator, and tuning to resonance is equivalent to connecting a high value of load resistance in series with the amplifier plate circuit. Hence there is a large r.f. voltage drop in the tank circuit and the average voltage acting to cause plate current to flow is reduced. The d.c. plate current is likewise reduced. When the tank circuit is off resonance its impedance to the crystal frequency is low and the r.f. voltage drop is negligible, hence practically the full d.c. plate voltage is continuously applied to the tube and the plate current is high. It is higher than in Class-A applications because the r.f. grid voltage drives the grid considerably positive with respect to the cathode over a part of the r.f. cycle. The variation in r.f. tank voltage can be observed by touching a neon bulb to one side of the tank condenser. The bulb will glow brightly when the tank is tuned to resonance but goes out when the condenser is detuned.

Note also that the grid current drops when the plate voltage is applied to the amplifier. When there is plate voltage on the tube some of the electrons which formerly were attracted to the grid go to the plate instead. The number thus diverted depends upon the effective plate voltage, which in turn depends upon the tuning of the tank circuit for the reasons mentioned above. With the tank circuit tuned to resonance the drop in grid current is slight, but if the tank is detuned the grid current may drop to as little as half its value with the plate voltage off.

Connect a 25,000-ohm 1-watt resistor between the plate of the tube and the positive plate voltage lead as shown at *R* in Fig. 11. Apply plate voltage and observe the plate current as the plate tank circuit is tuned through resonance, leaving the excitation the same as before — that is, adjusted to give a rectified grid current of about 10 ma. with no plate voltage on the amplifier. In this case the resonance point will not be quite as sharp and the minimum plate current will be higher than without load. Note that the off-resonance plate current is the same as before, showing that the off-resonance impedance of the tank circuit is so low that the presence of the load resistor does not affect it. At resonance, however, the tank impedance is reduced by the load resistor and the r.f. voltage drop consequently is less. Hence the average plate voltage causing plate current flow is higher and the plate current also is higher. The grid current also shows a greater drop, at resonance, with the load resistor connected, again because the effective plate voltage is higher and more electrons are diverted from the grid to the plate.

The same procedure should be followed with 10,000- and 5000-ohm 1-watt resistors as loads, when it will be found that the greater the loading, i.e., the lower the load resistance, the higher the plate current and the lower the grid current. As the load resistance progressively decreases the tank impedance also decreases, resulting in a lower r.f. voltage drop and consequently higher average plate voltage during the part of the cycle when plate current flows. If the tank circuit is detuned off resonance, however, the presence of the load resistor has relatively little effect on the impedance and the off resonance conditions are practically the same regardless of load resistance.

Observations on Class-C amplifiers can be carried farther by using the v.t. voltmeter to measure the r.f. output voltage. For this purpose the voltmeter may be connected to the plate circuit as shown in Fig. 10, using a very small value of coupling capacity so that the indication will come on the medium range of the v.t.v.m. If care is taken not to disturb the v.t.v.m. position or leads when changing load resistors, the relative variation of r.f. tank voltage with changes in load can be measured. It is also of interest, with a fixed value of load resistance, to measure the variation in r.f. tank or output voltage as the excitation is changed; the rectified grid current can be used as a measure of the excitation. Since power output is proportional to the square of the voltage, a series of such observations can be plotted in terms of power output vs. grid current, for a fixed load resistance and grid bias.

ANSWERS TO QUESTIONS IN INSTALLMENT 4

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

Assignment 12:

Q. 12 — 01.75 watts per peak volt or 0.24 watts per r.m.s. volt.
Q. 15 — 12.04 db.
Q. 18 — 31.6 to 1, input to output.
Q. 19 — 75 volts.
Q. 20 — 87 db.

Assignment 13:

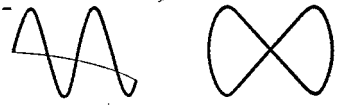
Q. 13 — 12,500 ohms.
Q. 14 — 667 ohms.
Q. 15 — 408 ohms, 48.9 μfd.
Q. 16 — 9000 ohms.

Assignment 14:

Q. 15 — 250 μμfd.

Assignment 15:

Q. 11 — The left-hand drawing below is with linear sweep, the right-hand drawing with sine-wave sweep.



P.O.W.

G. R. Tweed, KB6GJX, of Agana, Guam and Jasper Treadway, W6IJB, of Berkeley, Calif., are reported being held as prisoners of war in Japan.

The Old Lady Goes Down

W7DGY Writes a Letter About the Sinking of the "Lexington"

THE letter which follows was not written for general consumption. It is the personal missive of a son to his parents, written by RM1c Harold R. Littlefield, W7DGY, to his mother and father back home in Port Angeles, Wash. Knowing of her son's intense interest in amateur radio, however, and of the ham's tendency to pass a good yarn around, Mrs. Littlefield graciously forwarded the letter to *QST*. We are happy to present it in these pages, a graphic, moving recital of the last hours of a majestic ship and the personal experiences of a ham who joined the Navy to get action — and got it.

Dear Folks:

Your letter of June 5th received to-day and I was glad to hear from you after such a long lapse between letters. I noticed the confusion in your letter, wondering just why I had been transferred from the *Lexington* and where I actually am now. I guess the news headlines of the past three or four days readily explained to you my transfer from the good old *Lex*.

Now that the *Lex* is gone I guess there is no harm in telling you some of my experiences, seeing they have been pretty well covered in the news by various writers including the yeoman from our own K division of the *Lexington*. But I thought that you might like to hear my version.

As you know from the papers, our forces had done considerable damage to the Japs preceding the day we were sunk. In fact, the day before we were very elated upon receiving the news that our squadrons had blown a Jap carrier to bits. The following morning, general quarters sounded about 10 A.M., and we all manned our battle stations. Mine happened to be in the vicinity of some radio equipment located well up in the forward superstructure three decks above the bridge. It was a beautiful vantage point although not exactly the safest place in the world. Hi! I'm glad I was where I could see what was going on, though.

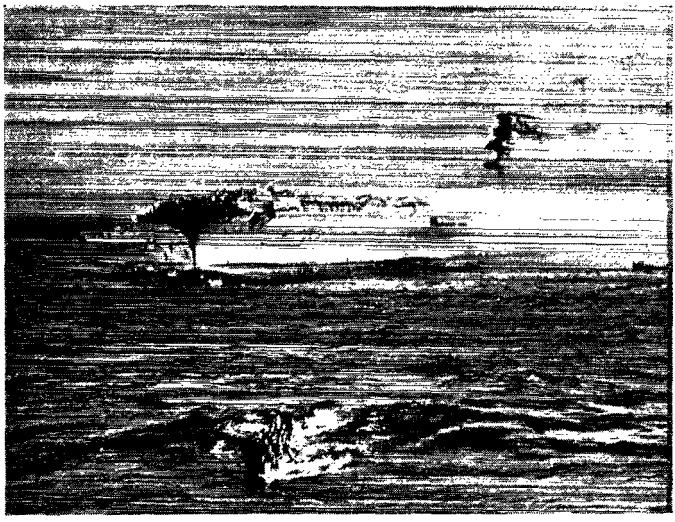
RM1c Harold R. Littlefield, W7DGY, radioman aboard the aircraft carrier U.S.S. *Lexington* when she was sunk in the historic Battle of the Coral Sea.

Shortly after 11 A.M. our guns opened up and that was the first I knew that enemy planes were around. I looked out to port. We were pouring lead into a Jap torpedo plane, and it seemed from then on that all Hell had broken loose. I saw several planes crash into the ocean, a mass of crimson flame. I vividly remember saying to one of the fellows who was with me, "We've been hit!" just as though he didn't know it as well as myself. There were other torpedo hits, too; just how many I'm not quite sure. Things happen so fast that you aren't able to see or remember everything that did happen. I do remember one bomb that hit us on the edge of the flight deck and set it afire. However, the fire crew was right on it and in just a few minutes the fire was out and everything seemed OK again. The very fact that, even though we had been hit several times and were leaving a dirty slick on the water behind us, we were still making fine speed made me feel good. I felt that, as long as we were moving fast and maneuvering well, in reality we weren't hurt very bad and that we were going to bring the old *Lex* through and take her into the Bremerton Navy Yard. It would have been a grand feeling to have brought the *Lex* back with us so that we could thumb our noses even more at the Japs, but Lady Luck was against us.

Among the other things I remember of the battle itself were the terrific roar of our guns and the deafening scream of our whistle as she was blown when we were first hit and it apparently stuck. After a few minutes someone must have cut it because it quit blowing. That in itself was a relief to our ear drums. I saw lots of Jap torpedo planes, and although I didn't see any of their dive bombers I heard them screaming down at us and saw huge pyramids of water rise up into the sky, some of them uncomfortably close but still misses. Sometime during that battle I felt a quick burning sensation in my arm and I looked down and saw a little cut under my arm between my elbow and my shoulder. Seeing that it was just a slight cut

and not an artery, I let 'er bleed till the battle was over. It didn't hurt anyway. I don't know just what it was that hit me, but imagine that it must have been a piece of shrapnel. Another fellow up there with me got hit in just about the same way I did. It was nothing at all. . . .

For a while after the battle everything seemed OK and we were sure that we were going to bring our wounded ship home with very little trouble. We were making excellent speed. We already had taken the list out of her, our flight deck was OK and we were taking our own planes on. Then, a while later, explosions started occurring. As they became more frequent and smoke began pouring out from below decks it became evident that we were in serious trouble. The fire-fighting crew did their best, but their equipment was already damaged and it was a pretty hopeless job. Finally our electric power went off and all of our equipment was dead. The ship came to a halt and the captain ordered the steam released from the boilers. By this time it was pretty apparent that we were going to have to leave the Old Lady, so most of us went down to the flight deck and started breaking out life rafts and carrying them to the bow and to the stern. This done and the lines run over the side, we stood by for further orders.



It was over a rope from the bow of the *Lexington* that W7DGY slid into the water, as shown in this view of the burning ship. Launches from accompanying cruisers and destroyers were loaded to the gunwales as they transported survivors to the escort vessels. In the center foreground a launch is seen carrying a heavy load of men to a cruiser. In its wake can be seen a seaman being towed on a line. *Official U.S. Navy Photograph.*

By that time she must have been burning furiously in the hangar deck, as I walked over the elevators several times dragging life rafts and the deck was very hot and smoke was pouring out. Those who were back aft had a treat that we on the bow missed out on. You may have read in the papers how the fellows were eating ice cream. That story was true. The ice-cream locker was back aft on the main deck so they broke her open and all the fellows there had all the ice cream they could eat. Although we up forward missed out on the ice cream, we did find a pan of sandwiches and a keg of drinking water in one of the forward gun galleys and proceeded to use them up.

By this time I believe all the wounded men had been removed to destroyers that came along side. Some of the "cans" attempted to fight the fires on the *Lex*, but when they started pouring water onto the ship the explosions seemed to increase, so they backed away. Shortly thereafter Captain Sherman (now Rear Admiral Sherman) came out on the bridge with his megaphone and called out the words which I shall never forget: "All right, now. All hands put the rafts over the side and abandon ship."

It seemed a shame that we had to lose her, but we knew that it was too late to think of saving her then, for there was the possibility that she might blow up any time. Before everyone got off there were several more nasty explosions, but I don't believe anyone was hurt in them. The morale of the men was excellent, I don't remember seeing any sign of panic. In fact, shortly before leaving ship I saw one fellow lying on the flight deck reading a magazine!

I left the ship over the bow going hand over hand down a line into the water. There was no rushing by anyone and each man waited until the one before him was pretty well down before he started. Several of us got hold of a life raft with one hand and swam with the other, and made out for a destroyer which was lying off our port side. The water was nice and warm and apparently there were no sharks around. When we got to the "cans" they had lines over the side and lifted us aboard.

As soon as I hit the deck an officer noticed blood on my arm and insisted that I be taken below right away for treatment, so I missed out on some of the final scenes of the Old Lady's struggle for survival. However, I got my clothes off, had several cups of hot coffee and a temporary patch on my arm. Shortly after they passed out cigarettes and matches to us and started the cooks going on chow. They turned out a

(Continued on page 120)

HINTS AND KINKS FOR THE EXPERIMENTER

REVAMPING 5-METER TRANSCEIVERS FOR 2½

THE following ideas may be of some help to hams who, like myself, have old 5-meter transceivers around the shack which might be converted for WERS service on 2½.

Since it is apparent that dry batteries are going to be very hard to get, it was decided that no strictly battery-operated equipment would be considered. However, every unit rebuilt was equipped with a cable and plug so that the unit could be operated from available batteries, if desired in the interests of greater portability. Most of the operation, we feel, will be from vibrator-pack or a.c. supplies. Accordingly, a power unit was built up which includes a Mallory VP554 Vibrapack and a 300-volt, 70-ma. a.c. pack.

To determine just what might be done with one of the old 56-Mc. transceivers so popular back in 1936 and 1937, before the ban on modulated oscillators on Five, the first job undertaken was that of changing one of the old rigs built around the types 76 and 41 for 112-Mc. operation. This rig had a 10-$\mu\mu$fd. tuning condenser of the single-bearing type with the so-called natural-bakelite low-loss insulation. In spite of the fact that this type of insulation is not the last word for u.h.f. work, it was decided to see what results could be obtained with minimum change of parts and layout. The revised circuit is shown in Fig. 1. A new coil consisting of four turns of No. 14 enameled wire, ⅜ inch in diameter and ⅝ inch long was substituted for the original five-meter inductance. This coil was rigidly mounted across the 10-$\mu\mu$fd. tuning condenser. The 5-prong socket of the 76 was replaced with an Amphenol polystyrene octal socket and a 6J5GTX was used in place of the original 76. The 6J5, 6J5G and 6J5GT were also tried and all gave good results, although the GTX seemed to be a shade better.

To get away from the necessity for a mike battery, the d.c. voltage was taken from the drop across a semi-variable resistor, R_6, which replaced the original cathode resistance in the audio stage. Different r.f. chokes were tried, but no change in results was noticed. A 'phone jack was installed with a switch, S_2, to cut off the speaker.

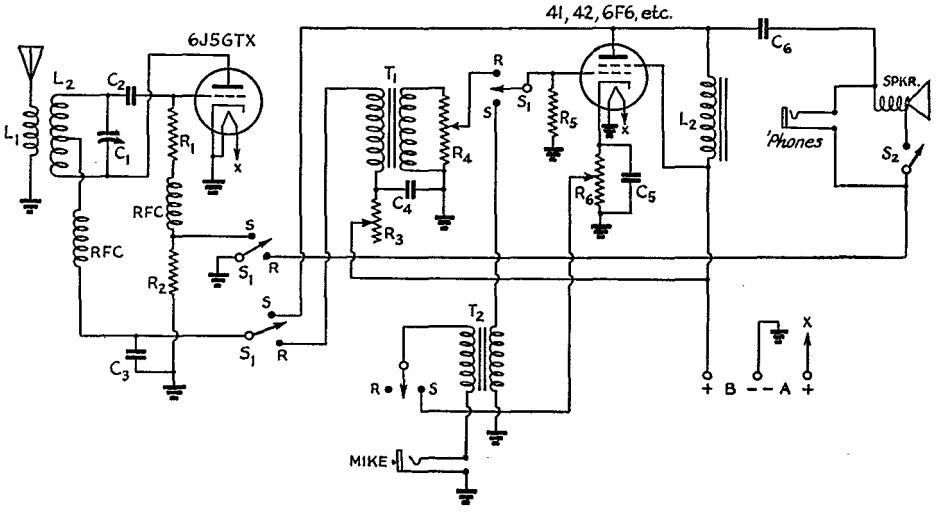


Fig. 1 — Circuit diagram of W1HIL's 5-meter transceiver revised for 2½-meter operation.

C_1 — 10-$\mu\mu$fd. midget variable.
C_2 — 100-$\mu\mu$fd. mica.
C_3 — 0.006-$\mu\mu$fd. mica.
C_4 — 0.5-μfd., 400-volt paper.
C_5 — 25-μfd., 25-volt electrolytic.
C_6 — 0.25-μfd., 400-volt paper.
L_1 — 2 turns No. 18 push-back wire between the turns of L_2.
L_2 — 4 turns No. 14, ⅜ inch diameter, ⅝ inch long.
L_3 — 30-hy., 100-ma. filter choke.
R_1 — 5000 ohms, ½-watt.
R_2 — 50,000 ohms, ½-watt.
R_3 — 50,000-ohm variable.
R_4 — ½-meg. variable.
R_5 — 1 megohm, ½-watt.
RFC — Ohmite Z-1 r.f. choke.
S_1 — 4-circuit, single-gang selector switch.
S_2 — S.p.s.t. switch.

A four-wire cable and plug were provided for the power supply. Plate voltage on this unit was run up to the maximum output of the power-supply units described above.

The unit gives very good results, considering the power input, and the bandspread seems to be ample. It is not fussy as to antenna adjustment. A ¾-wavelength antenna, fed by Amphenol concentric cable and a ½-wavelength antenna cut for 115 Mc. and fed by a single-wire feeder were used with about equal results. When the transceiver was used with a four-element beam antenna, similar to the one described by W1GAG in *QST* for September, stations within a 30-mile radius gave excellent reports as to both signal strength and quality.

The audio tube may be changed to a 42, or to a 6F6 if the socket is changed to an octal type. However, no great difference was noted. — *L. R. Mitchell, W1HIL.*

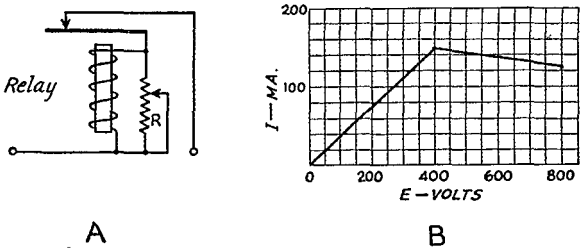


Fig. 2 — Overload protection system suggested by W3IXL. A shows the relay circuit, while the curve of B shows the output current *vs.* input voltage when used in series with a resistance as mentioned in the text.

—•••—

WHY NOT PROVIDE OVERLOAD PROTECTION FOR YOUR EQUIPMENT?

THE radio amateur and experimenter often has need for a device that will limit the amount of current that can be supplied to a changing load. This load may be a grid-leak-biased transmitter stage which tends to draw excessive current when out of tune or overcoupled to an antenna, or one of those ultrahigh-frequency, high-power oscillators which tend to run away when loaded too much. The conventional fuse, while giving satisfactory protection, is inconvenient. A fuse with a rating sufficiently low to provide adequate protection may be blown during the normal adjustment procedure. Replacing fuses also becomes costly if done very often. A circuit breaker eliminates the necessity for replacement of fuses, but it has the disadvantage that if it is set to provide the maximum protection, it will often open and need resetting even when the equipment is very near to its proper adjustment. Reducing the plate voltage supplied to the transmitter while adjustments are being made and selecting a fuse or overload relay of suitable value is a possibility, but this procedure is somewhat inconvenient. A series resistor is often used to supply voltage to such variable loads, but this is rather wasteful because, even under operating conditions, there is a certain amount of power lost in the protective device. A handier protective device would be something that would allow normal operation up to a predetermined current drain and then function so as to prevent this current from being exceeded, regardless of the output load or the applied voltage.

Such a device may be conveniently constructed from a normally-closed d.c. relay. The exciting coil of the relay is shunted so that the relay will open when the desired limit current passes through the winding-resistor combination. This coil is then connected in series with the relay contacts as shown in Fig. 2-A. The relay is placed in series with the lead supplying current to the device to be protected. While the current drawn by the equipment is lower than the desired limit, the protective device will have no effect on this current or voltage. Above the overload point, the relay will open, causing the current to be shut off from the equipment. Shutting off the current will then de-energize the relay coil so that the contacts will again close. This process will be repeated at a rate determined by the amount of excess current that the protected device tried to draw.

A typical operating characteristic is shown in Fig. 2-B. In this case, the relay was placed in series with a resistor and the voltage across the combination varied. The current through the resistor was plotted against this voltage variation. It will be noted that the current to the resistor was directly proportional to the applied voltage until the predetermined current value was reached. The current then dropped slightly as the supply voltage was increased. For a two-to-one increase in supply voltage, the current through the resistor stayed within 15 per cent of the maximum value, never exceeding this value. This characteristic will vary slightly with the particular relay chosen. The opening and closing of the relay will cause a modulation on the current supplied to the load. In most cases this will not be objectionable, since the device will operate only when the protected equipment is overloaded. If desired, a part or all of this modulation (and interference with other equipment) can be removed by use of resistor-capacitor filters, or inductor-capacitor filters, such as are commonly used for the elimination of keying interference in c.w. transmitters.

In choosing a relay, care should be taken to pick one that has sufficient spacing between the contacts so that the high voltage present across them when the relay is open will not start an arc. If an arc forms, the circuit will not open and the protective device will be of no value. For experimental purposes, it is often convenient to place a

variable resistor across the relay coil so that the operating current may be set at will.

A small d.c. relay shunted with a 250-ohm wire-wound rheostat makes a suitable protective device for small transmitters drawing not more than 150 ma. at 400 volts. These relays usually open with a coil current of 10 to 20 ma.

The system has been used in the laboratory in the development of several pieces of equipment in which it had previously been necessary continuously to replace fuses or run the risk of destroying expensive tubes. — *H. C. Lawrence, W8IXL.*

—•••—

OPERATING STAGES IN SERIES FROM A HIGH-VOLTAGE POWER SUPPLY

THE problem of using a single power-supply unit for a transmitter of several stages, some of which may operate at different voltages, is always a difficult one. It is usually solved by the use of inefficient dropping resistors. In contrast to this, Jim Blitch, W4IS, describes a rather novel way in which an entire c.w. transmitter is operated from a single 1500-volt supply.

The essentials of the circuit are shown in Fig. 3. The transmitter in this case consists of four stages: 6F6 Pierce oscillator, 6L6 buffer, 809 driver and push-pull 808 final, all operating at different voltages. Since the oscillator is designed to operate with very-low plate current, plate voltage may be obtained without great loss in power through the series dropping resistance, R_4. The voltage is prevented from soaring by the VR-105 regulator tube.

The innovation in the system is in the manner in which the two intermediate stages are supplied. As the circuit diagram of Fig. 3 shows, these two stages are connected in series across the supply, the series circuit from the positive high-voltage terminal being through the plate circuit of the 809 to its filament center tap, thence to the plate circuit of the 6L6 whose cathode forms the return connection to negative high voltage. Since the 809 normally operates with a higher plate current than the 6L6, and, since the current throughout the series circuit must be the same, the 6L6 is shunted by the resistance R_3 which is proportioned to carry the difference between the plate current of the 809 and that of the 6L6. This point may be made clearer by comparing the circuit with that of series-connected heaters, commonly found in a.c.-d.c. receivers. In cases where heaters of unlike current ratings are connected in series, those of lower current rating are shunted by resistors which limit the voltage across the heater terminals to the proper value when rated current is flowing through the heater of highest current rating.

Bias for the 809 is obtained by the drop across the cathode or centertap resistance, R_2, bypassed by C_1 and C_2. To obtain this bias, the grid is returned through L_1 and RFC_1. Since no coupling may be used, excitation is adjusted by a variable tap on L_1.

Idling plate current may be adjusted by varying the values of cathode resistance, while input to the 6L6 may be controlled by adjusting the size of R_3.

All values not marked are normal. The filament by-pass condensers, C_1 and C_2, and the filament transformer, T_1, should have voltage ratings of not less than 1000 volts. If a d.c. connection is made to the rotors of C_3, as shown in the diagram, a tank condenser with normal plate spacing may be used. However, if the rotor is grounded, the spacing must be increased to take care of the full supply voltage (1500 in this case) plus the peak r.f. voltage. C_4 should be rated to withstand full supply voltage. For the particular arrangement shown, 900 ohms, 25 watts and 25,000 ohms, 25 watts are appropriate values for R_2 and R_3, respectively. Also in this particular instance, the dropping resistance R_4 is 37,500 ohms. C_4 should have a voltage rating proportional to the full supply voltage. A resistance of 100 ohms for R_1 should be suitable. Such an arrangement is not suitable, of course, for 'phone work.

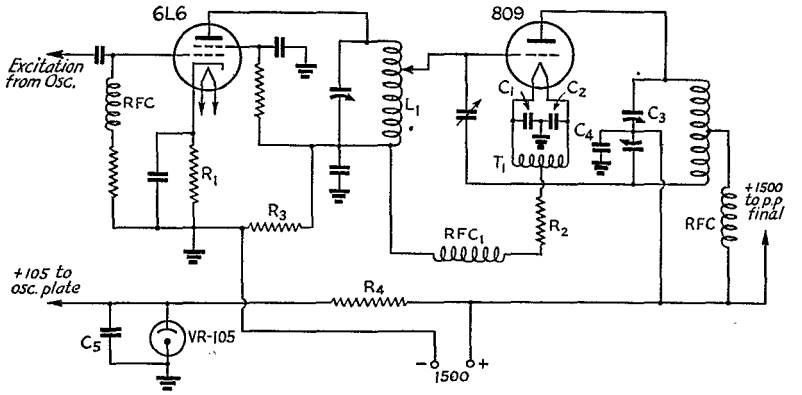


Fig. 3 — Two stages operating in series from a single high-voltage supply. Circuit values differing from those normally employed are discussed in the text.

STRAYS

Radiolocators may locate meteors and measure their velocity. From India comes word that radio short waves can be reflected from shooting stars.

While listening to the Delhi short-wave station only 10 miles distant, members of the Research Department of the All-India Radio report that they frequently heard whistles of a peculiar nature. Beginning with a shrill note, the pitch fell rapidly to nothing or disappeared in one-fifth to several seconds. This is the Doppler effect, which may be observed when a locomotive whistle is heard rapidly receding. From it can be determined the velocity of the object.

In this case, the velocities measured ran as high as 40 miles a second. Only meteors ever travel that fast through the air. In fact, watching the sky, the observers noted that when a meteor passed, the peculiar whistle was heard. This provides a new method, they pointed out, of measuring the velocity of a meteor. It cannot be used at present because of restrictions on the use of radio, but after the war perhaps some of our many radiolocators may be put to astronomical use. — *Science News Letter.*

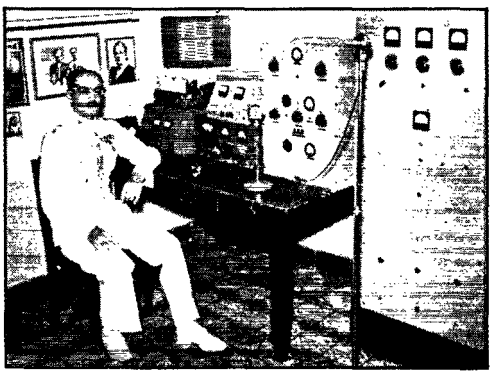
—•••—

On the basis of present wartime developments in the ultrahigh radio frequencies, peace will see devices by which air transport pilots will have constantly before them, on the screen of the cathode-ray tube, clear warning of any obstacles ahead, so that mountains will lose their terror in darkness and thick weather, and blind landings will be facilitated. At sea, the ship's pilot will detect nearby shipping or icebergs through fog and darkness as plainly as in clear weather by day. — *G.E. Bulletin.*

Left — Larry A. Walworth, K6BAZ, ARRL SCM for Hawaii, in BMTC (Business Men's Training Corps) togs, ready to welcome the Japs with pistol, tear gas and hand grenade.

—•••—

The purchasing agent of a large radio plant was amazed recently to receive a requisition from the laboratory for a million white ants together with instructions for breeding them. Investigation disclosed that feeding experiments were in progress to develop an insulation that would not be eaten by the ants. — *Ohmite News.*



Captain Rafael Gonzalez Cobo, S. D., CO2CL, is an aide to General Fulgencio Batista, the president of the Republic of Cuba. President of the Radio Club de Cuba, CO2CL is also an ARRL member and belongs to the ARRL Emergency Corps.

—•••—

Among the vast developments being made in the radio industry as a result of the war effort and which will eventually be universally available are a circular-type antenna which gives a higher field strength for a given transmitter power and a resonant inverter to replace dynamotors and vibrators. Present vibrators have to break the full-load current of the apparatus, whereas the new resonant inverter has electrical and mechanical resonant circuits such that vibrator contacts break only during periods when the current through the contacts is zero. — *G.E. Bulletin.*

—•••—

A 50-per-cent solution of hydrochloric acid and water will quickly clean oxidization from copper. The acid will not attack the copper, although the wire should be wiped clean with a water-soaked cloth after treatment. — *W5KTI/6.*

—•••—

Here are a few alphabetical sentences which are in step with the times and which will help to keep the fist in trim:

When the armistice is formally declared, every gallant brave soldier, who quietly excelled in zeal and patriotic duty, will rejoice with his kin.

Fast giant bombers zoomed over the city but quickly made their exit without injuring any people.

Several war zones and fronts jubilantly expected peace and quiet until many heavy guns suddenly broke loose. — *W9LQE.*

CORRESPONDENCE FROM MEMBERS

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

THE AMERICAN WAY IN PUERTO RICO

19 Lindbergh St., Santurce, P. R.

Editor, *QST:*

. . . I am enclosing copy of the notification received from the local FCC Office and a copy of the receipt/inventory form used by the Inspector-in-Charge in impounding amateur equipment in Puerto Rico and the Virgin Islands.

. . . The fact is that we had expected this action sooner or later and . . . had wondered why it had not already come to pass. Due to the above fact and the status of the majority of the K4 amateurs, who, since the emergency arose, have had little spare time, interest was at low ebb and we were accustomed to being without our hobby. I have personally heard no complaint whatsoever against the action of the Board of War Communications, and I doubt if there is amongst us any who dissents to their action. We realize the seriousness of the situation, and I believe I speak for all the K4 gang when I say that there is no sacrifice we will not be willing to make if it will contribute to our ultimate victory. . . .

— *E. W. Mayer, K4KD*

TO ALL RADIO AMATEURS OF THE CARIBBEAN AREA:

July 22, 1942.

Gentlemen:

You are advised that the Board of War Communications has decided that the successful conduct of the War requires that all Amateur transmitting apparatus in Puerto Rico and the Virgin Islands be removed and impounded. The apparatus will be removed by the Federal Communications Commission and be stored in space provided by the Army.

We wish to assure you that this order was based on certain military considerations and does not imply the slightest doubt of the loyalty and patriotism of our Amateurs. As a matter of fact, many of the transmitters to be removed are owned by soldiers, sailors and other persons holding positions of trust.

If you do not possess a transmitter please advise this office immediately.

Although your equipment will be removed by persons who understand how to handle delicate equipment and will be handled with the utmost care, warehouses cannot be made as dry as your home and there will be damage from oxidation if special precautions are not taken. We are therefore allowing a period of about two weeks in which you can prepare your equipment for storage! Please observe the following rules.

1. Remove tubes and crystals and wrap them separately, and pack them in a box by themselves.

2. Disconnect all wires leading from the transmitter so that it can be picked up and moved.

3. External equipment such as switches, microphones and key may be kept by you.

4. Make sure that all the parts inside the transmitter are securely fastened so that the vibration of the truck will not cause parts to fall out and break.

5. Objects of iron and steel such as transformer cores, chokes, nuts and bolts, panels, shelves, brackets and condenser shafts, oxidize very rapidly in this climate. Even aluminum oxidizes although to a lesser extent. This damage may be entirely eliminated by putting a thick coating of grease over all metallic parts. *This is most important.*

6. For greatest safety and protection your equipment should be packed in a wooden box filling in the empty spaces with paper or excelsior. The top should remain open for inspection at the time the equipment is removed.

You will find enclosed a form on which you may declare the value of your equipment. This same form will constitute a receipt after being signed by the official who removes your equipment.

If you live in or about San Juan or Rio Piedras please call this office by telephone and give us the date when your equipment will be ready for storage. We would like to remove the transmitters in this area during the week beginning August 3rd.

If you reside in some other locality we will pick up your equipment on the date shown. (A list of towns and the date on which equipment would be picked up was given here at this point.)

If possible we would like you to be at home on the day shown for picking up the equipment, but if this is not possible, please instruct some member of your family to make delivery.

Yours very truly!

/s/ Wm. R. Foley
Inspector in Charge.

EDITOR'S NOTE — The above correspondence is here reproduced because it displays a thoroughly commendable manner of handling a difficult problem, one which required exceptional discretion and in which it would have been so easy for officials to have acted in a high-handed and un-American way. Mr. Foley and his staff are to be congratulated on their handling of the matter.

MORE ON THE JAP CODE

32–41 85th St., Jackson Heights, N. Y.

Editor, *QST:*

Enclosed you will find the data requested on the Japanese telegraphic code. . . .

I don't know how conversant you are with the jargon . . . so I'll give you a quick once-over that should prove of interest to your readers and perhaps tempt some of the more studious into a deeper analysis of it. As it so happens, the translation of a non-enciphered message into English is not difficult and anyone with a reasonable amount of intelligence and a Japanese-English dictionary can do a pretty fair job.

In their writings the Japanese make use of three types of characters:

Katakana. This is the language in its simplest form and is used for telegraphic translation and legal documents. These ideographs are easily recognizable by their plain heavy make-up.

Hiragana. The symbols of this group are more elaborate and flowing than the Katakana. It is used principally in letter writing and for newspaper type.

Kanji. These have been taken from the ancient Chinese symbols and usually each character represents an entire word. They can be readily noticed by their complicated and ornate construction.

In any Japanese literary text all three of these "Kanas" may be found together, although usually it is either a combination of Kanji and Hiragana or Kanji and Katakana. Katakana or Hiragana may be used completely alone without the help of Kanji. "Rōmaji" is the term used for Romanized Japanese or, more correctly, the translation of the characters and their sounds into English equivalents. Just prior to Pearl Harbor there was a movement under way in Japan to completely Romanize the entire language.

All Japanese telegrams are written from a Katakana base and, while the tongue contains a few inconsistencies, a little outside study can readily iron them out.

There are two Es, pronounced identically but using different characters.

There are, similarly, two Is and two Os.

The character for HA is used for the sound WA when used for a post-position.

The symbol for TSU, when used in combination with several other specific ideographs, is Romanized by repeating the first letter of the following syllable; e.g., TSU and PA become PPA, TSU and KI become KKI, etc.

The letter N takes the sound of M when followed by the sound of m, b or p.

KI and KU sometimes drop their vowel when they precede a K sound; e.g., SE-KI-KE-N is Romanized to SEKKEN. When KA is alone at the end of a sentence it is not a word but simply a "question mark," e.g., SO DESU KA ("Is that so?").

NO has many meanings, such as *at, against, by, from, of, on, the;* it also can mean "apostrophe s" ('s) as in HINO (Sun's). NO is also a contraction for MONO (thing).

The recognition of long vowels and held consonants is important, as they change the meaning of a word; e.g.,

TORI (Bird) TŌRI (Street)
TOKU (Virtue) TOKKU (Already)

In telegraphic communication the long vowel or held consonant is usually transmitted by repeating the letter; e.g., TORI (Bird) TOORI (Street). However, there is a telegraphic code symbol for this lengthened vowel and it is sent just before the syllable effected. (See chart in September, 1942, *QST.*)

The Nigori (a small circle or two small quotation mark symbols at the upper right side of some Katakana and Hiragana characters) modify or soften the syllable sound; e.g., HA with the Nigori becomes PA and BA; TO with the Nigori becomes DO; KI with the Nigori becomes GI, etc.

The Nigori are expressed in telegraphic messages by the addition of two code symbols covering both of these signs. The small circle is dit-dit, and the "quotation mark" is dit-dit-dah-dah-dit.

These are a few of the peculiarities involved. The study is very fascinating, and you might find an interesting story in Yardley's *American Black Chamber* at your library, pages 174–190. . . . In fact, the whole book is good.

I don't know how far advanced the Japs are in their facsimile transmission, but if they get this down pat they can send their actual ideographs through the air.

I hope that some of this data will prove worth while to your readers and that some of them will be able to pick up transmissions from Japanese sending stations. . . .

— *Charles E. Holden*

DOUBLE PAYMENT

8330½ Pritchard Pl., New Orleans, La.

Editor, *QST:*

This epistle is of several parts. First, I wish to report that I am enlisting in the Marines the 19th of this month. . . . I feel that Uncle Sam has been most generous with us amateurs in giving us so much freedom of action and generous slices of ozone to tear up with QRM, and such generosity deserves a fair repayment. Therefore, here goes another payment from the fifty thousand afflicted with "radioitis."

Second, I wish to report that my equipment which was listed with you has been sold to the Signal Corps. The whole works — transmitter, receiver, test equipment and all — is gone, and things are sure bare. But I don't feel badly as I know that another bare spot in some far more important place is no longer bare, and my rig is going 599X for a real purpose. . . .

All good wishes to the Hq. gang. I am another firm believer in the League's value in these times, and want to compliment the staff on *QST.* The old rag has taken on an even greater value now in furnishing valuable technical information that is really new. I plan to have my mail issues continue to my home so that all copies will be here "after." I expect trying to keep up with a man in service would be practically impossible and the two bits additional will be well spent. I will drop you a line with my address when I get stationed.

— *J. Lewis Young, W5KRS*

EDITOR'S NOTE — Not the least appreciated portion of W5KRS's valued letter (parts of which were deleted for reasons of security) is that referring to retaining his home address. See box on page 41.

CRYPTANALYSIS COMMENT

963 N. Doheny Dr., W. Hollywood, Calif.

Editor, *QST:*

Reading the last few issues of *QST* I came across several articles written by John Huntoon, W1LVQ, on cryptanalysis. These articles intrigued me a great deal, to say the least. In this time of war, radio amateurs should, I think, know something about cryptanalysis. The possibility of receiving cryptograms over the air is very great indeed. The FBI and the FCC, I should think, would appreciate very much our work on any cryptograms that we might receive if we notified them of anything suspicious that should appear. Let me compliment W1LVQ and the ARRL on their foresight in seeing this. . . .

In closing I would like to express my appreciation of the close contact the editor of *QST* and the ARRL have had with the radio amateurs.

— *Leonard B. Gardner, II, W6URW*

---

815 W. Arch St., Portland, Ind.

Editor, *QST:*

The lessons in the science of cryptanalysis in the current issues of the *QST* are by far the finest thing that has been in that valuable magazine in years. . . .

— *Leonard M. Chalk, W9SNQ*

1119 Walnut St., Kansas City, Mo.

Editor, *QST:*

The recent articles in *QST* on cryptology have been most interesting. It is a very fascinating study and can become quite a hobby, taking the place of ham radio in a small way. . . .

— *S. M. Woodson, Jr., W9CXU*

1311 Spring Road, N. W., Washington, D. C.

Editor, *QST:*

Your articles on cryptanalysis in *QST* have been most interesting. . . .

I really hope to know more about it before your lessons are ended. There is no one I know here to talk it over with, and I can't afford to take too much time from Red Cross sewing and knitting. I am also a sector air raid warden. . . .

— (*Mrs.*) *Marion H. Briggs, XYL-W3CAB*

Rt. 2, Box 395, Phoenix, Ariz.

Editor, *QST:*

. . . I think this course is a most interesting one. I can hardly wait for the next one. I understand experts in cryptanalysis are needed by the armed forces of the U. S. Is this true?

— *Jerry Johnson*

EDITOR'S NOTE — It certainly is true. That's the principal reason we're running the series of lessons on cryptanalysis in *QST* — to arouse interest in the subject. And, judging from the widespread enthusiastic response, they are doing that job in a big way!

QSO JAG

12 Revell St., West Annapolis, Md.

Editor, *QST:*

QST is like a cool breath of the past. The first day after we've finished this job and can get on the air again, I'm going on a 24-hour QSO jag!

— *Lt. Robert D. Bass, USNR, W4QG-W3JSI*

FROM A SECOND-TIMER AT SEA

Editor, *QST:*

Just passing away some very pleasant time reading the latest issue of *QST*. I certainly admire the spirit the gang at Headquarters is showing. That's what it takes to keep you a good organization such as we amateurs of America have in the ARRL. I believe that it is the only thing that will bring back the good old days of hamming again, and I am for you 100 per cent.

I am now pounding brass for Uncle Sam in the good old U. S. Navy. I have been on active duty since March 3, 1941. At present I am doing sea duty, but previously I was stationed at NPG.

This makes my second time to exercise the pleasure and privilege of serving my country in time of war. I was in the U. S. Marine Corps during World War I. Although I am not a spring chicken, as the saying goes, I just couldn't miss out on this one. I like the field I am now in (radio), and the experience and knowledge I gained from amateur radio sure has come in very handy more than once.

Ever since I took an interest in radio I have been buying the *QST* from newsstands. But after seeing how the Headquarters gang are up there plugging for us at all times I sort of feel it my duty to become a member, and do my little part in keeping the ARRL in good old fighting form. So if you will be kind enough to enter my name for one year I will appreciate it very much.

— *Frank Gunther, RM2C, W6QLU*

HELP NOW

127 State St., Seneca Falls, N. Y.

Editor, *QST:*

Tonight, at the close of a Treasury Department program over NBC, Lionel Barrymore spoke. He said, "In the story of the fall of Bataan these lines appear: 'The men who escaped to Corregidor told that on the night of the fall of Bataan, as they were crossing from Bataan to Corregidor, they saw many flashlights blinking from the shores of Bataan. They were blinking in Morse code. What they were saying was — SOS SOS SOS.' "

Need any more be said to any radio amateur? Some of the boys behind those flashlights may have been brother hams of ours — all were brother Americans.

Come on, fellows — let us help to speed the day of their release. Let's buy more war bonds NOW.

— *John B. Merritt, W8TJN*

OPERATING NEWS

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

WERS Licensing. It is good news to hear that the first WERS licenses have been issued, they being granted in late August to the cities of Lawrence, Mass., and Akron, Ohio. Others will follow shortly. But there are many applications on hand which are being held because the applicant failed to comply with all the necessary stipulations of FCC regulations pertaining to filing applications. Radio aides preparing the material should pay particular attention to Sec. 15.62 of WERS rules requiring the submission of certain supplementary data. If based on warning district organization, a complete set of papers for a license application should include:

a) Form 455 properly executed and signed by the Mayor, Town Manager or similar city official.

b) Additional lists of equipment too long for inclusion on page 2 of the application.

c) A number of sheets similar to page 3 of the application giving technical data on types of equipment not shown thereon.

d) Form 455 (a), certification of the radio aide.

e) Copies of intermunicipal agreements made between the licensee/district-control-center and the various communities for which authorization is requested, properly signed by the Mayor or Town Manager or similar official of both cities in each case.

f) Forms 457, one for each operator authorization requested. Make certain these are properly executed and include two full-face recent photographs $2\frac{1}{2} \times 2\frac{1}{2}$ inches and signed by the individual on the back.

g) The general map of operations, extremely important. A street map available from the local city clerk should do the trick, with overmarking to show the communications plan. It should carry the location of all stations, and if portable units are included their boundary lines of normal operation must be indicated. For warning-district organization, probably it will be more convenient to submit, first, a chart of the entire district showing the channels between district and subcontrol centers, and second, a series of smaller maps showing individual communities and details of station locations.

h) A statement concerning the scope of service to be rendered and type of messages handled. That is, whether a service for air-raid wardens alone, or for emergency equipment dispatch, or "incident officer" contact, or a combination of several, or what.

i) Factual information on the exact area of operations to be included in the license.

j) A statement of the general operating procedure to be employed by all stations in the unit.

k) A list of all equipment procured, showing its source (outright purchase, amateur loan, etc.) and distribution (i.e., at which location each particular unit is installed).

l) A statement of methods to be used in supervising the operation of all stations, including data on monitoring, methods used to measure frequencies, provisions for periodic inspection by the radio aide, etc. If the latter has designated delegated controlling authority in other communities to deputies or assistants to act for him, this section should so state.

m) A positive statement of the licensee's ability to silence its units upon order of the regional defense commander. This entails establishing proof of close and continuous contact with the district control center and of arrangements for immediate relaying of any such signals. The very nature of district organization permits an easy answer to this requirement, of course.

n) Methods used to ascertain the loyalty and integrity of operating personnel. For one thing, this section should include a statement from the local chief of police giving the names of all operators for which licenses are requested and certifying to their character and loyalty to the United States. Also include data on plans for recruiting operators and whether they will serve on a paid or voluntary basis.

WERS Agreements. In September *QST* (page 14) there was published a sample form of intermunicipal agreement executed between each community of a warning district and the control center city, required by FCC before a district license can be issued. Although not a part of the license application, there should also be a form of agreement between an amateur and his local municipal government when he loans equipment for the duration. It might be in some such form as this:

AGREEMENT

I, ..., residing at ..... in the city of ...., ...,
being the unconditional owner of the radio equipment described in detail below, do hereby convey all my right, title and interest to such equipment to the City of Berkfield, Faryland, for use solely in the War Emergency Radio Serv-

Honor Roll

The American Radio Relay League War Training Program

Listing in this column depends on an initial report of the scope of training plans plus submission of reports each mid-month stating progress of the group and the continuance of code and/or theory classes. All Radio Clubs engaged in a program of war radio training are eligible for the Honor Roll. Those groups listed with an asterisk teach both code and theory. Those listed with two asterisks teach theory only. Others conduct only code classes.

*Adirondack Amateur Radio Assn., Gloversville, N. Y.
Baltimore (Md.) Amateur Radio Assn.
*Canton (Ohio) Amateur Radio Club
*Central Oregon Radio Klub, Bend, Ore.
*Civilian Air Reserve Monitoring and Relay System, Toledo, Ohio
*Cuyahoga Radio Assn., Cleveland, Ohio
*Detroit (Mich.) Amateur Radio Assn.
*Dutchess County Sheriff's Emergency Radio Corps, Poughkeepsie, N. Y.
*Edison Radio Amateurs Assn., Detroit, Mich.
*Electric City Radio Club, Great Falls, Mont.
*Elgin (Ill.) Amateur Radio Defense Council
*Federation of Long Island Radio Clubs, Jamaica, N. Y.
Galveston (Texas) Amateur Radio Club
Hannibal (Mo.) Amateur Radio Club
*Indianapolis (Ind.) Radio Club
*Iowa-Illinois Amateur Radio Club, Burlington
Knoxville (Tenn.) Radio Communications Club
*Orange County Radio Assn., Middletown, N. Y.
**South Jersey Radio Club, Merchantville, N. J.
Sunrise Radio Club, Hollis, N. Y.
Valley Radio Club, Spring Valley, N. Y.

ice; PROVIDED, THAT it shall be returned to me by the City at the end of the present war.

List of Equipment:

Dated this ..... day of ...., 194...

(Signed) .....

Witnessed by: .....

By its signed acceptance of this document the City of Berkfield acknowledges receipt of the equipment in good condition and pledges that at the end of the present war it will be returned to the above-named individual, the City releasing all claims, right, title and interest thereto.

Accepted this ..... day of ...., 194...

City of Berkfield, Farryland.

By .....

SEAL

ELECTION NOTICES

To all ARRL Members residing in the Sections listed below:

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

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

Due to resignations in the Missouri, Northern Texas and Nebraska Sections, nominating petitions are hereby solicited for the office of Section Communications Manager in these Sections, and the closing date for receipt of nominations at ARRL Headquarters is herewith specified as noon, Thursday, October 15, 1942.

Section	*Closing Date*	*Present SCM*	*Present Term of Office Ends*
Western Penna.	Sept. 1, 1942	Elmer Krall	Sept. 20, 1942
Utah-Wyoming	Sept. 15, 1942	Henry L. Schroeder	Oct. 1, 1942
Alaska	Oct. 1, 1942	James G. Sherry	June 14, 1942
Southern Minn.	Oct. 1, 1942	Millard L. Bender	Aug. 22, 1942
No. New Jersey	Oct. 1, 1942	Edward Gursky, Jr.	Oct. 15, 1942
Santa Clara Valley	Oct. 15, 1942	Earl F. Sanderson	Aug. 15, 1942
Kentucky	Oct. 15, 1942	Darrell A. Downard	Apr. 15, 1940
Hawaii	Oct. 15, 1942	Francis T. Blatt	Feb. 28, 1941
New Mexico	Oct. 15, 1942	Dr. Hilton W. Gillett	Apr. 15, 1941
Sacramer to Valley	Oct. 15, 1942	Vincent N. Feldhausen	June 15, 1941
Nevada	Oct. 15, 1942	Edward W. Heim	Nov. 1, 1941
Oklahoma	Oct. 15, 1942	R. W. Battern	Nov. 1, 1941
Eastern New York	Oct. 15, 1942	Robert E. Haight	Nov. 1, 1941
Western New York	Oct. 15, 1942	Fred Chichester	Dec. 6, 1941
Southern Texas	Oct. 15, 1942	Horace E. Biddy	Dec. 23, 1941
Virginia	Oct. 15, 1942	Frank S. Anderson	May 27, 1942
New Hampshire	Oct. 15, 1942	Mrs. Dorothy W. Evans	Sept. 1, 1942
Kansas	Oct. 15, 1942	A. B. Unruh	Oct. 29, 1942
Missouri	Oct. 15, 1942	Robert C. Morwood (resigned)	.....
Northern Texas	Oct. 15, 1942	George W. Smith (resigned)	.....
Nebraska	Oct. 15, 1942	Garold Bennett (resigned)	.....
Oregon	Nov. 16, 1942	Carl Austin	Nov. 22, 1942
Georgia	Nov. 16, 1942	William U. Hanks	Nov. 29, 1942
West Indies	Dec. 1, 1942	Mario de la Torre	Dec. 16, 1942

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

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

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

(Place and date)

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

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

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

The candidates and five or more signers *must* be League members in good standing or the petition will be thrown out as in-

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

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

— *John Huntoon, Acting Communications Manager*

ELECTION RESULTS

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

Idaho	Don D. Oberbillig, W7AVP	Apr. 15, 1942
Illinois	Mrs. Carrie Jones, W9ILH	July 11, 1942
Arkansas	Edgar Beck, W5GED	Aug. 17, 1942
North Dakota	John W. McBride, W9YVF	Aug. 17, 1942
Western Mass.	William J. Barrett, W1JAH	Aug. 17, 1942
Ohio	D. C. McCoy, W8CBI	Aug. 17, 1942
Wisconsin	Emil Felber, Jr., W9RH	Aug. 17, 1942

ARTICLE CONTEST

The article by Mr. H. W. Castner, W1IIE, wins the CD article contest prize this month. *We invite entries for this monthly contest.*

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

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

Our Insurance Premium

BY H. W. CASTNER, W1IIE*

ALL AMATEURS who have read Clint DeSoto's excellent book, *Two Hundred Meters and Down*, should review Chapter 9 at this time. Some of us recall the terrific struggle that barely rescued Amateur Radio after World War I. Few realize that, immediately after the signing of the Armistice, a bill was introduced that would have destroyed us for all time. How few, also, realize the frantic scramble that was necessary to present immediate opposition to this bill. There was enormous personal expense to a select few. In a large measure, Amateur Radio found itself practically disbanded. Old members were scattered to the four winds. Few knew the addresses of a sufficient number to create a respectable opposition that could be called a united front!

A small group was assembled. Under the able and effective leadership of Mr. Maxim, providing inspiration and guidance, these men succeeded in getting the bill defeated in committee. To them we owe an eternal debt of gratitude. Such a situation must never again be allowed to exist.

From the inspiration of this great man and his faithful followers, we are reminded also of a familiar maxim. "United we stand — divided we fall." Now is the time to maintain a united front. You can depend upon it, the old order has changed. The very moment this war is over we shall be confronted with attack on every side. History may repeat itself. We must maintain a united front such as only a strong, active organization with sufficient funds can offer. With such an ARRL to protect us, we will survive. If we have drifted away individually, allowed our membership in the League to lapse or do not represent a large group, we surely shall be in difficulty. We must, every one of us, maintain and extend our support of ARRL.

To again refer to our position at the close of the last war, we learn that we had to owe the printer for the June, 1919, issue of *QST* and had other debts amounting to over $7500. We did not have a single asset except that fundamental asset — membership confidence. A bond issue was offered to the members without any security. Those who placed their faith in this appeal know how gloriously it was justified.

But should there ever again be the necessity for such an appeal? In radio lingo, is it safe to risk such a load on the final? A maxim, according to Webster, is "a condensed proposition of important practical truth." If we keep our ARRL in a healthy condition, if we maintain unabated interest and support, if we all continue to be faithful to our traditions and remain united, *we shall stand!*

It will do no good to begin considering this necessity when the war is over. There will always be opponents who regard time as their most valued weapon. They will jump in there instantly with something to annoy us and attempt to rush it through before we have time to gather our forces. We hear much of unpreparedness. Let us apply it to ourselves and resolve that never again will we be caught without the means to defend our just privileges. We have a solemn duty to the boys in the service, to preserve these things for them when they return home. Furthermore, it looks as if world-wide amateur radio would be patterned after what the American amateur is able to obtain after the war. Whatever we preserve for ourselves, we preserve for the world.

Those of us who have been with the League ever since its beginning know the tremendous importance of maintaining membership. If you do but this, you have discharged your most important duty. Our present Board of Directors and officers represent a fine intelligent group of keen, active business men who are constantly working to protect our precious and pleasant hobby. While we are banned from the air they are working diligently, representing us at Washington, keeping liaison with all the powers that be. These men are working long hours every day. I speak from personal observation when I say that some of them hardly have a moment to spend with their families. No one who could possibly prevent it would desert leadership of this kind.

Few will argue against insurance premiums. We know their value even while we all hope our homes do not burn down. In our amateur radio the small membership fee is *direct insurance* that we shall again enjoy privileges justified by our contributions after the war. Maxim led us before. A maxim may point the way to our salvation this time. To stand together united and strong and always remain members of the American Radio Relay League is important. I'm going out after some new members. Who else will get on the band wagon?

* 147 Church St., Damariscotta, Maine.

BRIEFS

"The hell with the red tape! Let's get the job done," shouted one of our prominent ECs at his local CDC officials. An admirable attitude — and yet it can be carried too far. It behooves us to remember that much of what seems to be "red tape" is nothing more or less than necessary supervisional machinery. Back in December and January reactivations were being authorized without too many formalities — and you know the result! Perhaps if more of us had behaved ourselves then we would have less "red tape" now.

You think your WERS problems are tough? W3EEI, EC for Baltimore and vicinity, reports that there are approximately 2000 sector wardens in Baltimore alone. All in all, he has calculated that 2500 two-way rigs would be required, which would mean that, if every amateur in town were available, each would have to supply six units!

The Month in Canada

NOVA SCOTIA—VE1

From L. J. Fader, 1FQ:

HERE is some more dope on the VE1 gang for *QST*. It is still hard to get dope and we'd like again to mention that the coöperation of the gang will be appreciated.

Roger Oulton, 1JL, is a Pilot Officer with the RCAF stationed at Moncton, N. B. He was formerly on the staff of CBA at Sackville, N. B. Walter Morgan, 1IL, is now wearing two stripes. Walter is a member of the RCMP, stationed at Port Elgin, N. B. He was formerly at Moncton where he was one of the strong members of the Moncton Amateur Radio Club. Fritz Webb, 1DB, is instructing classes in radio servicing for the Educational Branch of the Canadian Legion. He was formerly a commercial operator for the Marconi Company and ran on the Eastern Steamship Boats between Boston and Yarmouth. He is service man for one of the local radio dealers.

John Morton, 1JM, recently paid a visit to his home in Halifax. He is with the RCAF as an instructor and was stationed for a time at Chatham, N. B. He has been transferred to Western Canada. He was formerly 3ALK, where he was on the staff of McMaster University at Hamilton, Ont. 1KU is a wireless operator with the Canadian Navy. He has spent considerable time overseas since joining up.

Merrill Young, 1GH, is now attached to station CBA at Sackville. He was formerly on the staff of station CFCY at Charlottetown. Many of the W boys will remember Merrill, for when he was on the air from his home town, Lunenburg, he operated on 20-meter 'phone, remote control, and worked duplex notably with our old friend, Oscar Hierlihy, VQ1I, of St. John's, Newfoundland.

Ainlay Croft, 1EU, is receiving congratulations on the arrival of a jr. op. Ainlay is with the RCCS and is slated for overseas duty shortly. Harry Grant, 1HG, is receiving the congratulations on the taking onto himself of an XYL. No doubt Harry will make a good second op. out of Jean when we get back on the ether waves. Harry Scott, 1KB, is awaiting the call from the RCAF. He is still doing service work with the Bligh Radio Service.

Bob Gouvreau, 1ME, is spending a well-earned leave in the city, visiting relatives and friends. He has been stationed in Newfoundland for the past several months with the Canadian Navy. He was formerly on one of Canada's Armed Merchant Cruisers, and has travelled a good many thousand miles on the ocean waves since signing up. John Harris, 1KJ, was a visitor to the city not long ago. John is awaiting a call from the RCAF. He was one of the foremost 10-meter men from the VE1 district.

MacMosher, an ex-VE2 who is known to many of the VE1 gang, and who has been a member of the CBC staff at the Halifax Studios for the past few years, has left for Montreal to join the Ferry Command section of the RAF. Mac was one of the youngest chaps to get a commercial op's license in Canada, both in Radio and Civil Aviation. The best of luck to Mac in his new venture.

Keith Rogers, 1HI, recently paid a visit to Halifax, where he renewed many old acquaintances. Keith is known to many of the W boys and is also the owner of station CFCY at Charlottetown.

QUEBEC—VE2

From Lin Morris, 2CO:

DOUG HUETSIS, 2BU, has been promoted to the rank of Lt.-Colonel. 2KH has been experimenting with a Blattnerphone. 2DR spent a few days furlough at his country place at Prefontaine. 2BK is engaged to be married to an English girl. 2IE rebuilt an old super.

T. J. Evans, 5 North Parade Tce., Monmouth, Mon., England, would like to have a ragchew with any VE's in his vicinity. 2CO would appreciate having the addresses of 2IO and 2JK. Woodworking is 2AX's latest hobby.

2HM, 2KS, and 2CO were in charge of the signals section of recent Air Cadet exhibition held in Montreal. Seen but not heard: 2FK, 2BE, 2BF, 2PW, 2DU, 2FV, 2GO, 2JI, 5TD, 2HI. Condolences go out to Bill Oke, 3AKO, whose father passed away very suddenly early this summer.

ONTARIO—VE3

From Len Mitchell, 3AZ:

FROM 3AOR comes word that 3DC now has a motorcycle and visits the H.A.R.C.'s shack at Waterdown, finding it in good shape with lots of weeds but lacking paint. 3GZ is in the south of England and has volunteered for Australian duty. 3AOR has acquired a wife and a new QRA at Dundas — congratulations, OM! 3HT had a year's leave as w.o. and is back now. 3ADO is still in Belleville.

From Kirkland Lake comes word that 3AUW and 3OD have left town for the Civil Service. 3ALW has also left to go on a construction job in Eastern Ontario. 3ALU and 3PA spent two weeks at Niagara-on-the-Lake with the Reserve Army. The Kirkland Amateur Radio League held its July meeting at the home of 3AGM in Virginiatown.

MANITOBA—VE4

From Art Morley, 4AAW:

PLEASE — how about some news?

4EI, who was at the RCAF Wireless school in Winnipeg, has been transferred to the recruiting centre. 4FS is now at the Wireless school. 4AEL recently received a commission in the Army. 4LV is now stationed at an RCAF station near Paulson. On the same station we find some DX in the person of ZL1TX.

An interesting letter was received recently from 4ME who is overseas with the RCAF. He states that several of the fellows are over there, and mentions 4DZ, 4APL and 3WU. He would like to know the whereabouts of 4VG. Also overseas is 4SO. 4ADM was seen in a Signal Corps uniform with three hooks up. The 75-meter 'phone man from Regina is floating around Winnipeg.

4ACR, the West's biggest teller of illiterate illogical inexactitudes is with the RCMP. 4OK is with an electrical house in Winnipeg as is 4AAI. AAI teaches Junior Air Cadets in his spare time. 4YM has joined the Navy. 4ARY is a WEM stationed at an RCAF station near Portage. 3AFH was last heard of as being near Portage. A personal QSO with 4ARX who is with the RCAF at Saskatoon resulted in the SCM being accused of not QSLing. Was my face red! Now's the time to catch up on that work, fellows. Ex-4ON, who is stationed at AFHQ in Ottawa, was a recent visitor in Winnipeg. 3AED and 4ADJ are with the RCAF in Winnipeg. 4CZ of 80-meter fame now has the rank of Squadron Leader and was last heard of at Rivers along with 4AEE of Swan River. The VE3s stationed there include WO11 Beck, 3PF, 3AQN, 3AHU, 3AUI and 3ACS.

Saw our friend 4BG in an Army uniform but never got a chance to speak. 4ACP, it is rumored, is joining the RCAF. Your SCM carries his camera a lot these days but lets the XYL, 4AJY, do the dirty work — the developing. 4JN and 4SS are only two of the several at the Wireless School in Winnipeg who have been seen lately. Winding up, I remind you that this is your column — if you want to see it regularly please send along the dope. It will be what you make it! 73.

SASKATCHEWAN—VE4

From Art Chesworth, 4SY:

HERE are a few items of interest covering the hams in Saskatchewan.

The following was received from L. Grace Lumb, 4YC, who is now located at Trail, B. C.: "4ADH and 4ABW are both with the RCAF somewhere in Scotland. 4ARX is with the RCAF at Rivers, Man.; he has a new junior op. 4ABF is radio op. at Glencoe, Ont." Thanks, Grace.

Due to the loss of members the Moose Jaw Club has found it necessary to close, the furniture and equipment is being stored away until the time we can put it into use again.

4OM, 4OP, 4JV, 4KA, 4EP, 4RE and 5Y are all still following their regular lines of employment. 4AIE has just joined the RCCS. W. R. ("Bob") Browne, 4ACR, is still connected with the RCMP at Winnipeg.

Are there any of the old gang left in Regina or Saskatoon? If so, the SCM would be very pleased to receive any dope as to what the boys are doing and where they are located.

DECIBELS are not units for measuring voltage, or voltage ratio. By definition, the decibel is a logarithmic unit which measures a power ratio, and equals ten times the common logarithm of the power ratio.

When the impedance and power factor of a circuit are constant, the power varies as the square of the voltage. Since it is easier to measure voltage than power, frequency characteristics and similar runs are commonly made by measuring voltages only, since the impedances can be kept constant. When this is done, the power ratio is equal to the square of the voltage ratio. For convenience in calculation, we have a formula and tables for figuring db's directly from voltage ratios for use in such cases.

We know of no logarithmic unit for indicating voltage gain, and we know of no logarithmic unit for voltage level either. Unfortunately, some try to use db's for these purposes which results in a lot of errors and confusion. Take two examples.

One widely sold reference book states: "If a preamplifier has a 35 db gain, and the speech amplifier has 65 db gain, the total gain is 35 plus 65, which equals 100 db." This is not true, as is shown by a practical example. Take the NSA Amplifier, for instance, which has a gain of 125 db and an output of 15 watts. Suppose we add to this a single stage preamplifier having a voltage gain of 20, and an input impedance of 10,000 ohms. The combination of the two units will therefore have twenty times the amplification of the NSA alone, yet the combination will have only 124 db gain, or one db less than the NSA alone. This anomaly is due to the fact that the NSA has 5 megohms input resistance, whereas the preamplifier had only 10,000 ohms. Consequently the combination required more input *power* than the NSA, in spite of the much lower input voltage.

If you think this is confusing, take the case of the amplifier which has 10 db gain at 50 cycles and 30 db gain at 5000 cycles, and yet has a frequency characteristic which is flat within 1 db throughout that range.

Or take the case where you wish to select a high grade audio transformer to drive push-pull output tubes, Class A, from a single plate. Can the transformer supply enough voltage? The manufacturer's catalogue says that the maximum level is "plus 15 DB". Question: What is the reference level? The catalogue does not say. Handbooks and textbooks say that 1, 6, 10 and 12.5 milliwatts are all common levels. Even if you guess at the reference level, you still must know the impedance and power factor of the transformer before you can convert to volts. The catalogue does not state the power factor. Question: Do you ignore power factor? Question: Where are you at?

The moral of all this is that db's are fine for frequency runs, attenuator calibrations and other purposes for which they were invented. But the best way to give a voltage rating on a transformer is to say "Maximum level 80 volts rms output, grid to grid." It saves lots of time, and it saves many mistakes.

CALVIN HADLOCK

Splatter

(*Continued from page 10*)

FOOTNOTES

IT'S a big problem these days to secure technical articles for *QST* from competent contributors outside the staff, simply because practically all the good men — ham or commercial — are busy full time and more with vital war work. We considered ourselves mighty fortunate, therefore, when **W. P. Bollinger, W3JDF,** was able to find odd moments from his research work for RCA to write the paper on a crystal-controlled f.m. exciter in this issue. For a comparative youngster, W3JDF has had wide experience in the radio field and electrical field, having developed amusement equipment, worked as a remote broadcast operator and designed police and aircraft equipment. That was prior to July, 1940, when he joined RCA. His work there is in the Special Apparatus Engineering Department — that's all we can say about it. **Robert G. Ling, W1IBF,** has been in ham radio since he was 12 (the first call was 1COP — no W!) but professionally he has managed to stay clear, being secretary, accountant and general factotum of a Boston investment management firm. It was as an ARRL EC that he started in civilian defense work, becoming regional radio representative for the Massachusetts Committee on Public Safety back in October, 1941. There's a long background of practical experience behind his recommendations on the organization of a workable WERS set-up. When **Whitney S. Gardner, W3IBX** (who we hope will become a *QST* fixture with his nostalgic vignettes on the ham days now past) writes the editor of *QST* it's as one editor to another. He edits a house organ, *News of the Fleet,* for the United States Fidelity and Guaranty Co. "Do you really intend contaminating the venerable pages of *QST* (bowed head) with that drivel?" he writes. "Well, m'fren', you asked for it. If cancellations start piling in, don't blame it on the war. Fact is I'm tempted to cancel my own." That must have been the editor speaking. The author wrote the next paragraph: "Anyway . . . I'm enclosing another effort and will continue to do so until you holler 'nuff or remain politely silent." So now you know what to do.

FEEDBACK

WRITES Len Smeltzer, W8MEU, on an American Airlines letterhead:

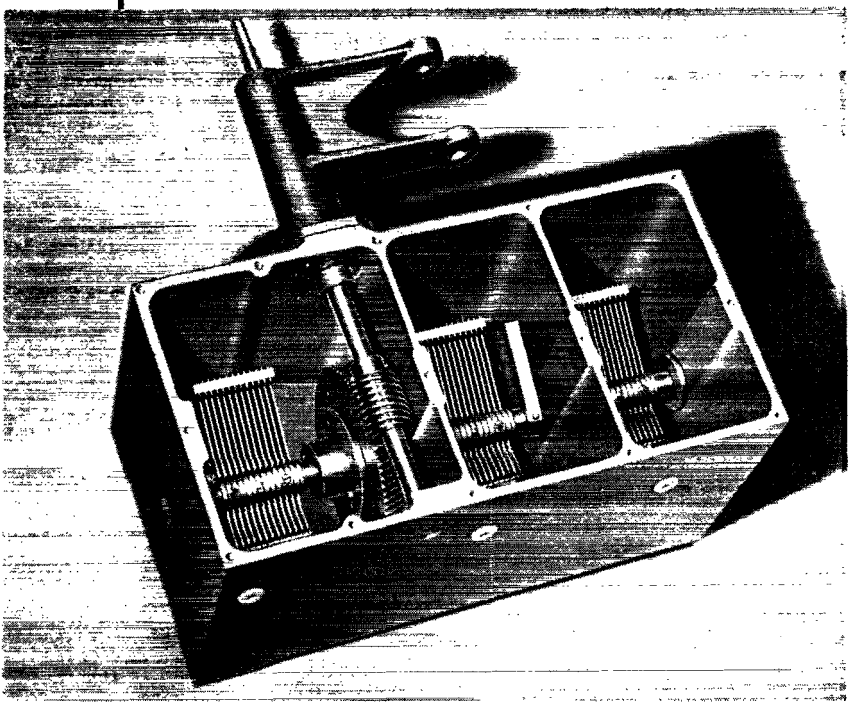
"I have a suggestion I believe should be passed along to all hams building and installing radio equipment in planes for the Civil Air Patrol.

"On the cover of the August 1942 issue, the cords for the 'phones and mike in the picture are shown draped around the control stick. That might be OK on the ground, but sure would be a hazard in the air.

"I suggest that this be taken into consideration when designing or installing radio equipment. On airliners the jack box is on the wall behind the pilots. This keeps the cords from getting fouled in the controls."

(*Continued on page 84*)

STABILITY—PLUS



Marine condenser built to withstand severe vibration.

OPERATING on an "All Out For Victory" basis Hammarlund is producing precision variable condensers for every Defense Communications Service. Many of these condensers are comparable to laboratory standards, though produced in great numbers on a mass production basis.

THE HAMMARLUND MANUFACTURING CO., INC.

460 West 34th Street, New York, N. Y.

(*Continued from page 82*)

W8MEU is chief operator for American Air at Detroit, so we listen with respect. As far as the photo is concerned, however, the radio op did not wear wings — which is to say he doesn't fly the ship, and the dual-control stick between his legs is purely coincidental.

IF YOUR COPY OF *QST* IS LATE—

Bear with us and the nation's transportation systems. We are both doing our best — *QST* is being printed one to three days earlier each month to help keep deliveries up to schedule — but unavoidable wartime delays sometimes do occur. So if *QST* is late, just be patient — it's on the way.

A Transceiver for WERS

(*Continued from page 15*)

bending the leads so that the position of the coil is changed with respect to the tank coil.

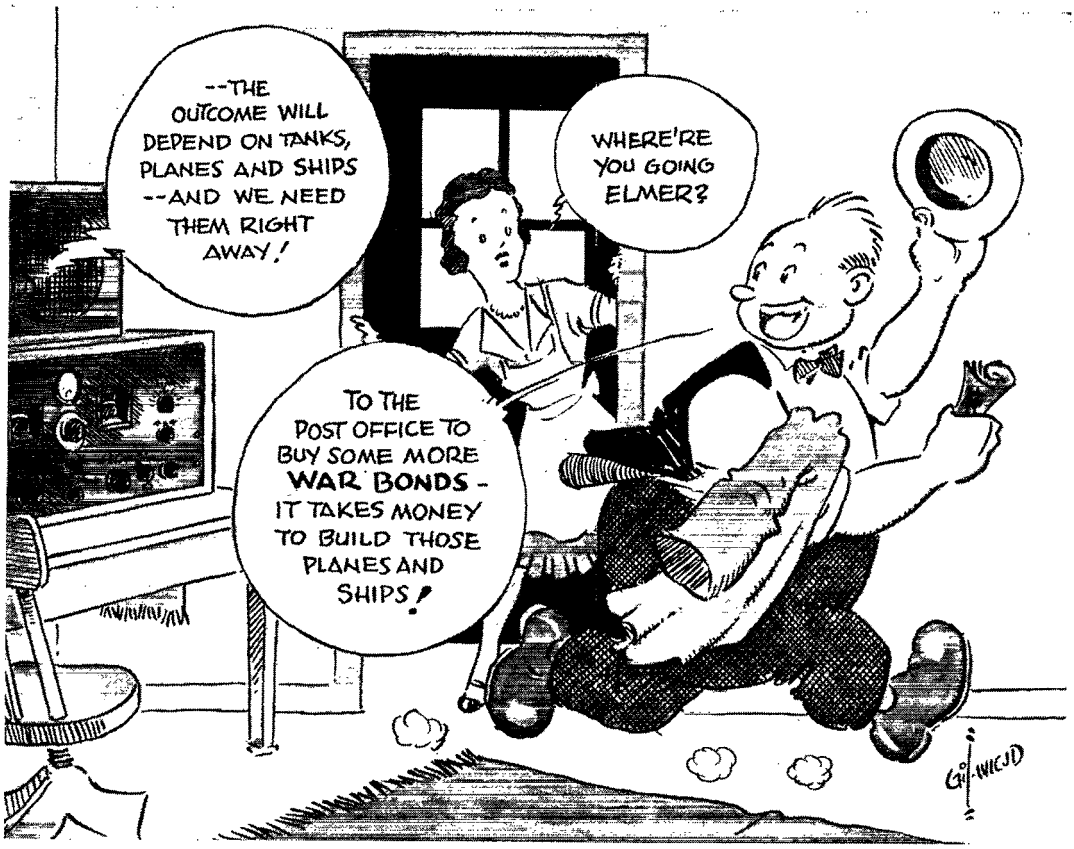
Power Supply

The circuit diagram of a vibrator-type power supply for operation from a 6-volt storage battery is shown in Fig. 2. The transformer is a universal replacement-type unit having a d.c. output, when operated from 115 volts a.c., of about 70 ma. at 250 to 300 volts, and provided with 6.3-, 5- and 2.5-volt filament windings. Although the circuit is much the same as in the case of the homemade units previously described,[2] the transformer is used "as is" instead of being supplied with a new 6-volt primary. As shown in the circuit diagram, the filament windings on the transformer are used in the battery circuit; the 6.3-volt winding provides one side of the battery primary, and the other side consists of the 5-volt winding in series with half the 2.5-volt winding. As previously explained, this method of operation gives lower output voltage than can be obtained with a properly-proportioned primary wound on, but it avoids the inconvenience of taking the transformer apart, rewinding, and reassembling. The output voltage is about 200 with a load of 60 milliamperes, which is just about right for the transceiver when using a 6J5 oscillator. This type of power supply also is useful to replace now-unobtainable dry batteries in transceivers such as the Abbott DK-3.

All the components in the supply with the exception of the 4-prong outlet socket are mounted on a piece of quarter-inch tempered Masonite measuring $3\frac{3}{4} \times 9$ inches. This fits into a plywood box having inside dimensions ($3\frac{3}{4} \times 9 \times 5\frac{1}{2}$ inches) just large enough to contain the equipment. The Masonite shelf rests on $\frac{3}{4}$-inch

(*Continued on page 88*)

[2] Grammer, "Power Supply for Emergency Equipment," *QST*, January, 1942.



NOW it's WAR BONDS instead of radio equipment.

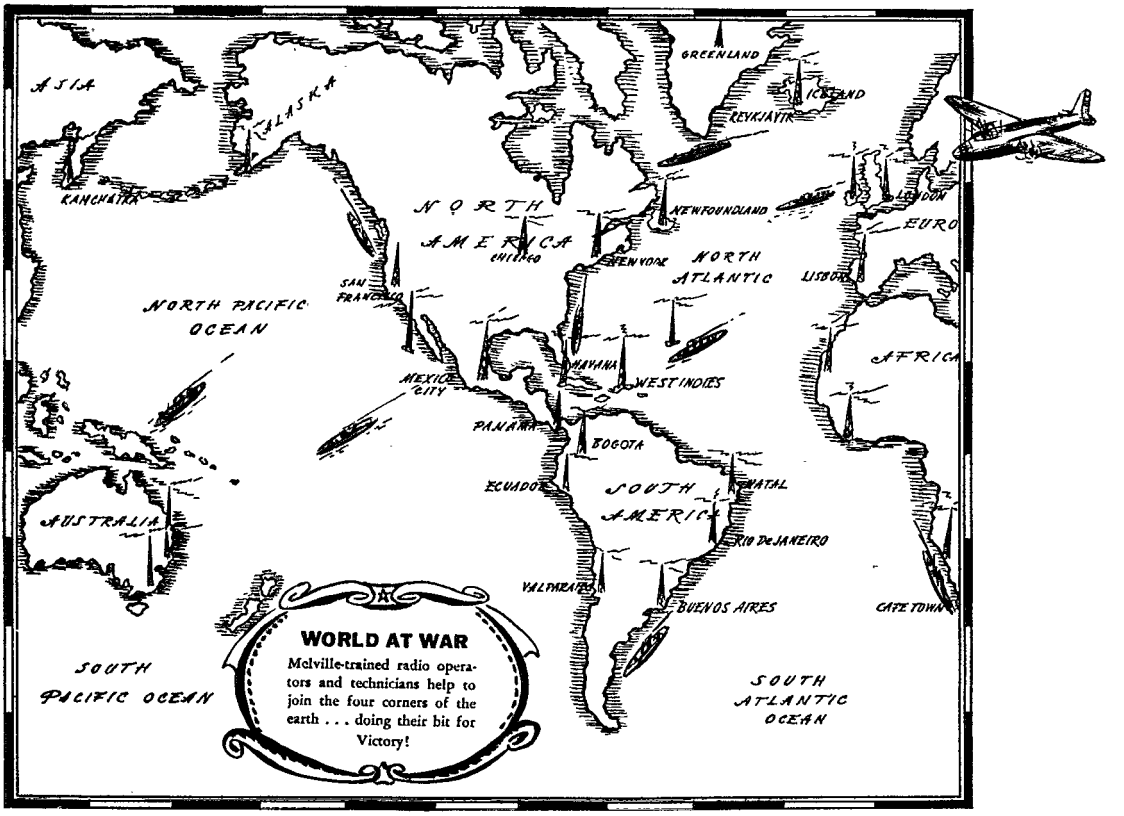
Buy Bonds as Elmer does with those extra dollars. Elmer is so enthusiastic because he knows the bonds he buys are going to preserve the principles which make possible amateur radio and all it stands for.

PRECISION PRODUCTS FOR BETTER RADIO

HAMMARLUND

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

In Every



OFFICIALLY APPROVED — THE ONLY SCHOOL OF ITS KIND

Director Frank Melville, founder of "The Radio-Communication School run by Radio-Communications Men," is an active transoceanic Flight Radio Officer with years of practical experience in many types of operation in widely-scattered parts of the world.

Little wonder, then, that his success as director of education at this school, over a group of carefully selected instructors, should bring such enthusiastic voluntary comment as the following:

PAN AMERICAN AIRWAYS-AFRICA, LTD.

"Of the original students submitted to you for training, all have been contracted by us and are now being prepared for departure."

AIRLINE COMM. EMP. ASSO.

"No doubt in my mind that anyone wanting to enter our profession can do no better, indeed he scarcely has no other choice, than to enroll in your school. There, I know, he will find modern equipment, competent instructors and last, but by no means least, a genuine *airline atmosphere;* all of which will provide the quickest and best means of entering the airline communications field."

WHAT MELVILLE GRADUATES SAY

"Due to the excellent quality of instruction I received while at MARS, I was able to obtain both my radiotelegraph and radiotelephone licenses in remarkably short time; something I was in no way qualified to do at the time I entered MARS, even though, previous to that time, I had spent nearly two years in one of the best known radio schools in the country."—J.M. Municipal Airport, Dundalk, Maryland.

"The individualized instruction and assistance I received from you and your able staff of instructors enabled me, as you know, to secure my present position with Pan American Airways at a salary more than twice what I was receiving before I entered your school."—C.M.

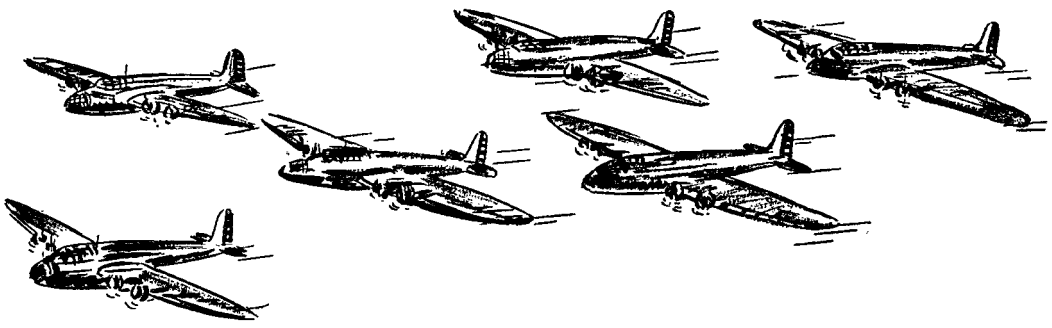
"Just a word to let you know that I have just qualified for entrance to the Air Corps Radio School at Scotts Field, Illinois. I do wish to say that the training I received at MARS was important and one of the main reasons I was able to qualify." — M.S.R. Miami Beach.

"I know that I would not have this fine position if it were not for your excellent supervision and very able staff. It is really more than I had ever hoped for. I know of no better airline school in the country and I would not hesitate to recommend it."—M.B. Flushing, N.Y.

* * *

RADIOTELEPHONE — RADIOTELEGRAPH — AIRLINE TELETYPE — ASSOCIATE OF MAJOR AIRLINES — The Melville Aeronautical Radio School has trained ground station and flight radio operators, engineers and technicians who are working at good salaries all over the world for American Airlines, American Export Airlines, Pan American Airways, Pan American-Africa Airways, Pennsylvania Central Airlines, Delta Airlines, Eastern Airlines, as well as in Army, Navy, Merchant Marine and other Airline, Broadcast and Communiction companies. No previous training or experience necessary. Completely equipped.

Quarter of the Globe



MELVILLE-TRAINED MEN ARE "POUNDING BRASS" FOR VICTORY

Behind communications equipment of every type—Government and Commercial—hundreds of Melville-trained radio operators and technicians throughout the world are busy day and night, doing their part for Victory. And when peace comes, many of these men will continue the climb to greater engineering responsibilities.

On the land, on and under the sea, in the air — everywhere radio equipment must be operated with speed, precision, and courage — there you find men who began their radio careers at Melville Aeronautical Radio School. Their outstanding performance is the reason why so many leading airlines of the world look to Melville for new men — why the Army, Navy, Merchant Marine and Coast Guard seek the cooperation they are getting from Melville for the instruction of young men from all parts of America. The management of this school is proud of every Melville graduate who is now "doing his stuff" in the service of the United Nations and in Commercial radio aboard the ships and planes of the world.

MELVILLE

AERONAUTICAL RADIO SCHOOL, INC.

45 West 45th Street **New York City**

Training Men for Radio in the Service of

AIRLINES — ARMY — NAVY — MERCHANT MARINE — COAST GUARD — INDUSTRY

(*Continued from page 84*)

square blocks, 1¼ inches long, glued to the corners of the box at the bottom. The top and bottom of the box are removable. This construction was adopted to avoid the use of metal chassis. To provide shielding and thus reduce hash troubles, the box is covered with thin iron salvaged from 5-quart oil cans — every garage and service station has cans of this kind which, most of the time, are simply in the way. The cans we secured were not tinned, but were coated inside with a very durable lacquer finish which made a much better appearance than any paint we could have put on. Where the edges bend around the box to make a joint, the lacquer was rubbed off with steel wool so that the pieces would make electrical contact, and the metal was tacked to the plywood with short escutcheon pins.

To make sure that the shielding would be complete, the top and bottom of the box slide into place from the side, with the metal covering extending out so that it fits tightly under a lip bent over from the metal on the sides. These lips also are cleaned of lacquer to permit good electrical contact. The general construction should be quite apparent from the photographs. The bottom is provided with rubber feet obtained at a hardware store, and the top has a small knob at each end so that it can be pushed out. This is essential, since the fit is good and there is no way to get either the top or bottom off, once on, without something of the sort to give a grip.

With the filtering and shielding provided, the hash is practically inaudible in reception; careful listening is necessary to distinguish it. It cannot be discerned at all on the transmitted carrier.

Conclusion

While the performance of the transceiver is not as good with receiving tubes as it would be with types more suitable for u.h.f. work, it is fully adequate for the purpose. The r.f. tube takes 20 or 25 milliamperes at 200 volts on transmitting, and has an output of a watt or so. With the audio system, the total current in the transmit position is in the neighborhood of 60 milliamperes at 200 volts. In reception the plate current of the r.f. tube is negligible, and the total current at 200 volts is about 30 milliamperes. From such indications as are possible without actual signals to work on, the sensitivity appears to be about normal. The circuit goes into superregeneration with 40 to 50 volts on the detector, which is a reasonably good value for this type of tube, although higher than the voltage required for u.h.f. tubes. The control is quite smooth when the tube is in the oscillating condition, and has no "drag."

Somewhat of a disadvantage is the fact that separate volume controls are not available for transmitting and receiving, but providing them would mean additional parts as well as switching complications. In practice the control should be set so that the most satisfactory compromise is reached between receiving volume and degree of modulation on transmitting. Using the proper voice level will help a great deal, and this in turn

Glass tubing becomes finished filament stem with leads sealed in position on this special upright lathe.

VACUUM TUBE *Performance* IN THE MAKING...

"Trifles make perfection and perfection is no trifle"*... The tiniest part of every Eimac tube is a "*tremendous* trifle," handled with the utmost care... the greatest skill. In an Eimac 304T tube there are more than fifty separate parts which pass through many fabricating operations before they are ready to be assembled into the tube. Through all these steps great care is taken to hold the dimensions of each part to a very close tolerance... to make every welded joint perfectly solid. Such painstaking care in the fabricating of each part, plus the achievement of extremely high vacuum... helps provide the outstanding performance capabilities which have made Eimac tubes famous. In the toughest jobs you'll find Eimac tubes in the key sockets most every time. They are first choice among the leading engineers throughout the world.

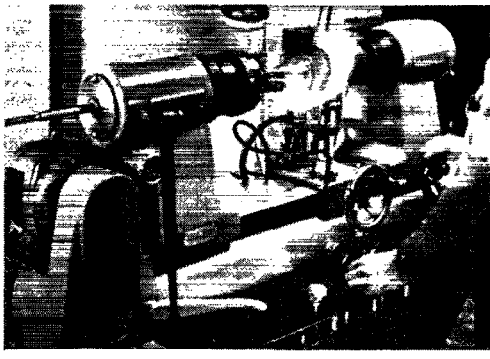
Follow the leaders to **Eimac TUBES**

*Michelangelo (C. C. Colton)

Manufactured by

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA, U. S. A.

Export Agents: FRAZAR & CO., Ltd., 301 Clay St., San Francisco, California, U.S.A.



Glass bulbs are annealed after tube is fully assembled. This operation relieves stress and strain in the glass itself which may have been induced during manufacture.

Deft fingers work steadily with tiny parts which are faultlessly produced. Here plate sections are being welded together in routine production.

(*Continued from page 88*)

will depend upon the sensitivity of the microphone.

Despite a few minor disadvantages of this sort, the transceiver appears to be a perfectly practical piece of emergency communications equipment, and one well worth considering in view of its simplicity both in construction and operation.

Neon-Tube Parts Checker

(*Continued from page 20*)

for d.c. the resistance across the lamp equals 62 times 500,000 divided by the external voltage. In view of the fact that R_6 is insignificant compared to the total resistance involved, its resistance is ignored. The voltage calibrations should then be marked down on the voltage curves to correspond with the resistance values obtained from these formulas.

The main dial chart is a paper circle with a 5½-inch diameter, having four additional inner circles spaced ⅜ inch apart to accommodate the four scales that represent the four functions of the gadget. The other two dials are 2-inch diameter paper circles with an inner circle spaced ⅜ inch from the outer circumference to accommodate their respective calibrations.

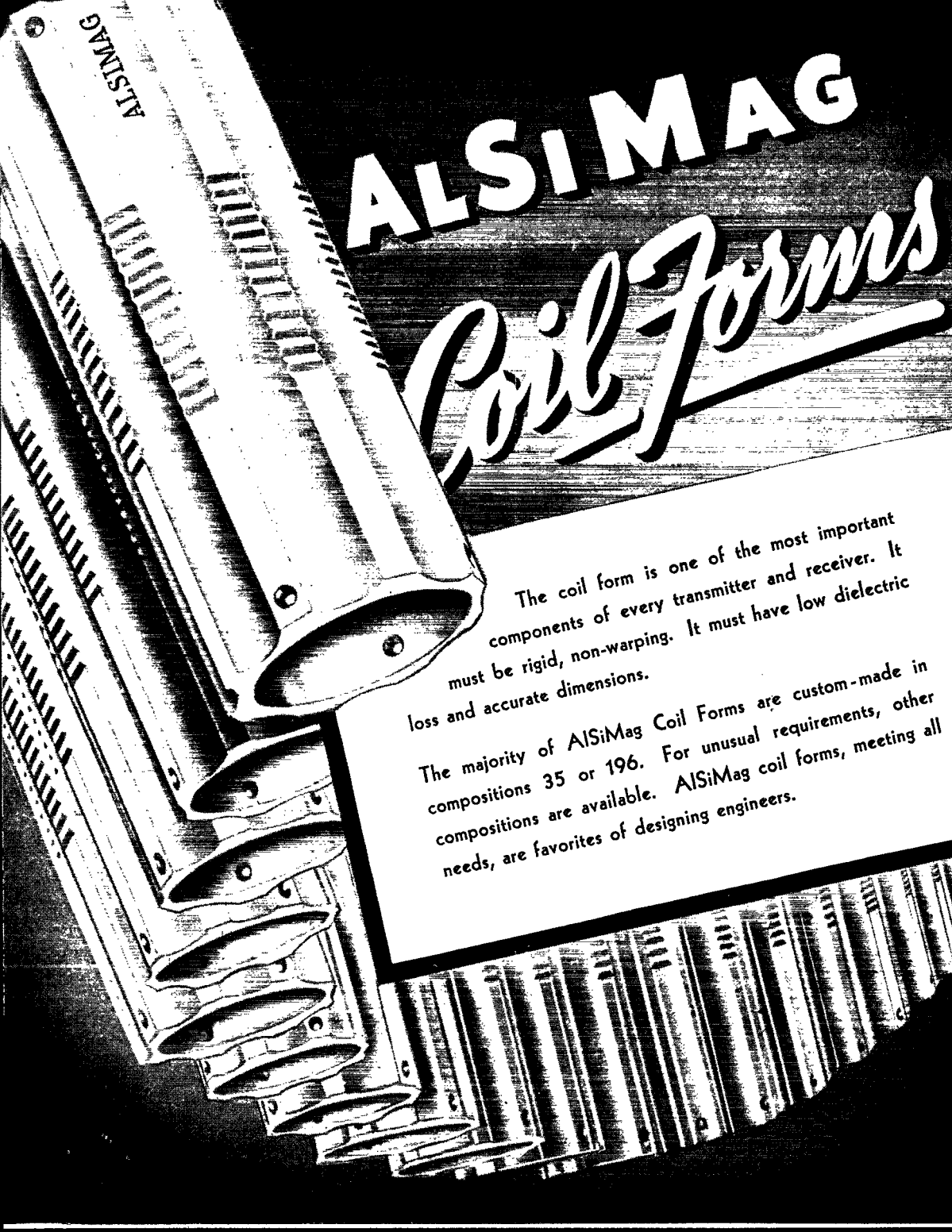
Although the main dial controlling a 500,000-ohm potentiometer is capable of measuring resistances as low as 100 ohms with fair accuracy — and indeed the checker could be complete with this one dial alone — the other two dials are added to provide "calibration spread" for the 0–5000-ohm and 0–50,000-ohm scales, respectively.

Making Measurements

Before making any measurements the neon lamp should be given an initial warm-up for about two minutes. This warm-up process seems to stabilize it so that readings will be more accurate. To do this, plug in the power cord, snap S_1 to the high position, snap S_2 to the right or ohms-capacity position, turn the main dial to maximum resistance position and short the binding posts with a test lead.

Line voltage adjustment is the next step. Let the test lead shorting the binding posts remain and, after turning all front panel dials to zero, attempt to extinguish the neon glow by turning the dial of R_1 (mounted on the left side). If this fails, snap S_1 to the low position and again turn R_1 until the glow is just extinguished. It must first be possible to light the neon lamp and then extinguish it with R_1. If it is neither possible to light nor extinguish the indicator lamp with any combination of R_1 and S_1, there are not enough turns on the secondary of transformer, T. As mentioned previously, with our particular transformer 240 additional turns were required.

The test leads are now clipped across an unknown external resistance. Turn the main dial, R_5, to the right until the neon glows, then slowly



The coil form is one of the most important components of every transmitter and receiver. It must be rigid, non-warping. It must have low dielectric loss and accurate dimensions.

The majority of AlSiMag Coil Forms are custom-made in compositions 35 or 196. For unusual requirements, other compositions are available. AlSiMag coil forms, meeting all needs, are favorites of designing engineers.

AlSiMag

Trade Mark Reg. U. S. Pat. Off.

AMERICAN LAVA CORPORATION

CHATTANOOGA, TENNESSEE

CHICAGO • CLEVELAND • NEW YORK • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • BOSTON • PHILADELPHIA • WASHINGTON, D. C

(*Continued from page 90*)

back it off until the glow is extinguished, and take the reading on the ohms scale at this point. Should it be impossible to make the lamp glow with R_5 at maximum setting, the unknown resistor is more than 500,000 ohms and cannot be measured with the resistances used in this circuit.

Suppose the main dial indicates the measured resistance to lie between 5000 and 10,000 ohms, and you desire a more accurate measurement. Then turn the main dial back to its zero setting and take a reading in the same way as before, but using the dial of R_4 instead of R_5. Whenever one of the three front dials is in use the other two must remain at their zero settings.

Electrolytic condensers cannot be measured with this checker as a.c. is present across the test leads. With an internal d.c. voltage source, however, electrolytics can be tested, but a new set of calibrations would then have to be made.

All other condensers are measured in the same manner as resistors. With all front panel dials set at zero, clip the test leads across the unknown capacity, turn the main dial until the lamp glows, then back it off to the extinction point where a reading can be taken from the capacity scale.

This same procedure is followed in making voltage measurements, but S_2 must, of course, be switched to the A.C.-D.C. Volts position.

The Cabinet

As shown in Fig. 2, the material for the cabinet can be cut from a single piece of ¼-inch plywood 32⅜ inches long and 6¾ inches wide. After cutting, planing and sanding, the wood was given two coats of gray enamel. Full dimensions of the cabinet are given in the front and side view drawings in Fig. 2. Measurements shown for the front panel layout should be made along the panel surface itself. Due to its slope the front panel is actually longer than indicated in the front view drawing. Wooden dowels, ½-inch square, are used in the corners.

The transformer and the neon lamp socket were mounted on the back of the front panel by machine screws threaded into undersized holes drilled to a depth of 5/16 inch in the plywood.

An excellent pointer for the main dial was made from a piece of celluloid, similar to those used on the ARRL Lightning Calculators, cemented to the underside of the bakelite knob.

Warning

The instrument is directly connected to the a.c. line and is subject to the dangerous possibilities outlined in *QST* for May, 1941, page 42. Few realize how little current from a 60-cycle source is needed to cause muscular paralysis. A statement to the effect that 97.5 per cent of people tested were subject to muscular paralysis when only 10 milliamperes of 60-cycle a.c. was passing through their bodies appears in the March, 1941, issue of Electronics. So, at least *be carefull*

Centralab

CERAMIC TUBULAR CAPACITORS with Temperature Controlled Characteristics

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

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

TYPE 850 High Frequency, High Voltage Unit

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

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

Terminals available in two types; same as Type 840.

TYPE 840 High Capacity

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

(1) Zero Temperature Coefficient up to 1500 MMF.

(2) Negative Temperature Coefficient up to 3000 MMF.

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

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

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

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

Terminals — two types available:

(1) Lug .030" thick threaded for 6-32 machine screw, or conventional soldering.

(2) Axial mounting post with 6-32 machine screw thread.

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

Diodes

(*Continued from page 17*)

So when we connect an a.c. voltage
Between the cathode and plate,
On the half of the wave when the plate is plus
The electrons will percolate.

How come? Well, let's go back a way
And basic facts uncover.
What is a plus or minus charge?
How come one or the other?

Each atom has a proton with
Electrons grouped about it.
Compare it with our sun and stars
And you won't ever doubt it.

The sun sits up there in the sky
Just like a big "plus" proton.
Each star, the moon and our old earth
Resembles an electron.

Some atoms have electrons that
To gad are always panting.
The minute that the heat is on
They start their gallivanting.

They don't go very far, of course;
Just to an atom neighbor.
But its electrons beat it, too —
To get next door they labor.

Now, let's sum up. The proton is
The atom's part that's plus.
Electrons are its negative,
And so a "charge" is thus:

The atoms which have given up
Their balance of electrons
Are "positive" in charge because
They're mostly only protons.

An atom, on the other hand,
Is negative in flavor
When it has more electrons than
Its next atomic neighbor.

But here is something you must know,
And please do not forget it:
The space charge plays a part in this
And here is where we get it.

The number of electrons that
From heat-fixed cathode flow,
Will be the same in toto
With voltage high or low.

But with plate voltage lower
Near electrons find a place.
The plate won't get the others;
They bump around in space.

But step plate voltage higher,
And, strangely to relate,
The electrons all will hop aboard.
The tube is saturate.

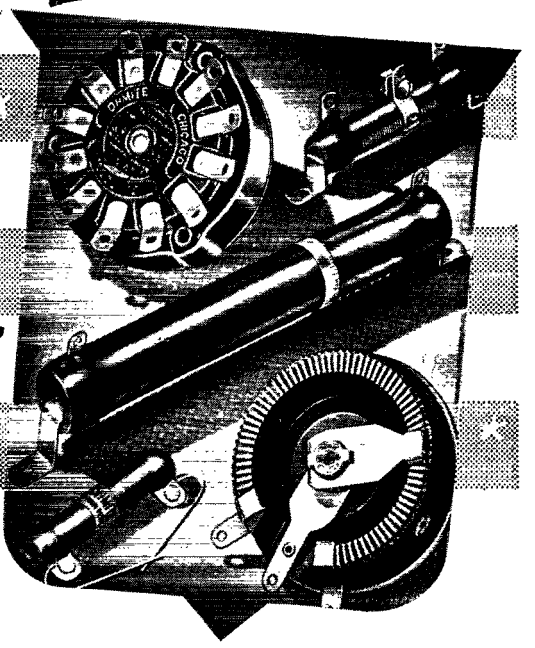
So we finish with space charge.
Saturation is nigh —

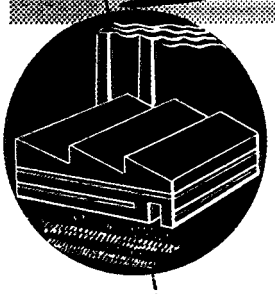
(*Continued on page 96*)

OHMITE

Rheostats · Resistors
Chokes · Tap Switches

HELP YOUR WAR EFFORT

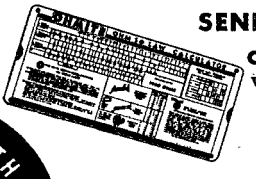




IN WAR INDUSTRIES Many of you now engaged in vital war work have long been familiar with the dependability of Ohmite Products. This knowledge gives you added assurance in dealing with today's resistance-control problems—it helps you do a better job. Particularly when you look about and find these same high quality units performing many functions—in products, laboratory and production, in communications and electronic devices, in test apparatus and electrical control equipment.

IN ACTIVE SERVICE Here, too, you find innumerable Ohmite resistors, rheostats, chokes and tap switches helping you fight a better fight—in planes, tanks and ships, in walkie-talkies and field units, in combat and in training, and in the development of new devices to defeat the enemy.

SEND FOR THESE HANDY AIDS



Ohmite Ohm's Law Calculator Helps you figure ohms, watts, volts, amperes—quickly, easily. Solves any Ohm's Law problem with one setting of the slide. All values are direct reading. No slide rule knowledge necessary. Size 4⅛" x 9". Send only 10c in coin to cover handling cost.

Quick-Reference Catalog 18 Gives up-to-date information on the wide range of Ohmite stock resistors, rheostats, chokes and switches used in all types of applications. Helps you select the right units for each job quickly, easily. Write for it now—*it's Free.*

Authorized Distributors Everywhere

BE RIGHT WITH ★ OHMITE Rheostats · Resistors Tap Switches

OHMITE MANUFACTURING CO., 4863 Flournoy St., Chicago, U. S. A.

(Continued from page 94)

No more current flows in the tube
No matter what volts you apply.

Just one more fact I'll write about
And then we'll end this lay.
Whatever direction electrons flow,
Why, current goes the other way.

L'Envoi

You can bet your Sunday hat,
Your smartest spring creation,
That this here head has also reached
A point of saturation.

QST Visits Fort Monmouth

(Continued from page 32)

to a section numbering from 40 to 50 men — his official unit during his stay at the school. Finally he was given his allotment of textbooks and his basic training got under way.

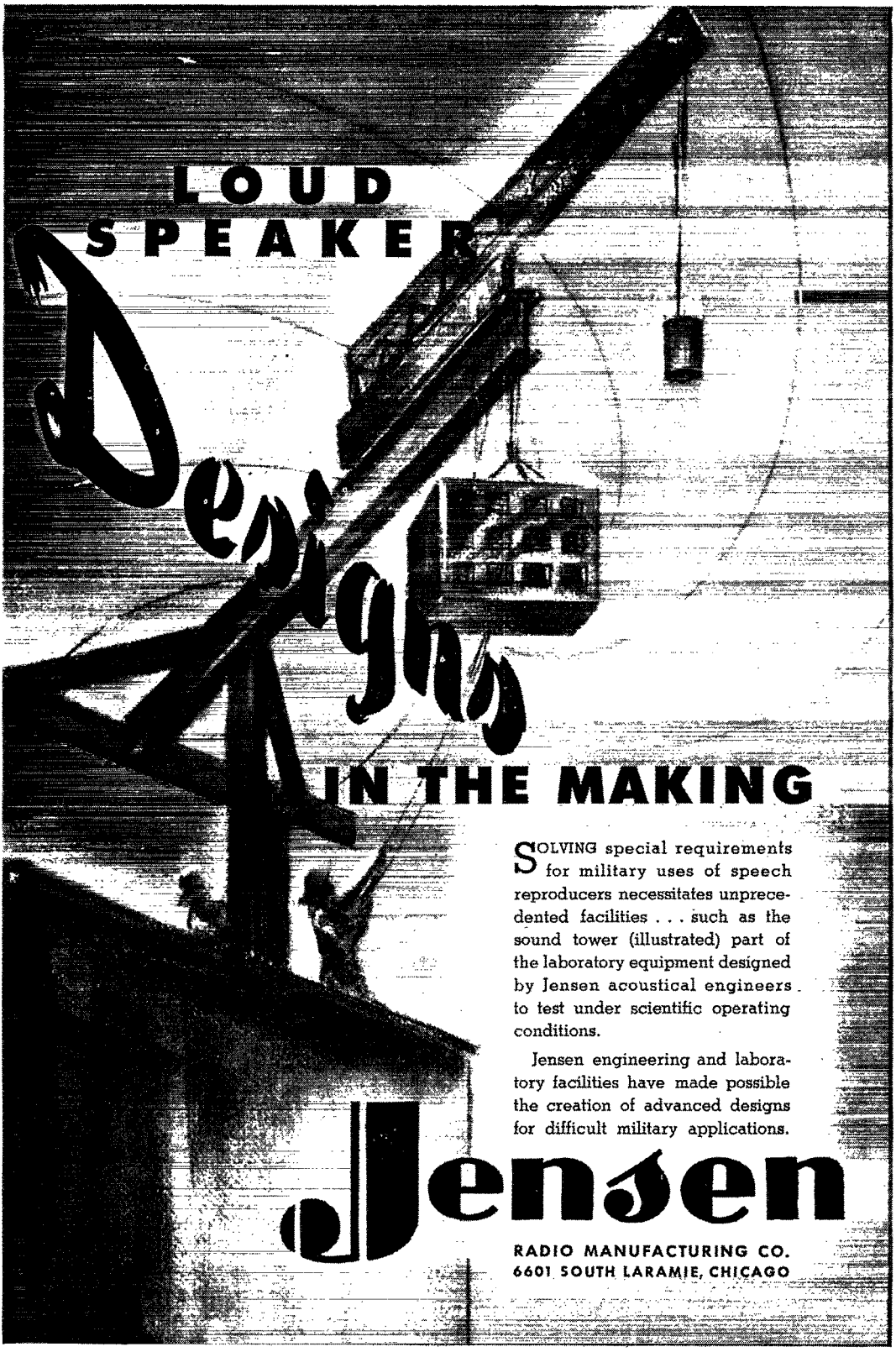
His training as an officer candidate is divided into three sections — basic, intermediate and advanced. Approximately a month is devoted to each. But this time his training, although covering the rudiments of electricity and all forms of communication, and in particular the actual use and application in the field of all types of Signal Corps equipment, places more emphasis on the specialized duties and requirements of an officer. He is given intensified schooling on such diversified subjects as map reading, military law, guard duty, administrative work (keeping of company records, etc.), military courtesy, the tactics of warfare, training methods and a variety of similar topics.

Speed in Training the Objective

It's an intensive course, a nerve-straining, brain-tormenting course. If our ham thought he had worked hard before, it was never anything like this — from 7:30 in the morning until 6:00 at night, with study periods after that. The idea is to get the men trained fast — to get them ready to go out into the field now, not next year when it may be too late.

He finds that there is more to being an officer than just wearing the bars. He must be punctilious in his behavior, alert in his class work, diligent in his studies. In short, he must be able to take it.

But our ham can take it — many of them have. Many have gone out into active service and distinguished themselves by their performance both on these shores and abroad. Some have stayed behind and are to be found in the highly-qualified corps of more than 400 instructors in the OC school — an exceptionally high percentage of whom are hams, incidentally, including the genial officer in charge of the advanced training, Major Charles H. Kenworthy, W3IBJ, ex-W3CZQ — who proved himself a nonpareil guide and mentor during our stay at the school, by the way. It was he who called our attention to the fact that there were desks at the school carved with calls from every U. S. district!



SOLVING special requirements for military uses of speech reproducers necessitates unprecedented facilities . . . such as the sound tower (illustrated) part of the laboratory equipment designed by Jensen acoustical engineers to test under scientific operating conditions.

Jensen engineering and laboratory facilities have made possible the creation of advanced designs for difficult military applications.

Jensen

RADIO MANUFACTURING CO.
6601 SOUTH LARAMIE, CHICAGO

(*Continued from page 96*)

After three months of this hyper-intensive training our ham emerges a full-fledged communications officer, the gold bars of a second lieutenant glistening on his proudly-held shoulders. He has made the grade — made it in record time, too. Given the proper breaks, Major Shidel told us, a hard-working, intelligent ham can progress through all the stages we have outlined — from induction through RTC, EMD and finally the OC school, normally totaling some fifteen months' training — in as little as seven or eight months' total time. And the opportunities for new volunteers are equally good!

We've confessed before that this mythical ex-rookie ham of ours with the bright gold bars now gleaming on his shoulders was largely a creature of literary license, constructed to show the workings of the system as a whole. Not every ham goes through all the phases of Fort Monmouth training and emerges an officer — but there are some who do it. One we talked with is Lt. H. A. Keep, W5EAL. Entering the Army as an enlisted man, he worked his way through the officer-candidate school, joined the famous Electronics Battalion, went to England to learn the secret uses of u.h.f. there, was transferred to VHF and is now back at Fort Monmouth training others who may follow in his footsteps. As thorough-going a ham as you'd ever meet, he is a typical example of the way hams as a class have thrived on the Signal Corps training — and have given the Army inspiring examples of devotion and ability in return.

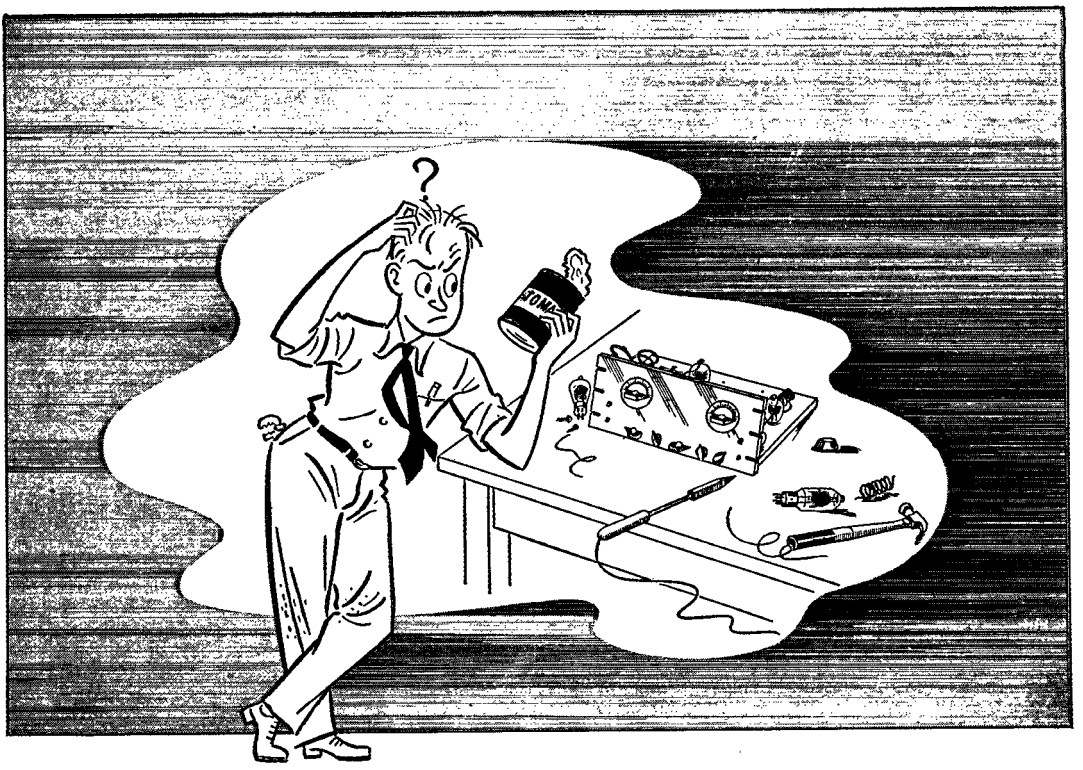
Training Radio Operators

Despite the comprehensive routing we have given him, there is one important phase of the training at Fort Monmouth that our newly-arrived officer-ham did not experience — that given the radio operators. The reason is that he is not two men — and no one man can be both an operator and a technician in the Signal Corps. A good maintenance man or communications officer has plenty of work of his own to do; it takes another fellow to do the operating.

This other fellow may also be a ham, although the Signal Corps is inclined to like wholly "green" material from which to build operators, and nowadays most of the hams are routed to the technical branches. But it is of interest to review the training these operators receive, as well.

First of all, it should be understood that they get no theory whatsoever. Theirs but to put down on paper what the receiver brings in — not to worry about how or why. Like all other Signal Corps enlisted men, they go first to the Replacement Training Centers, where they learn how to take code up to 7 or 8 w.p.m. If they show a natural inclination for the job — disclosed by almost infallible aptitude tests and the reports of their superior officers — they go on to take the radio operating course under the EMD's Radio Division and the capable tutelage of Lt. Reuben Abramowitz, known affectionately as "Abe" to the thousands of operators he has trained over the past twenty years. There after three months

(*Continued on page 106*)



TOMATO CANS NOW, MAYBE— BUT ONCE IT'S OVER, WHAT GEAR, OM!

RIGHT NOW there's a job to be done on the Home Front — for hams who are still home. It's War Emergency Radio Service, and it's a job the amateur knows how to do. No, you won't be operating your home station with your own calls, and you won't be able to get much in the way of new apparatus —have to build from parts knocking around, old BCL sets — yes, even tomato cans. But you'll be in there, with your gear and talents, serving your country.

When it's all over though, and you can go back to hamming with the old signals and the old gang, the *rigs* there'll be waiting for you! You can do a lot with a tomato can, besides pack tomatoes. And, don't forget, the fellows in the services haven't stopped tinkering, either. The same goes for the manufacturers; they may be busy with war production, but out in the lab engineers are putting ingenuity and wartime experience together—developing new and better gear for amateur operators after Victory — equipment the like of which you old BPs have never seen.

So while you're giving your services for civilian defense emergency communications, keep in mind, OM, during the silent hours, that there's a great day coming. And Isolantite* with its unusual combination of properties — high strength, dimensional precision, electrical efficiency, non-absorption of moisture—will be there to help you get the most out of your new rig, too, when that day comes.

ISOLANTITE

CERAMIC INSULATORS

ISOLANTITE INC., BELLEVILLE, NEW JERSEY

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

ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES — The Greater Phila. Amateur Radio Council is attempting to get all the radio aides of this Warning District together as a body to better facilitate the WERS. The City of Phila. group has appointed a technical committee who will locate and inspect the equipment offered for use by the local WERS. CAF is chairman of this committee. A large number of individual applications for WERS operator licenses have been received by the city, principally from the West Phila. Section. To date most of the operators have applied as a result of ITZ's labors. It appears that JLN/8ZAE has gone up another notch, now sporting two and a half stripes. JJN took himself a YF. He is also on 130-kc. wired wireless and building a 2½-meter transceiver. Been receiving some nice letters from the boys in the services. GYV was in the Carolinas when last heard from. QV is due for another promotion soon; he is now full lieut., USNR. GYV is now a sergeant. CHH reports a dearth of hams in Delavan, Wis., where he is now residing. When QV moved he had exactly one ton of radio junk. It appears that the war has taken about one third of the local hams out of circulation, and they represent the cream of the crop. This means that men who never took an active part in organized radio before will have to step forward if the WERS is to play the part cut out for it. Several of the local hams are making the best use of their time by getting the various commercial licenses. These tickets may prove to be of great value before long. There are hams from nearly every state in Phila. these days. I wish they would wear a call pin or something because, for all you know, the guy next to you in the subway may be some lonesome W7 whom you used to work on 20 meters. Our old ORS friend EFH jumped over the deep end. Will the various radio aides notify this column as they are appointed, so that uninformed amateurs will know to whom to report for WERS duty? Fellows, do your duty and keep me informed on matters of interest to the Section. 73 — *Jerry.*

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — SCM, Hermann E. Hobbs, W3CIZ — The Baltimore Amateur Radio Assn. reports its code classes going better than ever with the acquisition of a new Wheatstone tape perforator and transmitter. Classes are progressing rapidly, and proficiency certificates will soon be awarded. AXP visited his home in the early part of August. Jean Hudson is visiting in Denver and expects to attend the ARRL Convention while there. There are quite a number of hams in Washington, and it is reported that at least a third of the regulars are in the various government services throughout the country. PV, who has been under the doctors' care for several weeks, is much improved and hopes to resume his duties shortly. Perry E. Wightman of Hyattsville, recently named chief of the WERS of Prince George's County OCD, has announced the establishment of a county radio service for civilian defense needs, and urges all amateurs in the county to get in touch with him. 73.

SOUTHERN NEW JERSEY — SCM, Lester H. Allen, W3CCO — Asst. SCM, ZI; Regional Coördinator in charge of Emergency Corödination, BAQ; Emergency Coördinators: Atlantic City, EFM; Camden, KW; North Plainfield, GCU; Vineland, GMY; Somerville, EBC. This month finds a few more of the old South Jersey gang reporting their whereabouts. It sure is like old times to hear from some of the boys. OQ is busy servicing Signal Corps radio equipment. ABS and ACC are doing a bit of modulating via the a.c. power lines and getting pretty fair results. ABS reports his defense radio school is coming along nicely, and has sent three more pupils to the RI's for tickets. IOW is still down in Panama, and misses the gang. GNM is still in Texas learning the ins and outs of X-ray equipment. GRW is now affiliated with Eastern Aircraft. HWT reports from Pensacola that he is taking up flying, and expects to become commissioned very soon. CFT looks fine these days, and holds a tech. sgt. rating. ISY is now radio inspector for the Maritime Commission. GLG is now on active duty with the Navy, and has a rating of chief warrant officer. SW is on active duty somewhere in the Atlantic. VE/4HOE is now executive officer of the 71st F.A. Bn. ZI reports from Bridgeport this month after doing a bit of inspection work for the Signal Corps. HAZ, former secy. of the DVRA, is now a corporal and a permanent instructor at Fort Monmouth. AID is doing a little schooling at Grumman Aircraft, and expects to be with Eastern Aircraft in the very near future. GRW has put to sea once again after being torpedoed three times. The South Jersey Radio Club has scheduled for the next few meetings a course on radio fundamentals under the direction of FDF. KW is still giving code practice to all who are interested in the Camden area. Harry Bennett, corresponding secy. of the SJRA, has passed the amateur exam and now has that priceless ticket. CCO, your SCM, became a papa this month. The Delaware Valley Radio Association had an FB talk at this month's meeting on quartz crystals by ARN. Until next month 73.

WESTERN PENNSYLVANIA — SCM, E. A. Krall, W8CKO — Asst. SCM in charge of Emergency Coördination, AVY. OW is now a member of the married fraternity. Congrats, OM. NCJ has both second-class telegraph and first-class radiotelephone licenses, but does not know when he will have use for either. He and Beth are busy with plane-spotting work. They still copy on the mill in order to keep in trim for future developments. KWA is now at Washington, D. C., for further schooling, and claims the regular Navy men try to make life miserable for the "feather merchants," as the naval reservists are called. UAP is interested in contacting other hams who have a desire to experiment with wired wireless. JSY has been at the Naval Research Lab., and is doing important research work. PER, one of the ECs of Westmoreland Co., is doing good work, but should get more coöperation from the hams in his zone. He and MHE plan to call a meeting and place the whole WERS plan squarely before the hams. DLI and Mr. Nealy of station WKPA are teaching code classes at Parnassus. The July issue of "Hamateur News," the official organ of the Altoona Club, is filled with good dope for all hams. ADY is working at Schenectady, N. Y. WPA and WAP have entered the Signal Corps Training School. QNG is attending naval school. APQ has been transferred to Martinsburg. RTH is on the engineering staff of Martin Bomber. RFM is a jr. engineer at the York Lock and Safe Co. PDE is schooling at Phila., and expects to work for the FCC when finished. We advise every amateur to train and prepare himself for what is to come. The training is necessary, and if you are an air raid warden you can easily be transferred to radio work. Besides, you will get to know your community better than you ever did before with subsequent better coöperation from everyone.

CENTRAL DIVISION

INDIANA — SCM, LeRoy T. Waggoner, W9YMV — New Emergency Coördinators include: DGC, Evansville; LVT, Marion; and SWH, Fort Wayne. Welcome to the gang! The Richmond Amateur Radio Association has perfected plans for WERS in Wayne County. LZR is communications officer, and NVA, our E. C. for Richmond, has been appointed radio aide. Five zone center transmitters will be used in the setup, which includes five transceivers. ZFR and TYK are among the active members of the Association participating in WERS. EGQ reports eight or nine 2½-meter transmitters ready to go on the air at Gary. WERS plans are not fully formulated at this writing. ICY is communications coördinator for Anderson, with SUR as radio aide. They have 15 transceivers available, and have arranged for the necessary frequency checks at the local police radio hqs. Small fixed tuned crystal receivers are contemplated for the use of air-raid wardens. EMQ reports class of CAP to draw on for operating personnel for WERS. FOS, EC and radio aide for Marion County, is ably directing recruiting and classification of WERS equipment and personnel. The response has been very gratifying. There are at present about 75 operators ready for certification to the FCC. Thirty portable mobile rigs are ready to go, and seven fixed location transmitters are either finished or under construction. A new code and theory class will be inaugurated in Sept. by the Indianapolis Radio Club to furnish a reserve of operators. DMH is communications coördinator and YRR is radio aide in the South Bend area. LaRue reports 14 portable mobile and two composite transmitters are planned, with standardization throughout. He is also conducting a radio class at Central High with 110 students, and hopes to have additional operators available from that source. AB

reports that ZYK is communications coördinator for Mishawaka. No radio aide has as yet been appointed. Main control station will use 807 final doubler. Field transmitters will use 7A4s, HY 75s, etc., in transmitter-receiver units. There will be one or two pack units also. Many communities as yet unreported probably have made WERS progress. Please remember that this report to *QST* must be mailed not later than the 20th; so please get your monthly reports in as early as possible. Biggest obstacles to be surmounted so far include lack of definition of OCD Warning Districts, lack of information or misinformation on WERS regulations on part of local authorities, and failure to recognize value of WERS. However, these obstacles have been scattered and few and are rapidly being overcome. Discussion of your problems and progress is invited in the *Bison* to enable us to help each other. A postcard to the Indiana SCM will put you on the mailing list. AB sends in a swell list of Indiana hams in the Services to be passed on to Hq. GOE will spend ten days leave in Mishawaka. FSG of Mishawaka is an Army captain now. He is located on an island of the "Shangri-La" group. ELM has two sons in service now. King says it makes him feel as if he is getting old! 8VQY/9 has a jr. op. 9EOC is communication coördinator for Bicknell. DGA made a corporal rating in 7 weeks. KBL is now in Newark, N. J. HRW has had to resign as EC at Crawfordsville because of war work at Indianapolis. HRC has been promoted to associate engineer with Radar. DNQ at Fort Monmouth needed help in opening some of his mail this month! The Indianapolis Radio Club lost a 100-ft. tower to the drive for steel. FOS and JJC did all the work of removing the antenna, while YMV conveniently had acrophobia! 7A4s selected as standard for WERS units in Indianapolis created a marked shortage of loktal sockets. 6J5GTs were hastily substituted in a good many cases. Please report early on WERS plans and progress, as well as continue more personal reports. Yours for WERS, *Roy.*

MICHIGAN — SCM, Harold C. Bird, W8DPE — OOL writes us he is teaching in an aero academy in California. QN writes us from Chicago, where he is also teaching radio. NOH reports FCC has held examinations in his town, and many of the fellows took the exam for Class A; also reports that the Army collected all the receivers in town they could get, including his HQ120X. GUC sends in good report on OCD setup there, saying that the preliminary work has all been done including the appointment of radio aide who is James MacGreggor, DUA, chief operator at local police station. KNP is teaching at Fort Monmouth, and reports he likes his work very much. OEN reports that they are progressing rapidly in their town, having appointed their radio aide and having 20 members accepted by him for the OCD WERS setup. Have their u.h.f. equipment nearly completed with a few under construction. UGR reports that the OPA has given him a permit to buy a bicycle so he can call on the Emergency Corps members in his territory. DPE contacted the County secretary of the OCD and he was very much impressed, but as yet have not heard anything further. DYH reports that the DARA and the Detroit Radio Edison Club are coöperating in an effort to get a training school started. They have a well-equipped room with a nice table fashioned after the one in the Defense Handbook. The Muskegon boys are all set with u.h.f. equipment and are doing their best to get WERS started up that way. The Lansing boys also report that things are ready for WERS as soon as the city is ready for them. 73. — *Hal.*

OHIO — SCM, E. H. Gibbs, W8AQ — Congrats to Dan McCoy, CBI, on his election to the post of SCM. The Section could not have picked a better man, as Dan is well qualified by his experience as EC, ORS and OPS these last several years to take over the job. Let's all give him our fullest support and coöperation, gang. At this writing several applications have been made for licenses under WERS, but to date none has been issued in Ohio. The CARMARS group in Toledo has 32 wired wireless units in operation in a citywide net and is conducting code and theory classes with 37 enrolled. Cuyahoga Radio Assn. has 148 members in good standing, 19 secured from new classes started in July. Canton ARA has a WERS unit organized with 9 rigs ready on 112 Mc. Their classes in code and theory are still going strong. CBI has been appointed radio aide in Dayton, and his gang there has things organized in fine shape, and though they expected to use 56 Mc., the conversion to 112 Mc. is going along OK. TGU got his class A ticket and is ready to get back on the air. So are lots of us, Hal. TGU's niece, Ruth Mullen, 17, got her ticket but no call. Piqua is all set for WERS operation as soon as the license comes through, according to WKN. They have 7 fixed and 2 mobile rigs in addition to a crystal 24-watt rig for the hdq. station. SBB (Mary) and OPX (Jim) wish it to be known that they are planning to install two rigs in one shack, figuratively as well as literally. Now, gang, many thanks to all of you for all the help and coöperation you have given me during the six years as your SCM. Ohio is sure to carry on in the front rank under friend Dan. 73 and V. — *Ev.*

WISCONSIN — SCM, Emil Felber, Jr., W9RH — An appeal has been received from the Civil Air Patrol to radio amateurs of Wisconsin to lend or sell their radio telegraph keys and practice buzzers to the CAP for the duration. The apparatus is to be used to train pilots and other CAP members in sending and receiving code. Headquarters address is 110 E. Wisconsin Ave., Milwaukee. CDY, Milwaukee Radio Amateurs Club president, reports many new vacant seats at our first meeting, which was August 10th. Meetings will continue to be held every Thursday night at 8:00 P.M. in the Trustee's Room of the Milwaukee Public Museum at N. 8th and W. Wisconsin Ave. All out-of-town amateurs are invited to visit. ANA, the club's technical advisor for the last 10 years, is now at Lamesa Field, Texas, as a civilian glider instructor. An old-timer, ex-BBY, is a capt. in the Artillery. HMO is instructor at AAFTS School at Madison. EYH is with FCC at Sauckville now. FHA, EC of Kohler, reports plans are being formed to train 12 YLs for the WERS there. NVJ of Sheboygan is appealing to amateurs of that city for 2½-meter gear and operators. Clarence Brooks of Salem offers his help as a telegrapher at Trevor, and has now received his amateur operator's license. LIA of Hazel Green offers his services for any help necessary in his section of the state. CDC is at Madison taking civilian instructor course for AAFTS. BLB is a sgt. in Signal Corps. WSS and RBO are in Iceland. ITH is a radio operator in the Merchant Marine. MYG is in the Infantry. SYT is constructing a model WERS receiver and transmitter. DIJ is a sgt. with a telephone co. unit. DII left for Camp Grant. LGO has been promoted to a 2nd lieut. in the State Guard. NRP, a private in the military police, is on duty in Milwaukee. Attention, all ECs of Wisconsin. Would like to have a report from all of you for next issue and also when your appointment must be renewed, as I have no record of the expiration of most of your appointments. 73. — *Emil.*

DAKOTA DIVISION

NORTH DAKOTA — SCM, John W. McBride, W9YVF — BMR has started another class at SSS at Wahpeton. ENK and CGM are teaching NYA classes at the AC. YOY, MCV, RPD and OQQ are attending school at Chicago. EIG is in Omaha. ZGR and UJF are in Philadelphia. RPJ is an instructor at Philadelphia. QGM is now at advance radio school in Lexington, Ky. YTX will go to Dayton as asst. radio inspector, Sept. 1st. K6PLZ, XYL, and three harmonics are back from Honolulu. He is now stationed at Vocational School at Minneapolis. MLE is at Harvard. He is now 2nd Lieut. in USNR. KOY spent a few days with EVP and family at Camp Mead, Sturgis, S. Dak. BBD is now at Eatontown, N. J. YVF is to report for duty as student instructor at Sioux Falls Field, Army Air Force Technical School, the last of August. Thanks to BMR, KOY and RPJ for reports — let's have more of them and from some of the rest of you fellows. Please send them so as to reach me by the 10th or 12th. 73. — *John–YVF.*

SOUTH DAKOTA — SCM, P. H. Schultz, W9QVY — YOB resigned as EC at Rapid City so I am appointing ADJ, ex-SCM, in his place. BDF left Mobridge and, since YMB is only one there and is willing to take the job, I am appointing him EC. VOD at Philip and ZBU of Platte are reappointments. ZWL left Aberdeen and is now working for War Dept. at Camp Rapid. She and her OM, YQR, loaned their two big transmitters to Signal Corps.

NORTHERN MINNESOTA — SCM, Armond D. Brattland, W9FUZ — TEF, still with the Coast Guard, reports that HZM has now been promoted to sgt. Unit 2, North-Minn. Association Club, has abandoned meeting, having only one or two survivors at home. The last ones heard about are Several Barstad, who is with the Navy, and Pvt. Benny Kvenlog, who has just sent his full address to the SCM. KPO and XYL spent several days with FUZ family the first part of August. BHY, recently promoted captain in the CAP, A. C. Res., is spending a vacation at Cass Lake and Bemidji with his family, and visited FUZ, as did BMX, who is fishing at a near-by lake with his family. It seems like old times to see the oldtimers around now and

then. It has been suggested that this SCM act as clearing house for the addresses of hams of Northern Minnesota Section in the service. If you wish to have me do so, forward the addresses to me here at the Defense Training Center, Warren, Minnesota. Week-ends are spent at Bemidji, and mail reaching me there Saturdays will be answered before leaving on Sunday. 73 and luck, *Army*.

DELTA DIVISION

ARKANSAS — SCM, Ed Beck, W5GED — Henceforth, by notice from FCC, Little Rock has been declared a regular quarterly examining point with the next examination scheduled for Sept. 15, at 9:00 A.M. This has been patiently waited and hoped for by the gang in and around Central Ark., and we are truly grateful for this decision on the part of the Commission. DTI gives out with a nice bit of dope this month which hails from regions far away, and we learn that since leaving the air he rates a commission and has acquired an XYL, and still gets plenty of code practice. FPU is located on new job in Monticello for Uncle Sam. HDR is doing his bit on the East Coast and has something on his sleeve since leaving. KSP and the XYL, both ops, are wide awake in N. W. Ark. and not missing any tricks. IGM again takes on new duties, and is now going to introduce the vagaries of radio to Uncle Sam's air cadets or vice-versa. FXO is again located in L. R., and we are glad to have a ham of his potentialities back in our midst. HJA is now a lieutenant on duty in South Ark. ICN is spending the balance of the summer at home and is building test equipment. So far, reports of progress on WERS set-ups and achievements have been very conspicuous by their absence; this field still has virtually unlimited possibilities and doubtless should be worked to the fullest advantage in every community, regardless of its size. It also has an advantage of showing that ham radio is always ready, willing, and dependable. As a whole, the dope sheet reveals that the regular appointees have slipped up rather badly in submitting reports this month, so get 'em in, fellows, and do your slowing up, if you must, when things are going full blast. We still have too many communities without adequate EC service; take it on yourself to locate and get acquainted with your regional Emergency Coördinator and if unable to locate one, write in yourself regarding an appointment for your locality and you will find an abundance of coöperation at this end.

Attention, amateurs and students in and around Northwest Arkansas! Beware of anyone trying to sell code courses, pretending to represent a school of San Antonio known as "Radio Communications." Several of the boys have been "pulled in" by this party, until one of our alert hams suggested that your SCM conduct an inquiry, which was promptly done. At the present time your SCM holds adequate evidence that this is an unadulterated misrepresentation. This school does sell a "copyrighted" course in radio code, but *is not* a correspondence school and *does not* have any authorized agent or representative. "Radio Communications" advise that any information about this party would be very much appreciated and their address is on file with your SCM.

Well, gang, that's the crop for now. Don't forget to send in all the dope about yourself and your buddies by monthly report. 73 and all the best. — *Ed.*

LOUISIANA — SCM, W. J. Wilkinson, Jr., W5DWW — JET is PHM2c at USN Hospital. HSH and IDI are still training on West Coast. DXL is in U. S. Army Air Corps. KHC is with Federal Employment Bureau in Shreveport. KMC is civilian radio technician with Signal Corps. HEJ and HEK are civilian radio operators with SC. KOS has recently been made radio man with Army. GEK is rapidly recovering from old injuries suffered in automobile wreck. WN, DGB and several others are aiding the SCM in special work. WERS activity is advancing in this Section under guidance of ZS, CEW and QH. The SCM would like to hear from all the Louisiana gang, wherever you may be, either on the home front or in the services.

TENNESSEE — SCM, M. G. Hooper, W4DDJ — FDT has a fine grandson now. GIX has graduated from submarine school and promoted to RM2c, and is seeing very active service. FWP is civilian operator for Army. DEP is at Montgomery, Ala. GLL and FDT operated a radio class of close to 40 students until hot weather and long hours closed the class until fall. GMX of Norris, Tenn., sends his Emergency Coördinator certificate in for endorsement. Seems he is only ham left in Norris now, and likely he will accept a commission in Naval Reserve. ALO, EC at Union City, says his band has been scattered to the four winds, but that he feels it a pleasure to do anything to help the organization at any time. BUC keeps up his Emergency Coördinatorship. CBS sends in EC certificate for endorsement, says the Chattanooga gang is busy building some 2½-meter rigs, and application has been filed with FCC for WERS license and appointment of CBS as radio aide. GQQ recently moved from Chattanooga to Nashville. He is in the Dept. of Education. EUT says that since NYA camp folded he has not much to do but copy on the mill and dig into radio engineering.

HUDSON DIVISION

NEW YORK CITY AND LONG ISLAND — SCM, E. L. Baunach, W2AZV — WERS is beginning to take shape in N. Y. C. BGO is radio aide, and wants all operators to register with him both as operators and for the use of their equipment. New ECs are IYN, Richmond County, and DZH, Bronx County. ODO is alternate EC for Bronx County, and BKZ alternate EC for Queens County. MCZ, EC for New York County, is having various meetings for the instruction and guidance of the gang who will operate the WERS stations. Thirty stations are ready to go as soon as the FCC license comes through. GTZ, EC for Queens County, has the following lined up and ready to go on 112 Mc.: LOS, DTE, DKH, BKZ, JSM, NAX, CUQ, KTG, JGY, DGJ, NFU, JSV, KIV, NZJ, MYE, IHP and OYJ. DZH, EC for Bronx County, reports AQL, CBB, CLQ, DUP, DSG, EXR, EQG, FZ, GVT, GKB, IVW, JAX, KIY, KRS, KHW, LMP, LKP, MOF, MED, MXQ, MMW, MOY, NUE, NSX, OHE, OKM, OJR, OES, OCJ, OCO and VG are ready to start in the WERS. The Bronx Radio Club is building the master control rig for the county. KIY, OJR, VG, DZH, AQL, and KRS have donated for its construction. DOG, EC for Suffolk County, is getting the WERS started and all operators who live in Suffolk County are urgently requested to get in touch with him. FF is now with the Signal Corps. LPJ is located in Valley Stream. You fellows who wrote to BGO who live outside of N. Y. C. should get in touch with your local EC or SCM. BGO is only radio aide for N. Y. C. and cannot help anyone outside that area. CET is EC for Nassau County and DOG EC for Suffolk County. Thirty more ops have been licensed through the aide of the AWVS and they are all giving a helping hand to get the WERS going.

MIDWEST DIVISION

IOWA — SCM, Arthur E. Rydberg, W9AED — QGU joined Navy as a radio instructor. WTD on vacation in Idaho. NLA is the "professor" on radio theory at the Iowa-Illinois Amateur Club, QVA instructor in code. ESF joined local CAP squadron. FSH expects to have a private pilot license soon. ETS is home for a short vacation. VKZ took Class A exam. ZMA is technical sergeant. CCY is now a corporal with Air Corps. ZYS is with the Navy in Virgin Islands. GPN is in Philadelphia on secret war work. OJD is at Camp Crowder with Signal Corps. TGL writes from Middletown Air Depot. AMJ is now in Lexington, Ky. UGT is working for Uncle Sam. Ex-ZLV is helping make xtals for government. EFI and XYL are still teaching code classes. EKK is with the Army in Omaha. VRD is a radio instructor at Lexington, Ky. AHP is going to WOC, Davenport. AEP is a new EC. Des Moines Radio Amateurs Assn. is busy with WERS equipment. UOP and WHG are building transmitter for control station, LDM and SEJ building receiver, OLY and Herb Steinmetz building auto transmitter and receiver. YOV is in Medical Corps. YOU is with RCA in Schenectady. IHW is in the Navy. OLY and SCJ are working at WHO. Iowa hams in the services please send address, outfit and rank to your SCM. 73. — *Art.*

KANSAS — SCM, Alvin B. Unruh, W9AWP — Two new ESMDT classes in "Fundamentals of Radio I" and one in "Fundamentals of Radio II" have been organized in Wichita, through KU extension. About 150 have completed the first classes. ESL is teaching both theory and code classes at St. Benedict's College in Atchison. YOS, former KN SNCS, is new EC for Brown and Nemaha counties. MAE is EC for Kansas City, Kansas and for Wyandotte County. BRQ resigned as EC because of moving from Lyons to Hutchinson. He is now chief engineer at KWBW. VBQ reports most hams have left Lawrence, resulting in lack of 112-Mc. rigs for WERS. Oscar reports TVX was too young for military service, so now is op with merchant

marine. NSB is communications officer for CAP at Lawrence, but expects to leave soon. Mrs. NSB has an operator's license. UTK is with the Signal Corps. OUU reports he operates linotype for *Emporia Times* during day, and works at KTSW at night. He will give up one job when he goes to school. MDI took radio job in Dayton, Ohio. VBQ reports hearing a fist very much like old FLG's on the air, and wonders if Spet is helping the Army. Ex-TBR, now with the BC station in Atchison, was a Wichita visitor. TVU, who entered the Army in March, is now an instructor in radio in the Field Artillery School at Ft. Sill, Okla. BSP resigned as EC for Johnson and Miami counties; he has now recovered from injuries sustained while installing antenna in November. ZUA sent EC certificate in for endorsement. He is communications officer for CAP group, comprising thirteen counties. JZU has been appointed chairman of the State Board of Barber Examiners by the governor; he is EC for Cherokee and Labette counties. LVZ is instructor for aircraft engine repair at Duncan Field, San Antonio. DKI is electrician in Alaska. QZS is in Signal Corps school at Ft. Monmouth, N. J. GTY is attending school in Illinois; he belongs to the Navy. ZUA has new house with nice radio shack in which to copy press. GTH is in Navy. ZAW reports he and his father, WXE, are about the only hams left in Fort Scott. ZAW will attend KSC. UZD is ensign in Naval Air Force. ZVP is EC for Cowley and Sumner counties. The Navy said UWN was too old. He wants work with WERS. UWN and OTU went fishing in Minn. Let's hear from Kansas hams in the services. 73 — "*Abie.*"

MISSOURI — Acting SCM, Letha Allendorf, W9OUD — Four YLs from the St. Louis area are going to school at Scott Field, with pay, and will receive ratings as junior instructors in three months. They are DBD, ILH, JPT and ONW. ARRC (St. Louis) still meets on first Tuesday each month at the Barr Library, with ZVS president, JTG secretary, KIK activities manager. Some time is devoted to procedure using an oscillator. KEF is active in civilian defense. BQZ expected spontaneous combustion at the WERS meeting, held on the top floor of the library building with temperature around 120. The meeting broke up early. KJC reports that the Lawrence County defense setup is beginning to take shape. CJR is to be radio aide. The Lawrence County Amateur Defense Corps was formed last January and is ready to go. WYV has a Civil Service job at Atlanta, Ga. CKK is now located at Marionville. VMI says the gang around Crystal City is pretty much scattered and the CARC is suspended, but he is continuing as EC. WIS is still amazed at the amount he has to study in order to teach flying cadets. AHZ has been appointed Emergency Coördinator for KC to work with SSG, who has held the position of EC for over a year. The HARC Radio School is quite a success. Several students have passed their amateur exams, and others are nearly ready. MCX has finished the course in Fundamentals of Radio at Washington U. and is starting the advanced course. He signed up for WERS, and has his u.h.f. equipment set up, sold his NC-200 to the 7th CA and his Meissner to National Schools at Los Angeles, and is taking a two weeks' vacation in Minnesota with the XYL and children. WFK has organized the Monett hams to build u.h.f. equipment according to *QST* suggestions. The gang had 22 enrolled for code and theory classes, but two have taken jobs for the government. Let me introduce 5JRA and XYL 5KDE, who have come up from Biloxi, Miss., to Lavadie, Mo., where the OM is stationed as a minister. The two are interested in joining in CD work and are starting a class in radio for their community. NSU has become interested in entering contests recently. OUD is just keeping the home fires burning so far. GZR is teaching code at Camp Crowder. Do send along any news you can gather, and I'll pass it on so we can all enjoy it. Lots of luck to all and 73.

NEBRASKA — Acting SCM, Lt. Comdr. P. H. Quinby, W9DXY — Your incumbent SCM, WKP, was forced to resign due to entering defense work outside of the state, and DXY, Lt. Comdr. P. H. Quinby, 1425 S. 11th St., Lincoln, Nebr., has been appointed to succeed him until a duly authorized election can be held to fill the position. In the report of amateur activities in *QST*, Nebraska has been conspicuous by its absence from the Midwest Division reports in the last few months. Every Nebraska ARRL member should do something about this. Since many of us have left the state to enter the armed forces and other war production activities, it is the responsibility of those of us who remain to report regularly not only upon our own amateur activities but also upon those of our friends and acquaintances of whom we have knowledge. Therefore, let us each make a special effort to make a regular report to the new SCM by the 15th of each month so that Nebraska may again occupy its proper position in the Midwest Division report of amateur activities in *QST*. We know that you are not operating in the amateur bands, so let's let the world know that we are still here and what we *are* doing.

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Edmund R. Fraser, W1KQY — Our sincere sympathy to MXU and XYL whose five-year-old son recently drowned. Congratulations to Radio Announcer MJC and Chief Engr. LTL, both of WICC, who joined hands in matrimony for what appears to be Conn.'s first radio romance. Newly appointed Emergency Coördinators are IJ for Madison and KAT for Guilford, both communications officers for their local CD groups. KSJ, Waterbury, and DWP, New Milford, resigned as Emergency Coördinators due to business pressure. BPU, now in U. S. Air Corps and KKS of FCC, both former Conn. Net and AARS members, send their best to the gang. HCU and GRF, former GB members, paid the club a visit. Two students of GB's completed code class have joined the USN as radio operators, having benefited by instruction received. EUG has closed his radio shop to accept a job as shop electrician in a defense industry. KV has moved from Milford to Hamden. EAO, newly appointed state radio aide, and M. Cattaneo, state communications officer, are visiting the air-warning districts explaining the WERS form of operation. EER has been appointed district radio aide for the Stamford district. LUZ is installing antennae at fixed station locations in Norwalk. BCG is building a stable 112-Mc. rig. BRA is now sub-aide for Wilton and Weston. KEC, KSD, KTF, LUZ, MIQ, NE, NGD, AXB, HYF and CTI are active in WERS. AB and JXP are doing research work, and expect to sponsor an electronics course for engineers in their territory shortly. EFW recently completed a radio course for CAP at Meriden airport, in which only 4 out of 56 failed in commercial examination.

MAINE — SCM, Ames R. Millett, W1BAV — GVS has taken a job with the civilian department of the Signal Corps, and has left town for his basic training. FBJ has been in Rockland all summer attending to the Rockland factory. Although the regulations regarding the new FCC release on WERS set-ups are more or less complicated, it does seem as though things should be shaping up faster than they have throughout the state. The plans here in Portland are going ahead speedily under the able guidance of GHT. BNG expects to go into the service soon. LOA is in Philadelphia for a few months. ANQ works at the shipyards. EWN is in the Navy with a commission. GE has been spending the summer at the camp. KOU still wields the pen and performs the duties required of a Justice of the Peace. EJS is at the Bath shipyard. IFF is a machinist at Bath. KMM is a welder at the shipyard in Boothbay Harbor along with IIE, who is in the electrical gang there. IFZ is in Philadelphia. LHM has a new daughter, and has finished his house. Not long ago IIE and CFO had a pretty hotly contested bowling match in Portland.

EASTERN MASSACHUSETTS — SCM, Frank L. Baker, Jr., W1ALP — A few more new ECs for this last month: HMA for Braintree, DIR for Rockland, KYX for Bedford, JNV for Dorchester, Section 2. GDY is in need of operators to serve for the Boston Defense Net. Please get in touch with him if you are willing to help out. The following hams have gone into the various services: LQ, HDJ in the Army, MQV Army Signal Corps, MQO Coast Guard, LTP Navy, MMM with FCC. MNK is now in Washington. ARE is living in Scituate, Mass. CTR is running a class for restricted radio telephone operators so as to have ops for WERS. MFZ has new baby YL. MEG is now living in Natick. HUP is now in the Army Air Corps, radio. AXA reports that his gang are all set as far as WERS goes for his town, applications are filled out. The ECs are all busy getting the forms for WERS signed up, and meetings are still being held around the state. A few radio aides about to be appointed for some Warning Centers. Miss Wright of the Mass. Public Safety Committee is in charge of the various radio schools, and is doing a nice job. EAU is running a class for the restricted radio telephone operators. BLR is radio aide for Reading. MMU is now living in Quincy. Welcome, OM, to this Section. We hear MIM and LDV got married. IZT is home on leave. We still need some ECs for some towns. If your town has no EC, how about dropping me a line and offering your services? All that is needed is

ARRL membership and a willingness to do a job for your community.

NEW HAMPSHIRE — SCM, Mrs. Dorothy W. Evans, W1FTJ — ITF is new EC in Northwood. EAL is a lieutenant in the Navy and is stationed at South Weymouth, Mass. IVE, JIY, JJG and KUT are Berlin hams who have left for military duty. LVG, who is now a sgt. in the Army, was home on furlough recently. BWR, in charge of NYA at Concord, has been turning out radiomen for Signal Corps, BC stations, etc. FTJ is new national secretary for the YLRL. MUJ is still maintaining his radio service business in Wolfeboro. MRN, MVY and MUJ have been very active this summer, having built two transmitters for the local fire department for two-way radio. One transmitter is for fixed and the other for mobile operation. APK, GQV and MRN are on committee of the state defense set-up for radio and fire alarm communications. NEI has been playing around with telescopes. LMC is now employed in Laconia in defense work. BST is thinking of making his transmitter into a diathermy machine for use in his osteopathic practice. GVJ is employed in defense work. Jerry has just enjoyed a vacation in Maine.

All New Hampshire mourns the passing of W1MXL. Bill was but 25 years old, a graduate of Mass. Institute of Technology in Industrial Engineering, in which capacity he was doing his share in war work when taken sick. As one of his friends so aptly puts it: "Bill was a real man, with a sincere interest in amateur radio." He was an active member of the New Hampshire Emergency Net. His friends were many and his familiar fist will long be remembered. He leaves a wife and a daughter just eleven months old.

RHODE ISLAND — SCM, Clayton C. Gordon, W1HRC — Rumor has it that the gang have gone in for phonograph record playing in great numbers. The P.R.A. has been forced to raise their dues $2.00 per year, payable at the time of renewal of Y.M.C.A. membership. This raise was necessitated by the Y.M.C.A.'s raising the yearly dues by that amount. KKE has sold his 2½ emergency rig to the City of Cranston for WERS work. Ex-GTN has resigned as president of the Y.M.C.A. Camera Club and has changed his QTH. Ran into LWA in Navy togs the other night on the street. No letters from the gang in the service since KOG's some months ago.

VERMONT — SCM, Clifton G. Parker, W1KJG — Our OT Harry Page has joined the ranks of AEC registrants. JVS is leaving for East Springfield, Mass., where he expects work with Westinghouse. NJP is now located at Fort Ethan Allen. JKF is engaged in radio maintenance work for Northeast Airlines at Burlington. Congratulations of the Section are extended to KWB, who was married on August 17th. The hamfest at Mallett's Bay sponsored by the Burlington Amateur Radio Club was well attended, and an informal program was carried out throughout the day. All present reported a good time. Club certificates were awarded to JVS, KOO, KWB, NJU, NJP, AEA, IQG, KJG and to our new licensee, Dick Evans of Essex Junction who received his Class B license after Pearl Harbor. NLO is as busy as ever with the affairs of the club and in attempting to put into effect a WERS set-up for the Burlington area. Your SCM was fortunate to break the average for the past five years and was pleasantly surprised to receive a fine camera as one of the prizes. LYD was recently at his home in Wolcott during a furlough from military service.

NORTHWESTERN DIVISION

MONTANA — SCM, Rex Roberts, W7CPY — FUQ is in Seattle with Pan American Airways. ICM of Spokane is operator at KGEZ. IBH is teaching a group code in Missoula. FOM is operator at KGVO now. AYG is awaiting call to the Marines. From reports not received yours truly guesses that 99 per cent of the Montana hams are in the services.

OREGON — SCM, Carl Austin, W7GNJ — EC: JN. During a little trip around Oregon, HHH and myself found that there are still a few hams not in the services, for various reasons. APD, new EC for Rainier, says local authorities are interested in WERS. HTG at St. Helens is ready to go. EBQ at Astoria will supervise WERS. Met IQK at Seaside. BUH, EC for Tillamook, will direct WERS if locals want it. Met IKY and the mother of HSL, who reports Don in technical school at Treasure Island. Met BVV, Salem, who has turned farmer. GAT is busy with State Guard. EDU, EC for Heppner, says WERS will do little good there on account of isolated location, and also he is the only ham there. FHX, Lakeview, on the job and ready. HVX, EC for Bend, reports CORK Club radio classes still going strong and turning out real operators, and says another class will be started soon. Also says club wants to buy a used Teleplex, or other code machine, perforator type preferred. Address W7HVX, Bend, Oregon. HHH now has 3rd class phone, after 2nd class next. BGM, who never misses a report, is a G.E. tester at Ft. Wayne, and will soon move further east. Jerry Reece, graduate of CORK, received amateur license. Bend officials want to use WERS. The gang are busy rigging equipment, and expect to have 8 or more units by the time the license arrives. 73.

PACIFIC DIVISION

EAST BAY — SCM, Horace R. Greer, W6TI — ECs, OBJ, QDE; EC u.h.f., FKQ; Asst. EC u.h.f., OJU; OO u.h.f., ZM. On Wednesday evening, Aug. 19th, at the Hotel Leamington, Oakland, the regular meeting of the ARRL East Bay Section was held. The meeting was spent on general discussion on WERS and the u.h.f. Mr. Lloyd Shellabarger, W6EE, the radio aide who was appointed August 4th by the City of Oakland, was the guest speaker. Everything is progressing very satisfactorily and much interest in WERS is being shown in the East Bay Section. Lloyd has regular business hours at the City Hall 9 A.M. to 5 P.M., and suggests you take up your problems with him by calling TE-3600, or at his home in the evenings, where he is more than pleased to discuss WERS with anyone. The following were present and enjoyed an excellent meeting: 6's EE, EY, AHG, UFD, MPL, UJI, IKK, CRF, LGW, KZN, AYZ, MUR, SY, SK, SYO, TJP, FKQ, KGF, QAZ, QKA, NBR, SFT, QDE, UKZ, SEW, MNR, MZS, AEX, IMA, HH, TI, JEE, 1LEA, F. Arnberger, B. Corrigan, and F. Overhauser. GRF of Vallejo introduced their radio aide, IKK, who gave a report on WERS in Vallejo which is also in the East Bay Section. All the bay cities in the East Bay have hopes of becoming one unit, but are waiting word from the chief of OCD for Alameda County. Jules Cohn, JT, passed away on July 18th. Many of the gang are taking vacations late this year. DUB is getting to be a big-shot farmer these days. TT is getting to be an expert on how to grow a lawn. KZN reports married life is just FB. ZM attended state American Legion Convention in L. A. Attendance is holding up pretty well with the SARO gang. HS spends most of his time on the road. Richmond Radio Club is still holding regular meetings. In other words, everything is looking on the up-and-up, and until next time, 73 — *Ti.*

SAN JOAQUIN VALLEY — SCM, Antone J. Silva, W6QDT — The Modesto Amateur Radio Club held a dinner meeting, Thursday evening, July 30th. Those present were MIW, AXI, SEA, FNO, LMT, QER, COJ, UBQ, QDT, FKK, TMT and SEJ. TMT, SEJ and TID are attending Modesto Junior College, Signal Corp Civilian Radio School. DIY is electrician in the shipyards now. AXI is a member of the Civil Air Patrol. QEU is in the Air Transport Command, Army Air Forces, as flight radio operator. SPX is now employed at Bendix Aviation, in Burbank. QDT is giving code practice to members of the Civil Air Patrol. MHZ and MZD are both first lieutenants in the Army Air Corp communications. How about some news from the rest of you fellows in the Valley? Send in the calls of the fellows you know who have joined the armed services so that they may be forwarded to headquarters for the roster. 73. — *Tony.*

ROANOKE DIVISION

WEST VIRGINIA — SCM, Kenneth M. Zinn, W8JRL — LCN and CSF are new operators at WWVA. BOW and family recently visited their home at Wheeling with their new daughter. CYV is an operator on a troop transport; he was in Ireland and is now in New Zealand. BTV is now stationed at Altoona, Pa., with the Navy. HD spent his vacation fishing in Elkins. OXO also had a fishing trip in the southern part of the state. KWL is busy working on a local WERS net. NEP has been at the University of Michigan for the summer. TDJ/SPY is still keeping busy these days teaching his night radio classes. WWVA now has its 50-kilowatt rig on the air. ESQ recently visited with OXO in Elkins. WQF is new EC in West Virginia. Fifteen more

students graduated from code classes in Clarksburg at 15 w.p.m. Since MZD can no longer operate his transmitter, he has taken up fishing. PZT was home on a visit recently. MIP has taken up furniture refinishing as a hobby now. Fellows, don't forget to send in your reports each month so we can keep them printing at headquarters. 73. — *Ken.*

ROCKY MOUNTAIN DIVISION

COLORADO — SCM, Stephen L. Fitzpatrick, W9CNL — A final report from EHC as a civilian: he has been commissioned a 2nd lieutenant in the Signal Corps and ordered to Wright Field, Dayton, Ohio. KA4LH, Lee Hinckley and XYL, were on vacation when hostilities broke out. Lee is now with the WPB. QTH: 1035 Sherman St., Denver. He would like to meet the hams he has QSO'd. The Rocky Mountain Division Convention was a grand and glorious affair. There were many hams, XYLs, SWLs, prizes and good talks. Highlights were the talk by JFN, Gordon Johnston, chief specialist United States Navy, and radio equipment demonstrated by Lieutenant Maer of Lowry Field. OTG is now located at 975 Pleasant, Boulder. CAA keeps the telephone company radio equipment in shape. YXU should have been listed as one of the code instructors in the local high school code class. QCX is busy constructing a hi-fidelity amplifier. The AAROD finds that motion pictures help keep up attendance at meetings. EGH visited UPT, who is located at the air base as fire guard in Colo. Springs. MMI is in service training at Steamboat Springs. OMZ is in Watertown, N. Y., with a Civil Service radio job. HPA is attending Utah State College and is a fire fighter in Montana for the summer. DZB and BFQ are with radar at Fort McDowell, California. FNL is 2nd lieutenant at Miami Beach, Fla. WQO is attending radio Civil Service class in Denver. QDC is also attending the Civil Service radio class. All radio amateur clubs in Denver are planning on a picnic to be held the last Saturday in August at Stapleton Park, near Genesee Mountain. EZL is a radio operator with the Army. Do you realize how important home news is to the hams that are away in some other part of the globe? Why not use this opportunity to let them know what the home folks are doing? One letter reads, "Of course, always read the Colorado Section first to see what the rest of the gang are doing." Just drop a postal in the mail before, or at least by, the 16th of the month and you will be doing your part.

SOUTHEASTERN DIVISION

WESTERN FLORIDA — SCM, Oscar Cedarstrom, W4AXP — HET has finished his new home and has a special room in it for his amateur station, all ready for the day when the bands open up again. He reports that his son Jeff, a ham too, is doing his bit for Uncle Sam at Aberdeen, Md., as a Captain in the Army. DNA is doing radio constructing for the Army. He says he likes the job fine. John Blackman, an ex-W4 and a commercial op, is busy at Naval Air Station teaching code to the aviators. DAO is buying a recording outfit and building some audio amplifying gear. We welcome Mr. Wentworth and Mr. Wall into the League; they are both ex-service men and old timers in the radio field. AXP is learning touch typing. Let's hear from you and keep this summary going. 73 to all from AXP, The Old Maestro.

SOUTHWESTERN DIVISION

LOS ANGELES — SCM, H. F. Wood, W6QVV — Things are progressing in the Los Angeles area on the new WERS setup, and it appears that a good organization will be ready to go soon. We need more operators and equipment, so if you are interested or know of anyone who is, and will be available with or without equipment, please contact us at once so you may have a part in this big job. In those areas outside of Los Angeles proper, let us hear from you as to your activities. All AEC Members in this immediate district will be glad to note that we have been able to get the use of our regular meeting place once again, on the first or third Thursdays of the month, and regular meetings will be scheduled to keep all informed as to progress, operating procedure, etc., under the new setup as quickly as the organization is ready to go. We need more members, and in many points new Emergency Coördinators to take the places of those now in service. I am asking for volunteers. Please don't let me down. BUK of San Gabriel did some fishing in the High Sierras recently. RUE reports that TSL is monitoring for FCC, and PNV is at Radar with RM2/c rating. SML wants the gang, especially those who owe him QSLs, to know he is now living in Los Angeles, having recently moved from Santa Barbara, and can be reached at 2068 Escarpa Drive. His suggestion that we catch up on the QSLs we were going to send is a good one. SAA got his second-class radiotelegraph ticket and is pounding brass on a freighter. TGR has started a code class for Women's Auxiliary Corps, and Silvia needs a good oscillator as she has quite a sizable class and reports that they are making good progress. LI is very busy at Standard Oil in charge of all transportation, and also with sheriff's disaster and emergency radio work. PCK is 1st lieut. in U. S. Coast Guard teaching radio code to a class of 40 or more plebes. RTW is 1st radio operator in mobile tank radio corps, location unknown. SGP moved to Whittier. That's all for this time. More personals from time to time, but right now our job is under the new WERS. If you are not already into it, contact your OCD officials and get the ball rolling. 73. — *Ted.*

ARIZONA — SCM, Douglas Aitken, W6RWW — Phoenix is the first to report the formation of a WERS set-up and application has been forwarded. They will take in most of the Salt River Valley. TOZ is now chief op. at KSUN. TUW is lieut. (jg) in the Navy. ROD is lieut. in Signal Corps and is overseas. SBN has a telephone 1st. REO is new EC at Winslow. The Tucson bunch are continuing their code classes and doing good work. KOL graduated from M.I.T. and expects sea duty immediately. QWG has been making trips at sea as radio op. MLL now instructing in CPT course. UKB joins the Navy and goes to radio school. QNC dropped in on RWW. Tucson holds a ham picnic. TJH is now EC for Tucson. TRG is enlisted in Air Corps Reserve. Understand the Signal Corps made a cleanup on purchase of ham receivers and manufactured transmitters in the state recently. Wish to remind the ECs to drop a postcard once in a while and tell of doings in their districts and of any of the gang going into the services. MLL and myself are going to try a mimeographed ham news sheet, *The Cactus News* sent out once in a while, with news of the gang, as well as a "swap column," and we're going to need news and items, so let's have them! Vy 73. — *Doug.*

SAN DIEGO — SCM, Richard Shanks, W6BZE — Lots of activity in the Section in WERS. Lots of registering has been done of men and equipment, but we can still use more of both. Please get in touch with FAT. GNP has just graduated from "boot" camp and is now a full-fledged sailor. BAM is now in the Army and is located at Camp Crowder, Mo., address Co. D, 30th BIR. S.C.R.T.C., Camp Crowder, Mo. He expects to become a radio instructor. CNB is now radio instructor in the Navy at Corpus Christi, Tex. MXK is a civilian radio technician in the U. S. Army. In recent election at the Helix Radio Club, ANU is pres., FAT vice-pres., FTT sgt.-of-arms and JRM secy.-treas. Helix Club had a swell beach party last month; everybody had a swell time. Best of luck to all, 73.

WEST GULF DIVISION

NORTHERN TEXAS — Acting SCM, Gordon Ash, W5CY — ECA is the proud papa of a second junior op, born Aug. 11th. Bob is now a 1st lieutenant in the Signal Corps. JJ is finding his work in Denver, Colo., very interesting. If they don't quit shipping HIP around so much, they are going to wear him out. He is now back in San Antonio, where he is very well pleased with his work. HJX finally settled on an FB operating job. The Dallas Amateur Radio Club has been doing some fine work on the FCC's order No. 101, and hopes to have the ham fraternity of Dallas and vicinity 100 per cent registered. They sent out a very complete letter of instructions that should get the job done. Your Acting SCM will be in the East on a flying business trip in the next few days, and had hoped to be able to drop into Hq for a visit, but time probably will not allow.

NEW MEXICO — Acting SCM, J. G. Hancock, W5HJF — ENI is now on active duty as a captain in the Medical Corps, and HJF is holding down the reins as SCM in his absence. ZU/ZM is also on active duty as lieutenant in the Signal Corps. CXP is somewhere overseas. JZT has traded his key for a farm over near Las Vegas. JWA plans to join the Navy soon. Fellows, we are silent keys for the duration, that is true, but why be silent otherwise; let's keep track of one another so we won't have to look our calls up when the darned thing is over. I wonder about you, and I'm sure you wonder about lots of the OMs you used to chew the rag with, or who used to QRM you every time you had traffic. Let's use these pages as a sort of transmitter to keep in touch until we can use our sky wires again. Drop me a card every 16th and let me know what you are doing, and look in *QST* to see what the rest are doing. We are QRX for that report every 16th. 73.

(Continued from page 98)

they must be able to receive at 20 words per minute (plus), send (perfect copy) at 15, learn field procedure in traffic-handling and the installation and operation of field nets.

In teaching its operators the Signal Corps uses its now-famous "Z-letter" system, in which each letter is sent at a speed corresponding to 20 w.p.m., with extra spacing between the individual characters to bring the actual speed down to beginning levels from 5 w.p.m. up. An ingenious gadget called a "clacker" accomplishes this by a multiple rotary selector and stepping relay which picks out every second — or third, or fourth — character from a fixed-speed 20 w.p.m. tape and routes it to the student's phones. Thus a single tape gives anywhere from one to four separate signals.

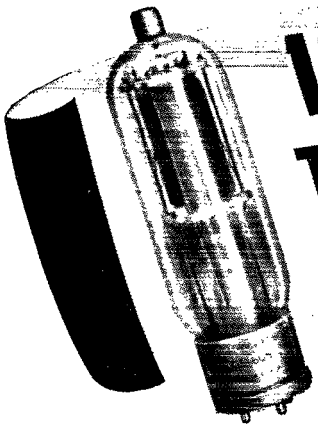
All code is fed to the students from nearly a score of Boehme photoelectric keying heads using Wheatstone perforated tapes, located in a separate fireproof automatic keying room in the Code and Traffic Section, over underground cables to the classrooms. These are situated in a large airplane hangar which is a relic of World War I days when the Air Corps was the "Aviation Section" of the Signal Corps. There it is delivered to the code-practice tables, each of which has twenty positions complete with millwells, headphones, keys and a switchboard which enables connecting up any combination from single pairs on up.

Field operators are required to progress only to the 20 w.p.m. level in graduated stages, writing — or rather, printing — the copy legibly in pencil. Fixed-station operators must learn to copy on the mill, however, and at speeds of 35 w.p.m. or higher. They also are given training in reading "slip," with individual tape-pullers at each practice position. In addition to elementary instruction in touch typing, the fixed-station operators are also given practice in "bug" sending and drilled in the specialized "War Department" procedure.

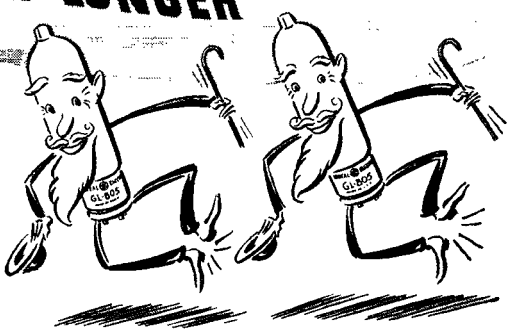
The final stage of the training involves actual "on the air" communication. At Fort Monmouth this drill goes considerably beyond the usual simulated procedure, and the students actually operate small individual c.c.o. transmitters which look like small ham Field Day portables, working other students in another building. Not only must they tune the rigs to the designated frequency and pick up their correspondent station, but they must copy through QRM, follow the drift of the other signal — sometimes no mean feat in itself! — and in general solve all the problems encountered in actual communication. So effective is this method of simulating actual operating handicaps that a student operator capable of a flashy 25 w.p.m. at the code table usually drops to 15 or so when he gets in front of one of these rigs, we were told.

So you see there, too, the characteristic thoroughness of Signal Corps methods. The operator classes follow the same precepts as the rest of the school — train 'em fast, but *good.*

And that about sums up the atmosphere that



10 Suggestions to make your THORIATED-tungsten-filament tubes LIVE LONGER



Here's how you can easily remove many of the causes of premature tube failure

1 Don't overload the tubes. Use adequate protective devices such as a fuse or relay. Heavy overloads are apt to evaporate the thorium surface from the filament, and permanently damage the tube.

2 Normal operating temperature for thoriated-tungsten-filament tubes is obtained by operating them at the *rated* filament voltage. Care should be taken to operate them *at this voltage* (except for standbys and when reactivating). Occasionally, under or over voltage will give longer life, but such operation should only be carried out after first consulting the tube manufacturer.

3 Tubes that have been momentarily overloaded, or run at subnormal filament temperature, can quite frequently be reactivated by following this simple procedure: Operate the filament at the rated voltage for ten minutes or more with no voltage on the plate or grid. This process can be accelerated by increasing the filament voltage to 20 per cent above the rated value for a few minutes.

4 Increase the filament voltage progressively (only a small percentage at a time) when a tube no longer responds to reactivation. New filament transformers may be necessary for such operation.

5 For tubes of *250-watt plate dissipation or higher,* when the load on the tube is intermittent, keep the filament at 80 per cent of normal voltage during standby periods of *less than two hours.* This helps keep the cathode surface replenished, and makes it more quickly available when raised to normal filament voltage. If the standby period is *more than two hours,* the filament current should be shut off.

6 For tubes of less than 250-watt plate dissipation, filament voltage should be removed for standbys of more than 15 minutes.

7 For all types of thoriated-tungsten-filament tubes if the off period is less than five minutes, operate the filament at full voltage continuously, as excessive heating and cooling cycles tend to distort this type of filament.

8 Keep tubes well ventilated—with fans or blowers, if necessary.

9 Run at lowest possible anode current and voltage.

10 Minimize plate dissipation by careful tuning of the transmitter.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment

These Suggestions Apply to Such Tubes As These G-E Thoriated-tungsten-filament types:

GL-146	GL-276A	GL-812	GL-849
GL-152	GL-800	GL-813	GL-851
GL-159	GL-801	GL-814	GL-860
GL-169	GL-803	GL-833A	GL-861
GL-203A	GL-805	GL-834	GL-865
GL-204A	GL-806	GL-835	GL-1623
GL-211	GL-809	GL-838	GL-1628
GL-217C	GL-810	GL-845	
GL-242C	GL-811		

TEACHING A RADIO CLASS? Ask for These G-E Aids

- FM Primer
- Cathode Design
- Experimental Electronics (Theory)
- Experimental Electronics (Applications)
- Electronics and Electron Tubes
- G-E Motion Pictures

Fill in the coupon for your sample package of these publications.

General Electric, Section 161-39B1
Schenectady, N. Y.

RUSH

☐ Please send me .....copies of "9 Ways to Make Your Tungsten-filament Tubes Last Longer," "How to Get Longer Life from Your Mercury-Vapor Tubes," and further information on the operation of thoriated-tungsten-filament tubes.

☐ I am conducting a radio class for ..... and would like a sample package of your textual manuals.

NAME..... STATION.....

ADDRESS.....

CITY..... STATE..... 8850

GENERAL ELECTRIC

(*Continued from page 108*)

prevails at Fort Monmouth as a whole. They're building the communications nucleus of a big army there — the biggest and best the world has ever known — but despite all the confusion of incredible magnitude and the insistent clamor for speed and more speed in getting these vitally-needed specialists to the front, they're doing their training job soundly and thoroughly.

And one A. Hitler and his pals are going to find that out — soon. They won't have the unforgettable experience of visiting Fort Monmouth and observing this training in process, as we did, but they will see its results in action — and they'll find that equally unforgettable.

Yes, the Signal Corps is getting ready to axe the Axis with everything from a Tommy gun to a soldering iron. We felt mighty privileged to be able to see them getting ready to do the job, but we're going to be a lot prouder after its done. And from what we were told by the hams there now — fellows whose calls you'd recognize as pre-war buddies from contacts over the air and at ham conventions — they're even prouder to be in there doing it.

How about you? If you have the necessary physical and other qualifications, there's a warm welcome awaiting you in the Signal Corps.

Cryptanalysis Lesson

(*Continued from page 55*)

Solutions to ciphers in the August issue:

1) This one is simple; wait until next month. (Simple substitution.)

2) Miss Emma Smith's horse has rather short hair in his mane. (Simple substitution.)

3) Skiing rabbit-trappers succor ill logger; proffer food, etc. (Simple substitution.)

4) In the emanation of the material world, etc. (Simple substitution, plus subsequent transposition by groups.)

Experimenter's Section

(*Continued from page 44*)

stage which, in turn, is transformer-coupled to a 2A5 output stage which delivers about 3 watts to a six-inch permanent-magnet dynamic speaker mounted in the center of a heavy cardboard baffle about three feet square which also helps in bringing out the low tone of a plane's motor. The original unit made use of a W.E. carbon single-button mike which was sensitive, but this was finally abandoned because of poor low-frequency response.

Some trouble was experienced with a high 60-cycle hum level which was finally eliminated by proper shielding of the input stage and good grounding. The power supply is a "junk box" affair which uses a type-80 rectifier and will deliver 130 milliamperes at 350 volts. Inasmuch as the total plate drain is only 55 milliamperes, the unit runs comfortably cool.

The range is estimated to be from five to ten miles depending on wind direction, the size of the

BRIGHT NEW WORLD....

Thousands of hams, offered a wide choice of Army duty, are actively forging the bright new world to come. And the Army is giving them new skills with advanced equipment. They are learning what it will take to be important men in that bright new world ahead.

See what the Army has to offer in "U.S.A. Calling!" on page 21 and in previous issues. Go to your nearest Army recruiting office, or write as directed in *QST*. Grab one of these exciting chances to dust off a really hot rig — for the sake of your country, for good pay and for your own future.

★ TERMINAL gladly calls attention to the important place you can have in the U.S. Army — and to the fact that thousands of fellow CQ hounds are already in it — up to here!

TERMINAL A Steady Source of All Radio Materiel
85 Cortlandt St., New York, N.Y.
Telephone: WOrth 2-4416
RADIO CORPORATION

(*Continued from page 108*)

airplane and the volume of local noise. In general the observers have become accustomed to using the amplifier and most of them think it is a great help. The post has been inspected by the Mayor of Newburyport and other city officials, and has been highly praised by Mr. Arthur Lunt, Acting Chief Observer.

The Newburyport installation has definitely shown that the use of ham-built equipment can assist the civilian defense authorities in their aircraft-warning work. It must be remembered that many citizens are *now* actively participating in this work and reporting the presence of every airplane that comes into view. This is not something that will go into use when and if the first hostile airplanes approach our shore, but *every* airplane, public or private is reported by these loyal, unpaid, diligent workers. It is our duty to provide them with every assistance we can render. — *Albert E. Hayes, Jr., W1IIN, Group Leader, and T. Richard Thomas, Asst. Group Leader.*

I am sixteen years old and a prospective ham. In the March issue of *QST* I saw your article on aircraft detection and decided to try it out. I want to warn you now that your ideal was badly treated when I started on it. Because of lack of amateur gear, a lot of substitutes were used. After digging around the pile of radio junk in the garage, I found an old carbon telephone mike and several good mike batteries and transformers. Well, everything was fine until the high gain amplifier was needed. A perfectly good Skybuddy receiver was sitting on my desk, so I hooked up the mike to the second detector of the receiver.

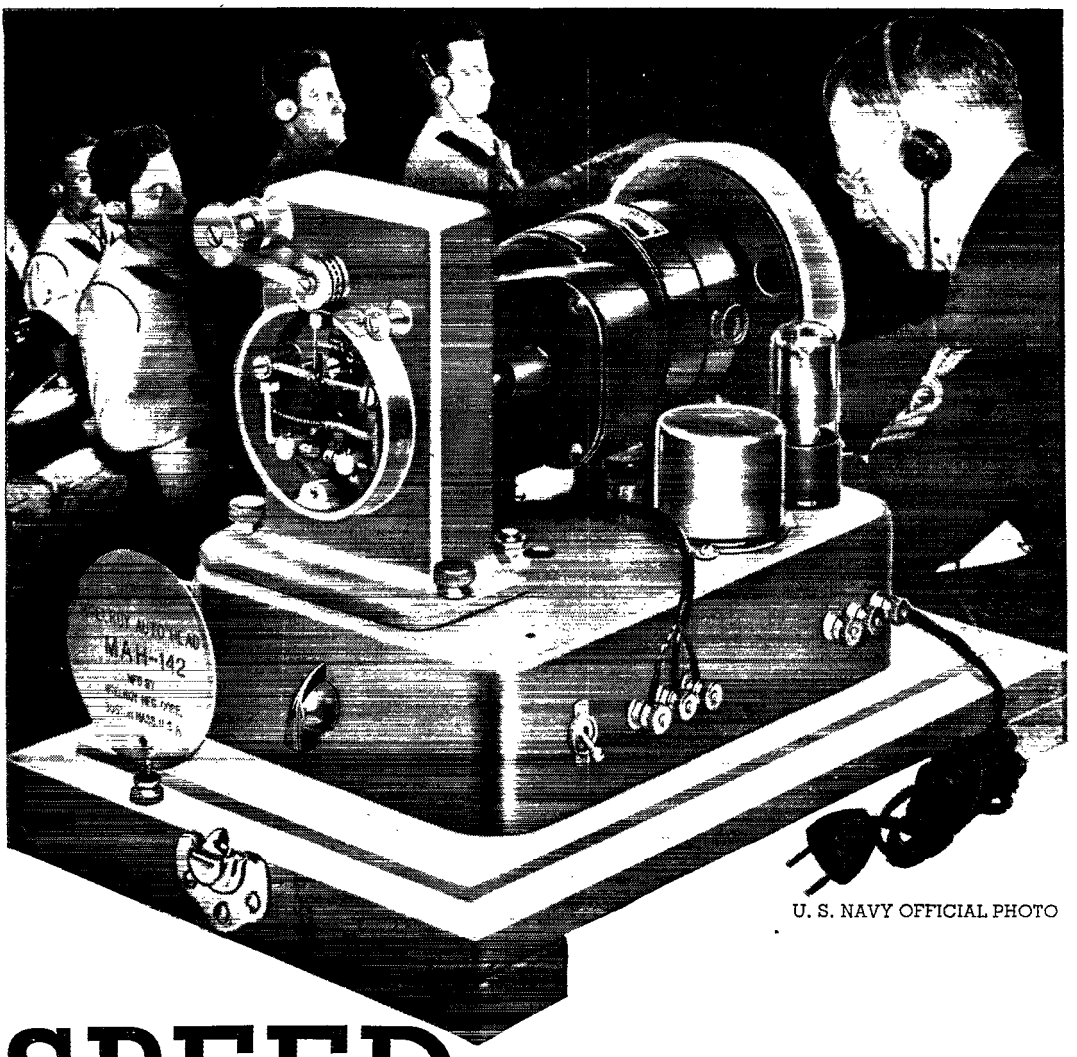
With a box of practically the same dimensions as pictured on the front of *QST* to put my mike in, I tried it out. By using this set-up aircraft motors can be heard from ten to fifteen seconds before they can be heard by the naked ear. Am now using earphones from the receiver and the mike is on top of the shack. — *Perry White, Oklahoma City, Okla.*

PROJECT F

Supersonics

ADDING to the previous references on supersonics which have appeared in these columns, we have: *Supersonics*, by Robert Williams Wood, published by Brown University, Providence, R. I. *Sondage par le Son*, by M. P. Langevin (translation in photostat form may be obtained from the Library of Congress, Washington, D. C.). These were suggested by W8FMF and W3GEX.

In terrain having a strata of bed rock only a few feet below the surface of the ground, could this layer be used as the propagating medium for supersonics? Suppose a rod were driven down to bed rock and used to transmit the waves to it, and another rod were driven in at the receiving end and a contact microphone placed on its upper



U. S. NAVY OFFICIAL PHOTO

SPEED will save lives

That's why at McELROY, we're straining every effort, working to the limit of plant capacity in the design and production of precision-built telegraph equipment, engineered by the world champion telegraphist and outstanding wireless operator of all time.

Illustrated is our Model XTR-442 Transmitter, which may be set to operate at accurately controlled speeds ranging from 5 words per minute to as fast as 250 words per minute.

Our fighting forces need operators, now! McELROY equipment can train these men . . . fast!

McELROY MANUFACTURING CORPORATION

82 BROOKLINE AVENUE BOSTON, MASSACHUSETTS

(Continued from page 110)

end; could appreciable ranges be expected provided the stratum of rock extended (largely unbroken) between the two stations?

The possibility of using audio frequencies in this way also occurs. Perhaps the simplest test would be to place an electric bell action above such a rod so that its hammer strikes the end of the rod. This should put out a fairly healthy, if somewhat raw, sort of signal. I should expect that vertical strokes would do the best job, but tapping the side of the rod might be tested also, with appropriate placement of the contact mike or crystal pick-up cartridge. — *Lt. Charles H. Chandler, Long Branch, N. J.*

Happenings of the Month

(Continued from page 37)

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

League members are classified as Full Members and Associate Members. Only those possess-

TRIPLETT

Thin-Line INSTRUMENTS

TRIPLETT *Thin-Line*

INSTRUMENT "SPECS"

- Minimum case depth.
- Full standard size rigid mechanism . . . no projecting base.
- Wider shroud strengthens face: focuses attention on scale.
- Simplified zero adjustment.
- Sapphire or equivalent jewels. All component parts finely made and of superior quality.
- Balanced Bridge Support.
- Metal Bridges at both ends.
- Separate Scale Mounting.
- Doubly Supported Core.

Also available in metal case

NOTE: When space is at a premium and for all installations where space is efficiently used, Triplett Thin-Line Instruments set a new standard of precision performance in "condensed" space. For full details write for Triplett Thin-Line Bulletin to **The Triplett Electrical Instrument Co., Bluffton, Ohio.**

(Continued from page 112)

ing certificates of Full Membership may nominate candidates, or stand as candidates; members holding certificates of Associate Membership are not eligible to either function.

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

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

For the Board of Directors:

K. B. WARNER,
Secretary

August 1, 1942

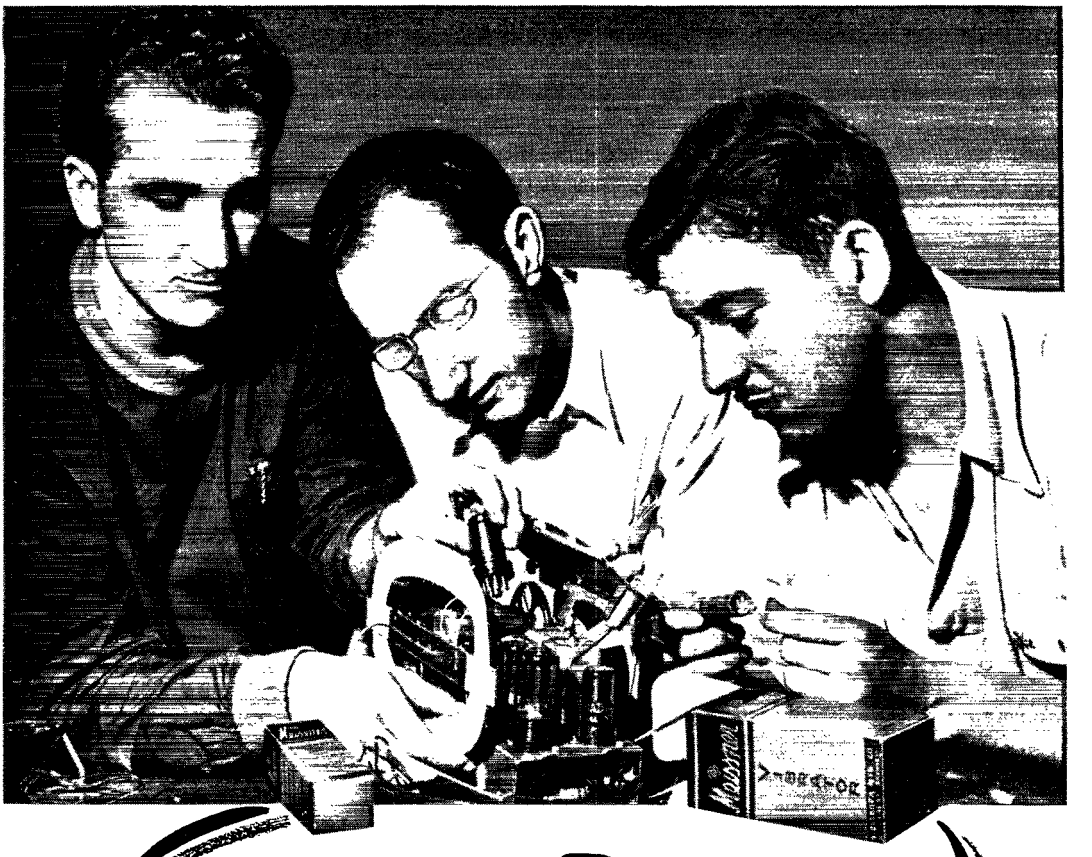
How Recordings Are Made

(Continued from page 59)

ing the arm and further by using an offset head or curved arm. The proportional angle for various types of arms is shown in Fig. 4, which also shows the improvement to be had by using a long arm radius. Another method of reducing the tracking error is the use of an inclined needle, the vertical angle of which changes as it progresses across the record.

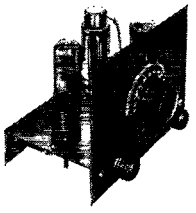
The importance of correct tracking may be realized from the fact that a tracking error of 15° may cause approximately 4 per cent harmonic distortion. This may be of considerable importance in a high-fidelity system. Also to be considered is the factor of record wear, especially on instantaneous recordings with relatively soft surfaces. This is aggravated where the needle tip does not precisely fit the groove conformation. With high-grit commercial pressings, tracking error causes the needle to wear unevenly, shortening playing life and increasing distortion.

In ordinary practice a maximum tracking error of less than 5° is considered entirely satisfactory, although in the best modern offset or curved pickups it is reduced to 1 or 2° over most of the playing area. The relatively liberal NAB standards provide that the maximum tracking error of the



Train 'em Faster with MEISSNER RADIO KITS

Signal Corps Schools know that in order to speed up radio training they must use kits that have been specially designed for student training purposes . . . Meissner radio kits are precision engineered for classroom use, saving valuable time for both instructor and student. Meissner pictorial Wiring diagrams simplify construction problems in basic radio training.



Meissner one, two and three tube add-on Kits are ideal for the beginner in classroom work . . . starting with a one tube Kit, students can, with the add-on features, construct two and three tube receivers—available for both AC and DC operations. Six and nine tube kits are available for the advanced student.

See your Meissner distributor for special SCHOOL NET PRICES

Meissner

MT CARMEL, ILLINOIS

"PRECISION BUILT PRODUCTS"

(*Continued from page 114*)

pickup shall be 6° at 4 inches diameter and 10° at 15½ inches diameter.

Equalization

The subject of recording characteristics, standard frequency response curves and equalization therefor has been covered previously in this series.[2] It is necessary only to apply the data in reverse to make it applicable to reproducers.

Ideally, of course, the output from the reproducing amplifier should correspond exactly with that supplied the recorder input. Specifically, the equalization problem in a playback amplifier is to compensate for the special characteristics of the record and pickup and make the overall output linear. Practically, if a modified constant-velocity record is being played with a magnetic pickup having the same characteristic, the amplifier should boost the lows below perhaps 700 cycles (depending on the combined turnover point) at a rate of 12 db. per octave. If a constant-amplitude crystal pickup is used, on the other hand, the compensation need be only 6 db. per octave. If a special high-frequency characteristic such as the NAB standard or NBC orthacoustic was employed in recording to improve the signal-noise ratio, the amplifier must have a characteristic that is the inverse thereof. And so on — the amplifier should be equalized to make whatever is put into it linear when it comes out.

Obviously, this is a process that depends wholly on the individual application; it is difficult to provide general rules. The typical circuits shown in Fig. 6 will, however, provide a basis for satisfying most of the requirements that may be encountered. Wherever possible, it is usually desirable to do the equalizing at the pickup. If recordings of different characteristics are to be played through the same reproducer and amplifier, however, it may be desirable to provide variable equalization in the amplifier proper to meet the various conditions. Where extreme equalization is required it is also desirable to do it somewhere in the amplifier after the pickup. This is because, as has been emphasized, equalization involves an overall reduction in response, and if this is done entirely at the pickup level its output may be too greatly reduced.

Translation Loss

Another important but until recently little-appreciated factor of reproducer performance is that of translation loss. This is the loss in upper-register response caused by the inability of the needle to traverse the sharply-radiused grooves which occur at high frequencies and small record diameters.

The translation loss varies with pickup inertia, needle shape and mass and record material, as well as with playing diameter. A soft (more elastic) coating will allow the groove walls to compress, allowing the needle to shortcut and thus reducing the amplitude. On the other hand, at

[2] See p. 67, etc., September, 1942, *QST*.

★ "MORE WATTS PER DOLLAR" ★

Taylor Tubes

RELIABILITY
DURABILITY
EFFICIENCY

√ TRANSMITTING
√ ELECTRONIC
√ RECTIFIER
√ INDUSTRIAL

TO OUR FRIENDS IN THE ARMED FORCES
Best of Luck To You. We Hope You Will Be Back Soon.

Taylor Tubes, Inc. is now licensed by RCA

Taylor HEAVY CUSTOM BUILT DUTY Tubes

TAYLOR TUBES, INC., 2341 WABANSIA AVE., CHICAGO, ILLINOIS

(*Continued from page 116*)

very large playing diameters the vibratory system of the pickup and the record material may resonate, accentuating the high-frequency response. Thus in a typical case of a 78 r.p.m. recording using a wide-range pickup the response at 10,000 cycles for a 14-inch playing diameter was 5 db. above the average middle-frequency level, while at 4½ inches it was 5 db. below. The softer the coating the lower and more pronounced is this peak. In the typical case mentioned the 10,000-cycle response was greater than that at 1000 cycles at all diameters above 6 inches.

With ordinary pickups the translation loss — which is primarily the limiting factor for high-frequency response — limits the useful upper-frequency range for various standard record sizes about as follows:

6-inch — 4500 cycles
8-inch — 7000 cycles
10-inch — 9000 cycles
12-inch — 10,000 cycles

According to NAB standards the pickup should be so designed that "the translation loss as determined by the difference in level of reproduction of 8000-cycle bands on the inside and outside of a standard 16-inch vinylite tone record be not in excess of 6 db."

Turntable and Motor Drive

Most of the important turntable and motor-drive considerations discussed in the second article of this series apply with equal force to the reproducer — and therefore need only to be emphasized, not repeated. It may be useful, however, to cite the standards recommended in a recent NAB committee report on this subject.

Under these standards the reproducing turntable "wow" factor — maximum instantaneous deviation from the standardized mean speeds of 33⅓ or 78.26 r.p.m. — must not exceed ±0.3 per cent of the mean speed. In other words, a "78 r.p.m." turntable should turn between about 78 and 78.5 r.p.m. for high-fidelity reproduction.

Obviously such accuracy requires stroboscopic speed adjustment — and a lightly-loaded constant-speed motor capable of holding the calibrated speed regardless of type of recording, temperature, line voltage and all other variables.

The report carries the further provision that recommended practice is to have the playback turntable at a height of 30½ inches — in case you're interested.

In building a reproducer certain precautions must be observed. The connecting leads from the pickup should be kept as short as possible. The leads should be shielded, the shield being grounded to the pickup arm or case (if made of metal) as well as the motor and turntable, and connected to an external ground. The mounting must be so arranged that motor vibration is not transmitted to the pickup. The turntable itself, of course, must be reasonably flat and true-running.

(*This article is No. 4 of a series.* — EDITOR.)

The Old Lady Goes Down

(Continued from page 69)

favorite American dish, fried eggs and ham — and for a destroyer that is *really* putting out chow. We never had fried eggs on the *Lex!* Later, I had a couple stitches taken in my arm, put dry clothes on and went up on deck.

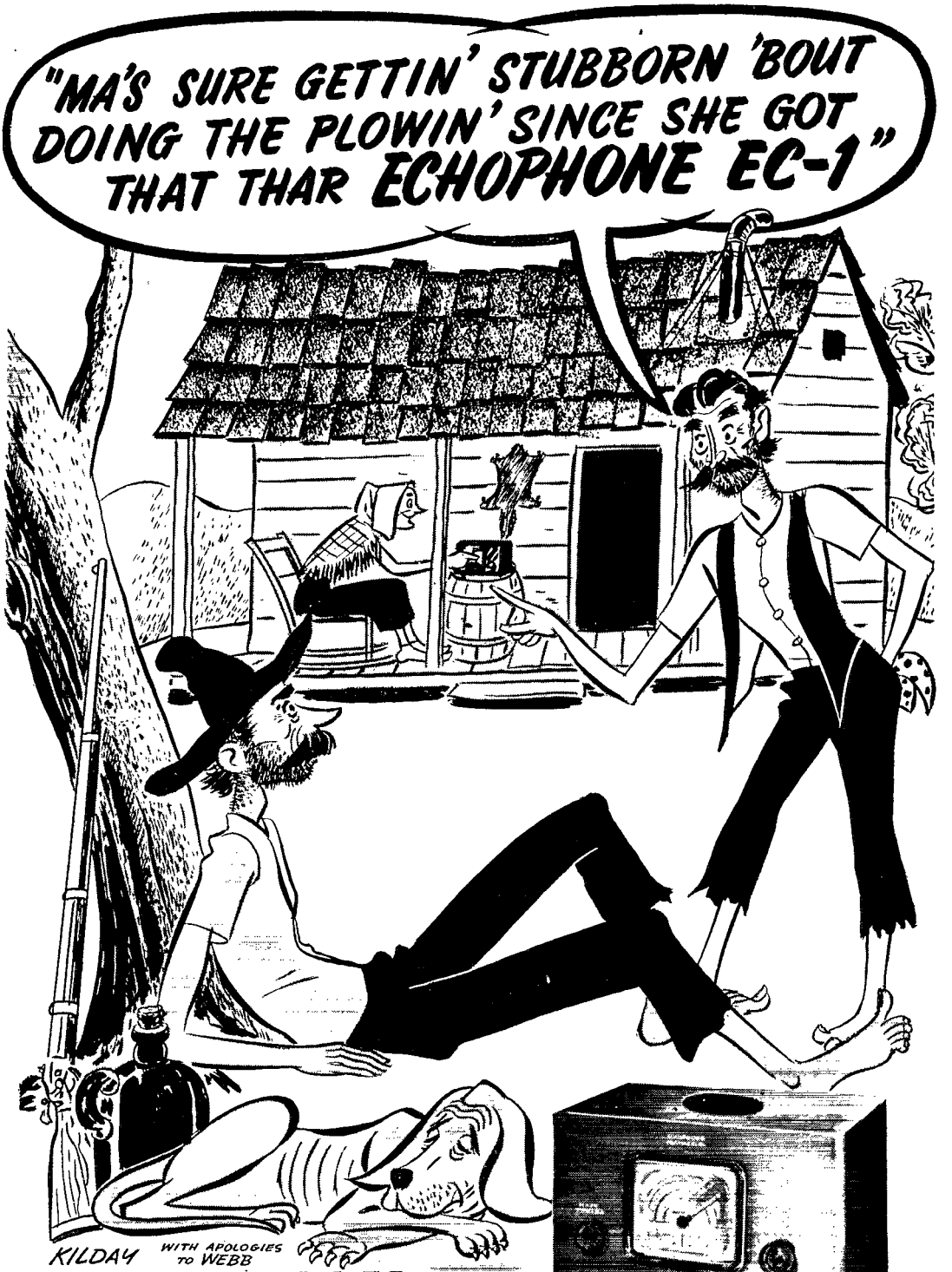
By now it was almost dark. Off in the distance sat our Old Lady *Lex*, flaming from stem to stern. It was a sad sight, a sort of fury in all its glory. She was a grand old ship and a "Fightin' Ship" and I hated to see her go. We pulled away fast and before long she was over the horizon. The actual moment of her sinking was described in the papers by those who were on the vessels that stood by to watch her go down. But long after she was over the horizon we could see the fiery glow in the sky as our one-time home prepared herself for a watery grave at the bottom of the Coral Sea.

As to where we were taken after the battle I am unable to tell you. However, it is more important to win the war than to worry about what ship you are on, and right now I would say that we have at least made a good start at wiping the Japs out.

Well, there is little more news that I can tell you at the present time. Until I got transferred I had visions of being in the States for awhile and getting some leave to come home, but those hopes are pretty well gone now. It made me feel pretty tough for awhile, but I don't mind it now. The sooner we lick these (you know what) the sooner I'll be going on permanent leave and permanent shore duty, and that will be a wonderful day.

With love to both of you,

Hal.



Echophone Model EC-1

6 tubes, 3 bands. Tunes from 550 kc. to 30 mc. Beat frequency oscillator. Bandspread logging scale. Self-contained speaker. Electrical bandspread on all bands. AC/DC. 115-125 volts.

ECHOPHONE RADIO CO., 201 EAST 26TH ST., CHICAGO, ILLINOIS

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 15¢ per word, except as noted in paragraph (6) below.
(4) Remittance in full must accompany copy. No cash or contract discount or agency commission will be allowed.
(5) Closing date for Ham-Ads is the 25th of the second month preceding publication date.
(6) A special rate of 7¢ per word will apply to advertising which, in our judgment, is obviously non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Thus, advertising of bona fide surplus equipment owned, used and for sale by an individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League takes the 7¢ rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and all advertising by him takes the 15¢ rate. Provisions of paragraphs (1), (2), (4) and (5) apply to all advertising in this column regardless of which rate may apply.

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

* * * * *

Gear is short. You can sell your old and extra gear through Ham-Ads

* * * * *

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

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

TELEPLEXES, Instructographs bought, sold. Ryan's, Hannibal, Mo.

CASH for your equipment. See advertisement on page 110. Let's win this war, quickly! Bill Harrison, 12 W. Broadway, N. Y.

SELL: audio amplifiers, Jensen PM12B, Stancor 10P, meters, parts. Write for list, photos. Would like bug. Trautwein, 4025 206 St., Bayside, N. Y.

WANTED: RCA, No. 906-P1 cathode-ray tube. State condition, hours used, and price wanted. P.O. 964, Minneapolis, Minn.

SEVERAL heavy transformers and chokes, time signal receiver — $25, transmitter — $50 — 18,000 brass screws 6-32 — $25. Leitch, Park Drive, West Orange, N. J.

WANTED: T55, TZ40, VR105. State condition, use, and best price. Must test OK. W1BB.

SWL cards printed. Samples? W8DED, Holland, Mich.

WANTED — radio tester, good condition. R. Ackley, Banning, Calif.

WANTED: #25 enameled copper wire. State quantity and price. Might consider #24, #26. W1BB.

WANTED: 2" or 3" C.R. tube new or used; National PW-O drive unit; also your list of parts for sale. W9JTR, 1915 N. Adams St., Hutchinson, Kansas.

WANTED: 0-50 or 100 microammeter 806, HK-354, RK-63 and 250-TH tubes. S. E. Adcock, W4GL (ex W4DYP), Knoxville, Tenn.

MEMORIZE code easily with KolorKards. New, practical, complete, — $1. KolorKards (W8RW), Bluffton, Ohio.

PATENT and sell your idea. Some radio manufacturers may want your clever, practical idea to improve his peacetime product. Complete all necessary patent procedures now in order to be in a position to negotiate with manufacturers when industrial production is again our primary aim. Send for free 48-page, illustrated book about patents, sale of inventions and other valuable information for men with practical ideas. Write today. Victor J. Evans & Co., 677-L Merlin Bldg., Washington, D. C.

WANTED: high fidelity linear standard UTC or equivalent input also 6L6 output audio transformer pushpull. Gottschalk, 6557 University Dr., University City, Mo.

WANTED — several good 2050, 2051, 884, 885 tubes. H. W. Babcock, 304 S. Grand Oaks, Pasadena, Calif.

SELL Hallicrafter SX-17 speaker $50. Cyriax, 219 E. 71 St., N. Y. C.

WANTED: Riders Manuals, 7 and up, cash. W9ARN, Bartonville, Ill.

SELL: 66 inch Bud cabinet. Want 6-400 volts 150-200 ma. dynamotor, aircraft band xtal. W9LZS, London, Ky.

USED equipment wanted. I will give you the best cash allowance for your used equipment. Send in details today and have cash in 'de pocket tomorrow. W9GFQ, Wholesale Radio Labs., Council Bluffs, Iowa.

WANTED — Copy of IRE Proceedings for January 1937, state condition and price. A. Earl Cullum, 3623 Overbrook Drive, Dallas, Texas.

CRYSTALS: for many needs are still available on high priority when orders are accompanied by WPB M-146 certification. High-grade type E62 and E64 Steatite units suitable for frequencies between 1600 and 10,000 kilocycles. Crystals also supplied to your holders and limited regrinding service available. Write us. Eidson's, Temples, Texas.

WE pay highest cash prices immediately for used communications receivers and transmitters. Write, telephone, telegraph description. Just as we have given you the best deal for fifteen years when you bought from us we will now give you the best deal when you sell to us. Henry Radio Shop, Butler, Mo.

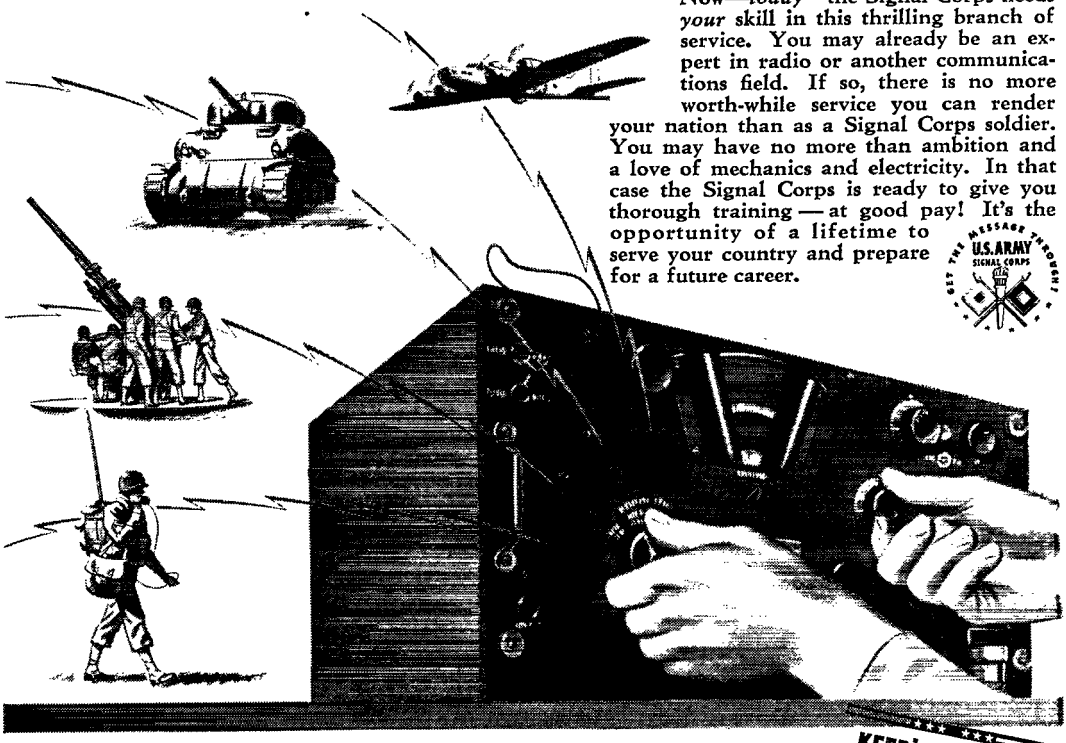
WE still have large stocks of communications receivers, transmitters, meters, code machines, radio supplies of all sorts. Your inquiries and orders invited. Henry Radio Shop, Butler, Mo., and 2335 Westwood Blvd., West Los Angeles, Calif.

The "Nerve Center of the Army" needs your skilled hands TODAY!

This is a war of speed—a radio war. Commands and messages must go through like lightning. Never have communications been so vital to victory, or have new devices meant so much.

The whole responsibility for "getting the message through" is in the hands of the U. S. Army Signal Corps. Hands that install and maintain countless thousands of radio sending and receiving sets — hands that adjust the marvelous mechanisms of America's newest and most secret weapons—hands that flash the orders to attack!

Now—*today*—the Signal Corps needs *your* skill in this thrilling branch of service. You may already be an expert in radio or another communications field. If so, there is no more worth-while service you can render your nation than as a Signal Corps soldier. You may have no more than ambition and a love of mechanics and electricity. In that case the Signal Corps is ready to give you thorough training — at good pay! It's the opportunity of a lifetime to serve your country and prepare for a future career.



HOW YOU CAN GET IN NOW

1. *ENLISTMENT*

If you are 18 to 45 and physically fit, you may apply for enlistment in the Signal Corps or in the Signal Corps Enlisted Reserve.

Direct Enlistment: Experience as a licensed radio operator, a trained radio repairman, a telephone or telegraph worker, will qualify you for active duty at once. From Private's pay you can advance rapidly as you earn higher technical ratings—up to $138 a month, with board, shelter and uniforms.

Enlisted Reserve: If you are skilled with tools but lack qualifying experience, you may enter the Enlisted Reserve. You will be given training, with pay, in one of the many Signal Corps schools, and ordered to active duty when you have completed the course.

Commissions: Graduate Electrical Engineers may apply for immediate commissions in the Signal Corps. And special opportunities for training and commissions are open to Juniors and Seniors in electrical engineering colleges.

2. *CIVILIAN TRAINING*

If you are over 16 years of age, and even though registered for Selective Service, have not received your order to report for induction, the Signal Corps offers you an outstanding opportunity.

If you have ability with tools—if you want to secure training in the vitally important field of communications—you may attend a school in or near your home city. You will be paid not less than $1020 per year *while learning*. And when you have finished your training—in 9 months or less—you can advance to higher pay as your technical skill increases.

Even if you have a minor physical handicap, Signal Corps Civilian Training may give you the chance you've wanted to serve the Army of the United States.

KEEP 'EM FLYING!

U.S. Army

• FOR FURTHER INFORMATION REGARDING ENLISTMENT—Call and talk this over at the nearest Army Recruiting and Induction Station, or write to: "The Commanding General," of the Service Command nearest you.

★

Or *write to:* Enlisted Branch, AM-1, A.G.O., Washington, D. C.

★

FOR CIVILIAN TRAINING INFORMATION — Call at any office of the U. S. Civil Service or U. S. Employment Bureau.

Your Nearby Dealer Is Your Best Friend

Your nearby dealer is entitled to your patronage. He is equipped with a knowledge and understanding of amateur radio. He is your logical source of advice and counsel on what equipment you should buy. His stock is complete. He can supply your needs without delay. His prices are fair and consistent with the high quality of the goods he carries. He is responsible to you and interested in you.

One of these dealers is probably in your city — Patronize him!

BALTIMORE, MARYLAND
Radio Electric Service Co.
3 N. Howard St.
Everything for the Amateur

BUFFALO, NEW YORK
Radio Equipment Corp.
326 Elm Street
W8PMC and W8NEL — Ham service and sound equipment

BUFFALO, NEW YORK
Dymac, Inc.
1531 Main Street — Cor. Ferry — GA. 0252
One of the Largest Ham Supply Houses in Western New York

CHICAGO, ILLINOIS
Allied Radio Corporation
833 West Jackson Blvd.
Complete standard lines always in stock—W9IBC, W9DDM, W9AUK, W9BWP, W9CKD, W9JFM, W9SFW, W9TXZ

CHICAGO, ILLINOIS
Chicago Radio Apparatus Company
415 South Dearborn Street (Est. 1921)
W9RA and W9PST — Amateurs since 1909

DETROIT, MICHIGAN
Radio Specialties Company
325 E. Jefferson Avenue
Ham Supplies — National & Hammarlund Sets and Parts

HARTFORD, CONNECTICUT
Radio Inspection Service Company
227 Asylum Street
What do you want? We have it. Radio exclusively

HOUSTON, TEXAS
R. C. & L. F. Hall
1021 Caroline Street
Equipment for sale to students and civilians interested in radio

KANSAS CITY, MISSOURI
Burstein-Applebee Company
1012-14 McGee Street
"Specialists" in supplies for the Amateur and Serviceman

KANSAS CITY, MISSOURI
Radiolab
1515 Grand Avenue
Amateur Headquarters in Kansas City

MILWAUKEE, WISCONSIN
Radio Parts Company, Inc.
538 West State Street
Complete stock Nationally Known products

NEW YORK, N. Y.
Harrison Radio Company
12 West Broadway
Harrison Has It! Phone WOrth 2-6276 for information or rush service

OAKLAND, CALIFORNIA
W. D. Brill Company
198 10th Street
W6KLO — The House of Parts — W6FJX

PHILADELPHIA, PENNSYLVANIA
Eugene G. Wile
10 S. Tenth Street
Complete Stock of Quality Merchandise

ST. LOUIS, MISSOURI
Van Sickle Radio Company
1113 Pine Street
Owned and Operated by Amateurs

YOU CAN BE SURE WHEN YOU BUY FROM

QST

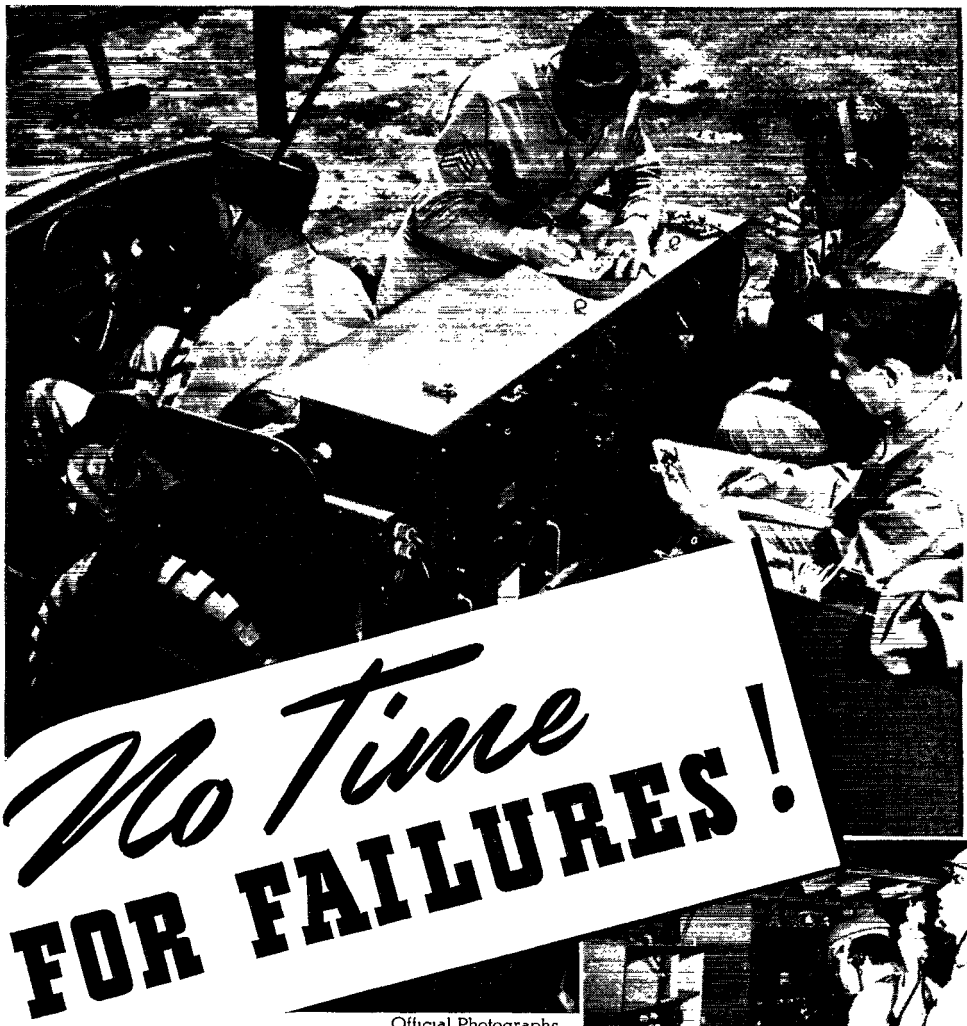
ADVERTISERS

"Advertising for *QST* is accepted only from firms who, in the publisher's opinion, are of established integrity and whose products secure the approval of the technical staff of the American Radio Relay League."

Quoted from QST*'s advertising rate card.*

Every conceivable need of a radio amateur can be supplied by the advertisers in QST. *And you will know the product has the approval of the League's technical staff*

Index to Advertisers



No Time FOR FAILURES!

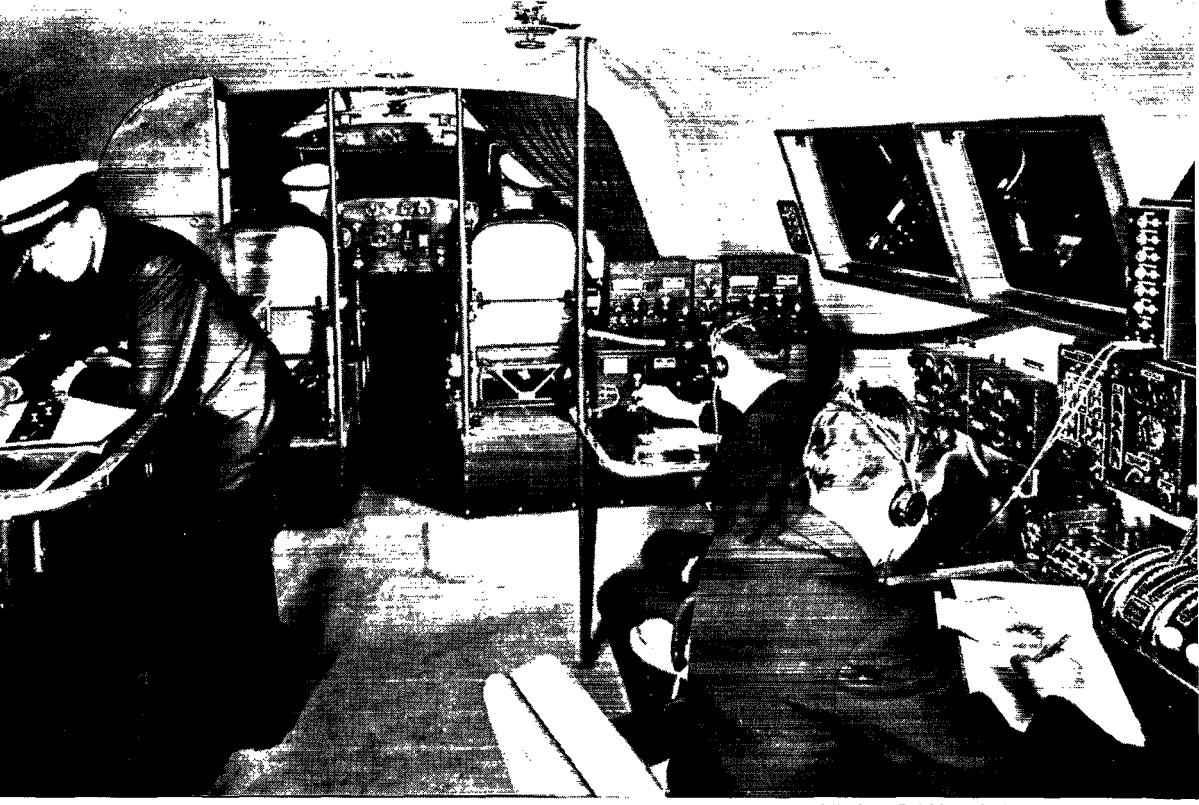
Official Photographs
U. S. Army Signal Corps

Dependable Men
Dependable Equipment
Dependable Transformers

When seconds are the determining factor in success or failure of an attack . . . When lives depend upon the perfect operation of communications equipment . . . then engineers insist upon dependable transformers. Thordarson transformers are engineered to give high quality performance under every operating condition.

THORDARSON
ELECTRIC MFG. CO.
500 WEST HURON STREET, CHICAGO, ILLINOIS
Transformer Specialists Since 1895

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

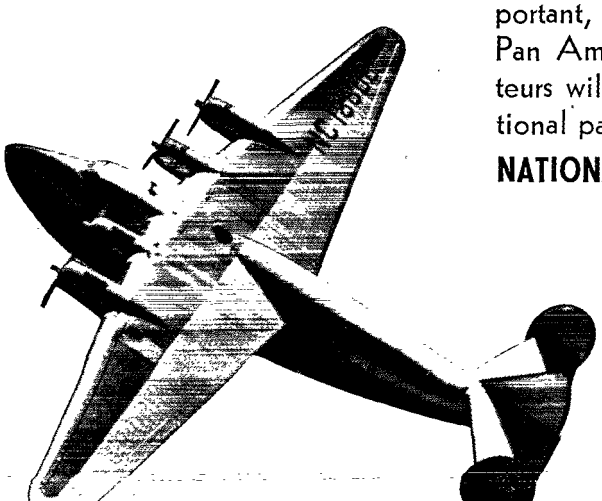


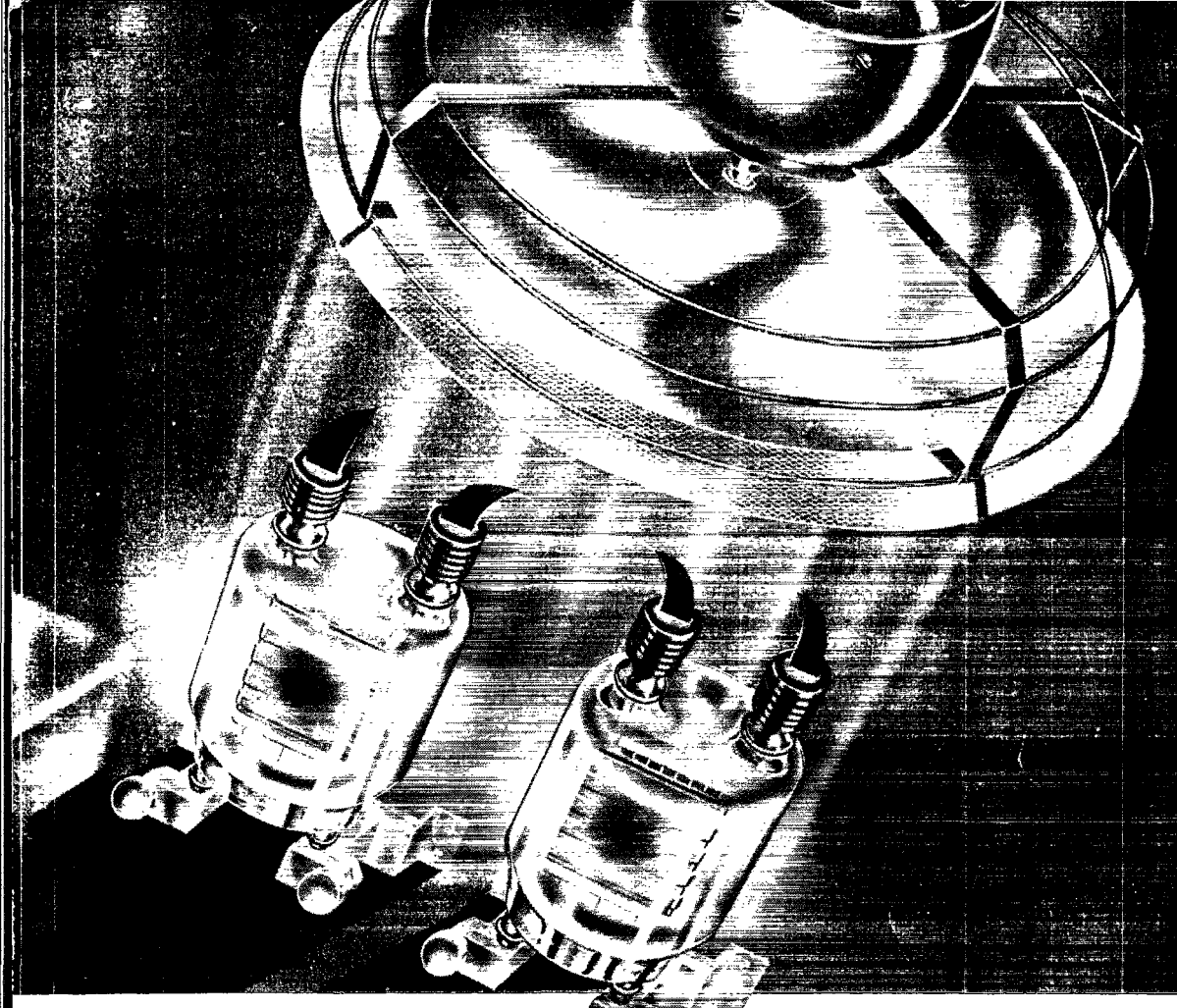
PHOTOS COURTESY OF PAN AMERICAN AIRWAYS, INC.

WHAT IS INSIDE A CLIPPER?

Well, take a look at the picture above. Most of a Clipper's equipment is unfamiliar to the uninitiated, but the clean efficiency revealed in every detail needs no description here. For in a Clipper, no detail is too small to be important, and no alibis are accepted. High as Pan American Airways' standards are, amateurs will not be surprised to know that National parts "measure up."

NATIONAL COMPANY, Inc., Malden, Mass.





COOLER TUBES LAST LONGER

No. 4 of a series devoted to extending transmitting tube life

These are days when extreme care in extending the life of transmitting tubes now in service pays big dividends. This care—far beyond any which might be considered advisable in normal times—can aid in guarding against failure and, perhaps, costly interruptions to your service.

One way of making an easier schedule for tubes is to keep them cooler. This can be done by reducing plate voltage and dissipation to the lowest permissible limits. Another, and often more feasible, method is to use forced-air cooling—even on tubes where it is not specified or, in other cases, to a greater extent than may be specified for normal use.

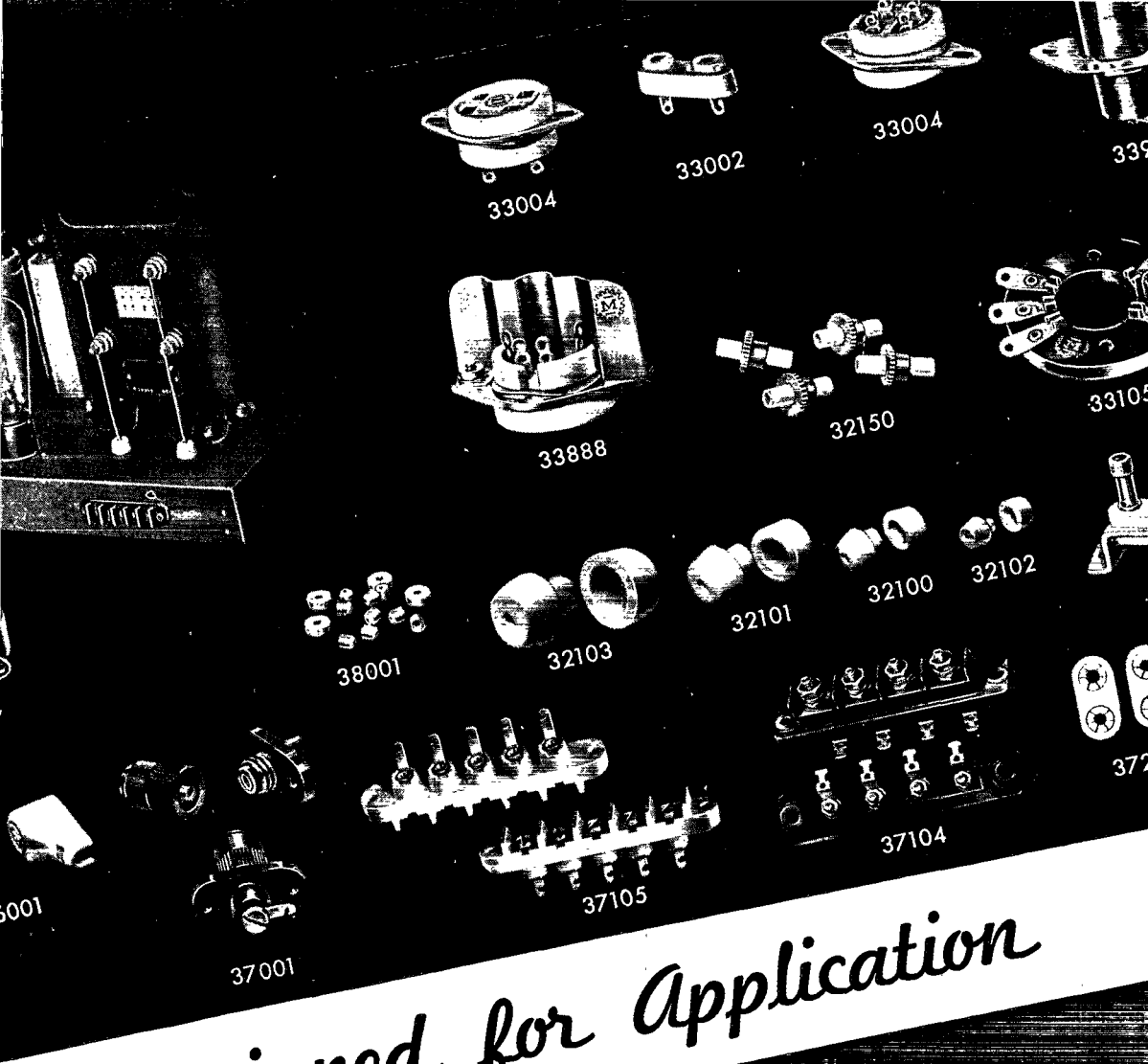
Where tubes are already being operated conservatively, additional air cooling may not be of any great benefit, yet is desirable as long as operating temperature limits are observed. In other cases, worthwhile savings in tube life may be obtained.

A few cautions should be observed in using air-cooling: Place fans so that their air blast is well distributed over the entire tube, not concentrated on one side. Screen fans with a fine mesh wire to avoid blowing dirt on tubes and clean the tubes regularly to remove any dust that may collect. Be careful not to over-cool mercury-vapor tubes. Hold all tube operation to specified temperature limits.

RCA

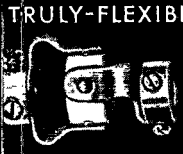
TRANSMITTING TUBES

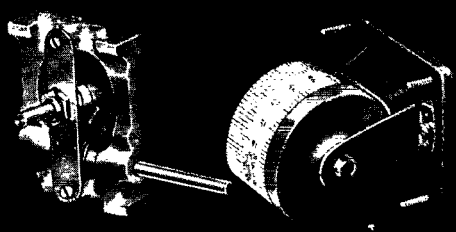
RCA Manufacturing Company, Inc., Camden, N. J.



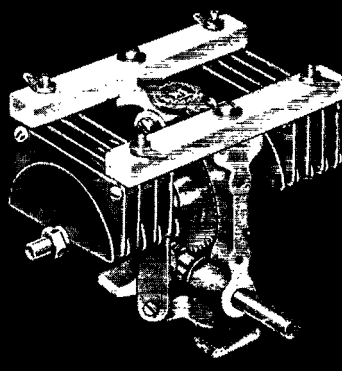
Designed for Application

TRULY-FLEXIBLE ISOLANTITE COUPLINGS

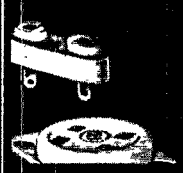


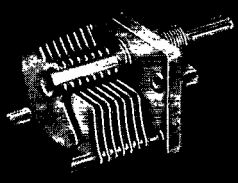


DIALS TO MATCH METERS

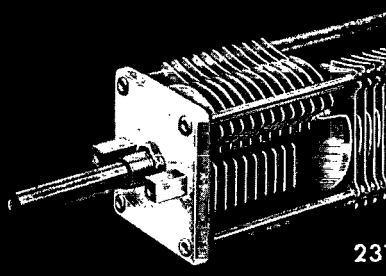


TRANSMITTING CONDENSERS

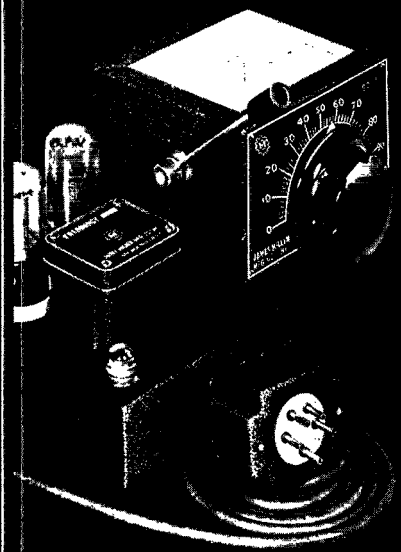


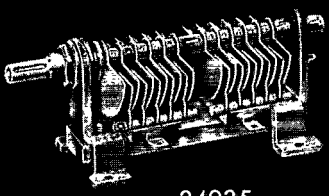


22075

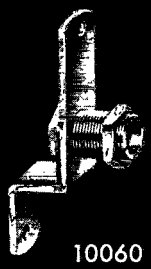


23





24935



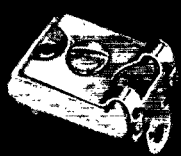
10060

90700

39006

39002

39003



28030