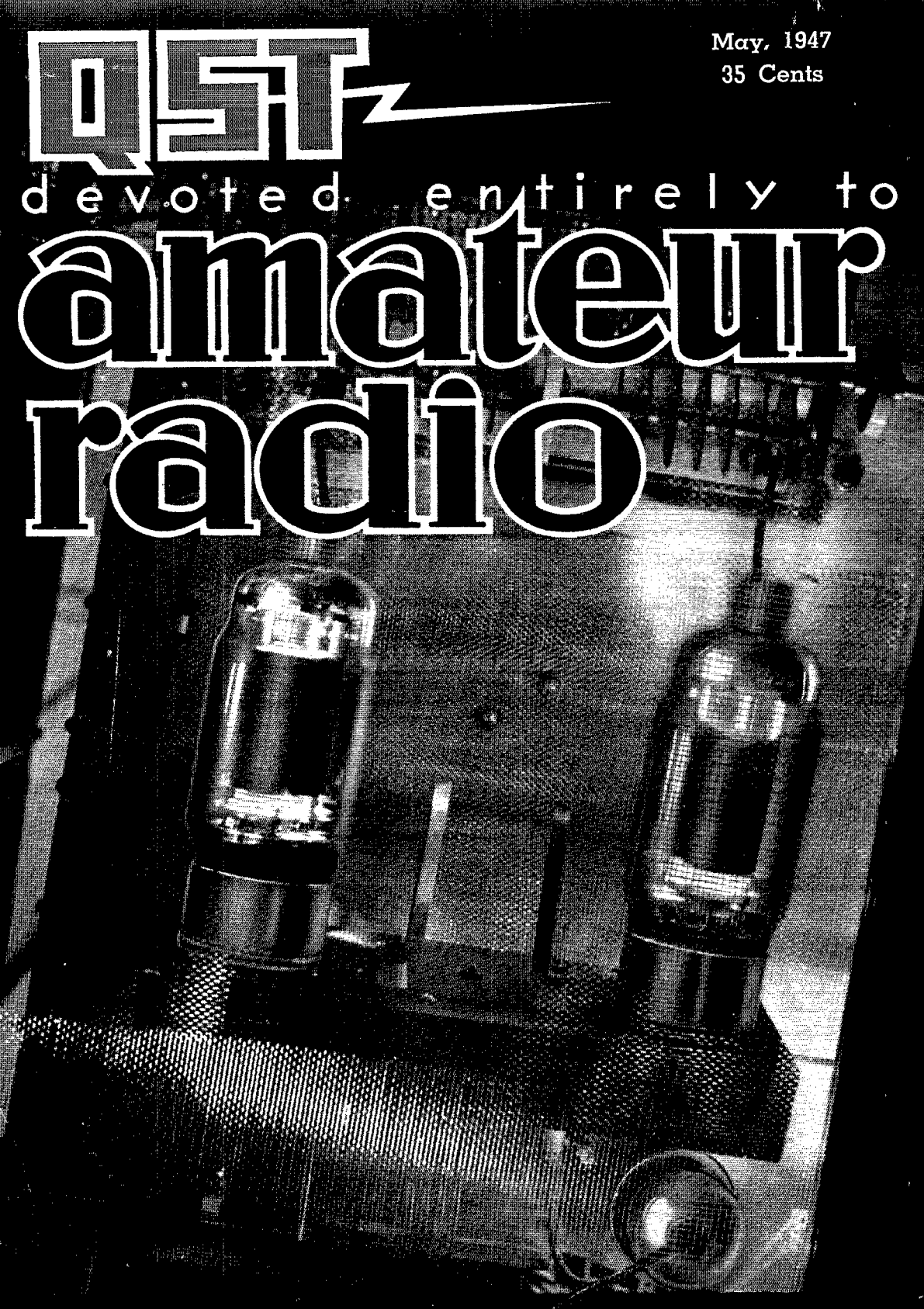
May, 1947
35 Cents

QST

devoted entirely to

amateur radio



IN THIS ISSUE — NEW SLANTS ON TRANSMITTER CIRCUITS AND LAYOUTS

Speak out... and be Heard!

Overcome Room Reverberation... Cut through **QRM**

THE CARDAX

CARDIOID CRYSTAL MICROPHONE

The Only High Level Cardioid Crystal Microphone with Dual Frequency Response

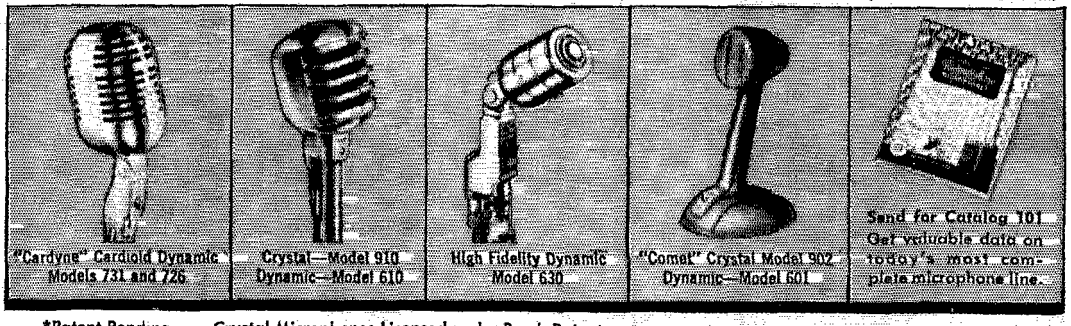
You can sit back and relax . . . when you call with the CARDAX. E-V Mechanophase* unidirectivity overcomes room reverberation, permits working at greater distance from microphone. Dual Frequency Response gives you high fidelity for clear channel or rising characteristic for *extra crisp* speech signals that cut through QRM. Brings *more* and *better* QSO's. For DX or Rag-Chewing, there's nothing like it! Smart looking, too! CARDAX, Model 950, lists at $37.

Authorized Distributors Everywhere

NO FINER CHOICE THAN

Electro-Voice

ELECTRO-VOICE, INC., BUCHANAN, MICH. *Export Division:* 13 East 40th St., New York 16, N. Y. Cables: Arlab



"Cardyne" Cardioid Dynamic Models 731 and 726

Crystal—Model 910 Dynamic—Model 610

High Fidelity Dynamic Model 630

"Comet" Crystal Model 902 Dynamic—Model 601

Send for Catalog 101 Get valuable data on today's most complete microphone line.

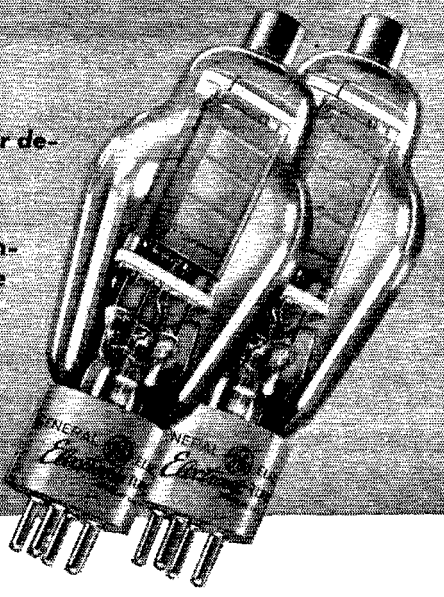
*Patent Pending. Crystal Microphones Licensed under Brush Patents

MONEY-SAVING TUBE LINE-UP

GL-1614 drives two GL-812's

✓ *GL-1614 as driver delivers up to 21 w.*

✓ *The GL-812's in push-pull need only 13 w drive —have 450-w total CW input (ICAS) to give your final plenty of wallop.*



...You get all three tubes for less than the price of one representative 500-w triode!

GENERAL ELECTRIC policy is not only to design and build good tubes, but also to help you get the most out of the tubes you buy—most in dollar-value—most in performance.

Type GL-1614, for example, makes an excellent driver. It's our old friend the 6L6 manufactured and tested for r-f service, and can be employed in any standard crystal-oscillator or buffer-doubler circuit.

Type GL-812 is widely known as a staunch, reliable power triode, with max CW input of 225 watts (ICAS). Two of these low-priced huskies in your final, will supply plenty of power to punch your signal through to its destination.

When rectifier tubes are added, this "package" purchase of a GL-1614 and two GL-812's gives you a complete CW-transmitter line-up. Yet—as mentioned above—the three tubes together cost less than one typical power triode or tetrode with equal plate input!

Your nearby G-E tube distributor will be glad to give you exact prices, and to supply you with a copy of Folder ETX-19 which includes facts about G.E.'s *complete* line of ham tubes. Or write direct to *Electronics Department, General Electric Company, Schenectady 5, N. Y.*

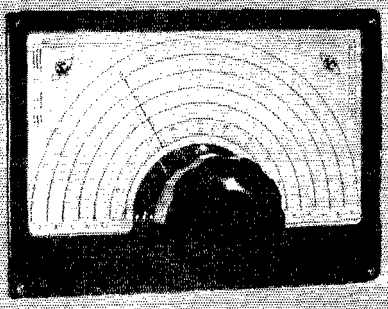
REALLY HOT 6 AND 10-METER CONVERTER

See the G-E May-June Ham News for instructions on how to build the new Guillotine Converter that gives top-notch performance, yet requires (1) few parts, (2) few tubes, (3) minimum effort to construct. Your G-E tube distributor has Ham News for you—FREE!

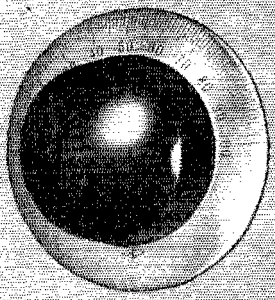
ELECTRONIC TUBES OF ALL TYPES FOR THE RADIO AMATEUR

GENERAL ELECTRIC

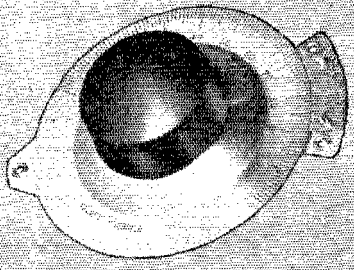
161-F10-6850



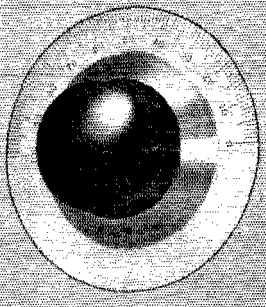
ACN Dial — Fine for frequency Monitors and VFO's. Five blank scales. Dial bezel size 5" x 7¼". Employs Velvet Vernier Drive 5 to 1 ratio. Fits ¼" shaft. Amateur net..... $3.00



AM Dial — The original Velvet Vernier mechanism is now available in a metal skirted dial 3" in diameter. Drive ratio of 5 to 1. Available with a wide variety of scales. Fits ¼" shaft. Amateur net..... $2.16



N Dial — Four inch dial. Engine-divided scale. Has a decimal vernier. Drive ratio of 5 to 1. Fits ¼" shaft. Amateur net..... $4.50



AD Dial — Four inch dial with die stamped scale. Employs a pointer. Drive ratio of 5 to 1. Fits ¼" shaft. Amateur net..... $2.84

A GOOD RIG DESERVES A "VELVET VERNIER" DIAL

These precision-made dials have been used by thousands of hams in constructing reliable rigs. Famous as "Velvet Vernier" dials even before the war, they were used in huge quantities by the Army and Navy because of their accurately divided scales and freedom from backlash.

Today, as hams once more "build their own", National "Velvet Vernier" dials are again in top demand. You will find a wide assortment at your local dealer.

NATIONAL

COMPANY, INCORPORATED
MALDEN, MASS.

National NC EST. 1914

MAKERS OF LIFETIME RADIO PRODUCTS

QST

MAY 1947

VOLUME XXXI • NUMBER 5

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

OFFICES

38 La Salle Road
West Hartford 7, Connecticut

Subscription rate in United States and Possessions, $2.50 per year, postpaid; $3.00 in the Dominion of Canada, $4.00 in all other countries. Single copies, 35 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.

CONTENTS

WANTED

One highly qualified amateur operator to accompany the Gatti-Hallicrafters Expedition to the Mountains of the Moon in Africa

IN the fall of 1947 the Hallicrafters Company of Chicago will launch a spectacular, six months' radio-equipped expedition to the romantic Mountains of the Moon in the heart of Africa's Belgian Congo. The commander of the expedition is Attilio Gatti, famed author and explorer, veteran of ten previous African expeditions. Heart of the expedition will be mobile radio units similar to the famous SCR-299's and 399's developed by Hallicrafters during the war. The expedition will establish a base camp, 6500 feet up the slopes of the Ruwenzori Range, some 30 miles W.S.W. from Fort Portal. The camp will be centered around a stationary radio shack from which regular schedules will be kept with all parts of the world describing the progress of the expedition, the nature of its findings and all the other glamorous details surrounding this scientific safari. From the base camp the mobile radio units will travel in all directions as the explorers extend their investigations into all phases of the flora and fauna of the Mountains of the Moon. The expedition's helicopter will carry a Hallicrafters Skyfone. Marine transmitters will be installed in the expedition's floating craft, completing a land, sea and air radio network that will wring new secrets from the jungle and relay them to the world. Amateurs all over the globe, will be in regular contact with the expedition as it operates through the last three months of '47, the first three months of '48. Prefixes like OQ5 for the Belgian Congo, VQ5 for the Uganda Protectorate, VQ4 for Kenya Colony, VQ3 for Tanganyika territory and VQ1 for the Zanzibar Protectorate will become more familiar than ever to the hams who know the thrills that come with successful long distance communications.

Since the central scientific core of the expedition is radio and radio experimentation and the main intent is to stimulate further international recognition of all amateur radio, the key figure, next to Commander Gatti, will be the amateur radio operator chosen to keep the expedition in touch with the outside world during its six months of operation. The Hallicrafters Co. is therefore inviting applications for this fascinating assignment from amateur radio operators in accordance with the terms of application and selection as set forth on the opposite page. This invitation is made exclusively in the pages of QST.

Deadline July 1

REQUIRED QUALIFICATIONS . . .

Conditions for application and acceptance

Licensed amateurs in the United States and Possessions are eligible to apply for assignment as official operator to accompany the Gatti-Hallicrafters expedition to Africa.

All applications are to be made in writing to the Hallicrafters Co., 4401 West Fifth Avenue, Chicago, Illinois.

Letters must be limited to 250 words. Snapshot or suitable photo must accompany letter. Neatness and legibility of your letter will help your case but "fancy" entries or elaborate presentations will be discounted.

Your letter must state your qualifications for the job with *specific reference to your radio experience.* In addition you can state any added qualifications that might make you a valuable expedition assistant: flying, photography, etc. Qualifying candidate must be able to pass a physical examination.

All candidates must hold a Class "A" amateur ticket and the applicant finally selected must have or be able to qualify for (by June 20th) a second class commercial telegraph ticket and an ARRL code proficiency certificate.

For the applicant finally selected the Hallicrafters Co. will pay all expenses to and from his place of residence for the duration of the expedition, approximately six months. The Hallicrafters Co. will provide complete insurance coverage on the life and health of the candidate selected and a moderate salary will be paid during the term of employment.

The applicant chosen will become part of a specialized corps of engineers, photographers, pilots and other technicians under the direction of Commander Gatti.

Applications for this assignment will be passed on by a Board of Review. Attilio Gatti, leader of the expedition, and W. J. Halligan, president of the Hallicrafters Company will serve on this board. F. E. Handy, Communications Manager of the ARRL, acting on behalf of the American amateurs who will be in radio contact with the expedition, has agreed to consult with the Board of Review when the successful applicant is being chosen.

Final selection will be made from a group of six applicants chosen by the Board of Review. The five finalists not selected for the assignment each receive a Model SX-42 communications receiver and matching speaker (net value more than $300.00).

No letters of application will be returned and under no circumstances will the Board members enter into correspondence regarding your application or talk with you in person or on the phone concerning it. Decision of the Board will be final and announcement of the candidate selected will be made as soon as practical after the deadline, July 1st.

Section Communications Managers of the ARRL Communications Department

Reports Invited. All amateurs, especially League members, are invited to report station activities on the first of each month (for preceding month) direct to the SCM, the administrative ARRL official elected by members in each Section. Radio Club reports are also desired by SCMs for inclusion in *QST*. **All ARRL Field Organization appointments** are now available to League members. These include ORS, OES, OPS, OO, and OBS. Also, where vacancies exist SCMs desire applications for SEC, EC, RM, and PAM. In addition to station and leadership appointments for Members, *all amateurs* are invited to join the ARRL Emergency Corps (ask for Form 7).

ATLANTIC DIVISION				
Eastern Pennsylvania	W3BES	Jerry Mathis	623 Crescent Ave.	Glenside Gardens
Maryland-Delaware-D. C.	W3BWT	Eppa W. Darne	132 Tennessee Ave., N.E.	Washington 2, D. C.
Southern New Jersey	W2GCU	Ray Tomlinson	623 E. Brown St.	Trenton 10
Western New York	W2UPH	Charles I. Otero	4158 Ridge Road, West	Spencerport
Western Pennsylvania	W3KWL	Ernest J. Hlinsky	509 Beechwood Ave.	Farrel
CENTRAL DIVISION				
Illinois	W9AND	Wesley E. Marriner	624 College Ave.	Dixon
Indiana	W9SWH	Ted K. Clifton	550 Eben St.	New Haven
Wisconsin*	W9DKH	Ralph Klein	1106 Manitou St.,R.F.D. 3	Manitowoc
DAKOTA DIVISION				
North Dakota	WØEVP	Raymond V. Barnett	406 17th St.	Bismarck
South Dakota	WØQVY	P. H. Schultz	118 N. Yankton Ave.	Pierre
Minnesota	WØCWB	Walter G. Hasskamp	116 3rd Ave., S.W.	Crosby
DELTA DIVISION				
Arkansas	W5JIC	Marshall Riggs	4405 Howell Ave.	Fort Smith
Louisana	W5VT	W. J. Wilkinson, jr.	Room 313, Jefferson Hotel	Shreveport
Mississippi	W5IGW	Harold Day	Route 1, Box 111	Greenville
Tennessee	W4FLS	James W. Watkins	220 North Howell St.	Chattanooga 4
GREAT LAKES DIVISION				
Kentucky	W5IEZ/4	Joseph P. Colvin	1653 Beechwood Ave.	Louisville 4
Michigan	W8SCW	Joseph R. Beljan, jr.	13959 Tuller Ave.	Detroit
Ohio	W8PNQ	William D. Montgomery	1290 Coolidge Ave.	Cincinnati 30
HUDSON DIVISION				
Eastern New York	W2HZL	Ernest E. George	2044 Lexington Parkway	Schenectady 8
N. Y. C. & Long Island	W2KDC	Charles Ham, jr.	151-06 84th Drive	Jamaica, L. I., 2
Northern New Jersey	W2IIN	John J. Vitale	57 Sayre St.	Elizabeth 3
MIDWEST DIVISION				
Iowa	W9PJR	Leslie B.Vennard	2712 Washington St.	Burlington
Kansas	WØAWP	Alvin B. Unruh	842 N. Terrace Drive	Wichita 6
Missouri	WØOUD	Mrs. Letha A. Dangerfield	411 Moffett Ave.	Joplin
Nebraska	WØPOB	Roy E. Olmsted	101 Arikari Ave.	Wauneta
NEW ENGLAND DIVISION				
Connecticut	W1KQY	Edmund R. Fraser	90 Atwater St.	West Haven
Maine	W1GKJ	F. Norman Davis	RFD 1	Old Orchard Beach
Eastern Massachusetts	W1ALP	Frank L. Baker, jr.	91 Atlantic St.	North Quincy 71
Western Massachusetts	W1AZW	Prentiss M. Bailey	62 Dexter St.	Pittsfield
New Hampshire	W1AXL	John H. Stoughton	RFD 2	Claremont
Rhode Island	W1HRC	Clayton C. Gordon	70 Columbia Ave., Gaspee	Plateau, Providence 5
Vermont	W1NDL	Gerald Benedict	23 Foster St.	Montpelier
NORTHWESTERN DIVISION				
Alaska	K7CBF	August G. Hiebert	c/o KFAR	Fairbanks
Idaho	W7IWU	Alan K. Ross	1017 East Jefferson St.	Boise
Montana	W7EQM	Albert Beck	2326 Amherst Ave.	Butte
Oregon	W7HAZ	Raleigh A. Munkres	Box 744	Baker
Washington*	W7EHQ	Lloyd Norberg	P. O. Box 281	Stellacoom
PACIFIC DIVISION				
Hawaii	KH6EL	John Souza		Wailuku, Maui
Nevada	W7CX	N. Arthur Sowle	Box 2025	Reno
Santa Clara Valley	W6BPT	Roy E. Pinkham	1061 Fremont St.	Santa Clara
East Bay	W6TI	Horace R. Greer	414 Fairmount Ave.	Oakland 11
San Francisco	W6NL	Samuel C. Van Liew	215 Knowles Ave.	Daly City
Sacramento Valley	W6MGC	John R. Kinney	5240 Jay St.	Sacramento 16
Philippines*	KA1CB	Craig B. Kennedy	25 Roosevelt Road	San Francisco Del Monte, Quezon
San Joaquin Valley	W6PSQ	James F. Wakefield	2940 Adoline Ave.	Fresno
ROANOKE DIVISION				
North Carolina	W4CYB	W. J. Wortman	c/o Duke Power Co.	Charlotte 1
South Carolina	W4BQE/ANG	Ted Ferguson	3422 Rosewood Drive	Columbia 25
Virginia	W4JHK	Walter R. Bullington	1710 Oak Hill Lane, Rt. 1,	Richmond 23
West Virginia	W8JM	Donald B. Morris	303 Home St.	Fairmont
ROCKY MOUNTAIN DIVISION				
Colorado	WØQVT	Glen Bond	2550 Kendall	Denver 14
Utah-Wyoming	W7LLH	Victor Drabble	1024 Oak St.	Ogden, Utah
SOUTHEASTERN DIVISION				
Alabama	W4GBV	Lawrence J. Smyth	808 Winona Ave.	Montgomery
Eastern Florida*	W4BYF	W. E. MacArthur	899 N.E. 92nd St.	Miami
Western Florida	W4MS	Lt. Comdr. Edward J. Collins	1003 East Blount St.	Pensacola
Georgia	W4HYW	Thomas M. Moss	570 Oak Drive	Hapeville
West Indies* (Cuba-P.R.-V.I.)	KP4KD	Everett Mayer	P. O. Box 1061	San Juan 5, P. R.
SOUTHWESTERN DIVISION				
Los Angeles	W6QWZ	Ben W. Onstenk	9631 3rd Ave.	Inglewood
Arizona	W7MLL	Gladden C. Elliott	1408 West Fresno St.	Tucson
San Diego	W6GC	Irvin L. Emig	4852 Marlborough Drive	San Diego
WEST GULF DIVISION				
Northern Texas	W5DAS	N. C. Settle	2911 Elm St.	Dallas
Oklahoma	W5HXI	Bert Weidner	Box 14	Crescent
Southern Texas	W5HIF	Ted Chastain	3037 So. Staples St.	Corpus Christi
New Mexico	W5HJF	J. G. Hancock	110 S. E. Nevada St.	Portales
MARITIME DIVISION				
Maritime (Nfld. & Labr. att.)	VE1DQ	A. M. Crowell	69 Dublin St.	Halifax, N. S.
ONTARIO DIVISION				
Ontario	VE3DU	David S. Hutchinson	827 Lovett St.	London, Ont.
QUEBEC DIVISION				
Quebec	VE2SU	Gordon F. J. Phelan	4829 Isabella Ave.	Montreal, Que.
VANALTA DIVISION				
Alberta	VE6LQ	W. W. Butchart	10740-107 St.	Edmonton, Alta.
British Columbia	VE7WS	W. W. Storey	3915 W. 32nd Ave.	Vancouver
Yukon	VE8AK	W. R. Williamson	P. O. Box 137	Whitehorse, Y. T.
PRAIRIE DIVISION				
Manitoba	VE4AM	A. W. Morley	26 Lennox St.	St. Vital
Saskatchewan	VE5CO	Norman Thompson	1120 7th Ave., N. W.	Moose Jaw

*Officials appointed to act temporarily in the absence of a regular official.

New 5514 ECONOMICAL TUBE TO GROW WITH!

STANDARDIZED FOR ECONOMY

The 5514 supplants the HY30Z, HY40, HY40Z, HY51A, HY51B, and HY51Z. Concentration on this one 65-watt triode gives you a better tube for much less – only $3.95. Two 5514's take 525 watts input in class C; deliver 400 watts output in class B audio – at CCS (continuous commercial service) ratings.

EFFICIENT AT ALL PLATE POTENTIALS

Low internal tube drop of the 5514 permits excellent efficiency over a wide range of plate potentials. In class C, two 5514's give plate power outputs of 60 watts at 400 volts, 400 watts at 1500 volts. Furthermore, associated components are economical and still usable as power is increased. Truly the 5514 is a tube to grow with.

READILY INTERCHANGEABLE

The 5514 has a standard 4-pin medium base, conventional overall dimensions, a 7.5-volt filament, and a high mu (145). Dependent upon the triode it replaces, the 5514 may require slight readjustment of filament voltage and/or grid voltage and driving power. Chances are you will need no new parts.

ALL-PURPOSE ZERO-BIAS TYPE

In either modulator or r-f amplifier, performance of the 5514 is exceptional. One HY69 or 807 can overdrive at maximum input two 5514's in class C. You need no costly fixed bias for protection. Economical, efficient, interchangeable, versatile – the 5514 was designed for you. See it at your jobber's.

HYTRON TYPE 5514

High-Mu All-Purpose Transmitting Power Triode
GENERAL CHARACTERISTICS

Filament	thoriated tungsten
Potential	7.5 ± 5% volts
Current	3. amperes
Grid-plate capacitance	7.9 $\mu\mu$f
Grid-filament capacitance	7.8 $\mu\mu$f
Plate-filament capacitance	1. $\mu\mu$f
Max overall length	6-9/16 inches
Max diameter	2-7/16 inches
Bulb	ST-19
Base	low-loss 4-pin medium

ABSOLUTE MAXIMUM CCS RATINGS – CLASS C

Characteristic	*Mod.†*	*Unmod.*	
D-c plate potential	1250	1500	v
D-c plate current	175	175	ma
D-c plate power input	175	262	w
D-c grid potential	-200	-200	v
D-c grid current	60	60	ma
Plate dissipation	43	65	w
Frequency (max ratings)	60	60	mc

PLATE POWER OUTPUT (CCS)
TYPICAL OPERATION*

	Plate Potential				
Service	*400*	*750*	*1250*	*1500*	
Class B audio #	50	150	330	400	w
Class C unmod.	30	70	165	200	w
Class C mod.	30	70	135	- - -	w

† Carrier condition with a max modulation percentage of 100. *To determine useful power output to load, subtract circuit and direct radiation losses from plate power output. #For 2 tubes.

5514 FEATURES

- Zirconium-coated Speer graphite anode
- Grid leads to both pins two and three
- Plate cap has ceramic insulating bushing
- Dual low-resistance plate connections
- Low-loss synthetic lava insulators
- Convenient low-loss 4-pin medium base
- Elements firmly supported by dome micas
- Efficient at low or high plate potentials
- Only 13 w drive for 262 w input class C

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

Twin-Lead a Natural for Amateur Antenna Systems

Amphenol Twin-Lead is one of those natural combinations of design and material which, together, produce maximum utility for the amateur. Originally designed to give television and FM a low cost, high-efficiency transmission line, Amphenol Twin-Lead was destined for a much wider and more interesting field of application in the antenna systems of amateur operators. Today, it is doubtful if there is an operating amateur in the world who has not heard of Amphenol Twin-Lead. In the United States, tens of thousands have purchased Twin-Lead from their distributors. With it they have designed and built efficient antenna systems with a convenience unknown before the war.

Twin-Lead Used for Folded Dipoles

Perhaps the greatest footage of Amphenol Twin-Lead in amateur station installations has gone into folded dipoles constructed thruout from Amphenol 14–056, 300 ohm Twin-Lead. Tests by amateurs, and by Amphenol, show that the folded dipole length at customary heights

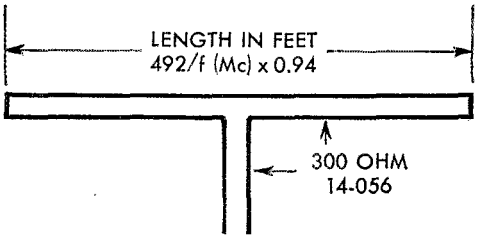


Figure 1

above ground, should be very close to that for a simple dipole, that is, as indicated in Figure I. To avoid breakage in windy weather, the ends of the folded dipole must be clamped within either plastic or metal plates which grip the polyethylene dielectric as well as the two conductors. The feeder may be molded to the folded dipole quite easily with a few scraps of polyethylene salvaged from left-over pieces of Twin-Lead. An ordinary electric flat iron may be used to supply both heat and pressure, and sticking of the polyethylene to the iron may be avoided by working with a piece of cellophane between the iron and the polyethylene being worked into the molded joint.

Figure II shows the efficient and widely used 8JK antenna made thruout from Amphenol Twin-Lead. Here, the impedance of each folded dipole is assumed (not measured) to be down to about 150 ohms because the two folded dipoles are only ⅛ wavelength apart. Consequently the feed to each folded dipole is made with Amphenol 14–079, 150 ohm Twin-Lead in equal lengths of any convenient value greater than ¼ wavelength. In the antenna of Figure II, the 150 ohm feeders to the folded dipoles do not act as matching transformers. They are paralleled and connected to the 75 ohm Amphenol 14–023 Transmitting Twin-Lead which forms the main transmission line. Note that one of the 150 ohm Twin-Leads must be twisted one-half turn to provide the 180° phase difference necessary between the two folded dipoles. Many other useful and efficient variations of the 8JK antenna, made from Twin-Lead or using Twin-Lead for

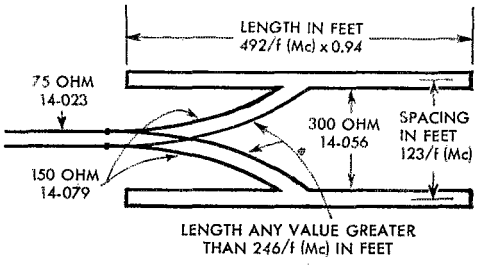


Figure 2

the transmission line, have been shown in the amateur publications. Some employ matching transformer sections to feed the folded dipoles thru permitting use of 300 ohm Twin-Lead all the way to the rig. All of them perform effectively.

Amphenol Silicone Compound Now Available

Nearly every amateur who has used Twin-Lead in a transmitting antenna system has had some experience with changes in the line impedance when the line has been coated with water. The reason, of course, is that the water film is in the dielectric field thus affecting the C factor in the impedance relationship between the inductance of the line and the capacity between the conductors. Surface water is least bothersome where the line is well matched to the antenna but its effects will be noticeable. To eliminate the formation of surface films on Amphenol Twin-Lead, Amphenol distributors are now supplying Amphenol 307 Silicone Compound. A one-ounce tube is adequate for the surface treatment of most Twin-Lead systems since the thinnest possible coating gives complete protection against the formation of a continuous film of water on the surface of the Twin-Lead. Amphenol 307 has the consistency of vaseline. It is easily applied and may be removed when desired by application of carbon tetrachloride. Amphenol 307 isn't new. It's a member of the famous Dow Corning Silicone family which Amphenol used thruout the war to moisture-proof AN electrical connectors, RF connectors and coaxial cable terminations. Only recently has the supply become adequate to permit general distribution.

See your jobber for full information about these and other Amphenol products, or write American Phenolic Corporation, 1850 South 54th Avenue, Chicago 50, Illinois.

New TEMCO series RA TRANSMITTERS

Custom Built

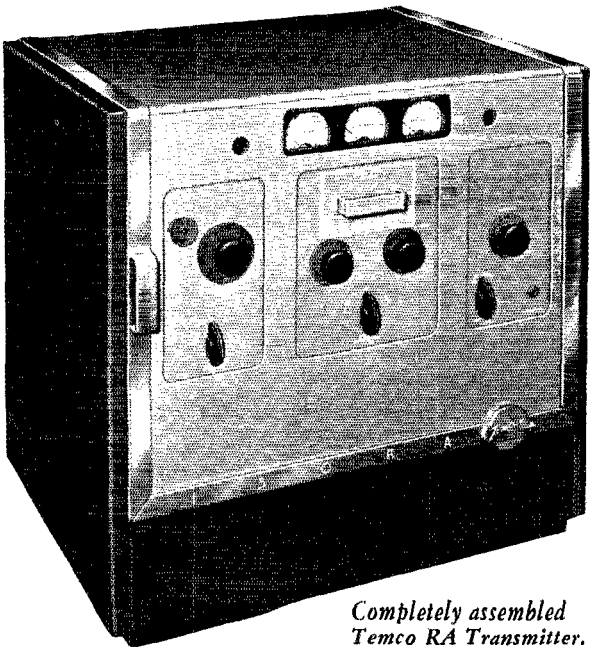
to Your Requirements by Your Dealer

While You Wait

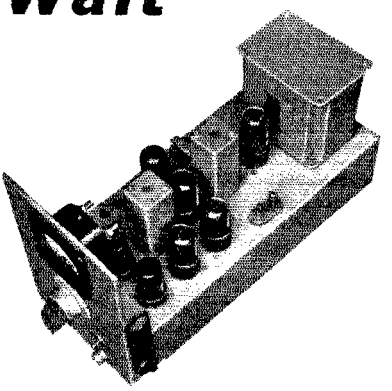
SOON . . . very soon, you will be able to go to your dealer and order a Temco 150 watt or 250 watt Transmitter and take it home with you. As quickly as a cabinet can be removed from its wraps and the selected individual chassis units taken from stock and plugged into the cabinet, that is how quickly your order will be filled.

Whatever your requirements may be—CW—CW and AM Phone—or CW and FM Phone—this new Temco system of 6 basic chassis units will enable you to have a factory tested Temco, custom built at your dealer *while you wait.*

Furthermore, you will be able to buy any of these individual basic chassis if you wish to augment your present equipment. Send us your name now for complete details and be one of the first to receive our new series RA Catalog. Also keep posted with your dealer for first demonstration date.



Completely assembled Temco RA Transmitter.



6 BASIC UNITS

(1) A FREQUENCY METER type Variable Frequency and Crystal Oscillator complete with self-contained, voltage regulated power supply and RF isolating stages.

(2) Wide band (3.5 to 29.7 Mc in 6 bands) frequency multiplying stages and 150 or 250 watts input final amplifier

(3) Speech amplifier-modulator for Amplitude Modulation. Audio frequency range 200-6000 cps. ± 2 db.

(4) Speech amplifier-modulator for Narrow Band Frequency Modulation employing phase shift modulation of crystal controlled oscillator by means of a balanced modulator. Complete with built-in deviation meter.

(5) Universal low voltage power supply. 350 or 450 volts at 250 ma.

(6) Universal high voltage power supply. 500, 750, 1100 or 1350 volts at 200 ma.

TEMCO RADIO COMMUNICATION EQUIPMENT

TRANSMITTER EQUIPMENT MFG. CO., Inc. 345 HUDSON STREET NEW YORK 14, N. Y.

THE AMERICAN RADIO RELAY LEAGUE, INC.,

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

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

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

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

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, W2KH
Washington, D. C.

Vice-President . . . . . J. LINCOLN McCARGAR, W6EY
Oakland, California

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

Communications Manager . . . . . F. E. HANDY, W1BDI
West Hartford, Connecticut

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

• • • • •

General Counsel . . . . . PAUL M. SEGAL
1026 Woodward Building, Washington 5, D. C.

DIRECTORS

President

GEORGE W. BAILEY W2KH
921 19th St., N.W., Washington, D. C.

Vice-President

J. LINCOLN McCARGAR W6EY
66 Hamilton Place, Oakland 12, Calif.

Canadian General Manager

ALEX REID VE2BE
240 Logan Ave., St. Lambert, P. Q.
Alternate: Leonard W. Mitchell VE3AZ
78 Raglan Ave., Toronto, Ont.

Atlantic Division

EDWARD G. RASER W2ZI
315 Beechwood Ave., Trenton 8, N. J.
Alternate: J. Victor Brotherson W8BHN
1743 Ottawa Drive, Erie, Pa.

Central Division

CLYDE C. RICHELIEU W9ARE
4901 So. 30th St., Milwaukee 14, Wisc.
Alternate: Harold H. Jansen W9DJG
3519 California Ave., Alton, Ill.

Dakota Division

TOM E. DAVIS . . . . . WØSW, ex-W9VVA
915 W. Becker Ave., Willmar, Minn.
Alternate: Harold B. Love W9ZRT
Box 426, Mandan, N. D.

Delta Division

GEORGE S. ACTON W5BMM
Plain Dealing, La.
Alternate: Eugene H. Treadaway W5DKR
P. O. Box 44, La Place, La.

Great Lakes Division

HAROLD C. BIRD W8DPE
114 Hickory Dr., R.F.D. 2, Pontiac 2, Mich.
Alternate: John H. Brabb W8SPF
1321 Berkshire Rd., Grosse Point Park 30, Mich.

Hudson Division

JOSEPH M. JOHNSTON W2SOX
427 Lincoln Ave., Avon-by-the-Sea, N. J.
Alternate: Robert A. Kirkman W2DSY
1910 Oak Drive, West Belmar, N. J.

Midwest Division

C. A. COLVIN . . . . . WØVHR
c/o Omaha & Council Bluffs St. Railway Co., Omaha 2, Nebr.
Alternate:

New England Division

PERCY C. NOBLE W1BVR
37 Broad St., Westfield, Mass.
Alternate:

Northwestern Division

HAROLD W. JOHNSTON W7DXF
2727 Belvidere Ave., Seattle 6, Wash.
Alternate: R. Rex Roberts W7CPY
110 W. Brennan St., Glendive, Mont.

Pacific Division

WILLIAM A. LADLEY W6RBQ
200 Naylor St., San Francisco 12, Calif.
Alternate: Elbert J. Amarantes W6FBW
1675 Dale Ave., San Jose, Calif.

Roanoke Division

H. L. CAVENESS W4DW
2607 Vanderbilt Ave., Raleigh, N. C.
Alternate: J. Frank Key W3ZA
Box 707, Buena Vista, Va.

Rocky Mountain Division

FRANKLIN K. MATEJKA . . . . . WØDD
P. O. Box 212, Estes Park, Colo.
Alternate: P. Arthur Smoll . . . . . WØKVD
529 No. Nevada Ave., Colorado Springs, Colo.

Southeastern Division

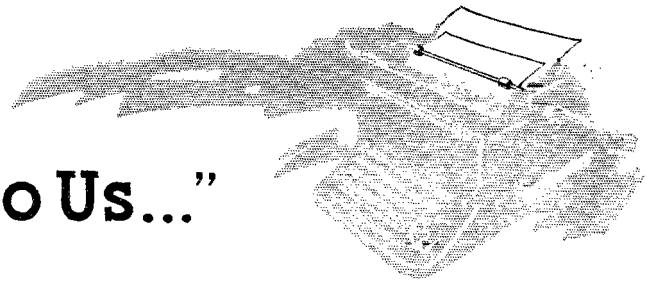
WILLIAM C. SHELTON W4ASR
527 Revilo Blvd., Daytona Beach, Fla.
Alternate: William P. Sides W4AUP
Fleming Road, Montgomery, Ala.

Southwestern Division

HANS R. JEPSEN W6KEI
6837 Ethel Ave., No. Hollywood, Calif.
Alternate: Arthur E. Schifferman, sr W6CGI
1445 Raymond Ave., Glendale 1, Calif.

West Gulf Division

WAYLAND M. GROVES W5NW
Mail Box 586, Station Humble Pipe Line Camp, Odessa, Texas
Alternate: Jack T. Moore W5ALA
4531 Fairway Ave., Dallas 4, Texas



"It Seems to Us..."

HO FOR 420 MC.!

There's a valuable little number in war surplus now becoming available on the amateur market. It's the 1FF set known as the BC-645A. You've probably seen it, or at least pictures of it in *QST* — it's the pretty little thing about the size of a portable typewriter case, full of tubes and relays and miniature long-lines and ending up on the transmitter side with a doorknob. Its value to us lies in the fact that it makes available, at very modest cost and a conversion job not too tough to contemplate (as recently outlined in our pages), a 'phone or i.c.w. transmitter and a superhet receiver for the 420–450 Mc. band. It can thereby give us in that band a start that otherwise would be much more difficult to attain.

An interesting story lies behind this rig. Developed in great secrecy for joint Army-Navy use, it went into production with large quantity orders about the time we entered the war. As we understand it, the British would not come along on the new system, having one of their own already established with which the American gear wouldn't work. After a period of hesitation in which the contractors worried about cancellations, the joint Army-Navy strategy people decided to let the production ride, so as to have something ready in case England fell. Just insurance. About 30,000 of the sets were made and stored. The American system saw only limited service, primarily in the Pacific. Most of the sets never left the warehouses. With their auxiliaries they cost something over $2,000 apiece. Sixty million for insurance on the shelf.

Now these 30,000 sets are flowing out of the warehouses to our market, bearing nominal price-tags — surely enough of them to provide one for every amateur interested in the band. They offer us an opportunity for our lowest u.h.f. band, one where our usual techniques, adequately refined, still apply. We think this will be particularly true of antenna experimentation in this band, element lengths for conventional arrays being convenient to handle yet the frequency being high enough to invite investigation of other systems. It sounds promising, and a break for us that will help us to get occupancy. The 420 band not only affords QRM-free operation but offers an excellent spot for rag-chewing local nets, which can be lots of fun when your conscience doesn't bother you about jamming a busy band with endless smalltalk. The advent of the BC-645A makes it possible for every amateur to contemplate a set for this purpose.

COME ELEVEN!

When you 10-meter addicts find the whole band discouragingly crowded, do you ever wish that you and a few select friends could slide over a few hundred kilocycles into relatively unoccupied territory and have swell QSOs to your hearts' content without appreciable interference? You possess just such an opportunity in the 11-meter band.

Normally, except for interference, there isn't discernible performance difference between 10 and 11. Theory indicates that when the whole 10-meter band is wide open, its upper end will be hottest, since something that approaches the maximum usable frequency gives the best results, but ordinarily you won't be able to notice the difference. However, there are times when the top end of 10 isn't open, and when maybe the bottom end isn't open either but is almost so. Under these circumstances we can find 11 working when 10 won't. Indeed, the 11-meter band under those conditions is capable of giving superlative results.

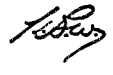
Starting from scratch not many months ago, this band now offers an increasing amount of foreign DX as well as more solid domestic contacts. The 11-meter group has grown to fair size but it still isn't nearly so large as a band of this performance deserves. If you work 10 at all you owe it to yourself to set up shop on 11 also. Give it a whirl!

SICK SIGNALS

One of the greatest factors in the congestion of the 'phone bands is inexcusably bad 'phone signals — signals too broad through overmodulation or that wobble under the impact

of modulation, so that they manage to tear their way through a dozen or more kilocycles. We've all heard them. The 'phone assignments urgently need cleaning up, an accomplishment that would considerably increase their effective widths. Some day, if our congestion continues to increase, we suspect amateur radio will be forced to adopt the point of view that 'phone operation is a special privilege that ought to be confined to those who can do a thoroughly good job of it from the technical and equipment standpoints. When that time comes, the demand for restrictions that will insure clean signals will come from the 'phone men themselves. It reminds us of the experience amateur radio went through in the matter of plate supplies. The desirability of d.c. plate power instead of self-rectifying circuits or poorly-filtered supplies was demonstrated in *QST* over a long period of years, but it was only when most hams came to insist upon it that it was made a requirement of our regulations. We won't be too surprised when eventually the voice operators similarly demand vastly more stringent technical requirements of those who would use 'phone.

Meanwhile, this being a free country, the greatest help that ARRL can give in the situation is to tell amateurs how to comply with present regulations, and to keep everlastingly after them to do so. That obviously doesn't accomplish what we all wish. It occurs to us that things would be improved considerably if more 'phone men would frankly tell guilty 'phone men when they have bad-quality and hoggish signals. We've been surprised to hear no more of this on the air than we do, especially in the very common case of obvious overmodulation. It seems to be regarded as in bad taste to give another amateur any real criticism of his improper signal. Yet we are sure that a little more frank talk between 'phone stations would help to remedy the situation, and we'd like to see it become the custom, feeling that nothing is so conducive to improvement as the criticism of one's fellows. If you men agree with us that the condition of the bands demands improvement, scare up the courage to tell the owner of a bad signal the bitter truth about it!



Our Cover

Looking through the copper-screen siding of this issue's "Table-Top Kilowatt" (next page) we see the p.p.-813 final fired to the legal limit. In constructing this rig *QST*'s technical editors pooled "all," and as a result have turned up some interesting circuits and layouts. How would you build it, OM?

A.R.R.L. QSL BUREAU

FOR the convenience of American and Canadian amateurs, the League maintains a QSL-card distributing system which operates through volunteer District QSL Managers in each call area. To secure such foreign cards as may be received for you, send your district manager a stationer's size No. 10 stamped self-addressed envelope. If you have reason to expect a considerable number of cards, put on an extra stamp so that it has a total of six cents postage. Your own name and address go in the customary place on the face, and your station call should be printed prominently in the upper left-hand corner. If you have held other calls in previous years, submit an envelope for each such call to the proper manager — there are many thousands of uncalled-for cards in the files. All incoming cards are routed by Hq. to the *home district* of the call shown in the address. Therefore, cards for portable operation in other districts should be obtained from the home-district manager.

W1 — Charles Mellen, W1FH, 320 Cornell St., Boston, Mass.

W2 — Henry W. Yahnel, W2SN, Lake Ave., Helmetta, N. J.

W3 — Maurice W. Downs, W3WU, 1311 Sheridan St., N. W., Washington 11, D. C.

W4 — Edward J. Collins, W4MS, 1003 E. Blount St., Pensacola, Fla.

W5 — L. W. May, jr., W5AJG, 9428 Hobart St., Dallas 18, Texas.

W6 — Horace R. Greer, W6TI, 414 Fairmount Ave., Oakland, Calif.

W7 — Frank E. Pratt, W7DXZ, 5023 S. Ferry St., Tacoma, Wash.

W8 — Fred W. Allen, W8GER, 1959 Riverside Drive, Dayton 5, Ohio.

W9 — F. Claude Moore, W9HLF, 1024 Henrietta St., Pekin, Ill.

WØ — Alva A. Smith, WØDMA, 238 East Main St., Caledonia, Minn.

VE1 — L. J. Fader, VE1FQ, 125 Henry St., Halifax, N. S.

VE2 — Austin A. W. Smith, VE2UW, 6164 Jeanne Mance, Montreal 8, Que.

VE3 — W. Bert Knowles, VE3QB, Lanark, Ont.

VE4 — C. J. Campbell, VE4CC, 276 Ash St., Winnipeg, Manitoba.

VE5 — Fred Ward, VE5OP, 899 Connaught Ave., Moose Jaw, Sask.

VE6 — W. R. Savage, VE6EO, 329 15th St. North, Lethbridge, Alta.

VE7 — H. R. Hough, VE7HR, 1785 Emerson St., Victoria, B. C.

VE8 — Yukon A. R. C., P. O. Box 268, Whitehorse, Y. T.

K4, KP4 — E. W. Mayer, KP4KD, P. O. Box 1061, San Juan, P. R.

K5, KZ5 — Signal Officer, KZ5AA, Quarry Heights, Canal Zone.

K6, KH6 — Andy H. Fuchikami, KH6BA, 2543 Namauu Dr., Honolulu, T.H.

K7, KL7 — J. W. McKinley, KL7CK, Box 1533, Juneau, Alaska.

A Table-Top Kilowatt

Some Different Ideas in Transmitter Construction

BY GEORGE GRAMMER,* W1DF, DONALD MIX,** W1TS, AND BYRON GOODMAN,** W1DX

AMATEUR transmitter design is largely a matter of prejudice, operating tastes, and cost, not only in the choice of tubes, circuit components, and the circuits themselves, but also in mechanical features of construction. These three reasons are more than enough to account for the fact that no two ham transmitters are ever alike, even where the same over-all result is obtained. This is a state of affairs that we aren't in the least inclined to deplore; ham radio would be dull indeed if the transmitter field were taken over by equipment manufacturers as completely as the receiver field has been.

Nevertheless, a little bit of compromising with rugged individualism sometimes can develop something interesting. Not long ago three of us got into a discussion (polite word for "argument") on the question of how we'd go about taking advantage of the remarkably low prices at which certain types of surplus transmitting tubes now can be bought. At the start we agreed on at least one or two points:

1) Cheap tubes are nothing more than what the merchandising people call a "loss-leader" if the rest of the transmitter cannot be built economically.

2) While you can't get away from the necessity for supplying power input if you want to get r.f. power out, at least things can be arranged so that the smallest possible number of power supplies will be required. Under present surplus conditions, the biggest chunk of the transmitter cost is in the power supply (to such an extent that the r.f. end is in the accessory class) because most of the kind of power-supply components we want are not to be found in surplus.

Independently of the surplus aspect, we found we agreed on a couple of other things:

3) Operating convenience is highly desirable, and the ability to change frequency quickly within a band is more important than the ability to change bands rapidly.

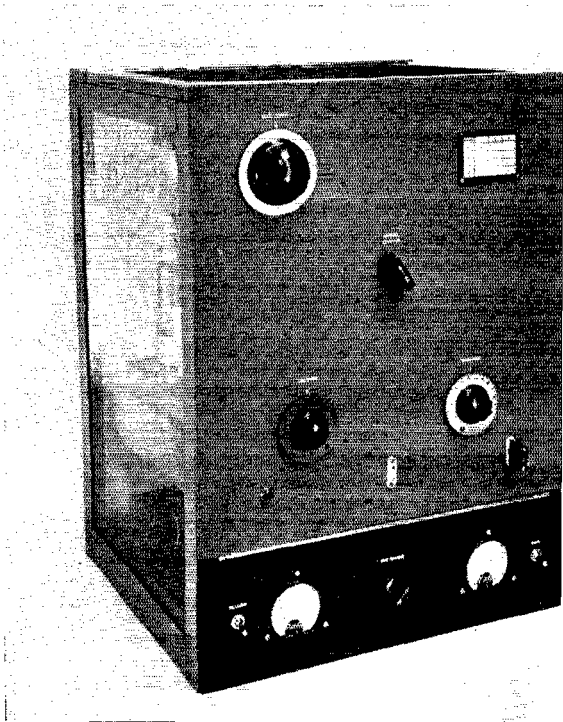
4) Especially when the power is in the kilowatt neighborhood, safety precautions are an absolute "must."

These four points made a good basis for development. If only the tubes are cheap, then obviously the transmitter as a whole can be economical only if the number of stages can be kept to a minimum. This likewise favors economy in the power-supply system. However, if a transmitter is to cover 3.5 to 30 Mc. with as few stages as possible — assuming that it is to work from 3.5-Mc. crystals — then the final stage has to use tubes that require very little excitation. There isn't much in surplus that fits this description except the 813. So a pair of 813s it was.

One nuisance with high-power screen-grid amplifiers is the necessity for supplying the screen. If the screen gets its voltage through a dropping resistor there is not only an additional load on the high-voltage power supply but good-sized resistors have to be purchased and mounted somewhere where the heat developed in them won't cause trouble. Furthermore, dropping-resistor screen supply is not readily adapted to keying in a stage ahead of the final without using additional circuits and components to hold the screen voltage down when the r.f. excitation is off. In the absence of such special circuits it is impossible to get plate-current cut-off in the

* Technical Editor, *QST*.
** Assistant Technical Editor, *QST*.

♦



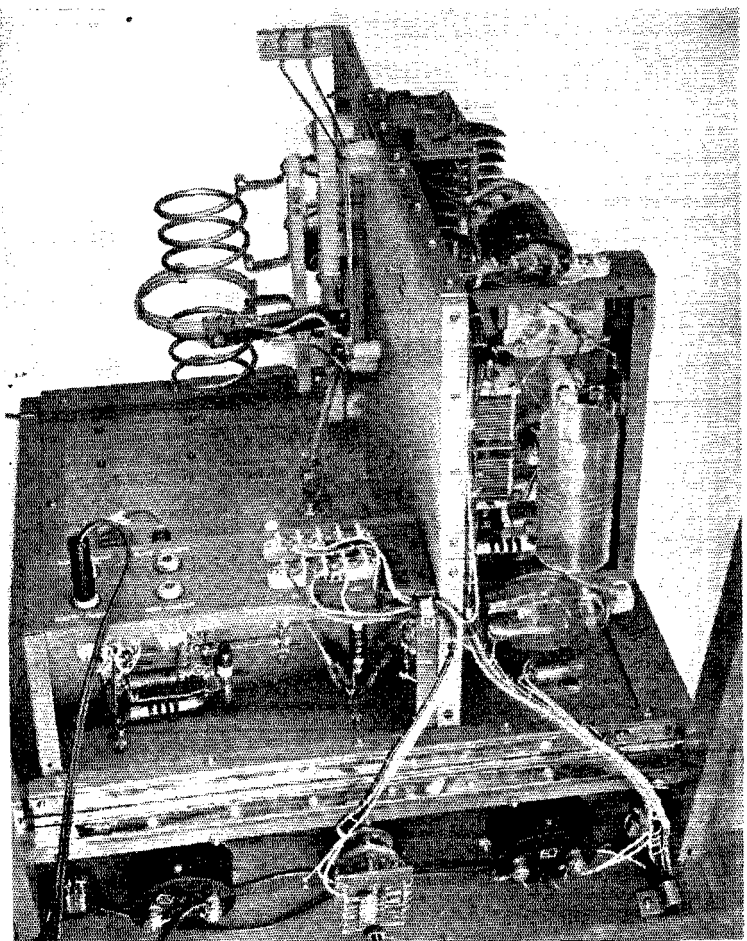
Three-stage 3.5–30-Mc. kilowatt transmitter using push-pull 813s. Measuring 18 inches wide, 24 inches high, and 16 inches deep, it would fit readily on most operating tables. The hinged front panel drops down for coil changing. Interlock switches combined with complete enclosure ensure against accidental contact with any high-voltage circuits when the power is on.

May 1947

amplifier when the fixed grid bias is set to the proper *operating* value. We decided, therefore, that a fixed screen supply was indicated, and since the 813 takes 400 volts on the screen the economy factor dictated that the exciter part of the transmitter also should operate at 400 volts, if possible.

In view of the low excitation power required by 813s it did not seem unreasonable to expect that a 400-volt exciter would work out. However, operating convenience as well as economy must be considered in the exciter. Without going to very elaborate mechanical design it is impossible to realize, even partially, single-control tuning of the final tank and antenna circuits, so it is only in the exciter that there is any real possibility of reducing the number of tuning controls. While the necessity for tuning may be eliminated entirely by using fixed-tune broad-banded circuits, this method requires at least one stage per band (and usually also requires an extra output stage to get the power level up to a useful point), is necessarily inefficient and consumes considerable d.c. power, and is complicated from a circuit standpoint. We wanted to keep the whole transmitter as simple as possible. It did not seem likely that a single-tube exciter working from a 3.5-Mc. crystal could drive the 813s successfully on 28 Mc., but it did seem possible that the job could be done by a harmonic-generating crystal oscillator, such as the Tri-tet, in conjunction with a frequency multiplier — particularly if the two exciter tubes were another surplus item, 807s. As it turned out, this was a good guess.

For quick frequency changing within a band, as well as rapid band-changing, the transmitter tuning controls have to be within easy reach from the operating position. From this standpoint, the best place for the transmitter is right on the operating table where its controls are just as accessible as the receiver controls. This in turn requires a fairly compact r.f. assembly, but achieving the necessary compactness is not out of the question with only three stages in the transmitter. It is necessary, though, to break away from the relay-rack tradition. However, a kilowatt transmitter on the operating table is not something to be treated lightly; some sort of protective enclosure is obviously required. Here we ran into conflicting viewpoints, one being that the enclosure was required not only for safety but for shielding as well (to prevent radiation on other than the output frequency by the transmitter itself), the other being that the equipment ought to be open for good ventilation and so that it could be watched while in operation. This was settled by compromising on a wooden frame covered with copper fly screening and using Masonite panels backed with the same material — a type of construction that blended nicely into the low-cost program. Inasmuch as the man who builds his own enclosure is free to do what he likes, we felt that the inconveniences of coil changing — for plug-in coils still represent the simplest way of changing bands — could be reduced considerably by building the whole transmitter on the front panel and then hinging the panel so that it could be dropped down to make the coils accessible. Combined with interlocks, the "drop-leaf" construction in a complete enclosure offers, we think, the maximum in convenience and safe operation.



♦

View from the back, with the front panel dropped down. The second 807 projects through the partition to bring its plate near the tuned circuit that feeds the amplifier grids. The 807 plate choke, visible just below the amplifier grid tuning condenser, is supported by a feed-through insulator mounted on the end of the exciter chassis. The four metering jacks are accessible only when the case and interlock switches are open, providing for safety.

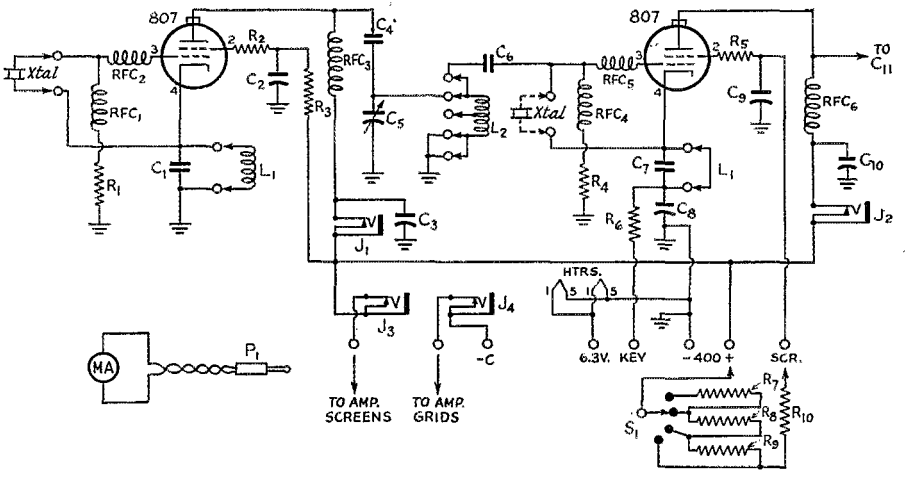


Fig. 1 — Circuit diagram of the exciter section.

C_1, C_7 — 150-$\mu\mu$fd. mica.
C_2, C_3, C_9, C_{10} — 0.01-μfd. paper, 600 volts.
C_4 — 470-$\mu\mu$fd. mica, 1000 volts.
C_5 — 50-$\mu\mu$fd. variable (National ST-50).
C_6 — 100-$\mu\mu$fd. mica, 1000 volts.
C_8 — 0.0047-μfd. mica.
R_1 — 0.33 megohm, 1 watt.
R_2, R_5 — 50 to 100 ohms, ½-watt carbon.
R_6 — 330 ohms, 1 watt.
R_3 — 25,000 ohms, 10 watts.
R_4, R_7 — 47,000 ohms, 1 watt.
R_{10} — 10,000 ohms, 1 watt.
R_8, R_9 — 22,000 ohms, 1 watt.
L_1 — Tri-tet cathode coil; for 3.5-Mc. crystals, 13 turns No. 22 d.s.c., close-wound, diameter 1 inch, shunted by extra 75-$\mu\mu$fd. mica condenser inserted inside form. For 7-Mc. crystals: 3 turns No. 22 d.s.c., close-wound on 1-inch diameter form. (Cathode coils wound on Millen No. 45004 forms.)
L_2 — Plate coils; for 3.5 Mc., 36 turns No. 22 d.s.c. close-wound; 7 Mc., 16 turns No. 18 bare, length 2 inches; 14 Mc., 8 turns No. 18 bare, length 2 inches; 28 Mc., 4 turns No. 18 bare, length 1 inch. All coils wound on 1¼-inch diameter forms (Millen No. 44001) and tapped at center.
J_1, J_2, J_3, J_4 — Closed-circuit jack.
MA — 0–200 d.c. milliammeter.
P_1 — Insulated plug.
RFC_1, RFC_3, RFC_4, RFC_6 — 2.5-mh. r.f. choke.
RFC_2, RFC_5 — Parasitic chokes; 18 turns No. 20 d.c.c. on ¼-inch diameter form (a high-value 1-watt resistor is suitable as a form).
S_1 — 4-position single-pole rotary switch.

These conclusions, as well as some of the circuit details, were not reached automatically. We all had very definite likes and dislikes that eventually were compromised to the extent that, while no one of us is completely happy about all details of the whole thing, there is in the main a feeling that conflicts of opinion have been resolved to as complete an extent as is possible in any outfit that is not designed by a single individual. And, we think, some useful ideas were generated in the give-and-take that preceded the actual construction of the set. This description is presented in the hope that, whether or not you've been thinking of building a "surplus" rig in this power class, some of its features may suggest modifications that will be adaptable to other transmitters. And, parenthetically, also in the hope that maybe it will help loosen the relay-rack strait jacket which has so profoundly influenced ham-transmitter design — and not always for the best.

The Exciter Circuit

Although the primary object of the whole design is to get as much as possible from as little as possible, the tubes are operated within ratings, and in the case of the exciter tubes, well under the maximum ratings. The circuit diagram of the exciter is given in Fig. 1. We had two considerations in mind in adopting this circuit arrangement: first, to permit oscillator keying for break-in on 3.5 and 7 Mc.; second, to make one set of coils serve for the entire frequency range. Either of the two 807s can be used as the crystal oscillator, the one at the right being so used to drive the final amplifier directly on 3.5 or 7 Mc. The one on the left is brought into operation for the higher-frequency bands, in which case the second tube is used as a frequency multiplier. In no case is the second tube used as a straight-through amplifier; the driving power is ample with frequency multiplication and self-oscillation troubles are avoided.

The cathode circuits of both tubes are arranged for Tri-tet operation with plug-in cathode coils. When the first tube is in use as a crystal oscillator, the appropriate cathode coil is plugged in its cathode circuit and a plain coil form with a jumper is used to close the cathode circuit of the second tube. This set-up is indicated in Fig. 1,

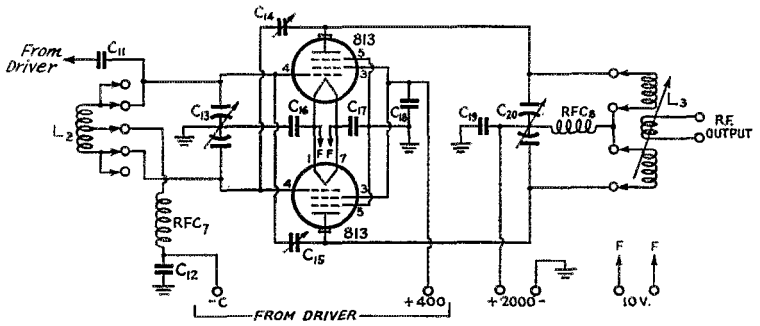


Fig. 2 — Amplifier circuit diagram.

C_{11} — 470-$\mu\mu$fd. mica, 1000 volts.
C_{12} — 0.0047-μfd. mica.
C_{13} — 100-$\mu\mu$fd.-per-section variable (Cardwell ER-100-AD).
C_{14}, C_{15} — Neutralizing condensers; see text.
C_{16}, C_{17} — 0.0047-μfd. mica.
C_{18} — 0.001-μfd. mica, 1000 volts.
C_{19} — 0.001-μfd. mica, 5000-volt working.
C_{20} — 100-$\mu\mu$fd.-per-section variable (National TMA-100DA).
L_2 — Same as L_2 in Fig. 1.
L_3 — Amplifier plate tank coils, Barker & Williamson HDVL series with following modifications:
3.5 Mc.: 9 turns shorted out at each outer end.
7 Mc.: 2 turns shorted out at each outer end.
14 Mc.: 1 turn shorted out at each outer end.
28 Mc.: No modification.
RFC_7 — 2.5-mh. r.f. choke.
RFC_8 — 2.5-mh. r.f. choke, 500 ma. (Hammarlund CH-500).

and is the one that would be used, for example, to get 28 Mc. output from a 3.5-Mc. crystal. In such a case the 3.5-Mc. cathode coil goes in the cathode circuit of the first tube, the 14-Mc. plate coil is plugged in at L_2, and the jumper closes the cathode circuit of the second tube. The fourth-harmonic output of the oscillator drives the second 807, which then doubles to 28 Mc. to drive the amplifier.

When the second tube is used as the oscillator, the cathode circuit of the first 807 should be opened (by removing the cathode coil) so that it will take no plate current. Also, there should be no plate coil at L_2 in this case. Removing the plate coil automatically disconnects the grid of the second 807 from the plate circuit of the first tube by means of the jumper on the plate-coil form; this arrangement was found necessary to prevent a low-frequency parasitic oscillation in the second tube when its grid was left connected to the first tube. The oscillation does not occur with L_2 in place between the two tubes, but this coil must be removed in order for the crystal to function properly in the second stage. It will be observed that, because of the flexibility of the plug-in arrangement, almost any combination one wants can be set up. Although it was not done in this exciter, it would readily be possible to arrange the cathode circuits so that either a Tri-tet, grid-plate, or straight tetrode oscillator could be used at will, simply by making use of the extra pins in the cathode coil forms to complete the proper connections between the crystal and the cathode.

The screen voltage on the second 807 can be varied by means of S_1 and the series of resistors, R_7 to R_{10}, inclusive. This gives control of excitation of the final amplifier. Overdriving, which is likely to occur at the lower frequencies unless steps are taken to reduce excitation, results in excessive screen dissipation with no increase in output so the grid current should be held within the 15-ma.-per-tube recommended limit.

For initial tuning adjustments it is desirable to measure the plate currents of the two 807s and also the screen-grid and control-grid currents of the final stage. The four jacks shown in Fig. 1 are for this purpose, the screen- and control-grid jacks for the final being mounted on the same chassis as a matter of convenience. A 200-ma. meter has ample range for these measurements.

The two chokes, RFC_2 and RFC_5, in the grid circuits of the 807s, together with resistors R_2 and R_5 in the screen circuits, are parasitic suppressors. From a great deal of previous experience with 807s, it seemed the better part of wisdom to put in the suppressors at the start. There are no v.h.f. parasitics in this exciter, but whether they would exist without the suppressors we don't know. If not, it would be about the first time we ever had an 807 that didn't require debugging.

The Final Amplifier

The two 813s in the final stage are used in push-pull, as shown in Fig. 2. The grid circuit is the usual balanced arrangement, capacitively coupled to the 807 driver. As compared with the more common link-coupled arrangement, this has the advantage of eliminating one tuning control, but suffers the disadvantage that it is not readily possible to control the loading on the driver stage. However, the excitation is quite adequate on all bands, and the driver tube is not

overloaded, so under the circumstances the elimination of an extra tuning control is worth while.

The final plate tank utilizes the circuit that prevents the d.c. voltage from appearing across the tuning-condenser plates through the use of the choke, RFC_8, connected from the rotor to the center-tap of the tank coil, and the insulating condenser, C_{19}.

Without much hope that we would get away with it, we tried the 813s first without neutralization but it was no go. Without a load the tubes oscillated merrily. Neutralization is extremely simple with these tubes, the condensers, C_{14} and C_{15}, merely being strips of aluminum mounted on feed-through insulators near the tubes as shown in the photograph of the amplifier unit. The capacitance between these strips and the plates of the tubes is large enough to neutralize the very small grid-plate capacitance of the tubes. Since neutralizing costs practically nothing and completely stabilizes the amplifier, the only argument against it is that 813s are supposed to work without it. Someday we hope to see an amplifier — with really good circuits — in which they will.

Layout

The layout shown in the photographs is essentially a breadboard arrangement that folds back on itself to save space. The vertical partition is the supporting structure, with the panel giving additional bracing. Most of the partition is covered with copper screening to provide shielding between the final tank coil and the amplifier grid coil. The exciter is built on a 5 × 10 × 3-inch chassis, with the first 807 on top and the second tube mounted horizontally on one end. It projects through a hole in the partition so that its plate is on the amplifier side. The construction should be quite obvious from the photographs; wiring is relatively simple.

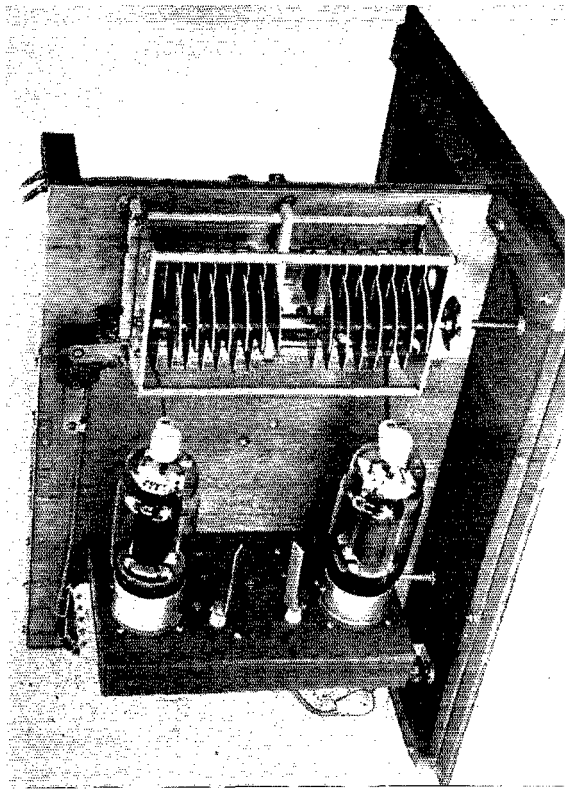
The amplifier tubes and the tuned grid circuit are mounted on a 5½ × 9½ × 1½-inch chassis fastened to the partition at sufficient height to clear the 807 driver and bring the shaft of the grid tuning condenser in line with the shaft of C_5 on the exciter chassis. The upper part of the partition is left unscreened so that the amplifier tank condenser can be mounted without special insulation.

♦

A homemade aluminum bracket forms a mount and ground (to the copper screen) for the plate by-pass condenser, C_{19}. Short connections of heavy wire go through holes in the partition from the stator sections of C_{20} to the proper jacks on the coil strip. An insulated coupling (high-voltage type) is used between the tank-condenser shaft and the panel bearing. A solid shaft and two noninsulated flexible couplings (Millen 39005) allow the swinging link of the tank coil to be adjusted for proper loading on each band. The link can be grounded through this solid shaft, if it is found necessary to do so to reduce harmonic radiation from the antenna.

Case Construction

To describe in detail the construction of the case or "chicken coop" might require more *QST* space than it merits, since it is very unlikely that any reader will not know at least seven different and better ways to build the thing. Many will prefer to work with metal, making the entire unit of aluminum or other angle and substituting "cane" or "expanded" metal for the wire screen. The wooden construction shown in the photographs was used because it is cheap, simple, and the most likely to be duplicated without fancy tools. The two front panels are made of ¼-inch Masonite, and the partition behind the panel, and the bottom of the cabinet, were cut from ⅝-inch plywood. The frame of the cabinet was made from strips of ⅝ × 1¼-inch wood joined together with glue and screws. An extra crosspiece was used at the rear, just above the baseboard, to serve as a support for the wire screening and yet leave an opening for the



The amplifier side of the partition. This view shows the plate tank condenser and the plate by-pass. The aluminum strips between the two 813s, mounted on stand-off insulators, are the neutralizing condensers.

power leads that must be brought inside. Piano-type hinges were used to hinge the front panel and the top door.

The frame was given two coats of gray lacquer before fastening the screen in place. Lacquer is a convenient covering because it dries fast and even, but paint will serve just as well. The wire screen is held in place by small screen staples, and then covered by prepainted ⅛-inch-thick strips. These cap strips serve only to cover the edges of the wire screen, and they are held in place by small brads. The clear-lacquered partition is held to the panel by flat-head wood screws through the panel, and further strengthened by the driver chassis which ties to both partition and panel.

As can be seen from Fig. 3, two interlock switches (S_3 and S_4) are used. One, a push-button type switch from a surplus BC-375, is mounted on an aluminum bracket near the rear of the cabinet, and its height is adjusted so that the switch closes when the front panel is in place and hence the rear of the partition is resting on the interlock. The other interlock switch is a roller-type Micro Switch, picked up in surplus, that is mounted on the top rear inside of the cabinet and doesn't close until the top cover is almost shut. This particular type of switch has considerable overtravel, so there is nothing tricky about its exact placement. As can be seen from Fig. 3, the two interlock switches are in series with the power switch marked "Plate," and all three must be closed for the plate power to be turned on, since the "Control" circuit represents the "hot" side of the power-supply control circuit, assuming 115-volt a.c. relays are used to switch on the plate transformer primaries. Although the interlocks will handle 10 amperes at 115 volts a.c., the small toggle switch, S_2, will not, and it is highly advisable to use relay control of the power supply. However, since a sticking relay will destroy the safety feature of the interlocks, it is desirable to connect a lamp across the primary of the plate transformer and mount this lamp inside the cabinet.

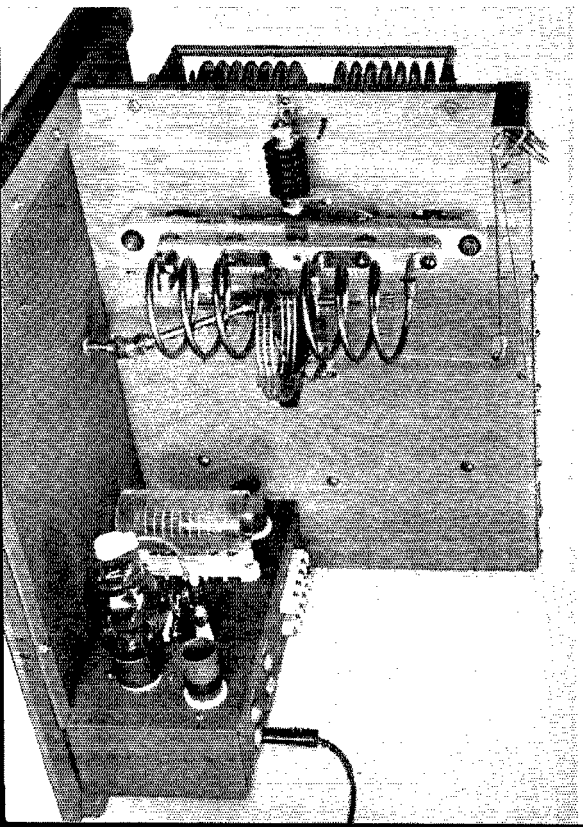
As an alternative, the two interlock switches could be connected in series with the transformer primary itself, leaving only the panel plate switch to control the power relay. However, the arrangement shown in Fig. 3 will be satisfactory for direct control, without a relay, of power of the order of 500 watts.

The terminal strips mounted on the baseboard are Millen 37104s, with a National GS-8 serving as the terminal for the 2000-volt line. Filament transformers were placed where convenient, and two 5-volt transformers were connected with their secondaries in series to furnish the 10 volts for the 813 filaments, since a single 10-volt transformer was not available. All wiring was cabled.

The meter in the center-tap of T_1 is a 0–100 milliammeter (surplus) shunted to indicate 0–1000 milliamperes. The shunt was made from a short length of resistance wire dug out of an old wire-wound resistor. It must be remembered that the meter in the center-tap reads the combined plate, screen and grid currents, and the actual value of plate current must be obtained by subtracting the screen and control-grid currents.

Power Supply

The 807s and the screens of the 813s require a power supply delivering 400 volts at 250 to 300 ma. Almost any supply delivering 1250 to 2250 volts may be used as the plate supply for the 813s, depending upon how much power output is desired. The tank circuit was designed assuming that the tubes were to be operated at 2000 to 2250 volts, 440 ma. total (maximum ICAS c.w. rating), although they may just as readily be operated from a 1500-volt 300-ma. supply with reduced excitation, if the higher-voltage supply



The exciter unit is mounted between the vertical partition and the panel, and serves as additional support for both. This view shows the first 807 with its Tri-tet cathode coil in the foreground. The plate tuning condenser is partly concealed by the tube, and to its right is the plate choke. The small bakelite coil form behind the plate coil is the jumper for the second-tube cathode circuit; when the latter tube is used as the oscillator a Tri-tet cathode coil goes in this socket.

The final tank-coil assembly and plate choke are at the top. The banana plugs at the right automatically engage a pair of jacks on the rear of the case when the panel is in position, providing connection to the antenna binding posts.

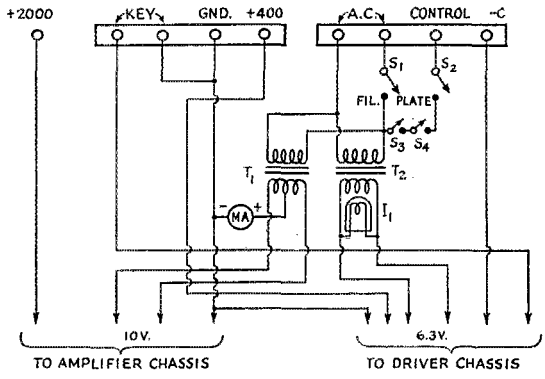


Fig. 3 — Schematic of the filament-power and power-terminal wiring. Two interlocks are included in the control circuit, to turn off the plate power whenever the "chicken coop" is opened.
I_1 — 6.3-volt pilot lamp.
MA — 0–100 milliammeter, shunted to read 1000 ma.
S_1, S_2 — S.p.s.t. toggle switch.
S_3, S_4 — Interlock switches. See text.
T_1 — 10-volt 10-ampere filament transformer.
T_2 — 6.3-volt 3-ampere filament transformer.

is not available. The data which follow apply to conditions of maximum input at 2250 volts. In any case means should be provided for reducing plate voltage while tuning up. A 150-watt lamp or equivalent resistance connected in series with the primary of the plate transformer makes a good voltage-reducing device. A switch may be used to short out the lamp after the tuning is completed.

A simple bias supply consists of a small receiver-type power pack delivering 200 volts or more (one of 50-ma. current rating will do) with a 10-watt resistor and a VR-150 voltage-regulator tube in series connected across the output, the resistor connected to the negative terminal. The resistor should be adjusted so that the tube just ignites from the pack voltage. The positive terminal of the pack is connected to ground, the bias terminal on the transmitter being connected to the junction between the resistor and the VR tube.

TABLE II

Comb.	*1st 807*	*2nd 807*	*Final Amp.*	*Undesired Harm., 2nd 807*
A	—	75	45	None
B	—	15	25	3rd-90
C	—	15	25	None
D	50	15	25	3rd-90
E	60	20	75	5th-60/6th-85
F	60	20	75	3rd-90
G	70	80	85	6th-20/7th-53
H	70	80	85	3rd-23

Adjustment

Since there is only a maximum of three tuned circuits to adjust, tuning the transmitter for any desired output frequency is a relatively simple job. Undesired harmonic responses, always to be found in a multiband rig, are quite readily identifiable as such, so there is little danger of tuning up on the wrong harmonic if a little care is used in watching the dial readings. For reasons given previously, the design does not provide for operating the second 807 output at the same frequency as that of the final amplifier and this sort of operation should not be attempted, even if the constructor is willing to make the extra coils, since the simplified construction does not provide the necessary shielding between the input and output circuits of the final amplifier.

The accompanying Table I shows the correct coils to be used in the 807 tank circuits, depending upon the crystal frequency and the desired output frequency. Combinations A, B and C, for 3.5- and 7-Mc. output, permit break-in operation in these two bands, since in each of these cases the keyed stage (the second 807) is operating as the oscillator. In the

TABLE I

Comb.	*Xtal f*	*Output f*	*1st 807 Plate*	*2nd 807 Plate*
A	3.5	3.5	—	3.5
B	3.5	7	—	7
C	7	7	—	7
D	3.5	7	3.5	7
E	3.5	14	7	14
F	7	14	7	14
G	3.5	28	14	28
H	7	28	14	28

remainder of the combinations, the keyed stage operates as a frequency multiplier, the first 807 becoming the oscillator which runs continuously.

Table II gives the approximate dial settings for resonance in the three tank circuits. Variations in wiring or coil dimensions will, of course, alter these readings, but they may be used as a guide. The last column to the right shows the dial setting where undesired crystal-harmonic responses may be expected in the multiplier circuit, the harmonics being identified.

It is advisable initially to choose one of the first three combinations from Table I — one which requires the use of only two stages. With the proper coils and crystal plugged in (be sure to plug the crystal in the right socket!), the low-voltage and bias supplies may be turned on and the key closed. At some point within the range of the 807 tank condenser the plate current should dip to a minimum, rising on either side. If

(*Continued on page 150*)

Narrow-Band F.M. for Voice Communication

A Comparison of N.F.M. and A.M. in Amateur Work

BY NATHANIEL BISHOP,* W1EYM

• The advantages of frequency modulation are well known, but how does narrow-band f.m. stack up with other forms of modulation in the matter of readability when the going is rough? W1EYM supplies some answers, based on carefully-conducted intelligibility tests, which indicate that n.f.m. is at its best under the borderline conditions so frequently encountered in amateur work.

AN INCREASING interest has been displayed by the amateur fraternity in the application of frequency modulation to amateur voice communication. Any of us who have followed the commercial development of wide-band frequency modulation are aware of its tremendous advantages over other systems of modulation where a high order of noise reduction is desirable, such as in broadcast and mobile communication services. This high-noise-reduction advantage of wide-band f.m. does not obtain unless the peak frequency deviation of the transmitted signal exceeds the highest modulation frequency by several times. Most wide-band f.m. systems use a peak deviation ratio of 5. Thus mobile f.m. equipment usually is designed for a peak deviation of ±15 kc. with a 3-kc. upper limit on the audio modulation range, while broadcast practice dictates a ±75-kc. peak deviation and a 15-kc. audio modulation range. Both systems are wide-band f.m. and have the same deviation ratio.

Both systems maintain their noise-reduction advantages over amplitude modulation down to a critical value of signal input, called the threshold of improvement, which occurs when the signal and noise voltages are comparable. Below the threshold of improvement, an a.m. system will, for the same carrier power, produce a usable signal which would be lost in a wide-band system operating under identical noise and carrier-power conditions. What this boils down to is that w.f.m. will do a far better noise-reduction job than any other system if sufficient channel width is available and if its use is confined to service areas where the signal is stronger than receiver and external noise.

The amateur, however, never considers his station as having a "service area" and is mainly interested in obtaining the maximum range of intelligible communication on any band for a given expenditure in equipment or parts. Crowded conditions on most amateur bands preclude the use of "sufficient channel width" for effective w.f.m. Is, then, a.m. the optimum system for voice modulation for amateur work? The author believes not, and his belief is based on a theoretical comparison of narrow-band f.m. and a.m., and a series of tests conducted on the 6-meter band with the able assistance of W1JKC, W2BYM and W2JCR.

Narrow-band f.m. may be defined as a system of frequency modulation wherein the peak deviation is limited to a value equal to or less than the maximum modulation frequency. Thus a signal which has a maximum modulation frequency range of 15 kc. and swings a maximum of ±15 kc. is, by definition, still narrow-band f.m., while a signal which has a 3-kc. upper limit on modulation frequency range but has a peak swing of ±15 kc. is wide-band f.m., though both occupy the same channel width. A more specific definition of n.f.m. for amateur voice communication depends upon the choice of upper modulation-frequency limit. Assuming that a high order of speech intelligibility is desirable, the upper frequency limit will fall between 3000 and 5000 cycles. The peak deviation of the transmitted signal should therefore be limited to the particular upper limit chosen, the choice of which is beyond the scope of this article.[1] If, for the sake of description, 5 kc. is chosen as the maximum desirable modulation frequency, the maximum peak deviation must be limited to ±5 kc. or less.

The question then arises whether the peak deviation should be limited to something less than the maximum modulation frequency in the interests of conserving bandwidth. Recent articles in *QST* have indicated that the second and higher-order sidebands, which fall outside a range of the carrier frequency ± the highest modulation frequency, assume appreciable proportions when the modulation index is unity. In order to inter-

* 835 Hope Street, Springdale, Conn.

[1] On the frequencies below 50 Mc. n.f.m. can be used in bands where a.m. is already entrenched only if it occupies the same channel width as that used by an a.m. signal, or less. This points to the desirability of limiting the audio pass-band to 3000 cycles. For 50 Mc. and higher, where QRM is not an important factor, this limit could be raised to 5000 cycles without harmful effects. — *Ed.*

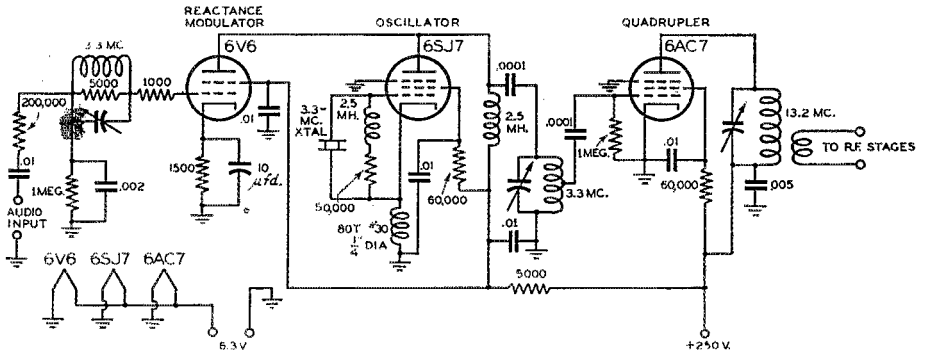


Fig. 1 — Schematic diagram of the phase-modulated exciter used at W1EYM. Output of the portion shown is on 13.2 Mc., requiring a further frequency multiplication of four times for 52.8-Mc. operation.

pret this statement in terms of the amount of adjacent-channel interference created by a voice-modulated n.f.m. transmitter, we must remember that the energy distribution in speech is such that the amplitudes of the high-frequency components are small indeed as compared to the lower-frequency components. In other words, a transmitter designed for a maximum modulation frequency of 5 kc. and a peak deviation of ±5 kc. will never, when voice-modulated, be deviating ±5 kc. at a 5-kc. rate, when the peak deviation has been limited by the gain-control setting. This is especially true when the high frequencies are *not* pre-emphasized in transmission, which omission is advocated by the author in the case of n.f.m. voice transmission.

It should be remembered that if the peak deviation is limited to something less than the highest modulating frequency, a loss in signal-to-noise ratio occurs which is proportional to the reduction in deviation. The receiver i.f. bandwidth must be equal to twice the highest modulation frequency. This bandwidth establishes the noise level. If we only swing the carrier one-half the receiver bandwidth, we take a 6-db. loss in signal-to-noise ratio (hiss noise, impulse noise, or both), and many advantages of the system disappear.

In the light of the above statements, the author submits the following as a trial balloon for amateur standards for n.f.m. transmission at 50 Mc. and above:

1) Maximum modulation frequency: 5 kc.

2) Maximum peak deviation during voice or keyed-tone modulation: ±5 kc.

3) Deviation *vs.* modulation-frequency characteristic essentially flat from lowest to highest modulation frequency. (No deliberate pre-emphasis of high modulation frequencies.)

Many of the advantages of n.f.m. over a.m. have been well covered in recent issues of *QST*. We know that an n.f.m. transmitter requires less equipment and consumes less power for the same carrier power, because of the elimination of the amplitude-modulation components. We know that the r.f. voltages in the final stage are less than when the a.m. is used, thereby simplifying insulation problems. The possibilities are remote of unwanted detection resulting in cross-talk in nearby b.c. receivers, telephone circuits, etc. Many such circuits have nonlinear elements which will detect a strong a.m. signal. Fortunately for f.m., detectors for it have to be designed and seldom occur by accident. These advantages are all fine; but what happens to the range, signal-to-noise ratio, and intelligibility of a voice communication circuit when n.f.m. is substituted for a.m. with the same carrier power and the same audio-frequency range?

Theory dictates that the signal-to-random-noise ratio of an n.f.m. system with a peak deviation ratio of 1 is 4.77 db. better than an a.m. system of equivalent carrier power and the same audio-frequency range, when the signal is comparable to or stronger than the noise. On impulse noise n.f.m. shows a 6-db. improvement under the same conditions. M. G. Crosby has indicated that at any detectable signal strength n.f.m. showed higher intelligibility than a.m. for the same received carrier.[2] The sum total of these advantages led the author to put the system to a practical test on the 6-meter band and the results obtained have more than repaid the time and effort involved.

The first series of tests was conducted over a 12-mile path between W1EYM and W1JKC. In this case the f.m. and a.m. signals were transmitted by W1JKC and observed at W1EYM. A breadboard transmitter, the exciter portion of which is shown in Fig. 1, was constructed which provided a 10-watt carrier at 52.8 Mc. Crystal control was used for both a.m. and f.m. N.f.m. was produced by phase modulation of the output of a 3.3-Mc. crystal oscillator. The audio input circuit was equalized to give essentially flat devia-

[2] "Band Width and Readability in F.M.," M. G. Crosby, *RCA Review*, January, 1941; also *QST*, March, 1941.

tion from 500 to 5000 cycles. The crystal frequency was multiplied 16 times, by one quadrupler and two doublers, this order of multiplication allowing a peak deviation of 5 kc. on speech without noticeable distortion. For a.m. transmission, the final stage was plate- and screen-modulated by a push-pull 6L6 modulator. The radiated power was adjusted by varying the final plate and screen voltage and varying the antenna coupling to the final stage.

The receiver layout at W1EYM may best be explained by reference to the block diagram, Fig. 2. It will be noted that the variable-bandwidth feature of the Super-Pro was not available in the n.f.m. channel where the i.f. selectivity was permanently aligned for a 10-kc. bandwidth.

When W1JKC first came on the air with maximum power and optimum antenna coupling, the signal, measured by signal-generator substitution, was 20 microvolts at the input of the 6-meter converter (S9+ on a report basis). The improved signal-to-noise ratio of n.f.m. over a.m. was readily apparent, though naturally not as striking as a comparison with wide-band f.m. W1JKC then dropped the signal level by decoupling the transmitting antenna and lowering the final-stage power input. As soon as the signal was attenuated to the point where a.m. reception was noisy and the speech intelligibility suffered, a shift to n.f.m. would increase the signal-to-noise ratio and restore the intelligibility. The signal was taken down to the point where a.m. speech was just audible but unintelligible. Even then the intelligibility of the n.f.m. held up. Up to this point the i.f. bandwidths in both channels were approximately the same. (The Super-Pro selectivity control set for 10-kc. bandwidth.) The bandwidth on the Super-Pro was now closed up to maximum selectivity (in our case about 4 kc.). The increase in signal-to-noise ratio on a.m. was thereby improved but the loss of high frequencies reduced the intelligibility. Without delving into questionable quantitative data, it was readily apparent that n.f.m. produced an entirely intelligible voice signal with a considerably-weaker signal input to the receiver. It should be emphasized that these results did not obtain when the n.f.m. was detected by detuning the a.m. channel.

About the Author

• Nathaniel Bishop, W1EYM, started playing with radio receivers in 1915, and was first licensed as 1JAP in 1918. This call was subsequently changed to 1AJP, which remained in force until 1927. He graduated from Yale University (Sheffield Scientific School) with a B.S. in E.E. in 1926. He has held his present call since 1931.

During the war he worked as a project engineer at the General Electric plant in Bridgeport, Conn., and had charge of WERS activities in Fairfield. He is now serving as an electronics consultant to Time, Inc., in charge of electronics research. He is a registered professional engineer in the State of Connecticut, and a senior member of the IRE. Old-timers on 56 Mc. know him best as the co-holder, with W6DNS, San Diego, Cal., of the all-time DX record of 2500 miles for 5-meter two-way work.

The exciter unit was then reinstalled at W1EYM and the n.f.m. receiver was shipped to W2BYM at Lakehurst, N. J., 95 miles airline from Fairfield. W2BYM used a DM-36 converter, revised for 6-meter operation, and a National HRO for the a.m. channel. To make a long story short, the transmissions to W2BYM further proved that n.f.m. outperformed a.m. in providing a highly intelligible signal over a greater percentage of each transmission time. Fading occurred during most transmissions, which condition is average over this path.

In an attempt to evaluate the readability provided by each system, lists of ten disconnected words were read on a.m. and n.f.m., changing lists for each transmission. An average of several tests indicated that n.f.m. was approximately 2 to 1 up on a.m. Words like "code" and "cold" were easily identified by W2BYM on n.f.m. Several transmissions on n.f.m. gave perfect "copy" but on a.m. the "copy" varied from 40 per cent to 60 per cent correct. It should be remembered that all these tests were carried on

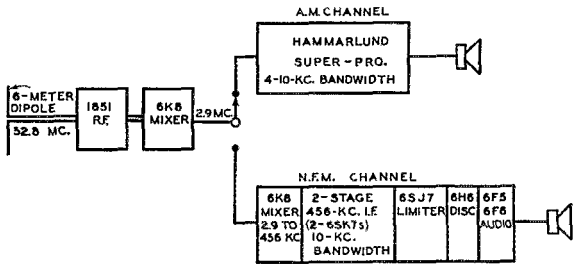


Fig. 2 — Block diagram of the f.m.-a.m. receiving set-up used in the readability tests. The 456-kc. i.f. unit in the n.f.m. channel uses a double-tuned input transformer, over-coupled, a double-tuned interstage transformer set for optimum coupling, and a single-tuned circuit between the second i.f. stage and the limiter.

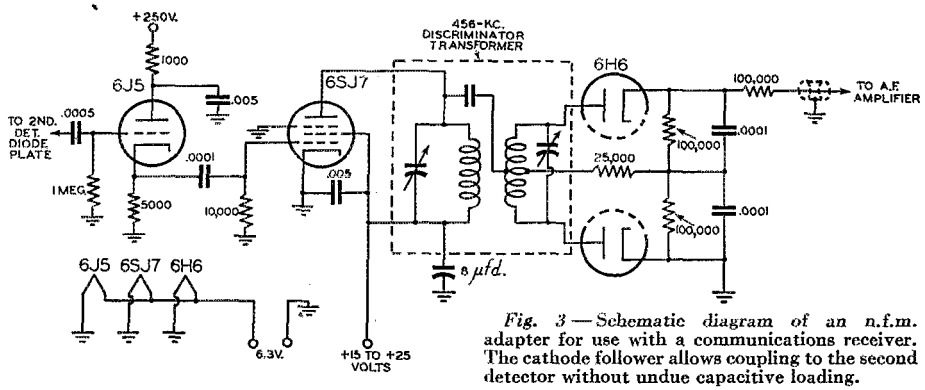


Fig. 3 — Schematic diagram of an n.f.m. adapter for use with a communications receiver. The cathode follower allows coupling to the second detector without undue capacitive loading.

with the same power input to the final stage, the same carrier frequency, the same microphone and speech amplifier, and the same audio-frequency range.

The author's Super-Pro has now been converted for n.f.m. or a.m. reception by the addition of a "black box" mounted on the rear chassis skirt. A 6J5 cathode follower is coupled to the Super-Pro second-detector diode plate (Fig. 3), which in turn drives a 6SJ7 limiter and 6H6 discriminator. The output of the discriminator is tied to the Super-Pro audio system through a switch which allows a choice of n.f.m. or a.m. audio. This system performs just as well as the n.f.m. i.f. strip previously described and has the added feature of variable i.f. bandwidth provided in the Super-Pro. Tests with W2JCR in New York, who has recently made provisions for n.f.m. transmission, gave further confirmation of the improved grade of reception provided by n.f.m.

As a conclusion to this article, I am going to ask and attempt to answer several questions which I am sure might come up if the reader were sitting across my desk from me:

Q) Do you feel that the advantages of n.f.m. will hold for the lower-frequency amateur 'phone bands as well as 6 meters?

A) Not without adequate tests on each band. It may well be that where crowding is at its worst, the peak deviation must be limited to something less than 3 kc. I would also like you to remember that early wide-band f.m. over long paths, where multipath transmission obtained, showed higher distortion than a.m. This may not hold for n.f.m. where the significant sidebands occupy approximately the same frequency range as in a.m. Only practical tests will tell the story.

Q) How about receiver and transmitter frequency-stability requirements?

A) The best transmission and reception techniques in use on 6 meters for a.m. are adequate for n.f.m. work on this band. Crystal control followed by phase modulation is ideal but not essential. A stable VFO, which may be reactance-modulated, will give adequate stability if carefully designed. Ample deviation may be obtained by grid modulating the VFO. Most well-designed v.h.f. converters have ample stability for successful operation on n.f.m.

Q) Isn't an a.m. receiver easier to design and align than an n.f.m. set?

A) If you are comparing an n.f.m. set with a superregenerative detector plus audio, the answer is yes. If, however, you are comparing a converter plus an n.f.m. i.f. and audio strip, the answer is that there is little if any added complication. The i.f. must be well aligned in either case. In n.f.m. the discriminator adjustment may be made by ear on any signal source.

The advantages offered by n.f.m. are cheap indeed in terms of equipment and power. In terms of effort, the attainment of these advantages calls for the best technical know-how that the serious amateur can bring to bear on the problem.

MIDWEST DIVISION CONVENTION

Hawkeye Downs, Iowa

May 24th–25th

• Iowa City and Cedar Rapids are cooperating to sponsor this year's Midwest Division Convention, scheduled for May 24th–25th at Hawkeye Downs, Iowa, home of the state fairs. Registration on Saturday will be followed by a series of technical talks, and the evening program calls for a banquet and dancing. ARRL President G. W. Bailey is expected to attend. A full schedule on Sunday includes tours of radio plants, a picnic lunch, a 2-meter hidden-transmitter hunt, and prize drawings. There will be a large display of amateur equipment by manufacturers and distributors.

Bring the family! Tickets may be secured in advance from D. D. Morgan, 430–35th St., N.E., Cedar Rapids, Iowa; two days, $5.50; Sunday only, $4.50.

House Cleaning the Low-Frequency 'Phone Bands

Transmitting and Receiving Techniques for Intelligible Reduced-Sideband Operation

BY GEORGE GRAMMER,* W1DF

• Something *can* be done — as this article demonstrates — about the ever-increasing litter of spurious sidebands and heterodynes that daily are wasting valuable kilocycles in the lower 'phone bands. But it's going to take more than complaint over the air and at the club, or in letters to *QST*, to clear the mess. Required is adoption by *all* 'phone men of a live-and-let-live philosophy of operation, the exercise of a goodly chunk of gray matter, and finally and most important, pulling the switches on the rig and wielding a soldering iron for a few nights. Read on!

INTERFERENCE in the low-frequency 'phone bands is something to marvel at or cuss about, depending on whether you're an onlooker or participant. But much of it can be avoided if we're willing to take a realistic viewpoint on amateur 'phone operation and adopt techniques that are designed for most effective *communication.* Broadcasting methods, either for reception or transmission, have no place in a communications picture.

The fact is that the 'phone bands are not being efficiently utilized. A lot of energy is being radiated, in the form of unnecessary sidebands, which serves no purpose other than adding to the general interference level. And the average operator seems to expect that he should receive signals, in a crowded 'phone band, with no more effort than a BCL puts into tuning in his favorite program.

Let's take the transmitting situation first. Although maximum efficiency may not be achieved until we have single-sideband carrierless transmission, that system is complicated and difficult, not readily adaptable to amateur needs, and there is some question as to whether it is practically usable at all under the conditions of amateur operation. It is beyond consideration at present. In the meantime, there is every reason for confining sidebands to those that are absolutely necessary for intelligible voice communication. Every reason, that is, if we really want to improve conditions in the 'phone bands. If "quality" is more important than communication, and if showing the world what a swell job of splashing and splattering can be done is more important than showing consideration for the other fellow, then there is no reason at all for keeping sidebands down. There is then also no reason for complaining about interference.

* Technical Editor, *QST*.

The Necessary Channel Width

Whenever the question of limiting the audio bandwidth — and, consequently, the transmitted channel width — comes up, the argument is sure to be advanced that the higher-frequency sidebands are relatively small in amplitude and do not cause much interference. Whether or not there is justice in this contention depends upon where you draw the line between "high" and "low" audio frequencies. We propose drawing that line just as far down the scale as it is possible to go and still have a high percentage of intelligibility. What the maximum necessary audio frequency is is not open to much question, actually; the facts have been determined in long and intensive studies by people to whom every cycle means money. No one can argue with real sincerity that the land-wire telephone does not do a good job of providing intelligible communication — with a high-frequency cut-off below 2500 cycles. (For "high fidelity" it goes as high as 2700!) The average ham 'phone has plenty of sideband energy above 2500 cycles.

If we do not need frequencies above 2500 cycles for intelligible voice communication then there is no justification for transmitting them. Amateur 'phones, as a general rule, go far above this limit because it is easy to make speech amplifiers "flat," and present-day microphones have good response well up in the audio range. The only practicable way to hold the bandwidth down to the minimum necessary is to use a filter,[1] preferably a good low-pass job, in the speech ampli-

[1] Formulas for the design of simple filters are given in the article, "Let's Not Overmodulate," by J. W. Smith and N. H. Hale, *QST* for November, 1946, page 25. Further details can be found in any textbook or handbook on communication engineering. The purpose of the present article is to outline broad considerations rather than exact methods

fier. Such a filter will have to be a part of every modulation system if the best use is to be made of the congested 'phone bands.

It may surprise those who have fixed ideas about audio-frequency range and "quality" to find that a system with a 2500-cycle cut-off sounds quite good. It is no surprise at all to those who know what the ordinary broadcast receiver gives out in the way of an audio-frequency range. Whether or not the sidebands are present in the transmission, they are usually cut badly by the receiver's selectivity — and through listener preference — by the tone control. More important than the actual upper-frequency limit is the relationship between the high- and low-frequency cut-offs. As a rule of thumb, the most natural-sounding result is obtained when the product of the maximum and minimum frequencies is about 500,000; in other words, if the high-frequency cut-off is at 2500 cycles the low-frequency cut-off should be at 200 cycles.[2] Extreme low-frequency response with a relatively-low high-frequency cut-off results in boominess, while the reverse gives a tinny effect. The ideal characteristic for amateur work, therefore, would appear to be about as shown in Fig. 1. A satisfactory characteristic at the low end is easy to achieve by choice of interstage coupling constants.

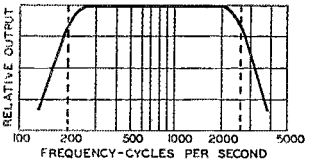


Fig. 1 — An audio-frequency characteristic of this type provides ample intelligibility, but confines sidebands to the minimum necessary for good communication. Contrary to what might be expected, it also gives satisfactory "quality" — if not too greatly distorted by receiver selectivity.

Cleaning Up the Transmitter

The installation of a low-pass filter is only a beginning; it does not guarantee that the actual sidebands will not have frequency components above those passing through the filter. Consider the conventional transmitter line-up shown in block form in Fig. 2. For many reasons the filter probably will be installed in the speech amplifier; since the operating voltages and currents are low, components are inexpensive and easier to obtain or make than if the filter were installed, say, between the modulator and Class C amplifier. Any amplitude distortion that occurs in the system *after* the filter will result in the generation of harmonics that nullify the effects of the filter in confining the bandwidth. There are several places where such distortion can occur:

1) In any subsequent speech-amplifier stage because of overloading or inherent nonlinearity.

2) In the driver for the Class B amplifier, because of insufficient power output, poor regulation, and so on.

3) In the Class B modulator itself, because of improper loading, overdriving, insufficient power capability, inadequate transformers, and poor commutation.

4) In the Class C stage because of nonlinearity (insufficient excitation is the most probable cause) and/or overmodulation.

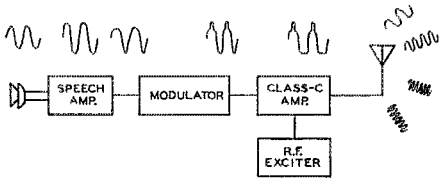


Fig. 2 — Every point in the system offers an opportunity for distortion — and unnecessary sideband frequencies. Proper design and adjustment of a 'phone transmitter to take minimum spectrum space requires know-how and care.

In fact, if a 'phone transmitter is to take up the minimum in channel width, *there can be no skimping in design anywhere along the line, and the utmost care has to be used to see that the proper operating conditions are achieved and maintained.* The speech equipment, exclusive of the low-pass filter, should be designed for low harmonic distortion and should have ample reserve capacity to handle larger-than-normal signals without folding up. It is only with such an amplifier that the filter can really go to work.

There is one bit of extra insurance that can and should be used. "Building out" the modulation transformer will help eliminate any high-frequency harmonics that may have been generated after the filter. In its simplest form, such building out requires only one or two high-voltage mica condensers, which fortunately are quite inexpensive in surplus these days. It is possible, too, to build a high-level low-pass filter for installation between the modulator and modulated amplifier and thus catch the unneeded frequencies at the end of the audio chain.[3]

Despite the conscientious use of all precautions

[2] From a report, "Down to Earth on 'High Fidelity,'" prepared by G. M. Nixon, C. A. Rackey and O. B. Hanson. The frequency range 200–2500 cycles is about the range reproduced by the small table-model b.c. receivers that probably represent the great majority of sets in use. Whatever the complaints about "quality" — and most people seem not to mind — on these sets, it is certainly not on account of lack of highs.

[3] W. W. Smith, "More on Speech Clipping," *QST*, March, 1947. To cut off at 2500 cycles, different filter constants are required (see Footnote 1) but similar construction can be used. Information on building out the modulation transformer also is to be found in *The Radio Amateur's Handbook*, 1947 edition, Chapter 14.

in the audio system, the good work can be undone completely if the Class C amplifier is not linear. And even a perfectly linear Class C stage will raise a rumpus throughout the band if it is overmodulated. Here is where the oscilloscope is practically indispensable. It is almost impossible to adjust a 'phone transmitter for proper operation without a 'scope, and there is no better modulation monitor. For checking either linearity or overmodulation the wedge pattern is best, which is fortunate because it is also the simplest type of pattern to get, requiring little more than the 'scope tube and its power supply.[4]

Confining the audio bandwidth to the minimum necessary, it should be observed, does not imply a "cheap" 'phone. Quite the reverse. It takes generous design, quality materials, and a thorough knowledge of how to set up and adjust a 'phone transmitter. Cutting the corners in design may do things to the audio characteristic, but they are usually not the *right* things. Combined with improper operating conditions, a poor audio system not only achieves a poor voice quality but also a channel much wider than is occupied by a good 'phone that actually handles much higher audio frequencies.

Under present conditions, spurious sidebands — by which we mean those resulting from harmonic distortion in the audio system, nonlinearity and overmodulation in the modulated r.f. amplifier — account for very much more of the existing unnecessary interference than do those legitimate sidebands above 2500 cycles that result from the use of flat audio systems. Until the spurious stuff is eliminated the improvement that can result from reducing the audio band is not going to be very marked. Cleaning up the transmitter and, once that is done, seeing that it is not overmodulated, is an obvious step that every 'phone operator is supposed to take anyway. Once it is actually done on a large scale, there is still something in the order of a 2-to-1 improvement in interference conditions to be realized by keeping the audio band to a minimum. The improvement is not automatic, however; in fact, it may be difficult to realize that it exists unless adequate receiving methods are used.

The Receiver

It is not generally realized, we believe, how important receiver limitations are in establishing the interference level. Imagine, if you will, using a receiver having an effective bandwidth of 100 kc. for the reception of amateur 'phone on the lower frequencies. With a receiver like that it would hardly matter whether or not transmitters were confined to the minimum channel width necessary for good intelligibility; in fact, all the

[4] See *The Radio Amateur's Handbook* for details of Class C amplifier adjustment and use of the oscilloscope for modulation checking.

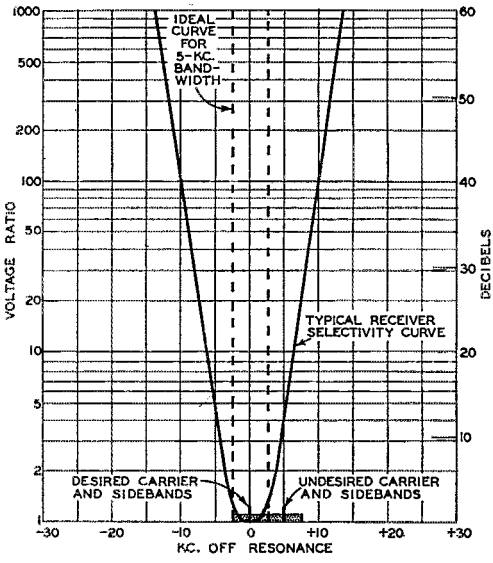


Fig. 3 — **The extent to which a practical selectivity curve departs from the straight-sided ideal is a measure of the interference that exists because of receiver shortcomings. The two signals blocked-out along the baseline are entirely independent in the frequency spectrum, but interfere with each other in a practical receiver.**

malpractices we've been talking about would be completely unnoticeable. Of course no one would think of using a receiver with such a bandwidth in the congested 'phone bands. The thought is introduced simply to emphasize the truth that *once transmitters have been brought to the point where they occupy no wider channel than is absolutely necessary for intelligible voice communication, the realization of the improvement in interference conditions that thereby becomes possible is entirely up to the receiver.*

Except during those times of the day when there is relatively little congestion, existing receiving practices are entirely inadequate. Note that the word used is "practices," not "equipment." Modern communications receivers are capable of doing a great deal more in the way of separating stations than most owners ever suspect. The receiver question deserves examination from the beginning.

Let us assume that transmitters are all properly modulated and that no audio frequencies above 2500 cycles appear in the modulation. The radio channel width is therefore 5000 cycles, and there is no energy *transmitted* outside that channel. Theoretically, then, two transmitters spaced exactly 5 kc. apart will create no mutual interference. The natural inference is that the receiver should have a passband of 5 kc., preferably in the shape of a selectivity curve with straight sides as indicated in Fig. 3. If such a selectivity

curve could be attained, either station could be tuned in without the slightest interference from the other, no matter what the relative signal strengths. However, practical receivers do not have such straight-sided selectivity curves; the solid curve is typical of present-day performance. With such a curve there will always be some interference even though the actual transmissions do not overlap in the spectrum; whether or not the interference is serious depends upon the ratio of the strength of the undesired signal to that of the desired station. It is apparent from the curve that if the undesired signal is around 15 db. stronger than the one actually tuned in (with 5-kc. separation between carriers) the desired and interfering signals will be about equal in strength.

However, there is nothing in the book that says we have to make the receiver passband wide enough to accommodate *both* sets of sidebands on the received signal. One set — whether the upper or lower does not matter — together with the carrier is sufficient for distortion-free reception. The fact that both have to be transmitted, at least at the present time, is unfortunate but does not alter the fact that only one set is actually needed by the receiver.[5]

Despite the fact that accepting only the carrier and one sideband does not in the least affect what is *transmitted*, this type of reception contains the possibility of increasing by 33 per cent the number of stations that can operate simultaneously without interference in a given band. Continuing the assumption that each transmitter occupies a channel of 5 kc. and that the receiver has an ideal selectivity curve of the type shown in Fig. 3, also 5 kc. wide, a carrier-frequency separation of 5 kc. as shown in A of Fig. 4 will permit

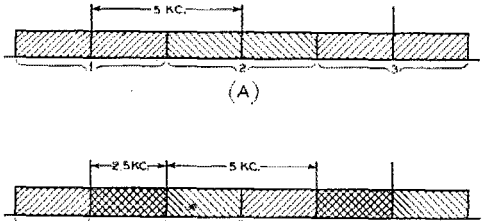


Fig. 4 — Showing how the effective spectrum space is increased by single-sideband reception of double-sideband transmissions.

interference-free reception of any one of the three carriers shown. But if the receiver passband can be narrowed to only 2.5 kc. so that only the carrier and one sideband are accepted, alternate carrier-frequency spacing of 2.5 and 5 kc. permits getting one more carrier into the same total space. The interference-free channels are numbered 1 to 4, the regions where sidebands from adjacent carriers overlap, and where interference does occur, being shown cross-hatched. (This wasted space is necessitated by the fact that the transmissions are double-sideband; if the carrier and only one sideband were transmitted it would obviously be possible to have channels only 2.5 kc. wide and thereby actually double the effective width of the band.) Of course, in actual amateur 'phone work the idealized spacing between carriers does not occur, but on the average the ratio should still hold.

There are other possibilities that do not appear on the surface. Referring again to Fig. 3, imagine that the undesired signal is moved a bit to the left so that part of its lower sideband, but not the carrier, falls within the ideal 5-kc. passband. Those sidebands that do fall within the passband will cause some interference to the desired signal, of course, but the carrier with which those sidebands are associated does not get through the receiver. Essentially, modulation is a heterodyne process, and *for intelligible speech to result, when the signal is detected, it is necessary that both the carrier and the sideband be present.* (This is one of the complicating factors in single-sideband carrierless 'phone.) In our ideal receiver the interfering sidebands produce not intelligible speech but monkey chatter — bursts of noise that are detected by beating with the desired, not the undesired carrier. This is still interference, it is true, but it is considerably less troublesome than the voice interference that would result under the same conditions in a receiver having the typical selectivity curve shown in Fig. 3. Because in that case, since the undesired carrier gets through, there would be two *voices* going at once, and it is much harder to concentrate on one voice when two are talking than it is to pull a voice through random noise of equal intensity.

Interference Suppression

Besides selection of the carrier and one sideband only, there is still another way in which the effects of interfering signals can be reduced. Fig. 5-A shows a state of affairs that is more common than not in amateur 'phone bands — two carriers so close in frequency that they both lie within the passband of the receiver. Using our idealized receiver, we have arbitrarily placed the desired and undesired carriers 2 kc. apart, the desired carrier being tuned in at the edge of the passband so that the whole of one set of sidebands can be accepted. The undesired carrier, being of the same amplitude as the desired one, will be detected in the usual way and the modulation on both signals will be heard, along with the heterodyne beat between the two carriers.

[5] A receiver operating on this principle was described in the June, 1941, issue of *QST*, by J. L. A. McLaughlin, under the title, "The Selectable Single-Sideband Receiving System."

In the simultaneous linear detection of two modulated signals on different carrier frequencies, it is well known that the modulation on one of the signals will disappear if that signal is considerably weaker than the other. This effect, which arises in the mechanism of linear detection, is

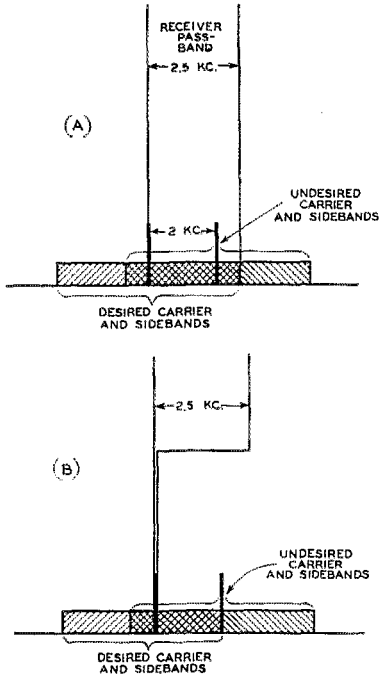


Fig. 5 — **"Exalted-carrier" reception, in which the desired carrier is amplified so much more than its own sidebands and interfering signals that certain forms of interference are suppressed in detection.**

very helpful in producing an apparent increase in selectivity, in that, in amateur 'phone, it eliminates one of the two voices that otherwise would be heard. Although neither the amplitude of the heterodyne beat nor the amplitudes of the monkey-chatter beats between the undesired signal and the desired carrier are affected, the elimination of the normal modulation on the undesired signal is nevertheless a worth-while gain. But to obtain it, the desired carrier always must be considerably stronger than the undesired carrier.[6]

The obvious way to ensure that that condition always will be met is to shape the receiver's selectivity curve so that the desired carrier is amplified a great deal more than anything else coming into the receiver. A selectivity curve something like that indicated in Fig. 5-B is called for, a curve having a sharp "spike" extending perhaps 20 or 30 db. beyond the flat plateau that takes care of the sideband. In single-sideband reception the spike should be at one edge, as shown, but for double-sideband reception it should be placed in the center of the selectivity curve. The relatively-great amplification at the carrier frequency keeps the desired-carrier amplitude well above the amplitude that any other carriers not exactly on the peak can attain, at least in the majority of cases. Thus the modulation will be stripped off any unwanted signals that may come within the normal passband.

A consequence of this type of selectivity is that the desired sidebands are considerably attenuated with respect to the carrier amplitude, although it should be noted that if the curve otherwise has a flat top as shown in Fig. 5-B this sideband attenuation is the same throughout the audio range and hence does not affect the way the signal sounds. The only effect is that the audio output of the detector is reduced, a thing that easily can be overcome by incorporating additional gain in the following audio amplifier. It should be noted, too, that to cope with the ever-changing interference in a ham 'phone band it is quite necessary, in using single-sideband reception on a double-sideband signal, to be able to shift the "spike" on the selectivity curve from one edge to the other of the passband at will.

These receiving techniques offer a great deal in the way of reduction of otherwise unavoidable interference. When adopted, they also begin to make the reduction in *transmitted* sidebands, discussed earlier, pay off in better conditions in the 'phone bands. For when every means at hand is used to increase receiver selectivity, the unnecessary interfering sidebands that fall within the passband of a receiver set to a desired signal are causing just that much interference — monkey chatter — that might have been avoided.

The Crystal Filter

Although these reception methods have been discussed in terms of ideal receivers, they aren't something for the future. They can be used right now — by any amateur who owns a reasonably-good communications receiver having a crystal filter. The crystal filter provides almost exactly the type of performance we've been talking about — if used correctly. Like any other practical device, it falls short of the ideal in some respects, and the receiver that backs it up has its shortcomings too, but with existing equipment it is possible to go a long way toward taking advantage of everything on the horizon that promises to reduce interference.

Take the spike on the selectivity curve in Fig. 5-B, for example. The filter can provide that —

(Continued on page 184)

[6] This is a form of "exalted-carrier" reception (M. G. Crosby, "Exalted-Carrier Amplitude- and Phase-Modulation Reception," *Proc. I.R.E.*, September, 1945). Exalting the carrier also reduces the distortion caused by selective fading of a modulated signal.

Atlantic City—1947

Part II†

BY A. L. BUDLONG,* W1BUD

IN THE previous section we outlined, as rapidly as was consistent with the facts, the history of amateur frequency allocations, both internationally and here in the United States.

Now we come to the question of the forthcoming Atlantic City conference itself. Like its predecessors, listed in the first section of this article, it has the power to make complete changes in the radio regulations, including such a drastic — though admittedly improbable — one as the complete elimination of a particular service from the allocations table, and so it becomes a matter of great interest to every service. Most amateurs, however, aside from knowing there is such a thing as an international conference and that it meets from time to time have very little idea how the sessions are conducted, how we amateurs, for instance, get represented and get our wishes placed before the conference delegates, and to what extent we participate and vote in the sessions. In this second half of our article we propose to sketch in the conference picture and the U. S. preparations for Atlantic City to date.

As a starter: Why is the conference being held in Atlantic City, why is it being held this year, and who is entitled to participate?

It is being held in Atlantic City this year because the United States, believing such a conference should be convened now that the war is over, was successful in getting at least 20 of the governments party to the existing treaty to express similar belief to the Swiss government, where the Bern Bureau is located; this is in accordance with a provision in the existing treaty. The suggestion was advanced by the U. S. to the signers of the present treaty the latter part of last year, and the necessary twentieth government came through with its approval of the idea shortly before the year ended. The United States had also offered to play host, and that suggestion met with the approval of a majority. So we hold a conference.

This conference will revise both the basic treaty, last revised at Madrid in 1932, and the appended regulations, which had their most recent going-over at Cairo, in 1938. We'll explain the distinction a little later. In the meantime, as to those who may participate in the workings of the conference, it may be said, generally speaking, that any nation in the world wishing to participate may do so. Under ordinary circumstances most of them do; this time, there will probably be some special angles in connection with Germany and Japan, for obvious reasons. The cost of holding a conference is prorated among the participating governments; Uncle Sam will send them all bills after the affair is over. Basic participation, it should be noted, is by *governments*. In fact, it is probable that *only* government people would be permitted to attend such conferences and participate in their workings were it not for the fact that the United States has a unique communications situation whereunder most of its communications set-up is privately owned and operated.[1] Because of this, the U. S. long ago sponsored a provision in the treaty which permits a government to "accredit" rep-

• In this second half of his article, Assistant Secretary Budlong tells about the development of "proposals" for the Atlantic City conference and briefly gives the story behind conference preparation and procedure, indicating how we amateurs make our case at such affairs. Mr. Budlong is well qualified to speak on the subject, having attended telecommunications conferences at Moscow (1946), Rio de Janeiro (1945) and Santiago (1940) for ARRL and, during the war, as Lt. Cmdr., USCGR, having been a Government delegate to the Anglo-American telecommunications conference at Bermuda, 1945, and the London conference on radio aids to marine navigation, 1946. During the war, as Chief of the Frequency Allocations Section of the Coast Guard, in Washington, he served for three-and-a-half years on the Interdepartment Radio Advisory Committee, during two of which he was chairman of its technical subcommittee, served on the Frequency Allocations committees of both the Joint and Combined Communications Boards, of the Chiefs of Staff, in Washington, until the end of the war, and has participated actively in every phase of U. S. preparatory work for revision of both the Madrid treaty and Cairo regulations since such work was first begun in 1943.

† Part I appeared in April *QST*.

* Senior Assistant Secretary, ARRL.

[1] Virtually all other radio and telephone facilities in the world are government owned and operated.

resentatives of its private companies, who may then participate in the conference "in an advisory capacity" to their own government group. Representatives of the ARRL have gone to all previous conferences under this proviso and as of this writing the League has just replied to the invitation of the State Department for Atlantic City by naming, with Board approval, Messrs. Warner, Segal, Budlong and Grammer, who will thus become a part of the U. S. group to be headed by the official Government delegation. In addition to such representatives of private companies, representatives of certain international organizations in the field of radio may also attend, in an advisory capacity, with the permission of the participating governments, and it is expected that President Bailey will so represent the International Amateur Radio Union, of which the League is headquarters society.

At this point, it should be noted that regardless of what other agencies may participate, only *governments* vote. Representatives of the League and the IARU may sit in on conference sessions and, in the case of the League, advise their Government people, but they cannot vote. We'll have more to say about both such participation and voting later on.

Conference Preparations

In an earlier paragraph we mentioned that this conference will draft both a new treaty and a new set of regulations. Since we're talking about them, let's see what they look like. Together, the two documents combine to form a volume of many hundreds of pages of normal-size type. Of these, the *treaty* [2] takes up only about two dozen pages; the *regulations* [3] hitched to the treaty occupy the remainder. The whole thing might be likened to a constitution and by-laws, the treaty (or "convention" as it is called in conference parlance) being the constitution and the annexed regulations being the by-laws. The convention portion is of no particular concern to us, since it deals with such broad aspects as organization and functions of the International Telecommunications Union, finances of the Union, provisions for conferences, establishment of the headquarters and secretariat, and similar generalities. Because it does treat only of the basic machinery such a convention ordinarily stands without revision for a good many years, as has the existing one (since Madrid, 1932); however, it is up for revision this time, and the United States, at least, is proposing sweeping changes in the Union structure. To revise the convention takes a full plenipotentiary conference, and at Atlantic City this conference will begin July 1st.

So much for the convention. From our standpoint, all the really important material appears in the regulations; it is in these that services are defined and frequency allocations set forth, for instance. The regulations are necessarily revised more often than the convention, to keep up with the rapidly-advancing art; the last previous revision of the regulations was at Cairo, 1938, and we would have had another in Rome, in 1942, had not the war intervened. Regulations may be revised at so-called administrative conferences, as against plenipotentiary conferences, which simply means they aren't so high-hat. There's a lot more action at them, though, and they usually take a lot longer — two to four months; for that reason, the "administrative-conference" part of Atlantic City will be given a head-start on the "plenipotentiary-conference" part, and will convene on May 15th. We'll be there in full force when they open the doors.

Now it is quite true, as we have said, that the conference has the authority to junk all the previous regulations and write up an entirely new set, but from a practical standpoint it is rarely necessary to go to such extremes, even where — as is the case now — the existing regulations are nearly ten years old. Many of the Cairo regulations are all right, even today; there is no sense junking them merely to rewrite them in the same language in a new document. So what will happen at Atlantic City is that everybody will scan the Cairo regulations, use them as the basis for a discussion of such changes as the participating governments feel are necessary, and finally agree on a final new set which will be in effect a modification of Cairo. The idea is to let alone the regulations that are OK "as is" and devote the time of the conference only to those needing revision.

It is probably unnecessary at this point to state that nations don't wait until they get to the conference to go over the old regulations and determine what they think needs revision. Studies along these lines begin months and even years before the conference, with groups of experts both within and without the government meeting frequently for weeks on end, studying the current needs of communications, projecting those needs ahead as much as four or five years, examining the old regulations in terms of such requirements and devising, word by word and paragraph by paragraph, the exact language for the necessary revisions.[4] Such detailed proposed changes are combined in one document and are

[2] Obtainable through the Government Printing Office, Washington, D. C., as Department of State Treaty Series No. 867, "Telecommunication Convention Between the United States of America and Other Powers," price 10 cents. This is the so-called Madrid Convention.

[3] Department of State Publication 1286, Conference Series 39, "General Radio Regulations (Cairo Revision, 1938) Annexed to the International Telecommunications Convention (Madrid 1932)," price 45 cents from the Government Printing Office.

[4] Representatives of the League have been participating actively in the U. S. work for Atlantic City for the past 2½ years; the author has just returned from nearly three months' daily work in Washington as a member of the group completing final drafts of the U. S. proposals.

referred to as the "proposals" of the country concerned. Ordinarily, each country sends its proposals to the Bern Bureau about a year in advance of the conference opening, where they are printed in a single "book of proposals," copies of which are circulated to all countries concerned five or six months later, so that everyone will have advance knowledge of what everyone else expects to revise and just how they propose to revise it; the purpose is to provide every participant with full knowledge of what to expect when they get to the conference, to determine in advance who agrees with whom and to prepare arguments against such proposals of other countries as may be regarded unfavorably. This customary procedure has not been entirely feasible in the case of the Atlantic City gathering because of shortness of time; nevertheless, the U. S. was able to complete its proposals in late February and transmit them to Bern early in March, and it is hoped Bern will have the usual book of proposals in the hands of most countries at least a month before the conference begins. The day that book becomes available in this country, a lot of wives are going to have to figure out their own amusements for quite a while, because all the U. S. people going to Atlantic City will spend days, to the exclusion of all else, very likely right up to train-time for Atlantic City, going over the proposals of every other country with a fine-tooth comb.

The U. S. Amateur Proposals

From the foregoing, it should be apparent that as of some months before each conference, the position of the United States has been pretty well established as the result of preparatory work which had been going on for several years. We hope this will be noted by amateurs who have been in a lather the past few weeks urging that the League "wake up and do something" to get the wishes of the amateur before our Government delegation to Atlantic City. We'd be in a fine pickle if we had waited until this late date to inject ourselves into the conference preparatory picture. Actually, as already mentioned, we have been working constantly with our Government people on this for several years. Furthermore, every step has been meticulously reported to the membership by frequent detailed items in *QST*.[5]

Well, what is the end result of the preparatory work? How do we fare in the U. S. proposals?

Reach for your April *QST*, the issue preceding this one, and turn to page 47 where, under the heading "The U. S. Amateur Proposals" you'll see word for word just what our Government is

[5] "R.T.P.B. Notes," p. 35, January, 1944, describing organization and objectives of Radio Technical Planning Board.

"Postwar Planning," p. 29, February, 1944, reporting outlook and ARRL plans.

"Pressure," p. 9, March, 1944, explaining problems confronting allocations planners.

"Amateur Frequencies," p. 62, September, 1944, reporting dual Government-industry approach to postwar allocations through IRAC-RTPB, and ARRL participation.

"Postwar Allocations," p. 35, October, 1944, same as above.

"Frequencies," p. 17, November, 1944, reporting IRAC-FCC-RTPB-Department of State allocations-planning progress, and ARRL participation.

"The Frequency Requirements of the Amateur Service," p. 18, November, 1944, complete text of Secretary Warner's testimony at FCC hearings.

"Allocation Work," p. 14, December, 1944, progress report.

"That I.R.A.C. Proposal," p. 15, December, 1944, detailing the points of view of the military services with respect to amateurs.

"Amateur Radio and Its Contributions to the Security and Welfare of the Nation," p. 16, December, 1944, complete text of President Bailey's testimony at FCC hearings.

"FCC Takes the Ball," p. 19, January, 1945, reporting RTPB frequency recommendations, ARRL objections to some features.

"Allocation Progress," p. 33, February, 1945, progress report.

"The F.C.C. Report," p. 14, March, 1945, complete table of FCC proposed allocations above 25 Mc.

"Allocations News," p. 17, April, 1945, analyzing above report and further describing ARRL participation.

"Allocations News," p. 22, May, 1945, further report on same.

"FCC's Final Allocations Above 25 Mc.," p. 11, July, 1945, complete table and description of final allocations above 25 Mc.

"FCC's Proposed Allocations Below 25 Mc.," p. 15, July, 1945, reporting proposed amateur bands below 25 Mc.

"FCC Allocates 44–108 Megacycles," p. 11, August, 1945, explaining adoption of Alternative 3 allocating 50–54 Mc. to amateurs.

"Allocation Below 25 Mc.," p. 24, August, 1945, complete text of ARRL testimony in oral argument concerning FCC proposed allocations to amateurs below 25 Mc.

"Allocation News," p. 21, September, 1945, progress report.

"Allocation Notes," p. 65, October, 1945, progress report.

"The Inter-American Radio Conference of Rio," p. 33, December, 1945, the author's report of his attendance on behalf of ARRL.

"1200-Mc. Band Relocated," p. 42, January, 1946.

"The Outlook," p. 42, February, 1946, reporting preliminary moves toward a world conference.

"Prospects," p. 36, May, 1946, situation report.

"The 160-Meter Band," p. 11, July, 1946, complete review of the developments affecting the amateur 1.75-Mc. band.

"Allocations Proposals," p. 36, September, 1946, progress report of U. S. planning for world conference.

"Microwave Changes," p. 36, September, 1946, reporting division of 5,250-Mc. band into two new ones.

"International Conferences — Budlong to Moscow," p. 38, November, 1946, reporting conference developments and the sending of an ARRL representative to a preliminary five-power meeting.

"Moscow," p. 25, January, 1947, the author's report on the five-power preliminary conference.

"Breather," p. 13, February, 1947, reports h.f. broadcasting pressures.

"Conference Preparations," p. 41, March, 1947, routine report.

"The World Conference," p. 13, April, 1947, complete editorial review of world conference situation.

"Atlantic City — 1947," (Part I), p. 36, April, 1947, complete history of amateur regulatory matters.

"Conference Preparations," p. 45, April, 1947, general report.

"The U. S. Amateur Proposals," p. 47, April, 1947, text of U. S. proposals for the amateur service as transmitted to Bern.

taking to the conference as its proposals for amateurs in the new regulations to be formulated at Atlantic City, and an inspiring exposition of the United States philosophy regarding the amateur service. This is the kernel to the nut, the climax of years of preparatory work, the end result of the League's representations and FCC actions and Government planning, as recorded step by step since 1944 in the *QST* references appearing in Footnote 5. It is what our country will do its very best to persuade other countries to adopt.

As will be seen, our Government proposes our existing 3.5-, 7- and 14-Mc. bands, a new band 500 kc. wide at 21 Mc. (all to be exclusively amateur), a 270-kc. band at 27 Mc. (shared with industrial, scientific and medical users), a somewhat smaller exclusive band (28.0–29.7) than we had before the war at 28 Mc., and then a whole raft of bands beginning at 50 Mc., all of them being brand new for us when they get above 240 Mc., compared to what we had prewar.

Now, while the total space proposed for amateurs both below and above 25 Mc. (an arbitrary dividing line in allocations work) is *more* than we have under existing Cairo regulations, there are two features that some amateurs question: omission of the old amateur band at 1.7 Mc. and the cut in the 28-Mc. band. The story behind both of these has been dealt with at length in *QST*[6] in more detail than is practicable to repeat here. Briefly, so far as 1.7 Mc. is concerned, the situation derives primarily from the wartime establishment of what was then a secret U. S. long-distance navigational device, known as loran. It went into our band for a variety of reasons, one of which admittedly was that it was about the only place it could go. The system was a vital part of our wartime operations in flights over the Atlantic and Pacific, including in the latter case the bombing of Japan. It is the belief of the United States Government that it is just as necessary for safe peacetime operation of routine overseas flying, an opinion shared by the international civil aviation organization. Up to the present, there is no substitute and loran is therefore, so far as the U. S. is concerned, a "must" for aviation safety. Experiments are being conducted for the same service on frequencies lower in the spectrum, and on other systems, but it is doubtful if they would displace the existing loran system within the next four or five years even if they turn out to be preferable, which it is not at all certain they will. As recorded on page 45 of the April, 1947, issue of *QST*, the U. S. proposal for the 1800–2000-kc. band actually shows amateur, fixed and mobile (the way the band is shown in the Cairo regulations) in addition to loran. The FCC has already announced[7] that it would, under the U. S. proposals if they prevail, provide some channels for disaster communication "including amateur disaster networks" in the region 1605–1800 kc. (the League has asked that the amateur networks in such case be in the 1750–1800-kc. region) and the U. S. proposals include the 21-Mc. band, never before available to amateurs, as partial compensation for the loss of "160." In conclusion, a point not to be overlooked is that neither the League nor the FCC had any opportunity to argue the original establishment of loran in the spectrum; it was established during the war, secretly, as a necessary part of our war effort.

As concerns 28 Mc., the story hinges on the FCC's industry-wide hearing in the fall of 1944, in connection with the Commission's preparations for postwar allocations recommendations and its formulation of domestic allocations above 25 Mc. At these formal hearings, probably the most comprehensive in the history of radio in this country, the League's case for the amateur[8] included request for continuation of the band in its full width, 28–30 Mc. When the FCC issued its preliminary report[9] in February, 1945, it included our band at the requested figure, 28–30 Mc., and at the subsequent opportunity for oral argument on the preliminary report, at which the League again appeared, we indicated our approval (the Board having so authorized). However, when the final report[10] was issued in May, 1945, subsequent to the oral argument, and as the Commission's final say on the subject, our band appeared as 28.0–29.7, the first time such a figure had ever been mentioned. The FCC, in its accompanying explanation, stated the cut had been necessary because of an expanded requirement for industrial, scientific and medical users which could be met in no other way but stated amateurs might share the 270-kc. ISM band centered on 27.32 Mc.[11] This being the final report of the FCC, no appeals were possible, and our 28-Mc. band became the present figure, so appearing in the current U. S. proposals.

The Atlantic City Conference

Now to the conference!

Our U. S. proposals are in, the position of this country for amateurs announced, and we're just about ready to head for Atlantic City and the conference itself. Presumably, this will behave very much as have all the others before it; readers interested can find the story on previous affairs (Washington, Madrid and Cairo) in *QST* for January, 1928, February, 1933 and July, 1938.

[6] *1.7 Mc.*: 15, July '45; 24, August '45; 11, July '46; 45, April '47. *28 Mc.*: 12, July '45.

[7] 15, July '45 *QST*.

[8] Secretary Warner's testimony is printed in full beginning on page 19, Nov. '44 *QST*; President Bailey's testimony appears beginning on page 16, Dec. '44 *QST*.

[9] 15, March '45 *QST*.

[10] 12, July '45 *QST*.

[11] Of the 300 kc. taken from our 28–30-Mc. band, 270 kc. went to the ISM services (shared with amateurs) and 30 kc. was added to the Government and non-Government fixed and mobile services.

The last step in connection with U. S. participation at Atlantic City will be the appointment of the U. S. Government delegation. As we write, late in March, no announcement of the make-up of this delegation has been made; it is customary to wait until the last month or so prior to the conference before this is done. Our delegation will probably hit an all-time high for size, estimates at the moment running in the neighborhood of forty people. There will be a chairman, and delegates from the FCC, Army, Navy, State Department and other interested Government departments; with them will go technical advisors — experts all — translators, stenographers and clerks. With the exception of the clerical help these people will for the most part be men who know amateur radio and with whom we have worked and conferred on our common problems over the years, both in this country and at previous conferences. Also from the United States will be a large group of the accredited private-agency representatives referred to earlier, among whom will be the League's representatives. At Atlantic City our U. S. group will join similar delegations and representatives from 60 or more countries, a total of many hundreds of people.

First, will be the holding of the opening plenary meeting — a plenary meeting being a full-scale meeting on a formal basis of the whole conference group. There are comparatively few such meetings during the course of a conference, since they are far too unwieldy to get down to detailed negotiations, but they are held to effect some of the opening preliminaries and also at the end of the conference to put the official stamp of approval on what will by then be a virtually agreed-upon set of documents. At the opening plenary session, someone of pretty high rank from the United States will greet the delegates and welcome them. Then will come, rather quickly, the formation of the main committees of the conference (usually five) and the election of their chairmen and vice-chairmen, these representing considerable politicking and being largely prenegotiated. But these main committees also are much too big to do any real work, so they will quickly meet and form subcommittees in various categories, these in turn electing chairmen. During this shaking-down process, which may take some days, the known work of the conference will be parceled out to the various committees, with nations wishing to participate in each committee or subcommittee so signifying and naming their representatives for the jobs; similarly, we and the other non-Government people will be keeping a sharp eye on the things we're interested in, seeing where they go, making notes of the various Government people who will be working on them, and registering our own desire to sit in on the groups we'll be concerned with. Things will really start moving in the subcommittees as the actual problems are disclosed, and additional subcommittees will be appointed to study them as they develop. After that, for perhaps half the length of the conference, it will be a process of study, hit a snag, appoint a subsubcommittee, study, hit another snag, appoint a subsubsubcommittee, until finally most of the real work of the conference is in the hands of such small working groups, or *petites comités*, the schedule of whose daily meetings will fill the bulletin board and take plenty of work to keep track of. Here's where the real work gets done. As studies are completed, some of the smallest groups will turn in their completed jobs to their parent groups and be discharged; then the parent groups will report to *their* parent groups and so the process of recombination will take the place of subdivision until finally the main committees will make their combined reports to the whole conference and the result will represent a new treaty or set of regulations. When the final plenary sessions approve the documents the delegates sign the official copies and the conference is over.

Now, as we've indicated, Atlantic City — like its predecessors — will be a conference of nations, with the active participants and voting members being strictly government people in each case and with nongovernment representatives like those of ARRL being permitted to attend only in an advisory capacity, without vote. How do we amateurs figure in all this business, and get an opportunity to get in our licks on matters affecting us?

First and foremost, without any qualifications whatsoever, is the matter of getting ourselves the best possible treatment in the initial U. S. proposals of which we have already spoken. Our U. S. proposals represent what this Government goes to the conference pledged to fight for to the very limit of its ability; more than that, they represent what all our Government delegates, advisors and non-Government representatives alike, are obligated to support in their entirety. The U. S. group at Atlantic City will be solidly behind every feature of the U. S. plan, and make no mistake about it; anyone caught sabotaging a part of the U. S. plan in an effort to benefit himself at the expense of other U. S. interests would quickly find himself on the outside, lucky even to look in, and with chances remote of ever again being a member of a U. S. group. Thus, when it comes to one of these conferences, our greatest asset is the U. S. set of proposals; that is why the League spends so much time and effort to associate itself closely with every phase of the preparatory work.

Second is our association with the U. S. delegation at the conference, arising from our status as an accredited group. When it gets to Atlantic City, the U. S. delegation will set up shop in a number of rooms with extensive facilities for mimeographing, typing and stenographic work,

(*Continued on page 186*)

C.W.-Transmitter Monitoring

The Problems and the Solutions

BY BYRON GOODMAN,* W1DX

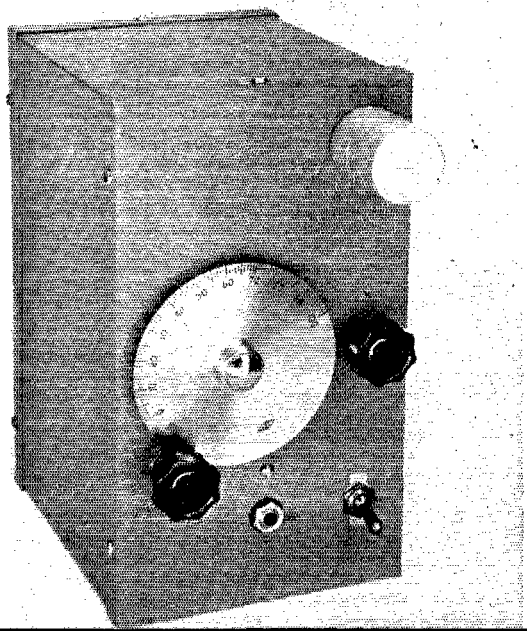
• Do you want to know how to get a good c.w. signal? Here is the secret, resurrected from the dusty archives of amateur radio, and it boils down to a very simple idea: "Listen to your own signal!" This breath-taking revelation may be a disappointment to those who expected something more sensational, but the truth is that too many operators these days just don't know how their signals sound. This story tells how you can find out.

IN the eighteen months that have passed since amateurs have been back on the air, few legitimate excuses have been offered for the inferior signals one hears. Enthusiasm for "getting on," without allowing enough time to clean up the signal, is understandable — but that excuse is only valid for the first few days of operation. After that, even a tin-ear should know when his signal is afflicted with chirps, bumps and grinds, clicks, thumps, parasitics and all of the other prevalent ills. After listening to some of the old-timers who are guilty of continued operation with poor signals, one gets the impression that these "leaders" in the field have forgotten how to check their signals. The LSPH gang cannot be held responsible for poor signals any more than they can for adopting the DX-hog techniques of their more experienced contemporaries since, being young and impressionable, they probably are misled into thinking that if the old-timers do these things, they are the right things. 'Tain't so! There is no alibi for continued operation with a signal that sounds like a sparrow with the hiccups, unless one enjoys wearing a badge that identifies him as an operator who doesn't know any better — or worse, doesn't care.

Back in the late '20s and early '30s, *QST* conducted a campaign to encourage operators to use "monitors" to check their keyed transmitter characteristics and, as a result, the average signal on the air sounded rather good. A monitor was necessary because most of the transmitters were simple self-controlled oscillators and they had to be adjusted properly to avoid chirps and modulation. Soon crystal control became popular and, with amplifier keying, it was easy to obtain a signal that had no chirps or modulation and the necessity for monitors died out. Then, too, superheterodyne receivers became available and popular, and operators found they could monitor their "sending" — i.e., the formation of characters — without too much trouble, although the receiver seldom gave a faithful reproduction of the signal. However, times have changed, and keyed VFOs and crystal oscillators are the order of the day, but far too many operators seem to let the chirps fall where they may, without ever determining if their signals are as clean as they might be.

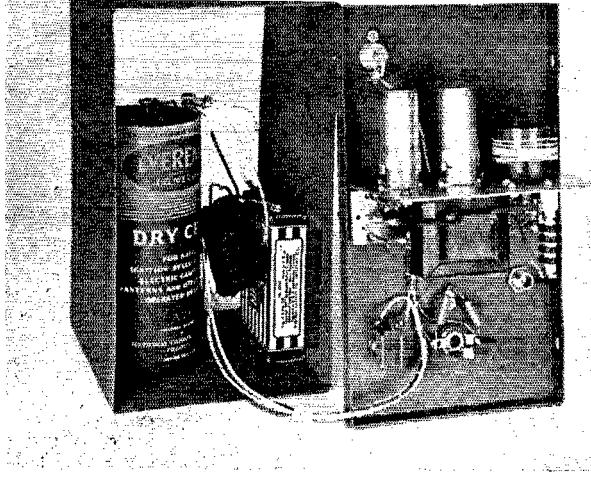
Let's look at the popular methods used for checking one's signal these days. The first — and apparently most popular — is to ask the fellows you work "how the rig sounds." The chief merit of this system is that it may start an interesting discussion on practically anything, but it is otherwise worthless, so far as an accurate check on one's signal is concerned. Depending on how the other fellow's dinner sets with him, and whether or not he wants your QSL, you can get reports ranging from "peachy" to "FB." Even if he did describe as best he could what your signals were like, it wouldn't mean much because his standards might not be as high as yours.

♦



A two-tube battery-operated monitor. The extra knob is a regeneration control, and the little aluminum box in the upper corner is a shield can for the antenna terminal.

* Assistant Technical Editor, *QST*.



A view of the monitor disassembled, giving an idea of the arrangement of parts and the batteries. The tube shields cover the audio amplifier (left) and the oscillating detector (*center*).

♦

The next most popular monitoring method is to use the station receiver, and often this isn't too bad. If one uses low power or is not troubled with line-voltage variations during keying, the receiver makes a good monitor if it is a *good* receiver. The safest way to use a receiver for a check on one's signal is to short the input terminals of the receiver, to minimize pick-up and consequent blocking effects. If the line-voltage fluctuations with keying affect the receiver, the receiver may be moved to another part of the house and plugged in on the other side of the line, if the house uses a 220-volt three-wire system. This will reduce the voltage changes to the receiver and also remove the receiver from the strong local field of the transmitter and, used intelligently, can give an operator a good check on his signal. Extension leads to the key are a necessity, however, to allow keying from the receiving position.

An elaborate variation of the foregoing is to use a Raytheon or Sola a.c. voltage regulator ahead of the receiver, but one look at the catalog prices is enough to discourage most amateurs. And it is still not satisfactory to use the receiver in close proximity to a high-powered transmitter unless the receiver is extremely well shielded. Some of the surplus receivers, like the BC-342 and BC-348, are shielded well enough to serve as monitors close to the transmitter, provided the line-voltage variations are eliminated by one means or another.

One of the best methods for checking one's signal, but probably the least convenient, is to trade stations for an evening with another ham in the vicinity. You then know exactly what your signal sounds like to the lucky — or unlucky — fellows who have to listen to it. The disadvantage, aside from the transportation problem, is that changes in the rig cannot be immediately checked.

But there you are — there just isn't a simple way to know definitely that your transmitter has a signal to swell your pride. Monitoring equipment, for either c.w. *or* 'phone, is never simple if it is really good. Of course, there is one redeeming feature about many of the monitoring dodges — if the signal is distorted by the monitoring system it always sounds *worse* than it actually is. But that's just where the danger lies. Upon hearing his signal badly distorted, the operator is likely to dismiss the tests with "Well, I know it can't be *that* bad!" without ever determining just how bad — or how good — the signal is.

Self-Contained Monitors

Going back over the discussion, it is obvious that the monitor for a keyed transmitter must be a receiving system that is independently stable and not affected by proximity to the transmitter. The first requirement immediately suggests battery operation, and that brings us back to the old battery-powered monitor. The second requirement might be met by a well-shielded battery-powered monitor, but let's look around for other possibilities. Suppose we use a power detector of some type and beat the transmitter signal against another oscillator — the beat could be amplified and a faithful reproduction of the signal would be obtained. However, the other oscillator would have to be rock-steady and not affected by the transmitter, and this implies excellent shielding or operating the oscillator on a submultiple of the transmitter frequency. If the beating oscillator is run on the transmitter frequency, it will tend to be "pulled in" by the transmitter if the signal level is too high, so the power-detector idea is out for fundamental operation unless the oscillator is well isolated. Using harmonics of a low-frequency oscillator is a possibility but leads to more equipment than one might want to put in a monitor. Also, the oscillator-and-power-detector combination requires audio amplification following it, to bring the signal up to usable headphone volume.

All of which brings us right back to the old monitor of the early '30s — an oscillator-detector in a shield can. What was so bad about it? Drawing on memories of those "good old days," the chief shortcomings seem to have been that they never had enough audio output and they couldn't be depended upon always to give a faithful reproduction of the signal. The answer to the low-audio objection is not a hard one to figure out, but why couldn't the gadgets always be trusted? As a posthumous guess, it was probably because they were never equipped with a regeneration control, and the degree of feed-back and hence the operation condition was largely a matter of chance. Some of them, in a strong feed-back condition, could be triggered by a strong signal into peculiar types of oscillations that, although they served to make them excellent "sending" moni-

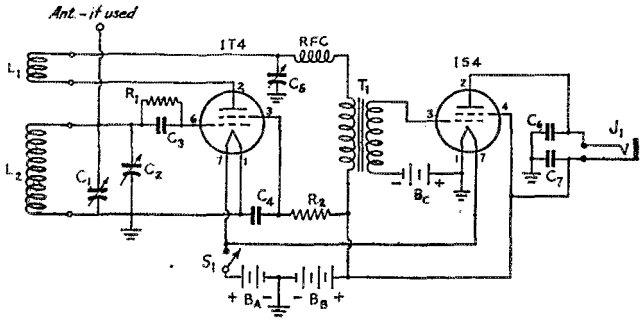


Fig. 1 — Wiring diagram of the battery-powered monitor.

C_1 — 10-$\mu\mu$fd. midget variable (Bud LC-1648).
C_2 — 3-30-$\mu\mu$fd. mica trimmer.
C_3 — 47-$\mu\mu$fd. mica.
C_4, C_6, C_7 — 0.001-μfd. mica.
C_5 — 75-$\mu\mu$fd. midget variable (Hammarlund HF-75 or Bud LC-1645).
R_1 — 0.1 megohm, ½ watt.
R_2 — 10,000 ohms, ½ watt.
L_1 — 7 Mc.: 5 turns. 14 Mc.: 3 turns. 28 Mc.: 2 turns.
L_2 — 7 Mc.: 14½ turns. 14 Mc.: 6½ turns. 28 Mc.: 2⅜ turns. L_1 and L_2 are close-wound with No. 24 d.c.c. on 1⅜-inch diameter tube-base forms. Final adjustment of tuning range made by spacing top turns of L_2 and/or setting C_2.
B_A — 1½-volt dry cell (Eveready No. 6 or equiv.).
B_B — 45-volt "B" battery, small size (Burgess XX30).
B_C — 4½ volts. Three "penlite" cells connected in series and wrapped with friction tape.
J_1 — Open-circuit jack.
RFC — 2.5-mh. r.f. choke (National R-100S).
T_1 — Interstage audio transformer, 3:1 ratio (Thordarson T13A34).

tors, rendered them inaccurate for checks on the quality.

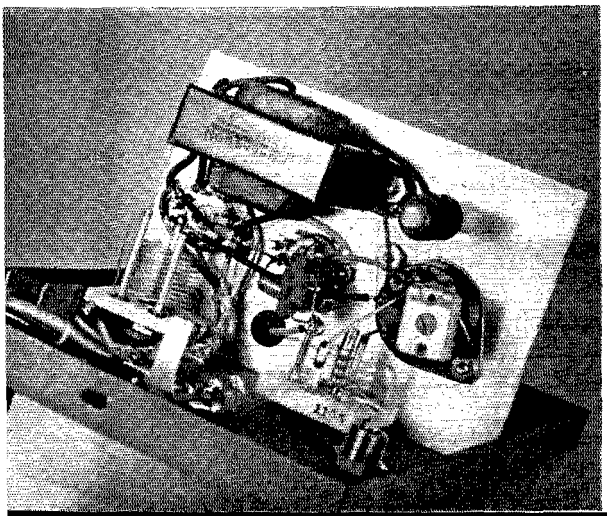
In an experiment to see what could be done to build a practical and reliable monitor, the unit shown in the photographs was assembled. It consists of an oscillating detector, *with a feed-back control*, and a stage of audio amplification. No attempt was made to shield the unit elaborately, because it was felt that any untoward amount of mechanical work would discourage its duplication, but some slight pains were taken to avoid unnecessary leaks in the shielding. An antenna post was provided but designed to be completely shielded if so desired.

The gadget was a pleasant surprise. Not having worked with battery tubes since the old days of the microphonic Type 30, it was a nice experience to find that the 1T4 proved to be a very stable oscillator, even at 28 Mc. Although the regeneration control pulled the frequency of the detector slightly, it was no great hardship, since the strength of the signal determined how much the regeneration control should be advanced to avoid "blocking." The shielding wasn't good enough to allow the monitor to be used on the operating table alongside a 150-watt 14-Mc. transmitter, but by removing the monitor about 20 feet away — and running some key leads over — good signals could be obtained that were an accurate reproduction of the transmitted signal, and the headphone signals were loud enough to show up any aberrations which, fortunately, weren't present on the signal in this instance. With a transmitter running higher power, it would probably be necessary to move farther from the immediate vicinity of the rig, but nothing unreasonable.

As can be seen from the wiring diagram of the unit, shown in Fig. 1, there is nothing unusual about the circuit. The oscillating detector is made medium-C, and capacity control of regeneration is used. Bandspread tuning was included to make it easier to tune in a signal and study its characteristics, and a low value (0.1 megohm) of grid leak was used to increase the power-handling capabilities of the detector. The battery switch was made independent of the headphone jack, to reduce the possibility of the signal's being coupled in through the jack to the filament circuit, as might happen if the switch were part of the jack. By-pass condensers across the headphone jack attenuate signals coming in through the 'phone cords. The jack is insulated from the front panel by fiber washers to avoid shorting the battery.

The construction is apparent from the photographs and is quite simple. A 5 × 9 × 6-inch "utility cabinet" was used to house the unit, and the chassis is a small piece of sheet aluminum supported by the two variable condensers. The variable condensers fasten to the panel (cover) of the cabinet by the usual single-hole bushings, and the tapped mounting brackets of the condensers then serve as two brackets to support the chassis. While this construction may appear to

(*Continued on page 130*)



A close-up view of the underside of the monitor chassis, showing the main tuning condenser (right), the padding condenser mounted on the coil socket, and the feed-back control condenser.

Eliminating Car Noise in 28-Mc. Mobile Reception

Effective Suppression of All Types of Electrical Interference

BY HAROLD G. PRICE,* W2OEM/4

BEING a victim of the housing shortage for the past year, the author has had to depend upon a 10-meter rig in his car for his ham activities, while the big rig is in storage. Much has been learned about mobile operation and the purpose of this article is to pass along information gained by experience in the elimination of interference set up in the receiver by the car itself. Judging by the number of inquiries received by the author during his trips around the country, the subject of car interference is most interesting to those concerned with mobile operation.

Almost every ham encountered who has worked mobile seems to think that it is useless to try to remove the interference and that the only solution is a good noise limiter in the receiver. The author was about in the same frame of mind until several months ago, when a decided effort was made to approach the problem logically, to determine if car noise in the receiver could not be reduced to a point where it would not interfere with reception of weak signals. This has been accomplished in the author's car which is a rather "war-weary" 1938-model Chevrolet. Those with better automobiles will undoubtedly have less trouble in eliminating interference.

First, it should be determined just what types of interference are present. Often it may be necessary to cure one type of interference before another type in the "next layer" will show up. The more sensitive the receiver, the more car interference there will be. The author's receiver is a four-tube converter consisting of an 1853 r.f. stage, an 1852 first detector, a 6J5 oscillator and a VR-150 voltage regulator. The converter feeds a six-tube broadcast auto receiver with an 1853 in the r.f. stage and the combination is exceedingly sensitive, with an excellent signal-to-noise ratio. With only a 48-inch whip antenna, DX can be heard on this receiver in a manner which equals the performance of many high-priced communication receivers. When the rig was first installed in the car it was found almost impossible to operate with the car in motion because of interference from the car itself. The following types of disturbances were found to be present:

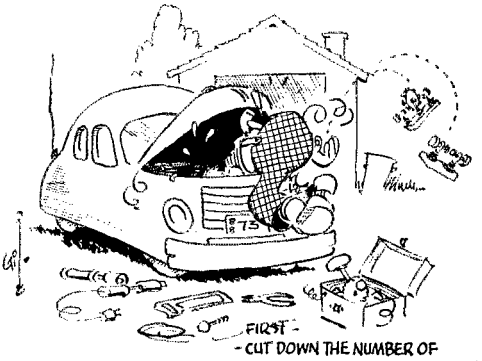
1) Ignition interference
2) Generator interference
3) Front-wheel static
4) Rear-wheel static
5) Tire static
6) Voltage-regulator interference

The symptoms and the method of treatment for each source will be described in turn.

Ignition Interference

As might be expected, the ignition system is the source of the most severe interference and should be treated first. It should be considered that any spark gap in the ignition system is a very potent transmitter and that any wire connected to it thereby becomes a transmitting antenna. The receiving antenna is located outside the car and theoretically is shielded from these spark transmitters by the metal hood and the rest of the car body. If the receiving antenna is picking up a signal from the spark transmitters, the signal is being carried to the inside of the car body or to the outside of the car by some wire or metal part acting as a conductor, and then radiated to the receiving antenna. A spark signal can be sufficiently strong to penetrate the body shielding.

The first thing to do is to cut down the number of spark gaps in the ignition system, and thereby



the number of transmitters, to the very minimum required to run the engine. This will be the number of spark plugs plus one, the extra one being the distributor rotor gap. This may sound like an attempt to be funny since everyone will assume that there are no other gaps. In the author's case, however, a total of 14 other gaps was

* Director of Broadcasting, *The Knoxville Journal*, Knoxville 6, Tenn.

• Anyone who has done any serious amount of 28-Mc. mobile work understands the problem presented by electrical noise from a moving car. The consequence is that most "mobile" work turns out to be "fixed-portable" work in fact, since most of the operating is done with the car stationary and the motor stopped. And many a "mobile" operator has had to "push" his way home after an hour or so of operating has laid his battery low. Although, as the author says, "Having accomplished this dirty and uninteresting work, we proceed to some further dirty and uninteresting work," it is well worth the efforts he describes to have completely noise-free reception after the job is finished.

found. The high-tension wires connecting the spark plugs to the distributor and the distributor to the ignition coil all had gaps at each end. Ordinarily, in mass production, the metal lugs are simply clamped to the ends of the Packard cable or rubber-covered high-tension wire. A small sharp spike on the lug is supposed to pierce the insulation and make contact with the wire. It rarely does, however, and the result is a small spark gap. The remedy is to get new lugs and clamp them on in the usual manner but leave extended about a half inch of uninsulated wire which can be soldered to the lug. The spark plugs should be cleaned and reset to the proper gap width. The distributor rotor and cover should be in good condition.

In order to cut down the r.f. generated by the rotor gap, the gap should be narrowed by carefully peening (tapping with a ball-peen hammer) the metal tip of the rotor so as to stretch it out. It should be polished and shaped with a file and should be checked after replacing by putting chalk on the edge of the tip and turning the motor over to make sure that the tip is not touching the cover contacts. Allowance should be made for expansion of the rotor when the distributor gets hot, otherwise there will be a mystifying squeak in the motor caused by the rotor rubbing the cover contacts. Incidentally, all of this will deliver a hotter spark to the plugs and should make the car run better.

Needless to say, the distributor points should be in good condition. There should be no opportunity for sparks to jump to ground through the insulation on the high-tension cable. Fiber spacers should be installed, if necessary, to hold the cable away from the motor block. High-tension wires should be arranged to keep them as far as possible from low-tension wires in order to keep to a minimum the r.f. transferred to the car wiring system.

Having reduced the number of spark gaps to that necessary to run the engine, the next thing is to reduce the intensity of the r.f. generated at the gaps. A good carbon suppressor should be installed at each plug as well as one at the distributor. Ford owners will have to use their own judgment here. The suppressors should be checked with the dealer's ohmmeter before purchasing, since about one-third of his stock will be found to be open or with widely-varying resistance values. The proper value is about 10,000 ohms plus or minus 20 per cent. All suppressors chosen should have the same resistance. Installation of these suppressors should have no noticeable effect on the performance of the engine if it is in good mechanical condition. Having accomplished this dirty and uninteresting work, it is now time to proceed to some further dirty and uninteresting work.

Checking Shielding

To determine if the receiving antenna is picking up all the interference, the shielded lead-in should be disconnected at the point where it is attached to the antenna. The motor should then be run with the receiver gain wide open. If no ignition noise is heard in the receiver, then all noise is being picked up by the antenna. If the noise is still heard, even though reduced in volume, then some signal from the ignition system is being picked up by the antenna lead-in. The lead-in may not be sufficiently shielded or properly grounded, or the noise is entering the receiver through its 6-volt power lead. This cannot happen if the necessary r.f. choke and by-pass-condenser filter are provided in the power lead and mounted inside the receiver case.

Having determined that the pick-up is all by way of the antenna, or having eliminated any chassis pick-up that may be present, the antenna should then be reconnected to the lead-in and the receiver controls set at their most sensitive positions, with the dial turned so that no signal is being received. The motor should then be run at idling speed, or just slightly faster. There should be plenty of gas in the tank and lots of time available for there is much testing to be done. It will be better if several hours at one sitting can be devoted to this part of the operation. An attempt to do it a few minutes at a time on different days will result in forgetting what has been tried before, and much effort is likely to be repeated and tempers aggravated by an apparent lack of progress. The procedure is to try things one at a time to see if they reduce the ignition noise. If something helps, even slightly, it should be permanently incorporated before trying something else. It should be assumed that any wire, control rod, metal tube, steering post, etc., going from the motor compartment through an insulated bushing in the bulkhead to the interior of the car, will carry the noise signal to a point where it can be radiated to the antenna. There-

fore all of these things should be stripped of their ability to carry r.f. The metal rods, tubes, steering post, etc., should be grounded to the bulkhead with heavy wire or braid. This isn't a hard job and should not be dodged. A heavy soldering iron and some soldering paste make this task quick and easy. The bulkhead should be scraped to the bare metal before attempting to solder to it.

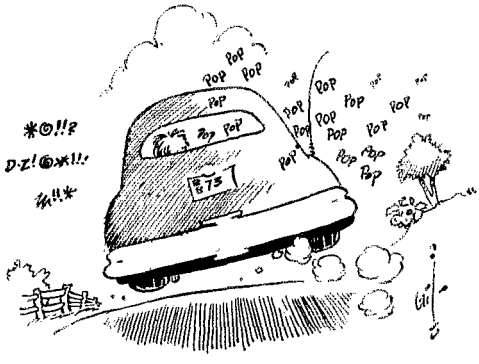
Wires going through the bulkhead can be stripped of r.f. by by-passing them to ground with 0.5-μfd. metal-cased paper condensers. Usually it is more convenient to affix the condensers to the binding posts where the wires terminate under the dash, rather than where they pass through the bulkhead. Surely the following will have to be by-passed in every case: battery lead at the ammeter, gasoline gauge, ignition switch, headlight and taillight leads, and any other accessory wires running from the motor compartment to the dash or outside of the car. For cars having the Electrolock ignition system, there is a special condenser for later models which fits in the space in the top of the ignition coil and by-passes to ground the battery-supply wire from the ignition switch to the primary of the ignition coil. For earlier model cars, such as the author's, there is space in the top of the coil in which to mount a large mica condenser such as a 0.02-μfd. 1000-volt type. Molded mica is recommended because of the heat involved. One side of the condenser is connected to the binding post on the coil itself and the other side can be connected to a bare wire which may be attached to the motor block by one of the bolts holding the coil. The top of the coil can be replaced by forcing it down over the wire. (No condenser should be attached to the binding post at the other end of the coil from which a wire goes to the distributor. A condenser from that post to ground would be shunting the ignition points on the car and would affect their operation.) This installation is very effective since it prevents the main source of r.f. from feeding into the interior of the car.

For cars without the Electrolock system, a shielded condenser mounting can be devised to mount near the coil. The wire from the coil to the switch should be shielded in that case and the shielding grounded at the bulkhead. Naturally the bulkhead should be grounded to the frame of the car and the motor should be grounded to the bulkhead with flexible braid. If the exhaust pipe and muffler are insulated from the frame by rubber mountings they should be grounded with flexible braid, because they can provide a path for r.f. from the motor compartment to the outside of the car.

If these directions have been followed the receiver should now be virtually free from motor noise. If some still remains, not enough shielding or by-passing has been done at the proper places. Each car will vary but undoubtedly each case can be cured by keeping the fundamentals in mind. All tests should be made with the hood closed and latched and the doors closed.

Generator Interference

Generator noise is caused by sparking at the generator brushes. It shows up as a high-pitched whine, the frequency of which varies with engine speed. Although not present at all on the broadcast band in the author's case, it was extremely strong on the 10-meter band. Both paper and mica by-pass condensers were tried from generator output terminal to ground with no noticeable improvement. No condenser should be attached to the generator field-coil terminal on voltage-regulated models since it would cause the voltage-regulator points to burn. An r.f. choke in series with the generator output lead was then tried, also without results. A choke used here has to be wound with wire heavy enough to handle the total generator output. Usually a few turns of No. 10 wire, loose-wound, will offer enough impedance to r.f. to kill the generator noise. In the author's case, however, it was necessary to build a 10-meter parallel trap circuit consisting of about 8 turns of No. 10 wire space-wound in a coil about one inch in diameter and shunted by a compression-type mica trimming condenser of about 30 μμfd. The trap was connected in series with the generator output lead and tuned to the middle of the 10-meter band. It was mounted on a



piece of bakelite which was attached to the generator by a bracket. It effectively removed all trace of generator noise. It was roughly tuned before installation by connecting it in series with the antenna lead of a communications receiver set at the middle of the 10-meter band and tuning the trap condenser for minimum noise in the receiver. It was found necessary to touch up the trimmer after installation since tuning is fairly critical.

Front-Wheel Static

This shows up as a steady "pop pop" in the receiver at speeds over about 15 miles per hour on

smooth streets. It is usually not noticeable on dirt, gravel or wet roads. It is caused by the grease in the front-wheel bearings insulating the wheels from the car. Static picked up by the wheels then discharges to the car frame by jumping through the grease. The remedy is a static collector which fits inside the dust cap and bears on the end of the front axle, effectively grounding the wheel at all times. The one sold by the car dealer should be used rather than the universal type because clearances between the dust cap and the axle vary and the universal type does not always fit well. Obviously one should be installed on each front wheel. If the cotter key on the axle is in the way, the prong which is bent over the end of the axle may be cut off. These static collectors usually wear out in about 10,000 miles and therefore should be checked frequently. They are designed to operate without lubrication and the end of the axle and the dust cap should be cleaned of grease before the installation is made.

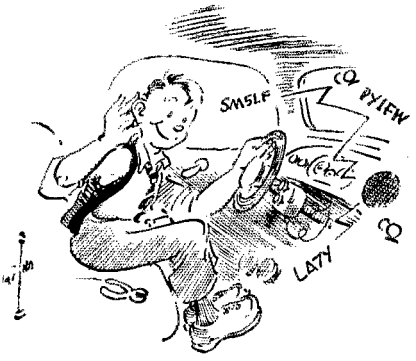
Rear-Wheel Static

The same remarks apply here as in the case of front-wheel static except that the static collector is designed with a brush that bears on the inside of the brake drum. It will be necessary to purchase these from the car dealer since there is no universal type of rear wheels. The dealer may not have them in stock and may never have heard of them, in which case it will be necessary to order them from a zone warehouse or the factory.

Tire Static

This is one of the things that almost caused the author to give up. There seemed to be no cure. It is caused by the static charge generated on the tires themselves by their continual flexing on the road. Apparently friction between the inner tube and the tire casing has something to do with it, although this is pure conjecture on the author's part. It is more noticeable on smooth, dry roads. It sounds somewhat like interference from a leaky power line. Incidentally, it is often very troublesome on the broadcast band. Finally, a radio-installation mechanic at a garage mentioned "tire powder." Investigation disclosed that Chevrolet is furnishing with most of its new auto receivers Chevrolet part No. 986035. It consists of a large envelope containing five smaller envelopes each filled with about a teaspoonful of black powder having the appearance of graphite.

The instructions on the envelope say to let the air out of the inner tubes, introduce the powder from one envelope into each tube with an injector, Chevrolet part No. 986033, and then to inflate the tires to the proper pressure. Not having the injector, the author managed to get some of the powder into each tube through the valve stem (after removing the valve) by means of a small funnel and a piece of solder as a pusher. The method is long and tiresome as the powder wanted to go everywhere except into the valve stem. It isn't recommended if a better way can be devised. The injector is a little metal gadget, one end of which screws on the valve stem and the other end of which has a valve where the air hose is applied. It screws apart in the middle so that the powder may be deposited inside it to be blown into the inner tube. It should certainly be worth its price if one can be found. An inquiry to a zone warehouse brought a reply to "order through your dealer" (who never heard of it). Ingenious hams with a machine shop and a supply of mate-



rials should be able to make one in a couple of weeks. Anyway, the introduction of even the amount of powder the author was able to maneuver into his inner tubes completely removed all trace of tire static and restored his faith in mobile operation. Incidentally, the tires and tubes were all new Goodyears.

Voltage-Regulator Interference

This showed up on 10 meters only and consisted of a hash in the receiver. It was caused by the voltage-regulator points sparking as they operated to reduce the charging rate when the battery approached or reached full charge. They alternately open and close the ground connection on the generator field coil at a fast rate. The higher the battery voltage the less time the points are in contact and therefore the less current goes through the generator field-coil winding and the less output current delivered by the generator. The remedy for this interference consists of mounting on the dash a toggle switch which shorts these points when it is thrown to the closed position. This removes the interference and also acts to provide full generator output. This does no harm so long as there is sufficient load on the battery to prevent it being overcharged. Continuous overcharging of a battery will quickly ruin it because of heat generated in the plates which causes them to buckle. That is why a faulty voltage regulator is the cause of many battery failures. The switch should be in the open

(Continued on page 132)

Happenings of the Month

CONFERENCE NOTES

The League is establishing amateur headquarters at the Ambassador Hotel in Atlantic City for the duration of the world telecommunications conference. Our registered representatives will be President George W. Bailey, General Manager K. B. Warner, General Counsel Paul M. Segal, Senior Assistant Secretary A. L. Budlong and Technical Director George Grammer, with the probability that Communications Manager F. E. Handy and Assistant Secretary John Huntoon will be called in from time to time to assist.

The Radio Society of Great Britain is sending over its honorary president, S. K. Lewer, G6LJ, and its general secretary, John C. Clarricoats, G6CL. While we have heard of no other representatives of amateur societies, we have advance word of a surprising number of amateurs in government service on the delegations of various countries, so there will doubtless be some international hamfesting as well as amateur councils of war during the conference.

With minor exceptions the proposals of foreign nations have not yet been announced but planning for the three conferences continues on all fronts. We should have word for you next issue on the initial proposals. We shall plan also to give you monthly reports from Atlantic City during the conference — watch for them.

ANNUAL BOARD MEETING

The ARRL Board of Directors will hold its regular annual meeting in West Hartford on May 2nd. The directors wish to know the opinion of members on the various subjects that will be before them at this meeting. All the known topics were laid before you in an article at pp. 45–47 of April *QST*, and no new proposals have since been filed. If you have not yet done so, it is suggested that you read this article and write to your director — he will be glad to hear from you.

A.R.R.L. BOARD HOLDS SPECIAL MEETING

The Board of Directors of ARRL held a special meeting in West Hartford on March 14th solely for the purpose of examining, reviewing and perfecting the League plans for the protection of the amateur position at the coming world telecommunications conference. A full examination was made into the work that has been done in the past several years in the protection of amateur interests in the activities of the United States Government in preparing for this conference; special reports were received from the officials of ARRL on their work to date and their suggestions for the future; and the problems and hazards of the conference, and the best means of combating them, were studied at length. At the conclusion of its session the Board expressed its approval of the plans proposed by its officials, and its confidence in them, and instructed them to continue their best efforts. Earlier in the meeting, some new plans were considered and adopted by the Board but, after further study, were decided to be unsuited to the situation and were canceled. Considering that this meeting was held especially because of uneasiness over our conference outlook expressed by amateurs in some sections of the country, the Board desires the members to know that it has met specifically to make a thorough review of our situation, and that it is well satisfied that we have made the best possible preparation.

At the conclusion of this article will be found the formal minutes of the meeting with the exact texts of the motions introduced, in numbered paragraphs. At this meeting the proceedings were also taken down in shorthand for the information of directors, and the Board directed that the transcript of its proceedings be used as the basis for a more detailed account in *QST* than is the usual custom. The following report of the meeting is based upon that transcript. Where there is a reference in parentheses, such as (§5), the reader is referred to the correspondingly-numbered paragraph of the minutes themselves for the official text of the motion and the official record of the voting and action taken.

Mr. Davis of the Dakota Division moved that the Board adopt a more aggressive policy (§5), proposing the immediate establishment of a League office in Washington with a staff under a resident public relations director, to maintain constant contact with Government agencies and to be responsible only to the Board; the director of publicity to be chosen by the Board, after a solicitation of candidates by advertisement, at a salary of not over $25,000 a year, pursuant to the recommendations of a special committee. Mr. Richelieu of the Central Division seconded the motion, saying that the members of his division were alarmed and felt that ARRL has done a poor job in selling amateur radio, and that he has many communications urging a more aggressive policy. He said we have lost frequencies over three decades, while our numbers grow, and we cannot hope to preserve ourselves against commercial and other competition unless we take the proposed steps. He does not wish to replace present staff members but to add to our present forces. After a second reading, the motion was adopted by a roll-call vote, 9 votes to 7.

Mr. Richelieu moved that the Executive Committee be instructed to immediately retain additional legal counsel to represent our interests adequately (§6), he to be experienced

in international law as it relates to amateur operation. Mr. Davis seconded. Mr. Groves thought our present legal representation adequate, with Mr. Segal in Washington. Answering a query by Mr. Colvin, Mr. Richelieu said his motion contemplated supplementing our present counsel, retaining the latter in a consulting position. The roll being called, the motion was adopted, 12 votes to 4. Mr. Segal was recognized, and stated that it had been his wish for some time to resign and that he now did so retroactive to January 1st. He said the Board action in calling in unnamed additional counsel betrays ignorance of the relationship between client and attorney; when a lawyer requires special advice for a particular problem, he so informs the client; when a client is dissatisfied with his lawyer, he replaces him with other counsel; in borderline cases a client can ask his attorney whether or not he needs particular assistance. The motion adopted does none of these things and it would be fantastic for him to retain further association with ARRL. As his last official act he wishes to comment on the motion adopted to create a publicity office independent of the officers and the Headquarters policy. It will result in setting up a high-salaried lobbyist in Washington with the nebulous duty of enunciating Board policies. In his long experience with the policies of this Board they are kaleidoscopic, ill-considered, and based on lack of comprehension of directors' duties under Connecticut law. Newer directors particularly start out with no conception of the management of the League and to their amazement discover that the League is probably the most effective organization of its type in America, and that the failure has been that the directors have not adequately informed their membership of what is going on. He has no doubt that they can get a lobbyist, who will be calling on the wrong people and persons who have no connection with the effectuation of the League's policy. This lobbyist will not be working with the Headquarters organization, which has the only effective knowledge, but will be responsible only to a Board that meets once a year. Set up independent of the Headquarters experience, the Board will have great difficulty in directing such an office by mail, as it grows in power and ambition. There is a definitive League policy maintained by the outstanding men who are League officials but it is a career type of activity which the directors cannot hope to learn in its everyday details. He deplored the results upon the American amateur position of a blatant campaign pursuant to an aggressive attitude, pointing out that amateur radio is primarily an American institution, with most of the world aligned against the whole American radio position, something that will create a most involved situation in which it will be an amazing thing to see an independent lobbyist working at cross-purposes with the Headquarters officials. Mr. Acton, pointing out that he had voted opposed, deplored the haste of the new directors and called for more calm deliberation. Mr. Acton further observed that we have been through international meetings before, that we have not suffered in the preparations for this conference, and that the Board hasn't yet received latest reports from its officials on the situation. He felt that the tendency of the present actions was to destroy amateur radio, that the Board was discarding the accumulated experience of its officials, and urged that we retain the mechanism that has worked successfully for us in the past. Before going into these matters he thinks the Board should get some reports and learn what the situations are. Mr. Davis wanted to make it clear that there was no criticism of Mr. Segal's abilities but he thought that the world conference may require treaty action by our Government and believed that that required us to have additional specialist counsel with knowledge of international law. He therefore asked Mr. Segal to reconsider his resignation. Mr. J. M. Johnston proposed that the Board decline Mr. Segal's resignation (§7) and, Mr. Davis seconding, it was unanimously so voted. Mr. Segal said he appreciated the action because it sprang from motives of kindness and friendship but it was irrelevant to his relationship with the Board, and that as General Counsel he must be the one to decide whether or not additional counsel is needed. Mr. McCargar called attention to the existing grant of special powers to the President, armed with an authorization of $10,000, to take any necessary actions to protect amateur frequencies. He pointed out that this authorized the President at any time to hire additional counsel or lobbyists or do any other thing necessary to protect the amateur position, and he thought that adequately took care of the situation, so perhaps the Board would wish to reconsider its recent motion. Assistant Secretary Budlong was asked to comment on the effects of the two resolutions adopted by the Board. Mr. Budlong thought the one regarding additional counsel an amazing action that would not promote the confidence of any reputable lawyer in accepting a similar assignment. He was mainly concerned with the other motion because it affected the work he had expected to be doing for the League. Recounting his close familiarity with frequency work in Washington through his wartime duties, he saw no way of reconciling the necessary Washington activities of the League with the set-up that has been proposed and felt that it was adopted without knowledge of the problem. He does not see how it will permit him to do anything effective for the League now and if it stands as written he will feel it necessary to give his resignation to Mr. Warner. Mr. H. W. Johnston thought the Board would be wise to ask for reports from the President and Secretary on what has been done. Mr. Richelieu asked first to reply concerning additional counsel; he regrets that Mr. Segal interprets the motion as an affront; he has hundreds of communications asking for more aggressive action, and the motion's purpose is to implement and assist Mr. Segal, not to terminate his services. Mr. Davis, as the seconder of the motion on additional counsel, moved its reconsideration (§7), and that was unanimously voted. Without further discussion the proposal to engage additional counsel was then voted on again and this time was unanimously rejected. (Members should understand that this action satisfied Mr. Segal's objection, and that he remains the League's General Counsel.)

Mr. H. W. Johnston again requested that the Board hear the President and Secretary on League preparations for the conference. The Secretary, asked to speak first, expressed surprise that the Board should take these actions without first hearing an up-to-the-minute report, thereby giving the impression that we had no organization or past experience. He made a brief statement outlining the League's past history in world conferences, explaining the magnitude of such affairs and the extensive preparations that a government makes, reminding the Board that it has itself participated in planning the position for this conference over the last several years, the history of which work he reviewed. At that point the directors gave unanimous consent to suspend the stenographic record to permit a freer report. Thus speaking off the record, Mr. Warner stated that, contrary to recent rumors, the world conference is to be held at Atlantic City and the United States has made thoroughgoing preparations for the protection of its interests. This preparatory work has been going on for between three and four years, involving innumerable hearings and a series of meetings with many scores of people participating, a prodigious task of preparation. In this preparatory work, every service has experienced pressure on its frequencies. ARRL has participated throughout this work these several years and has succeeded in securing the adoption of a U. S. point of view that preserves all the amateur frequencies above 3500 kc. The U.S. Government still intends to occupy the 160-meter band, chiefly with loran, but has been induced to propose that the international allocation of 1800–2000 kc. include amateurs on a shared basis, to use any loran channels not so used in a particular area. Concerning adverse proposals by foreign countries, he said that they are inevitable and have confronted us at all previous conferences. They are to be expected at Atlantic City, with more pressure than at previous conferences. The U.S., up to the moment, is committed to defend us along with all its other radio interests, although the problem is complicated by the fact that there still exists some difference of opinion within our own country about the allocations for h.f. broadcasting. A Washington committee is still studying this matter. It is possible that there could still be a formal amendment of the pending U.S. proposals now transmitted to Bern, but so far no one has been able to devise an allocation plan that could take care of U.S. services and give the h.f. broadcasting agencies what they wish. Their plans include asking for 7200–7300 kc. but they have found no support for this proposal in any American quarter. The h.f. broadcasting

problem is very difficult and unquestionably will be a major one at Atlantic City. He then described the workings of an international conference. Sixty to eighty nations will send several hundreds of delegates who will open offices in hotels. Such a conference itself is held in a large building supplied by the host administration. Extensive facilities are set up, in many office rooms, including translating and interpreting and mimeographing bureaus, facilities for registration and for the distribution of documents throughout the conference, a large central meeting hall for the main meetings, and a considerable number of rooms for the committee meetings, which are expected to last for months. Although a conference of the delegations of nations, each country has the right to admit representatives of its recognized private agencies, who have the right to attend all meetings and to participate in the committee discussions at the request of their national government, although not with the right to vote. The formal sessions of the conference, generally participated in only by ranking delegates, serve chiefly to set up committees, assign them fields of work, and review their findings. The committees themselves meet chiefly on only such a basis, dividing their problems and assigning them to subcommittees. The first process is one of further and further division into smaller and smaller subcommittees, negotiating and coming to agreements on different phases of the work. The second phase is the reverse process of recombining, the lower subcommittees reporting back to their parents, and the work gradually progressing back up the ladder. From our standpoint, therefore, this work does not take the form of having individual amateur matters placed before the entire conference, but is one of participation in the work of many subcommittees, assisting the assigned members of the U.S. delegation. The preparatory work of the U.S. has been accomplished by the most highly skilled persons in the Government service, with the aid of experts from industry and private agencies. The ARRL representatives who have participated in this work are personally acquainted with all of the people in the U.S. picture and have been closely associated with them for many years. The U.S. preparatory work is now accomplished, and probably other nations have completed theirs also. Mr. Warner said that the U.S. is now about to name its delegation. It will probably send a staff of about forty people, including translation and stenographic and mimeographing facilities, and will open headquarters offices. He said that although no one had been officially named to the delegation yet, it was expected that it would include a number of persons whom he named and who were well known to be informed on the amateur position and friendly to our interests. The delegates and their technical advisers will comprise a group of a score or more of the best minds in American radio. It is expected that they will be divided into working teams or "task forces", each group handling problems with which it is especially familiar and having annexed to it the recognized non-Government representatives of private enterprise. He described the working organization of the American group, saying that its teams would duplicate the set-up of the conference, that all the Americans present would be committed to the support of a common point of view, and describing the daily meetings of the American group through the conference to receive progress reports and plan for the attainment of U.S. objectives. The ARRL expects to participate in this daily work of the U.S. delegation, which he considers the most important part of the conference. To achieve success in its efforts, he said, any private group must have representatives acceptable to and well known to the members of the U.S. delegation. Although our starting position as the conference opens is satisfactory, it will run the course of many difficulties, with numerous opposing ideas from foreign countries. Since the U.S. cannot dictate to other countries but can only negotiate with them, there is always the danger of compromises. The U.S. need to be a party to the world treaty is so great that it is not profitable to think of this country refusing to ratify the treaty. Moreover, reservations at the time of ratification are not feasible to contemplate, since they are simply proposals for amendments, unless they have been agreed to by the other countries. It is to be hoped that a treaty can be negotiated that fully preserves amateur allocations. If foreign countries will not agree, the U.S. must be induced to make reservations on behalf of amateurs at the time it signs the agreement, and as part of the signed papers of the conference, so that this U.S. position is accepted by all of the other signatories. He considers, then, that the most important ARRL work is in attending the conference and participating in the daily work of the U.S., helping it to maintain a firm attitude on amateur matters, assisting it in the accomplishment of a proper allocation, and persuading it if necessary to make reservations in such respects before signing. Concerning the expected hazards, he said that in all probability Europe would wish to reduce our 80-meter band and that its higher end would probably also be under pressure from tropical broadcasting, but that these heretofore have been regarded as regional frequencies, and that it should be possible to effectuate a continuance of the arrangement whereunder this is exclusively an amateur band in this country. He said that there probably would be proposals to lop off 100 or 150 kc. of our 7-Mc. band for broadcasting and that, although the U.S. proposes that this be exclusively an amateur band all around the world, it might be impossible to prevent the Europeans from taking it for broadcasting, as it is in many European countries today, but that in such an event it ought to be possible to arrange for the United States to reserve the whole band for amateurs in this country. U.S. h.f. broadcasting interests are hopeful that the U.S. will yield to foreign pressure in this respect, but he did not think they would. He pointed out that the executive branch of the Government has sole authority to negotiate treaties and international arrangements and that the Congress can be of no assistance to amateurs at this point. Although we have a good chance of success, the conference is definitely a hazard, but he said that he and his associates knew no more effective way of attaining our desires than the contemplated arrangement followed by all American interests, whereunder the League would send acceptable and experienced representatives to the conference to participate in the daily work, particularly that of the U.S. delegation. In consultation with the President, he said, he had contemplated the enrollment of President Bailey as the representative of IARU and the representation of ARRL by Mr. Budlong, Mr. Segal, Mr. Grammer and himself. He contemplated at least two representatives in constant attendance, some of the work rotating as particular skills were needed, and Mr. Segal attending as special problems arose. Although Mr. Bailey could not be expected to be in daily attendance, he could attend when needed. He reminded the Board that an arrangement already existed whereunder the President had a grant from the Board both of considerable finances and of complete authority as a Committee of One to take any extraordinary steps necessary in the preservation of amateur rights, and said that it had been his belief that this was an arrangement of immense usefulness in the event of difficulties at the conference. In the event of the U.S. persisting in signing a treaty that cut amateur bands in this country, then we would be in the position of being abandoned by our own Government as a matter of policy. In that case he was sure the President would call an immediate meeting of the Board, and in such a contingency he would favor any and all emergency measures that could be devised. In the meanwhile it had been his thought that representation by the persons named, who had both the necessary experience and the acceptance, in both Government and industry circles, offered us our best probability of success at the conference. He considered that the decision to establish a public relations director was so contrary to the established American practice in the preparation for and the pursuit of an international conference that it would undo our many years of work and be quite destructive to our interests, a major reason among others being that, to his knowledge, the ideas of such a "lobbyist" is extremely distasteful to the type of persons who will comprise the American delegation. In conclusion he said that, in view of his opinion of what would happen to our interests because of the Board's decision to set up a Washington lobbying office, he must ask to be relieved of any participation in or responsibility for our representations at Atlantic City.

The Vice-President taking the chair, President Bailey

told the Board of his numerous wartime activities in Washington, where he was also known as representative of and spokesman for the amateur and where he had unusual opportunity to become well acquainted with many important officials. Off the record, Mr. Bailey stated that the people with whom we deal in Washington are well aware that he is the unpaid and honorary president of the League, an arrangement which in some instances gains him special entree to people important in the conference work. He praised the work of Messrs. Warner and Budlong in Washington, saying it was well known and appreciated there, and that there was no conflict with his own representations. He is not concerned with technical details but with personal contacts. He detailed some of the assurances of amateur support which he has received from Government officials in whom he has entire confidence, and also reported a recent public pledge by the new communications head of the United Nations that they would not touch any amateur frequency. He thought that the Board action to set up a high-power "public relations' man in Washington would damage the work of the League and accomplish harm, not good, particularly considering that Congress has no part in the coming conference. For instance, if a Congressman were to get in touch with the top officer of a military radio agency and ask him for "the preservation of the amateur frequencies", it would hurt us. The military officer would wonder whether our President doesn't believe what he is told about their support of the amateur. The decision to employ a hired man does not affect him personally, but in reality he is the Board's "public relations" man, and he believes the Board will find it difficult to visualize a paid promoter succeeding in doing for us in Washington things of the nature he had recited. Washington is full of people demanding "rights" from Congressmen, and such devices get absolutely nowhere. Our past relations in Washington have gained us the complete confidence of the responsible radio officials, while no paid lobbyist would ever be permitted such freedom of participation. Our present position has been thoroughly outlined; what more is there we can do? He knew of nothing additional which was desirable at this time, bearing in mind the special grant of authority to him and the availability of the brilliant mind of our General Counsel if conference developments are such that reservations in our behalf appear necessary. He therefore believed that our present arrangement is ideal and that it should be continued. Whereupon Mr. Bailey resumed the chair.

Mr. Jepsen stated that it was felt in his division that every effort should be made to secure additional representation in Washington, regardless of cost, but now that the Board has heard from the League officials and it has become clear that progress has already been made in preserving our frequencies, he moved that the motion to set up a Washington office be reconsidered (§8). Mr. Caveness seconded and, without discussion, it was so voted, with Messrs. Davis and Richelieu asking that it be reported that they were opposed to the reconsideration. Another vote was therefore taken on the motion to set up a Washington office (§8), and the roll call showed it to fail of adoption, two votes to thirteen.

After the lunchtime recess Mr. Davis spoke on publicity, saying he did not believe our relations with the general public have been good, and moving (§10) that every opportunity and means be used to further amateur interests by obtaining favorable publicity with the general public, and also that we always strive to improve our contacts and relationships at Washington. Mr. J. M. Johnston thought the publicity idea good but inquired specifically what plans were in mind. Mr. H. W. Johnston thought that the needs would be met by the proper kind of press releases to the newspapers. Whereupon the motion was unanimously adopted.

The directors having asked Mr. Budlong to speak off the record on some of the problems involved in the allocation studies, he stated he was prepared to give a complete history of the development of the U.S. proposals, if that were desired, but would first speak on some of the broader considerations involved in these proposals. He stated he assumed we were all interested in protecting our interests to the utmost, taking advantage of any course of action that would improve our position, satisfying ourselves that the best that could be done was being done, and then wholeheartedly backing those arrangements. He referred to his four years in the military service and the opportunity this had given him to see the problems from the Government side. The problem of setting up a frequency allocation table is not easy, and is becoming increasingly difficult as needs increase but the size of the spectrum does not. He stated he had found the people in Washington who had this problem under their control to be sincere, hard-working, honest and coöperative, faced with the difficult problem of somehow fitting all the services into a narrowing spectrum, and relying to a great extent on industry advice; but that since compromises are inevitable, the results are not always to everyone's liking. So far as concerns the existing U.S. proposals, he pointed out that whereas amateurs retain substantially all their existing privileges or their equivalent, other services have suffered losses as against Cairo, the principal service so affected being the fixed service. The losses to this service in the current U.S. proposals were sufficiently drastic that the fixed service has been told that unless it goes in for such advanced techniques as multiplex and multichannel operation, higher stability and use of relay points and such operating practices as forked, shared, and duplicated frequencies, the space allocated will be inadequate for the service. Even as concerns the maritime service the bands being made available under the U.S. proposals presuppose an extremely high degree of planned use if the service is to operate at all, involving compulsory crystal control on shipboard, arbitrary assignment of crystals to space stations evenly throughout the bands, revised calling procedures, etc. In this connection he mentioned an address just the previous week by Commodore Webster, to members of the National Federation of American Shipping, in which Commodore Webster had informed shipping that "communications conducted in the prewar manner will not longer be possible in the postwar world", and that the proposed highly-organized system of operations, involving a complete renovation of prewar marine communications, is the only alternative to communications chaos in the limited amount of frequency space that will be available to the marine services. Mr. Budlong mentioned that aviation is being told it must adopt v.h.f. for its domestic air-ground communications, so that the limited long-distance channels provided for aviation will be available primarily for overseas routes, and that ship-shore telephone service is already being faced with the necessity for planning to adopt such techniques as single-sideband operation if it is to operate successfully on its frequency assignments. He pointed out these things to show just how critical allocations problems are becoming. He cited further the existence of a policy which discourages the use of radio for domestic communications where wire lines exist or can be made to serve, solely to conserve frequencies, and cited in this connection the closing down of domestic point-to-point circuits by the Coast Guard, Navy and Army, even in wartime, except for some emergency and other special uses. With respect to the future, he referred to the inevitable close scrutiny that all services will be given to an increasing extent in the future, so that their actual minimum needs may be established in the minds of Government people having the responsibility of fitting all the users of radio into the spectrum, and in this connection called attention to a provision appearing in the allocation table when the existing regulations for frequencies above 25 Mc. were issued by the FCC in 1945, to the effect that "All non-Government services will be established in the bands above 450 Mc. on an experimental basis pending adequate showing as to need and technical requirements", and stated that this still was in effect. Summarizing, he thought that amateurs will more and more be called on, as are other services, to show proof of use and need, as well as orderly and intelligent use of facilities, if amateur assignments are to be justified, and he suggested that officers, directors and members should give thought to this aspect of our future. Subsequently, Mr. Budlong replied to questions from directors on his views as to where pressure on our bands was indicated at the forthcoming conference, the future of loran and prospects of return of the 160-meter band in whole or in part to amateurs, and the development of and reason for the situation resulting in loss of 300 kc. from the

high end of the 28-Mc. band under U.S. proposals. Canadian General Manager Reid then told the Board about the preparations that Canada had made for the world conference and of his own participation in them as a representative of the amateur, including his work in the Canadian Radio Technical Planning Board, of which the Canadian section of the League is one of the contributing sponsors. He said that Canada supported amateurs as strongly as did the U.S. and reported that the Canadian proposals in general would be the same as those of the U.S. but would include the entire band 28 to 30 Mc.

The Board having completed its inquiry, Mr. Ladley of the Pacific Division introduced a resolution (§12) which stated that the Board had heard detailed reports and examined into the policies, plans and procedures of its responsible officials, and that it approved the plans and had confidence in those officials, and that it directed the latter to persist, as heretofore, in their efforts on behalf of amateur radio. This resolution was unanimously adopted, and the President thanked the Board for it because it showed that the Board was behind the officers and the headquarters staff and gave the united front which is necessary for the preservation of our frequencies. The meeting then adjourned.

The Board is to have its regular annual meeting in West Hartford on May 2nd, for the usual consideration of all other League business and for any further necessary actions concerning the world-conference situation. Here are the official minutes of the special meeting just held:

MINUTES OF A SPECIAL MEETING OF THE BOARD OF DIRECTORS OF THE AMERICAN RADIO RELAY LEAGUE

March 14, 1947

1) Pursuant to the call of the President, the Board of Directors of the American Radio Relay League, Inc., met in special session at the Hartford Golf Club, West Hartford, Conn., on March 14, 1947. The meeting was called to order at 9:07 A.M., EST, with President George W. Bailey in the Chair and the following other directors present:

J. Lincoln McCargar, Vice-President
Alexander Reid, Canadian General Manager
George S. Acton, Delta Division
Harold C. Bird, Great Lakes Division
Hugh L. Caveness, Roanoke Division
C. A. Colvin, Midwest Division
Tom E. Davis, Dakota Division
Wayland M. Groves, West Gulf Division
Hans R. Jepsen, Southwestern Division
H. W. Johnston, Northwestern Division
J. M. Johnston, Hudson Division
William A. Ladley, Pacific Division
Franklin K. Matejka, Rocky Mountain Division
Percy C. Noble, New England Division
Edward G. Raser, Atlantic Division
Clyde C. Richelieu, Central Division

Absent: William C. Shelton, Southeastern Division. There were also present Assistant Secretary Arthur L. Budlong, Technical Director George Grammer, Communications Manager Francis E. Handy, Treasurer David H. Houghton, Assistant Secretary John Huntoon, General Counsel Paul M. Segal and Secretary & General Manager K. B. Warner.

2) The meeting was welcomed and briefly addressed by the Chair, in explanation of the purposes of this special session. On motion of Mr. Davis, unanimously VOTED that the regular order of business is suspended.

3) On motion of Mr. McCargar, unanimously VOTED that there is hereby appropriated from the surplus of the League, as of this date, the sum of four thousand dollars ($4,000.00), for the purpose of defraying the expenses of holding this meeting of the Board of Directors, any unexpended remainder of same to be restored to surplus.

4) On motion of Mr. Matejka, VOTED, 10 votes in favor to 5 opposed, that the entire record of the proceedings of this meeting, whether as an assembly or a Committee of the Whole, shall be taken in shorthand and transcribed, a copy of which transcription shall be sent to each member of this Board and made the basis of a full and complete record for publication in *QST*. After discussion, the Board was in recess from 9:22 to 9:31 A.M. and from 9:37 to 10:05 A.M., while the services of a stenographic recorder were procured.

5) Moved, by Mr. Davis, that the Board of Directors of the American Radio Relay League adopt a policy of more aggressive, progressive, and forthright action in representing the American radio amateur; and to that end we propose: (a) The immediate opening and establishment of a permanent ARRL office at Washington, D.C., properly staffed and under the direction of a paid, full-time, resident Public Relations Director whose duties shall be the promotion of the best publicity possible for and in the interest of the American radio amateur; which duties shall include the constant contact with Governmental agencies and other persons in authority in the promotion of the general welfare of the radio amateur. Said Director in the execution of his duties shall carry out the enunciated policies of the Board of Directors and be responsible directly, and only, to said Board. (b) That said Director of Publicity be chosen by the Board as soon as possible and that said choice and approval be made upon the basis of a Board vote, upon and after the review of submitted qualifications of such applicants for said position; which vote shall be taken by mail after submission to each Director of all information concerning the qualifications, capabilities, and references of such recommended applicants as shall be specified by the hereinafter named committee. (c) That immediate publicity be given through national news services and by other means looking toward the gaining of applications for said position. The said position shall pay a salary of not more than $25,000 per annum and the applicants for this position shall be personally interviewed by a committee of this Board appointed by the Chairman and comprised of not more than five members who shall thereafter make due and proper recommendations to the Board as a whole. After discussion, the yeas and nays being ordered, the said question was decided in the affirmative: Whole number of votes cast, 16; necessary for adoption, 9; yeas, 9; nays, 7. Those who voted in the affirmative are Messrs. Bird, Davis, Jepsen, H. W. Johnston, Matejka, Noble, Raser, Reid and Richelieu. Those who voted opposed are Messrs. Acton, Caveness, Colvin, Groves, J. M. Johnston, Ladley and McCargar. The President abstained as required. So the proposal was adopted.

6) Moved, by Mr. Richelieu, that the Board of Directors instruct the Executive Committee to take immediate steps to employ and retain such additional legal counsel as may be necessary to adequately represent and enbance the interests of the American radio amateur. Said counsel shall have not only the usual qualifications of an attorney but shall be experienced and well versed in questions of international law as the same pertains to amateur radio communications. The yeas and nays being ordered, the said question was decided in the affirmative: Whole number of votes cast, 16; necessary for adoption, 9; yeas, 12; nays, 4. Those who voted in the affirmative are Messrs. Bird, Caveness, Davis, Jepsen, H. W. Johnston, J. M. Johnston, Ladley, Matejka, Noble, Raser, Reid and Richelieu. Those who voted opposed are Messrs. Acton, Colvin, Groves and McCargar. The President abstained as required. So the motion was adopted.

7) Mr. Segal was recognized and made a statement resigning as General Counsel, retroactive to January 1, 1947. After discussion, on motion of Mr. J. M. Johnston, unanimously VOTED that the Board most emphatically declines to accept Mr. Segal's resignation. Mr. Segal declined to withdraw his resignation in view of the adoption of Mr. Richelieu's motion. After further discussion, at the request of the Board, Mr. Budlong spoke on the pending arrangements for the Atlantic City conference and stated that, in view of the motions previously adopted by the Board, he would give to the Secretary his resignation as Assistant Secretary. After further discussion, on motion of Mr. Davis, unanimously VOTED that the Board will now reconsider its action in adopting Mr. Richelieu's motion about additional legal counsel. Upon reconsideration, the said motion was unanimously rejected.

8) At the proposal of Mr. H. W. Johnston, the Board decided to ask for reports from President Bailey and Secretary Warner on the status of the League's preparations for the Atlantic City conference. The Board was in recess from 11:00 to 11:12 A.M. Mr. Warner made a brief report of the

League's work in this respect. Thereupon, unanimous consent being given to suspend the record, he gave the Board a detailed report lasting an hour on the conference plans and preparations and outlook. He concluded his remarks by asking, in view of the adoption of Mr. Davis' motion, to be relieved of responsibilities in connection with the representation of the League at the Atlantic City conference. Vice-President McCargar assuming the chair, Mr. Bailey gave a report on his representations on behalf of the League and on the preparations for the conference. (Applause.) Mr. Bailey thereupon resumed the Chair. On motion of Mr. Jepsen, VOTED that the motion made by Mr. Davis and adopted by the Board, in effect to set up and immediately staff a Washington office, will now be reconsidered; Messrs Davis and Richelieu requesting to be recorded as voting opposed. Upon reconsideration of Mr. Davis' motion, the yeas and nays being ordered, the same was decided in the negative: Whole number of votes cast, 15; necessary for adoption, 9; yeas, 2; nays, 13. Those who voted in the affirmative are Messrs. Davis and Richelieu. Those who voted opposed are Messrs. Acton, Caveness, Colvin, Groves, Jepsen, H. W. Johnston, J. M. Johnston, Ladley, Matejka, Noble, Raser, Reid and McCargar. Mr. Bird abstained, and the President abstained as required. So the motion was rejected.

9) The Board was in recess for luncheon from 1:12 to 2:17 P.M.

10) On motion of Mr. Davis, after discussion, unanimously VOTED that it is the consensus of this Board that every available means and opportunity be used by the League's headquarters staff and the officers of this League in furthering and promoting the very best interests of the amateur operator by employing such means as is possible in gaining favorable publicity with the general public for the radio amateur; and, secondly, that we do not relax but ever strive to improve our contacts and relationships at Washington.

11) Unanimous consent to suspend the record being given, Mr. Budlong, at the request of the Board, reported on his recent representation of the League in conference preparations and on some of the problems that will confront the conference. General discussion followed. Mr. Reid gave the Board a report on his representation of Canadian amateurs in the conference preparations of the Canadian Government and on the satisfactory amateur proposals being put forth by that country.

12) The examination of the amateur position thus being concluded, on motion of Mr. Ladley the following resolution was unanimously ADOPTED:

> Whereas this meeting has been especially called for the purpose of canvassing amateur radio's status and expectations as regards the forthcoming international telecommunications meeting, and
>
> Whereas, pursuant to this, the directors have heard detailed reports from the President, the General Manager and Mr. Budlong and now have detailed information as to the policies, procedures and plans of the responsible officials and employees of the League,
>
> Be it RESOLVED: that the Board expresses its confidence in those officials, and its approval of those plans, and
>
> Be it further RESOLVED: that the Board instructs them to persist, as heretofore, in their efforts on behalf of amateur radio.

13) On motion of Mr. Caveness, the Board adjourned, *sine die*, at 3:38 P.M.

Secretary

COMMISSION REASSURES AMATEURS REGARDING FREQUENCIES

Under the above title, FCC on March 20th issued a news release to the press, responsive to numerous letters received from worried amateurs. The release is self-explanatory. We quote it in full:

The Commission is receiving many letters prompted by speculation about possible action of the International Telecommunications Conference, which will open at Atlantic City in May, with respect to amateur frequency allocations.

This conference will consider frequency allocations as a whole in the light of world needs. The subject has been rendered complex and difficult by radio's postwar developments and applications. It is necessary more than ever before to have international agreement on the use of frequencies for all types of international and long-distance radio communication.

Under the Cairo Radio Regulations, Article 7, certain bands of frequencies were established for amateurs. The Commission has made essentially all of these amateur bands available for use in the United States. A comparison of the prewar and current allocations to the domestic Amateur Radio Service follows, together with a column showing the United States proposal of February 18, 1947 to the forthcoming conference covering frequencies between 10 kilocycles and 30,000 megacycles:

Prewar	*Today*	*Proposed*
1750–2050 kc		
3500–4000 kc	3500–4000 kc	3500–4000 kc
7000–7300 kc	7000–7300 kc	7000–7300 kc
14000–14400 kc	14000–14400 kc	14000–14400 kc
		21000–21500 kc
	27.185–27.455 Mc	27.160–27.480 Mc *
28–30 Mc	28–29.7 Mc	28–29.7 Mc
56–60 Mc	50–54 Mc	50–54 Mc
	144–148 Mc	144–148 Mc
	235–240 Mc	220–225 Mc
	420–430 Mc	420–450 Mc **
112–116 Mc	1215–1295 Mc	1215–1295 Mc
224–230 Mc	2300–2450 Mc	2300–2450 Mc
300 Mc and above	3300–3500 Mc	3300–3500 Mc
(400–401 Mc)	5650–5850 Mc	5650–5850 Mc
	10000–10500 Mc	10000–10500 Mc
	21000–22000 Mc	21000–22000 Mc
	30000 Mc and above	

* A band of 270 kilocycles to be available to the United States Amateur Radio Service

** This band to be shared with altimeters

Following the frequency allocations hearing of 1944–1945 the Commission recommended a revision of the entire table of frequency service allocations. The United States adopted the Commission's recommendations and transmitted to the Bureau of the International Telecommunications Union its proposal for the entire radio spectrum from 10 kilocycles to 30,000 megacycles. The United States recommendation was accompanied by an explanation of the need for adequate amateur facilities, a pertinent excerpt from which reads:

"The basic principles considered by the United States in the choice of frequency bands for the amateur service are: (1) Observance of the Cairo bands, insofar as possible; (2) Harmonic relationship, where feasible; (3) Adequate new bands in the VHF (very high frequency), UHF (ultra high frequency) and SHF (super high frequency) spectrum; (4) Exclusive bands. The Cairo band 1715–2000 kc now is required for the internationally recognized maritime and aeronautical navigational aid known as Loran . . . . and for other services. To compensate at least in part for the loss of this band, the United States is recommending a new band exclusively for amateurs in the high frequency harmonic series to start at 21000 kc. During the higher part of the sun-spot cycle, which now is approaching, it is expected that amateurs will find this band most useful, as it bridges the gap of frequencies lying between the bands at 14000 and 28000 kc."

At that time the United States proposal pointed out the tremendous public interest in the domestic amateur service, commenting: "Many of the developments and techniques now in common use are due to the inventiveness and ingenuity of the radio amateur . . . Since 1913, amateur radio has been the principal, and in many cases the only,

means of outside communication in more than 100 storm, flood and earthquake emergencies in the United States."

The number of amateur operators now approximates 75,000 as compared with about 60,000 before the war. There are some 50,000 amateur stations, this lesser number being due to the fact that some stations are operated by more than one person, especially in the case of families. About 1,500 applicants for amateur operator licenses are examined each month.

Amateur frequencies were, of necessity, "borrowed" for war use. They have been returned to the amateurs as rapidly as the military were able to relinquish them. In consequence, the self-styled "hams" have recovered nearly all their prewar frequencies, and many additional ones.

Being fully aware of the value of amateur operation, the Commission will continue, as in the past, to give sympathetic consideration to the problems which affect the welfare of that service. The United States has indicated its clear intention vigorously to advocate, support and defend adequate world-wide allocations for the Amateur Radio Service.

STAFF NOTES

The Headquarters staff recently observed three anniversaries in the *QST* Circulation Department. Treasurer & Circulation Manager David H. Houghton on April 10th completed 25 years of service to ARRL and has been the recipient of many congratulations. He was preceded a few days by the 20th anniversary of Senior Assistant Circulation Manager Ralph T. Beaudin, W1BAW, and the 10th anniversary of Assistant Circulation Manager Harold K. Isham, W1MFA. The triple-barreled event was celebrated at a staff dinner on April 10th, with President Bailey as our guest.

We are sorry to announce the loss from our staff of Everett L. Battey, W1UE, since 1929 the Assistant Communications Manager. Following service as a Lt. Commander in naval training work in the late war, Ev has gone to the Navy Department in Washington as a Civil Service career expert to deal with electronics-officer training. Joseph A. Moskey, W1JMY, becomes the new executive officer of our Communications Department. A new member of the CD staff is Edward E. Miner, W1ODY, now the man who checks your contest records.

CHIEF ENGINEER STERLING

George E. Sterling, W3DF, the senior assistant chief engineer of FCC, becomes its chief engineer on April 30th, succeeding George P. Adair, ex-W5AMT, who after 3 years as chief engineer has resigned to enter private engineering practice. Mr. Sterling entered the Government service as a radio inspector in 1923, was supervisor at Baltimore in 1935, and joined the FCC Engineering Department at Washington in 1937. Named chief of its National Defense Operations Section as war approached, he organized and operated its famous wartime Radio Intelligence Division, and since the war has been in charge of the Field & Research Branch. He began amateur radio in Portland, Me., in 1908 as one of Maine's first hams and has been continuously active, now operating both 'phone and c.w. on the usual bands. He is also well known as the author of *Sterling's Radio Manual.*

So George is still chief engineer. And both Georges have our best wishes!

W8WV DECORATED BY CHINA

Captain Hoyt S. Scott, USNR, W8WV of Cleveland, recently received the Army-Navy Air Distinguished Service Medal of China at a ceremony in Washington. The decoration was presented at the Chinese Embassy by V. K. Wellington Koo, Ambassador from China to the United States. Captain Scott was cited for his work in China as engineer in charge of Naval communications systems at Chunking. Six other Naval officers were decorated at the same time, including Fleet Admiral Chester W. Nimitz.

Captain Scott, a well known Ohio amateur, has been an illuminating engineer at the General Electric lamp department in Cleveland since 1934. He was called to active duty in Naval communications in 1941 and during the years of his service enjoyed the distinction of flying around the globe three times. His naval career has reflected credit upon the institution of amateur radio as well as upon himself.

♦

Fleet Admiral Nimitz, Chinese Ambassador Wellington Koo, and Captain Scott, W8WV.

Looking Over the Postwar Receivers

The Hallicrafters SX-42

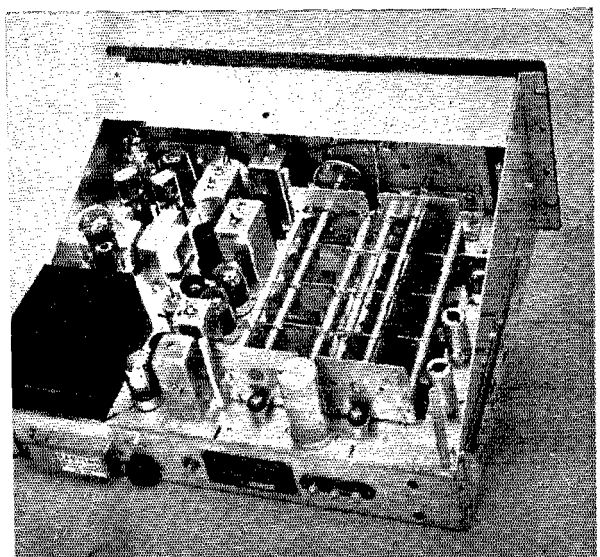
THE SX-42 has several valid claims to distinction. It is the first wholly-new postwar communications receiver to achieve anything like volume production, it covers a wider frequency range than has been available hitherto, and it is designed so that it serves admirably those amateurs who must combine home-entertainment and communication reception in a single unit.

By employing a dual i.f. channel, which is automatically switched from 455 kc. to 10.7 Mc. when the bandswitch for the r.f. section reaches the proper position, the SX-42 provides not only the customary coverage from 540 kc. to 30 Mc., but goes on without break, up to 110 Mc. Six degrees of i.f. selectivity (labeled "Broad I.F.," "Medium I.F.," "Sharp I.F.," "Crystal Broad," "Crystal Medium" and "Crystal Sharp") are provided on the 455-kc. range, which is used for all amateur bands through 30 Mc., and the broadcast band.

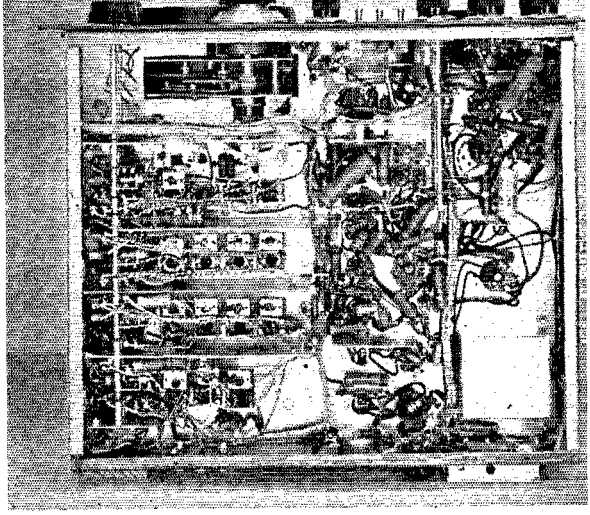
The bandwidth of the 10.7-Mc. i.f. is not variable, but a choice of a.m. or f.m. detection is available. The radio-frequency ranges are such that the 10- and 11-meter bands may be received on either i.f., but the 50-Mc. band can be received only on the high-frequency channel. The passband of the high i.f. is designed for high-fidelity f.m. broadcast reception, so that the last two bandswitch positions, covering from 27 to 110 Mc., are too broad to be of much value for amateur work. They do provide superb f.m. broadcast reception, however, and the continuous coverage of the whole frequency range up to 110 Mc. is of considerable help to the v.h.f. enthusiast who is interested in studying propagation effects. The ability to monitor the frequencies between 40 and 50 Mc. is particularly useful to the 50-Mc. DX aspirant.

The receiver employs 15 tubes, including the two in the power supply: two 6AG5s as r.f. amplifiers, a 7F8 dual triode as mixer and oscillator, a 6SK7 1st i.f., 6SG7 2nd i.f., two 7H7s as amplitude limiters, two 6H6s, one functioning as a discriminator and the other as a combined a.m. detector and noise silencer, a 7A4 as a combination b.f.o. and S-meter amplifier, a 6SL7 audio inverter, and a pair of 6V6s in push-pull in the audio output stage. A 5U4G rectifier is used in the power supply, and a VR-150 regulator tube stabilizes the plate voltage applied to the oscillator section of the 7F8 and to the b.f.o.

Since the SX-42 was designed for high-quality reception in the standard broadcast, short-wave and f.m. bands, in addition to its primary function as a communications receiver, its audio system is worthy of note. Its push-pull 6V6s are capable of delivering 8 watts of low-distortion audio (maximum harmonic distortion is 6 per cent) with a flat response from 50 to 15,000 cycles. A "tone control" is provided, and the instruction book gives a chart showing the frequency response in each position. On "low" there is an attenuation of 5 db. at 1000 cycles, increasing to 30 db. at 10,000 cycles. The "medium" position has a less steep slope, and there is a "bass-boost" setting, which provides a rise of 5 to 7 db. between 50 and 150 cycles on the otherwise flat response curve. A phonograph input jack is located at the back of the chassis, and one of the front-panel controls includes a "phono" position, so that the pick-up may be left connected permanently. The phonograph connection is made to the 6SL7 grid via the gain control, so that the receiver controls may be used to regulate the phonograph volume and tone quality. 'Speaker terminals, for 500 or 5000 ohms impedance, are encased in a small box, the cover of which is held in place by a stiff spring. This is a safety feature, to meet with Underwriters' approval, since the



Top-chassis view of the Hallicrafters SX-42, with r.f.-section cover removed. The miniature tubes at the right are the two 6AG5 r.f. stages and the 7F8 dual-triode mixer-oscillator. At the back of the chassis, left to right, are the encased 'speaker terminals, the battery-operation plug, S-meter adjustment and antenna terminals.



Bottom view of the SX-42, showing arrangement of the r.f. coils about the bandswitch. All coils are slug-tuned, and the ones for the two highest-frequency bands are mounted directly on the bandswitch terminals. Ceramic trimmers are used in critical circuits, and all adjustments are sealed in wax.

♦

'speaker terminals are "hot" for audio, but the spring cover is also something of a rattrap, if one attempts to use a 'speaker having anything but lug-type leads.

Circuit-wise, the SX-42 is replete with interesting features, such as the dual triode serving as combined mixer and oscillator; the two miniature-tube r.f. stages, one of which is omitted on the broadcast range; the two-channel i.f. amplifier, which switches automatically from 455 kc. to 10.7 Mc. for the two highest-frequency r.f. ranges; the three methods of detection, wherein the output of the 455-kc. i.f. channel is handled by a 6H6, the other half of which is the noise limiter, the 10.7-Mc. a.m. detection which is accomplished by the second limiter, and the f.m. detection handled by the limiter-discriminator combination; and the use of a 7A4 triode for the dual purposes of c.w. beat oscillator and S-meter amplifier.

There are a number of novel mechanical features also. The r.f. section employs "split-stator tuning," [1] and the method of changing from general coverage to bandspread tuning is new in concept. Three concentric knobs are employed, the outer one controlling the main condenser gang, the smaller knurled knob turning the bandspread gang, and the third serving as a lock for either of the other two. Other front-panel controls include the bandswitch, volume control with a.c. switch, crystal phasing, selectivity, tone control, phono-a.m.-f.m.-c.w. switch, c.w. pitch control, and r.f. gain. Automatic volume control, noise limiter, send-receive switch, 'phone jack and a carrier-level meter complete the front-panel detail.

Calibrated bandspread is available for the 80-, 40-, 20-, 10- and 6-meter amateur bands, and calibration of the entire tuning range available in the general-coverage position is given with good accuracy. Bandspread is not quite as generous as some of us have come to think necessary, but no trouble was experienced in actually tuning in signals, once we became accustomed to the difference in technique, as contrasted to the dial-spinning school. The cabinet is fitted with a cane-metal cover, which, when lifted, provides easy access to all the components above the chassis.

In keeping with the dual identity of the SX-42 as a home-broadcast and communications receiver, the instruction book is written in two parts. The first is a simple-English version of how to operate the receiver, written in language such that any nontechnical individual can learn to operate it correctly with a minimum of trouble. The second section of the book gives detailed technical operating instructions, and includes charts which give a graphic presentation of the operation of the crystal filter, noise limiter and tone control.

— *E.P.T.*

[1] "A New Tuning System for the Amateur Receiver," Halligan and Foote, May, 1946, *QST*.

Silent Keys

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

W1AXR, Fred E. Davis, Quincy, Mass.
W1IA, Dr. George H. Ryder, Quincy, Mass.
W1LTT, Walter A. Barry, Lawrence, Mass.
W1MTO, Edmund W. Ogden, jr., West Newton, Mass.
W1NCI, Lt. James L. Williams, AAF, Harvard, Mass.
W3RBI, Arch Foster, New Castle, Penna.
W4FQO, Robert L. Bode, Denton, N. C.
W5GPI, Noah H. Hazel, Marked Tree, Ark.
W6PSH, Mathew W. Funston, Oakland, Calif.

Basic Principles of Self-Synchronous Repeaters

How Synchros Work and How to Use Them

BY JOHN K. GOSSLAND,* W2BJK

THERE are almost as many different kinds of position repeaters as there are ingenious individuals to conceive them. Some of the better-known ones are d.c. systems using potentiometers, step-by-step systems, Magnesyns, and the one used so much during the war, the Selsyn or "synchro" system. Since this latter is the most flexible and the most widely used, and because so many of the units are showing up in surplus at reasonable prices, the purpose of this story is to acquaint the amateur with the working principles.

A synchro is simply a device for changing mechanical movements into electrical information and vice versa. This movement is usually the angular rotation of a shaft. A basic synchro system consists of two synchros: one, a generator or driver, the other, a motor or follower.

One of its commonest uses is to transmit information on the angular position of a radar antenna, either to give target position relative to ship or plane heading, or by introducing information from a gyrocompass, through a differential synchro, to indicate target position with respect to true north. But they can of course be used in any application where it is necessary to duplicate at a distance some given angular setting, and amateurs are using them for beam-position indicators and for some remote-tuning applications.

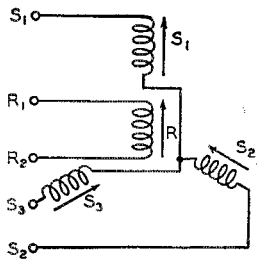


Fig. 1 — The basic synchro unit consists of a single rotor, *R*, and three equally-spaced stator windings. The arrows represent the voltage across the winding or the direction and magnitude of its magnetic field, when the rotor is excited by a.c.

Synchros, so named by the Navy, when made by G.E. are called Selsyns, when made by Bendix are called Autosyns, and are called Teletorques by Kollsman. They may be grouped into five types according to their use, as follows: (a) generator (transmitter); (b) motor (receiver); (c) control transformer; (d) differential generator; (e) differential motor. For amateur applications, a knowledge of the generator and motor operation is sufficient.

*8 Jones St., New York 14, N. Y.

Synchro Operation

A synchro motor or generator consists of a single rotor winding, as *R* in Fig. 1, and three stator windings spaced 120°, as S_1, S_2 and S_3 in the same diagram. If a.c. is applied to *R* through terminals R_1 and R_2, voltages will be induced in S_1, S_2 and S_3. If, for the purposes of illustration, the rotor winding *R* and the three stator windings all have the same number of turns, the voltage induced in S_1 will be equal to the voltage across *R*. However, since S_2 and S_3 are not so closely coupled — their axes are 120° off the axis of *R* — lower voltages will be induced in these other two stators. The arrows alongside the rotor and stators can be used to represent the voltage across the coils or the magnetic fields of the coils and, while it is known that the direction changes with each reversal of current, the relative amplitudes and directions remain constant for a fixed relative position of the rotor and stators.

To simplify the diagram, the arrows only are redrawn in Fig. 2 and separated into three rows labeled "rotor," "stators" and "resultant." Fig. 2-A is, of course, the same as Fig. 1, and shows the rotor in a position that will be called "0°". If the rotor is now rotated 30° clockwise, it is at right angles to S_2 and no voltage is induced in that stator, but voltages of equal magnitudes are induced in S_1 and S_3, as represented in Fig. 2-B under "stators" for 30°. As the rotor is moved another 30° (60° in Fig. 2-C) the voltage induced in S_1 is further reduced, a voltage is induced in S_2 but in the *opposite* relative direction, and the voltage induced in S_3 is increased. Diagrams for other steps of 30° are also shown in Fig. 2, and it can readily be seen how the induced voltages vary with rotation of the rotor.

Since it was agreed that the arrows represented voltage or magnetic field, it can be seen that the arrows of the three stators as shown under "stators" represent the individual magnetic fields of the stators. These three fields can of course be combined in one "resultant" field, and this is shown in the third row of Fig. 2 under "resultant." Note that in every case the resultant has the same direction as the arrow used to represent the rotor voltage or field.

If now a similar synchro motor is connected in parallel with the synchro just under consideration, as in Fig. 3, and the rotors are excited with a.c., a synchro *system* will result. If the rotor of the generator has a position of 0°, as in Fig. 3, the

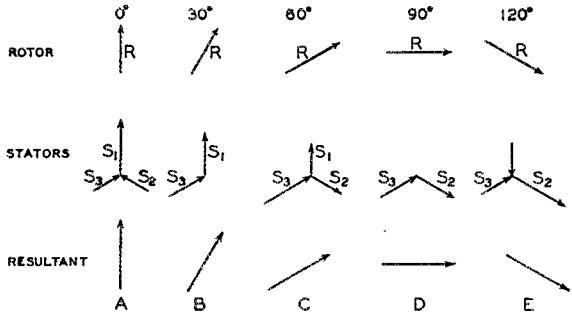


Fig. 2 — A representation of the changes in rotor and stator voltage or fields, with different positions of the rotor between 0° and 120°. The relations for the remainder of the revolution are not shown, but they can be easily derived from the above.

voltages generated in the *motor* stators *by the motor rotor* will be equal to those in the generator stators *if the motor rotor has the same position* (0°) *as that of the generator rotor.* However, if the generator rotor is moved, a different condition of voltages will appear at the generator stator terminals, and this different voltage condition will be transmitted to the stator terminals of the motor by the connecting wires. These voltages, combining with the generated voltages at the motor stators, combine to form a resultant field that exerts a torque on the motor rotor, and the motor rotor turns, if possible, until its field is aligned with the newly developed stator field of the motor. When it reaches this new point, there is no further torque on the motor rotor, but it is held in position because torque immediately develops if the motor rotor is displaced. It is thus apparent that maximum torque is developed in a synchro system when there is a considerable difference in setting between the generator and the motor rotors. Actually, however, the motor rotor is clamped securely in place by the stator field and there is no tendency for it to "wobble" about its proper setting.

It will be apparent from the preceding discussion that there is no difference between generator and motor action, and if the generator shaft is

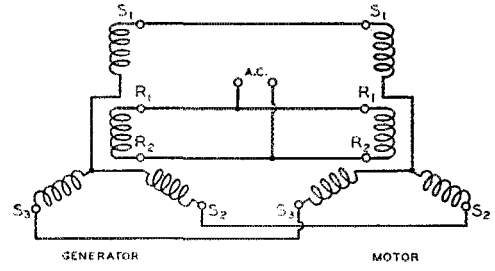


Fig. 3 — Connecting two synchros together as shown and exciting the rotors with a.c. results in a synchro system. The rotor in one Selsyn will automatically adjust itself to the position of the other rotor.

free to move, it will follow changes in the position of the motor rotor. However, the generator is usually tied rigidly to a heavy object like a radar antenna, and so it has no chance to run away, as a synchro motor would when it once got started. Thus the generator is essentially simple since, being tied directly to the driving mechanism, it cannot get out of line. However, the motor rotor is usually only used to drive a lightweight dial or pointer, and if the rotation is fast enough, as it can be in a 36-speed synchro, it can keep rotating, generating enough voltage within itself to burn itself up. Therefore the motor has a damping device, usually a flywheel, to act as a brake. Since accuracy is one of the important characteristics of a synchro system, the motor must be lubricated with a very fine grade of oil, and there must be no appreciable load on the rotor to create any error. The flywheel brake is usually constructed to take effect only during a change in speed. One way this is done is to mount the flywheel as shown in Fig. 4.

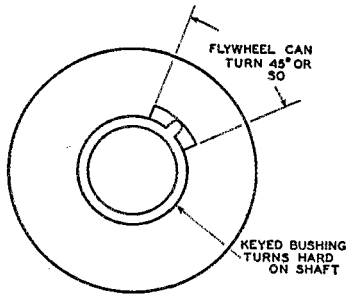


Fig. 4 — A type of brake used on synchro motors to prevent their "running away." The inertia of the flywheel resists sudden changes in shaft position but has little effect on slow ones.

General

If two synchros are connected as shown in Fig. 3, no trouble should be experienced. However, if the connections to S_2 and S_3 are reversed on *one* of the synchros, the generator and the motor will turn in opposite directions. This is a useful feature in any application where, for mechanical reasons, the synchros must turn in opposite directions.

Many of the synchros available in the surplus market were designed for 115-volt 400-cycle operation. However, they can be used satisfactorily on 60-cycle supplies if the voltage is reduced, generally down to about 45 or 50 volts. When 400-cycle units are being used with 60-cycle excitation, only sufficient voltage should be used to develop enough torque to move the indicator, and there should be no appreciable heating of the unit.

The 13th ARRL DX Contest— Some High C.W. Scores

ALTHOUGH very few logs are in at deadline time for this issue, there is enough information at the time of writing to indicate that the c.w. portion of the 13th ARRL International DX Contest, held on a weekend in February and one in March, was rough going but a big success. The bands took a dive on the Sunday of the first weekend, and conditions were mediocre most of the second one, but this didn't stop the real contest men from running up some amazing scores. A number of stations reported their biggest thrill of the contest a long-sought-for 7-Mc. WAC, while others were happy in adding a few rungs to the ladder toward DXCC. Universal complaint among the lower brackets was the usual "I need more antennas and more power," and the rock-bound crystal men found themselves completely lost without the flexibility of VFO.

Many a W went into the fray with the best of intentions to call DX a few kc. off his frequency, but finding it didn't pay off quickly joined the mob clustering on each foreign station. A few smart operators, like XU6GRL and CR9AG, used "LM" and other signals to indicate they were listening off their own frequencies and helped to keep their channels clear, but the hundreds of foreign stations whose frequencies were jammed had only themselves to blame. Finally, in self-protection, the Ws acquired a rhythm and made their calls short, in an effort to avoid jamming and repeats. But it was more evident than ever before that the solution to the QRM problem is for the foreign stations to indicate a listening frequency removed from their own if they want to save time and repeats.

The general impression seems to be that good sportsmanship was very noticeable during the contest, unlike everyday DX operating. Perhaps it can be attributed to the rapidity with which most foreign stations worked Ws and VEs, or it might mean that no one wished to jeopardize his chances for a contact. But there was more clean "standing-by" for the other fellow than has been apparent for many a moon, and it sounded good.

But enough of the chit-chat — let's look at the scores. The highest score reported at the time of writing was run up by Henry Bach, jr., W2GWE, who worked 10, 20, 40 and 80 for a total of 310 contacts in 92 different countries, for a score of 153,450! Contacts with VR5PL and OY3IGO were not claimed because the terrific QRM made it impossible to confirm QSO. The second highest scorer (to date) had an even greater number of different countries — 97 to be exact! Yes, Jerry Mathis, W3BES, perennial threat in any contest, worked 97 different countries for 147,000 points. To show how the top men bunch in one small area of the country, B. H. Stevenson, W2BXA, comes next with a total of 129,504 points. Fourth highest scorer is a familiar operator to DX contestants, W6SZY, who ran up 127,000 points. You don't recognize the call? That just happens to be Dave Evans, ex-W4DHZ, who was national high man back in 1936. Dave has been off the air a long time, but he doesn't seem to have lost the touch at all. He acquired an old Press Wireless transmitting site and now covers the land — and the world — with close to a dozen rhombics. Close on Dave's heels comes another old-timer, Brenton Carr, jr., W6HZT, with 112,000 points. The next high score, 108,500, comes from John Ransome, W2SAI, who will bear plenty of watching, since this is his first DX contest. John was off the air only three hours the first weekend, and one of those hours was spent repairing an antenna! The only other score above 0.1 meg comes from Jack McCullough, W6CHE, with 101,200. Jack shared his operating with Hank Brown, W6HB, making the score ineligible for an award.

In passing, the work of Bert Brown, W4FU, should be mentioned, since Bert worked 96 different countries in running up his total of 83,185.

Highest foreign score comes from CM2SW, with 172,950, followed by KP4AO, ex-K4DTH, with 147,000. It is known, however, that XE1A worked all W and VE districts on all five bands, with the single exception of W1 on 11 meters. Since CM2SW didn't use 11 meters, it is probable that he is topped by XE1A.

Some other high scores follow, but it must be remembered that these represent claimed scores only and, in many cases, only an approximation before cross-checking for duplicate contacts: W1ME, 75,000; W1AXA, 69,650; W1IAS, 69,500; W1TW, 50,000; W2PWP, 75,000; W2ALB, 53,200; W3HFD, 70,000; W3ENX, 67,000; W4BPD, 94,433; W4BRB, 74,650; W4KFC, 51,200; W5EGA, 72,200; W6LDJ, 90,000; W6HX, 86,000; W6CEM, 74,000; W6AM, 66,585; W6MLY, 52,000; W6SC, 50,000; W8BKP, 99,188; W8WZ, ex-W8OFN, 98,955; W8JIN, 98,208; W8HYC, 63,504; W8FGX, 53,180; W9AEH, 66,933; W9ERU, 66,640; VE4RO, 52,090. Foreign: XE1KE, 116,405 on 10 and 20 only; CE3AG, 91,125; VO6F, 68,510; KV4AA, ex-K4AAN, 56,230.

Next month some of the high 'phone scores will be given. — *B. G.*

How's DX?

CONDUCTED BY JOSEPH E. GRAHN, * WICH

How:

Sales of Listerine antiseptic, Sloan's liniment and Simmon's Beautyrest mattresses soared to new heights in late March; the DX Contests were over. But important business still faced our valiant though weary hand and throat artists. There was mainly the homework of computing scores, filling out QSL cards and bringing countries-worked lists up to date. All of which seems to account for the universal salutation of DX addicts during these post-Contest days, viz., "Howdja do?" To relieve some of the suspense, this issue of *QST* is carrying a last-minute compilation of early-reported "claimed" c.w. scores. You'll find the preliminary accounting on the facing page.

What:

Where frequencies are not given in this report, it is assumed or known that VFO is used. W2UFT, who was licensed on January 24th of this year, spent the next thirty days on 14 Mc., working 25 countries, among which were **CN8ED** (14,010), GM3RL (14,001), KL7AD (14,006), ON4GU (14,000), **EL3A** (14,025), **SM7PY** (14,001), **OZ2XA** (14,000), **I1SV** (14,035), F8TM (14,000), **YR5V** (14,033), **LA3B** (14,000), **VP4TR** (14,028), **OK1SV** (14,000), **ZS5BZ** (14,015), **HB9CX** (14,005), **LZ1XX** (14,025) and **VP8AD** (14,100). Don sez this may help to settle the argument as to which district works the best DX, W6 or W2. Oh yes, I neglected to state that W2UFT is just thirteen years old. Nice work, *OM* . . . . . From W6TI we learn that GW3ZV will QSL 100 per cent. Horace, in one 24-hour session, snagged ZL4AR, OK1ZB, OK1PN, D4APU, LA3Y, SM4UZ, ZM6AC, VS1AT, VS9AN, ZS5BK, ZS6IJ, VS7ES, G3XL and ZS1AN . . . . . W2TXB is up to 60 postwar countries, the latest of which are **LA7R** (14,100), **UB5FE** (14,060), **HA4RS** (14,025), **TF3A** (14,180), **CT2XA** (14,145) and **I1MQ/YL** (14,060) . . . . . W9AND sends in a nice list for several bands: on 20 they were ZS6DZ, W6VDG/KW6, W6WDN/KW6, D4AFR, OZ5SN, I6USA, ZC1AN, UA3AW, OZ1W, VQ3HJP, VE8MF, SM4WZ, OK1AW, ZS5BU, EI9N, VK6SA, VK6MO, CN8BL, and a flock of Europeans . . . . . W3EVW sneaked up to 99 postwar with **ZD1KR** (14,100), **EP1AZ** (14,120), **OH7NG** (14,090), **HA1KK** (14,100), **XABT** (Trieste) (14,150), **XU6GRL**, **W2OUB/C9**, **J3AAD**, **EK1AA**, **EK1AB**, **HE1CE**, **FG3FP**, **PK2AA**, **VP8AI**, **W8URU/C7** . . . . . WØNTA is licking his chops after partaking of **PK6HA** (14,070), **FF8WN** (14,035), **PZ1OY** (14,050), **J2AHI** (14,100), **CR9AN** (14,065), **EL5B** (14,070) and **XU1MCF** (ECO) . . . . . W7EYS kept busy with ZS1T, W6VRF/KG6, ZS4H, J2SJS, W6VIB/C7, J9CRP, J9AAB, J2ACS, G4MS, D4AQY, and W7KJK/MM near the Marcus Islands . . . . . The choice ones at W1AVJ include UA9CB, OAØKAA, VS7ES, C1DK, ZS6DW, GC4LI, LZ1XX and ZB1A . . . . . W1KFV is steadily plugging along, his latest being **CP1AP** (14,030), **J4AAK** (14,060), **CR9AG** (14,075), **SV1RX** (14,050), and **UA9CA** (14,120), for a total of 82 postwar . . . . . VK3UM comes through with a nice list, the best of which are **HZ1AB** (14,080), **I7AA/I6** (14,050), **W6VKV/I6** (14,100), **W6BWS/KG6** (14,175), **KP6AB** (14,125), **ST2AM** (14,020), **T1NS** (14,050), **TG9JK** (14,000), **UAØUA** (14,100), **VO2G** (14,000), **VQ2GW** (14,080), **VS1BO** (14,150), **G5KW/ZC1** (14,060), **ZD2G** (14,050), **UD6BM** (14,070), **VQ4KTH** (14,090), **VQ5JTW** (14,115), **VS4BJ** (14,110) and **VO6K** (14,075) . . . . . A letter from J2AHI informs us that J-land is a wonderful place for DX; an evening's work includes G5QA, PY2IM, VK2AX, VK3IW, W6RXW, J3AAD, W2GWE, W8HYC, W3GAU, WØNTA, W3KJJ, WØIVV and ZD6IJ, and goes on to say no attempt was made to work WAC — it comes so easy . . . . . W2ALO, who lives on the fourth floor of a 28-family apartment house, uses an antenna folded up along the molding in the

*53 Quinapoxet Lane, Worcester, Mass.

Dr. Stuart, W6GRL, Receives Chinese High Award

Dr. Charles E. Stuart, W6GRL, who is now temporarily signing XU6GRL at Nanking, China, a prominent radio amateur and wartime operator of the radio listening post of the Chinese Ministry of Information at Ventura, California, has been awarded the Special Collar of the Order of the Brilliant Star by the Chinese National Government.

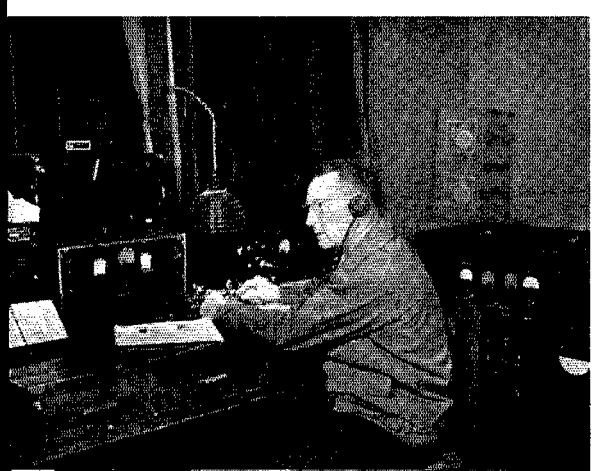
The presentation, made on March 21st by Dr. Peng Hsueh-Pei, Chinese minister of information, was for Doctor Stuart's "outstanding meritorious service to the Chinese people and government through the years of China's resistance to Japanese aggression." Said Dr. Hsueh-Pei, "The continued, selfless devotion of our American friend and his dear wife to the cause of peaceful national reconstruction in our country is indeed a challenge and inspiration to everyone of us." Among the many Chinese dignitaries attending the presentation banquet was Mr. K. T. Chu, president of the China Amateur Radio Relay League.

A dentist by profession, W6GRL entered radio in 1912. He is a DXer and contest high-scorer of fame. During the war Dr. and Mrs. Stuart received, transcribed and delivered to U. S. press associations millions of words of news and features from XGOY, the "Voice of China" station, located at Chungking, Chinese wartime capital. In the same period, 2500 radio rebroadcast programs, both live and recorded, were relayed to American radio networks and stations. Dr. Stuart is now directing the installation of a 10-kw. relay station at Nanking, and while thus occupied on the Asiatic mainland is operating his own station, XU6GRL, which is pictured below.

bedroom. The center portion is 12 feet long and the hanging ends are 9 feet long. It is fed with 52-ohm co-ax. With this "antenna" Jules grabbed ZC1AN, PK6HA, FF8WN, PK2AA, PK6EE, OH7NG, OE9AA, OY3IGO, UO5VW, I6USA, KP6AA, W7GXR/KG6, OQ5AV, YI2AM and W6WDN/KW6, for a total of 83 countries in the past four-and-one-half months . . . . On 'phone, W2MPA knocked off these meaty ones: J9LG, J9AAN, KA1SS, KA1AK, W6OQ/KG6, ZE1JX, VQ4ERR, PK1AW, XU6GRL, ZS4P and KP6-AA, bringing his postwar total to 109 . . . . W1AKY has worked 20 SM stations in their own lingo and suggests we issue him a certificate for "Most SM Hams Worked." Must it be printed in *Svenska*, Eddie? . . . .

The 3.5-Mc. band is conspicuous by an absence of reports, and only a few were received for 7 Mc., too. This can be attributed, no doubt, to the fact that the gang has been tuning up on the higher-frequency bands in preparation for the contest. W4BRB spent some time on 7 Mc. and managed to hook **ZK1AH** (7180), **W6BWS/KG6** (7020) and **J3AAD** (7160). J3AAD gave Gene his long-awaited 7-Mc. WAC . . . . W6MUR finds plenty on 7 Mc., some of the best being **LU9AX** (7150), **KV4AA** (7100), **FP8A** (7250), VS1AF, J2FOX, UAØKTU, J9AAQ, VO6F, W2CDJ/J2 CX1FB, KA1ZU and J3AAD . . . . W8KOS is very happy with **HC1PC** (7025), **KL7CG** (7046), **ZL3JT** (7045), **VK2ZX** (7048) and **HH2FE** (7046) . . . . In the contest, W9NUF's 807 raised EI9J, FP8A, G6ZO, HP4Q, KP6AB and G5GK, for a total of 23 . . . . Concentrating on Alaskan contacts is big sport to W7RT, who now has seventeen new ones to his credit along with plenty of other stuff.

28 Mc. seems to have attracted some of the old-timers with years of DX under their belts. W8BKP, for instance, tapped the little rubber knob to raise **W6VDG/KW6** (28,030), **SU1DM** (28,010), **ZK1AA** (28,030), **CR8AX** (28,005), **VQ3EDD** (28,290), **VQ3TOM** (28,250), **OH8NW** (28,360), **W7IMW/C7** (28,280), **YI2WM** (28,380), **VU2AF** (28,475); on 'phone: **VU2WP** (28,350), **PK1AW** (28,290), **ZC6FP** (28,460), **VP8LK** (28,-000) . . . . George sez his best WAC time on 28 Mc. is 1 hour and 32 minutes . . . . W3DPA chinned with HZ1AB, J9LG, J2GHQ, J3AMA, J9AAQ and HA4R . . . . W5ALA had the novel experience of working 24 Gs before QSOing any for the second time; G8DT turned the trick . . . . W5ASG works the most DX where the QRM is — he says — and proves it with a list showing, on c.w., W6VDG/-KW6, ZM6AC, PK6AX, PK4KS, PK2AA, W6MYR/Saipan, PK6VR and HZ1AB, and on 'phone, it's ZB1AD, XU6GRL, CN8EA, ZD4AB and W6ONP/KW6 . . . . W1JMT had the thrill of working his first Asian, a YI . . . . W7HXG/6, after spending much valuable time listening to long-winded CQs by both the DX and Ws, found time to swap sigs with GI2HLT, LX1AO, CR9AN, LA4P, FA8IH, GW3AKB, D5FF, FA8BG, XU6GRL, EI9J



♦

XU6GRL, Nanking, China

This Asiatic station is operated by Doc Stuart, W6GRL, who needs no introduction to the DX fold. The BC-610 rig at Doc's temporarily transplanted QTH usually feeds a reversible rhombic, 67 feet high and 350 feet to a leg, shooting at the States. A similar rhomboid, 36 feet high, beams at Europe. Other antennas on the XU6GRL "antenna farm," as Doc calls it, consist of 2 half-waves in phase aimed broadside directly east and west, for 10 and 20 meters The main receiver is an **HQ-120.**

11AY, ZS2Y, UA3DS, LU8AK, PZ1FM and NY4CM . . . . . Some of the new stuff at W2CYS is **VU2AF** (28,490), **VU2LR** (28,100), **UA1AA** (28,400), **KP6AC** (28,120), **ZC6FP** (28,350), **J2COM** (28,400), **YI2WM** (28,360), **YI7G** (28,125), **PK1AW** (28,100) and **LZ1XX** (28,490), the before-mentioned list being a mixture of 'phone and c.w. . . . . .

Where:

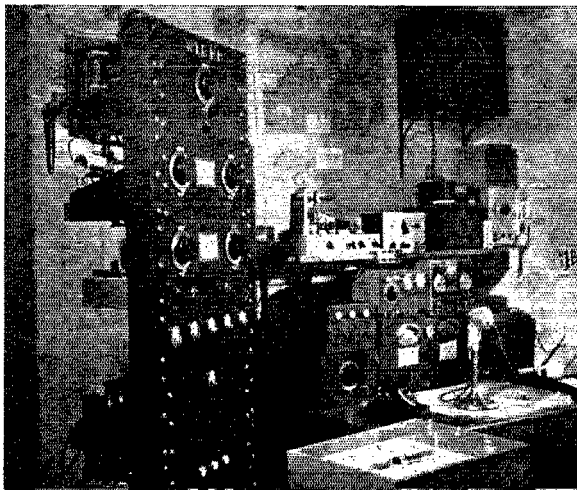
You'll save lots of time and stamps, gang, if before writing in and requesting the QTH of a DX station, you check this column in back issues of *QST* . . . . . We'll start off this month by donating the following: VS6AZ, Luk Yui Kwong, 224 Nathan Road, 1st Floor, Kawloon, Hongkong; VS4BJ, Cpl. E. J. Bailey, Sig. Det., RAF, Labuan Island, British North Borneo; LI2BO, C/o John Osborne, Talbot House, Cairo, Egypt . . . . . W8CVU sends along: VS7AP, Box 72, Colombo, Ceylon; PK1RX, C/o Radio PTT, Garoot, West Java . . . . . W6VOE contributes: KA1JI, 6 Domingo Street, Manila, P. I.; W6KE/KW6, C/o PAA, Wake Island; CR7VAL, ERE PO, Quelimane, Mozambique; CT2XA-CT2AB, APO 406, C/o Postmaster, N.Y.C.; W7GXR/KG6, Capt. Norman, APO 234, C/o Postmaster, S.F., Calif. . . . . From W3LPF we get: W2WM/C1, Post Box 2497, Shanghai, China . . . . . WØLAE hands us: VP9K, P. J. McConnachie, Cavello Bay, Somerset, Bermuda; PZ1OY, Box 679, Paramaribo, D. G. . . . . W6SN, the old reliable, helps out with: PK3TT, Niasstreet 126, Sourabaya, Java; HK1BZ, Pablo Paralta, Radio Laboratorian, Cartegena, Colombia; VU2PB, RAF Sig. Section, Port Blair, Andaman Islands; TG9LC, Aviateca Air Lines, Guatemala City, Guatemala . . . . . Via W3DPA comes the new address of VU2BG: G. A. W. Ballantine, Dongri Police Station, Bombay, India . . . . . Thanks to W3EVW, we have: ZD1KR, Norman Wadsworth, C/o Post Office, Freetown, Sierra Leone . . . . . Many requests have been received for the QTH of NY4CM, so here goes again: Lt. Cmdr. McCullough, Box 55, Guantanamo Bay, Cuba, Navy 115, C/o FPO, N. Y. C. . . . . We received a fine letter from OY3IGO, via W9JVI, who says he has never worked the U.S.A., but is on with 50 watts and still trying. *You* may be the first legit Faroes-U.S.A. contact,

GI6TK, F. A. Robb (left), and GI5TK, A. R. Irwin, are DX men of renown, having been worked by most of us through the years.

so keep this QTH in mind: OY3IGO, Ingvar G. Olsen, Faroe Islands . . . . . Cards for CN8ED should go to W4IJW, whose QTH is OK in any *Call Book* . . . . . From W3IYE we have the good word that EA7AV wants his full QTH given in the column, viz., Radio EA7AV, Commandante Portella, Ministerio Marina, Madrid, Spain . . . . . VK3UM sends: ZD2G, R. W. Stevens, Posts & Telegraphs, Lagos, Nigeria; and VS1BO, F/Lt. J. P. Wilson, Sig. Branch, Air Hq. RAF, Malaya . . . . . From W3JTE: VR5PL, Mr. Mortensen, Civil Airways, Fua Amotu Airport, Tonga Island. W9KMN sez cards for VP4Y should go C/o Pan-American Airways, Piarco, Trinidad, B.W.I. . . . . W1AH sends along:

(Continued on page 158)

♦



W1BPH, Tewksbury, Mass.

Owned and operated by Don Bennett, W1BPH is a prominent 20-meter 'phone DXer. The rig consists of a 47 xtal oscillator, 802 doubler, p.p. 809s and, finally, p.p. 810s. Power input is conservative, running 500 watts. The skywire is a close-spaced, 3-element array atop a 35-foot pole. A Howard receiver and a homemade preselector combine to bring in the rare ones.

Matching the Line to the Ground-Plane Antenna

Design Data for Co-ax Feed

BY JOHN T. McWATTERS,* W2CBK

• By proper predimensioning of the antenna and shunt corrective stub, a proper match to practical coaxial-line impedances is assured with the ground-plane antenna. The necessary dimensions can be determined by a few simple calculations.

THE ground-plane antenna,[1] consisting of a vertical radiator approximately a quarter wavelength long extending above four ground radials at right angles to the antenna, together with a supporting-and-matching stub, has been described in *QST*.[2] Herewith are some data which are useful to those building such antennas.

When used with four ground-plane radials a quarter wavelength long the antenna (vertical section) is resonant when its length is about 89 degrees with the matching stub disconnected. When this condition obtains, the antenna impedance is a pure resistance of about 24 ohms.[3] Since the usual transmission line has an impedance greater than this, some system of impedance transformation must be applied so that the resonant antenna resistance, R_r, as seen by the transmission line is the same as the characteristic impedance, Z_o, of the transmission line. If we desire to feed the antenna with a coaxial line having a characteristic impedance of 50 ohms, for example, we must make R_r equal to 50 ohms at the resonant frequency.

Practically, this can be done in two ways. We can connect between the antenna-system feed point and the transmission line a quarter-wave section of matching line whose characteristic impedance is equal to the geometric mean of the antenna resistance and the transmission-line characteristic impedance, Z_o. This is the so-called "Q" matching system. Incidentally, the supporting stub could be replaced by this quarter-wave concentric matching line, the shorting plug at the bottom being omitted and the concentric transmission line connected in its place. This is a good arrangement if it is desirable or convenient to suspend the entire antenna system by the upper end of the vertical antenna section.

Another approach to the impedance-matching problem is to reduce the length of the antenna (vertical section) slightly so that at the operating frequency the antenna impedance is composed of both resistance and capacitive-reactance components, R_a and X_a respectively, and then shunt the antenna feed point with an inductive reactance that brings the system back to resonance. When this is done the antenna impedance is a pure resistance and will have a value different from the self-resonant value. The equivalent circuit is shown in Fig. 1. Suppose, for example, the antenna length is reduced so that, in Fig. 1, $R_a = 18.4$ ohms and X_a becomes 31 ohms capacitive. Then $Z_a = R_a - jX_a = 18.4 - j31$ ohms. Suppose we connect across this an inductance so that $X_s = +j41$ ohms. Then R_r in Fig 1 is found by:

$$R_r = \frac{j41(18.4 - j31)}{[18.4 + j(41-31)]} = \frac{(1271 + j754)}{(18.4 + j10)}$$

$$= \frac{1480\ \angle 29°}{21\ \angle 29°} = 70\ \angle 0°\ \text{ohms}$$

In the application of the ground-plane antenna some means of supporting the structure must be provided. If it is not desired to transform the antenna resistance, the antenna can be supported upon a quarter-wave section of coaxial line. In this case the line acts as a metallic insulator, because if the lower end of the line is shorted the end connected to the antenna presents a very high impedance and acts the same as though we had a radio-frequency choke connected across the antenna feed point, where the antenna im-

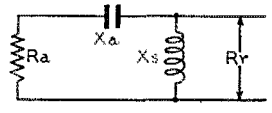


Fig. 1 — Equivalent circuit of the antenna and matching stub. The shortened antenna appears as a capacitive reactance, X_a, in series with a radiation resistance, R_a. With a shunting inductive reactance, X_s, of the proper value the system appears as a purely resistive load, R_r, having a value determined by R_a, X_a and X_s.

* Dryden, N. Y.

[1] Brown & Epstein, "An Ultra-High-Frequency Antenna of Simple Construction," *Communications*, July, 1940.

[2] E. Dillon Smith, "Ground-Plane Antennas," *QST*, August, 1945.

[3] "Back Talk," *Electronics*, December, 1943. Data from experimental measurements at 60 Mc. on an antenna ⅝ inch in diameter. Slight modifications are to be expected with antennas having a different diameter/length ratio.

pedance is very low relative to the line impedance at the point of attachment. In practice, the support stub is a section of rigid coaxial line with the bottom end shorted; the ground-plane radials are connected to the top of the outer conductor and the antenna is simply an extension of the inner conductor. When the antenna is supported by a quarter-wave section shorted at the bottom, and whose function is only that of mechanical support, the characteristic impedance, Z_{os}, of the supporting stub is not important generally, since the impedance will nearly always be much greater than the antenna impedance.

However, when the support stub is shortened for impedance matching, a characteristic impedance of about 41 ohms is desirable because the length of a stub of this impedance is found to be almost constant over quite a range of matching conditions.[3] To give an idea of the dimensions of a 41-ohm concentric line, the ratio of the inside diameter of the outer conductor to the outside diameter of the inner conductor should be 1.982/1. Incidentally, a line having an outer conductor of two-inch water pipe and an inner conductor of ¾-inch water pipe yields a line whose characteristic impedance is nearly 41 ohms. The inside diameter of 2-inch water pipe is given as 2.067 inches and the outside diameter of ¾-inch pipe is given as 1.050 inches.[4] The general idea of the construction, and the important dimensions, are shown in Fig. 2.

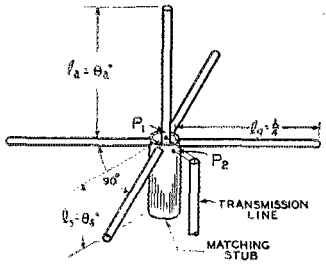


Fig. 2 — Construction and important dimensions of the ground-plane antenna. The inner conductor of the transmission line is attached at P_1 and the outer conductor at P_2. The inner conductor in the matching stub is shorted to the outer conductor at the bottom. Below this point the support can be an extension of the outer conductor.

By supporting the ground-plane antenna with a coaxial stub as shown in Fig. 2, we can, by shortening the antenna somewhat and also shortening the support stub a certain amount, make the feed-point resistance, R_r, any value we want between practical limits of say 25 to 100 ohms, by the principle indicated in Fig. 1. Here the length of the support stub is adjusted so that it furnishes the required inductive reactance, X_s, of Fig. 1.

[4] Eshbach, *Handbook of Engineering Fundamentals*, John Wiley & Sons, Inc. (Pipe table.)

To simplify and generalize the design of the system, equations are presented herewith which make the design of this type of antenna a "one-two-three" procedure. These are presented in the correct order for the usual case. They are:
(1) The length of one electrical degree l_d is:

$$l_d \text{ feet} = \frac{2.734}{f_{Mc.}}$$

where $f_{Mc.}$ = resonant frequency in megacycles.
(2) The length of each of the four equally-spaced ground radials, l_g, measured from the inside of the outer stub conductor to the end, should be:

$$l_g \text{ feet} = l_d \times 90°$$

(3) The length of the antenna (vertical portion measured from the upper end of the outside conductor of the stub) in electrical degrees, θ_a, for matching lines with Z_o between 25 and 130 ohms, is found by

$$\theta_a = 73.16 + \frac{79.2}{\sqrt{Z_o}} \text{ degrees}$$

For convenience, this equation is plotted as curve *A* in Fig. 3. The physical length of the antenna, l_a, will be:

$$l_a \text{ feet} = \theta_a \times l_d$$

(4) When the antenna length is θ_a degrees and each of the four ground-plane radials is 90° long, the resistive component of the antenna impedance, R_a, can be found by:

$$R_a = 0.00529\theta_a^2 - 17.8 \text{ ohms}$$

(5) Capacitive-reactance component X_a of the antenna impedance, for an antenna length of θ_a degrees and ground-plane radials 90° long will be:

$$X_a = 5\theta_a - 445 \text{ ohms}$$

(6) Knowing R_a and X_a, we can find the required value of shunting inductive reactance, X_s, required for resonance by:

$$X_s = \frac{(R_a^2 + X_a^2)}{X_a} \text{ ohms}$$

All values taken positive. This equation is plotted as curve *B* in Fig. 3.
(7) The characteristic impedance, Z_{os}, of the supporting stub, when the insulation is air, is given by:

$$Z_{os} = 138 \log \frac{D}{d} \text{ ohms}$$

where D = inside diameter of outer conductor
d = outside diameter of inner conductor
(8) The length of the matching stub, θ_s degrees, is then:

$$\theta_s = \tan^{-1} \frac{X_s}{Z_{os}}$$

For the case where Z_{os} = 41 ohms, θ_s is plotted

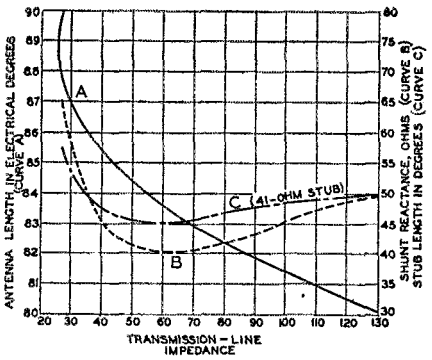


Fig. 3 — A — Antenna length, in electrical degrees, required for matching to lines of various impedances by the shunt-reactance method. B — Inductive reactance required for matching. C — Length of shunting inductive stub in electrical degree when the stub characteristic impedance is 41 ohms.

in Fig. 3 as curve *C*. The physical length, l_s, of the stub is:

$$l_s \text{ feet} = \theta_s \times l_d$$

As an example of the application of Equations 1-8, assume we wish a ground-plane antenna designed for a frequency of 52 Mc. and wish to feed it with a 70-ohm coaxial transmission line. We are to match this line to the antenna by adjusting the antenna and stub length to effect the required match. We will assume a stub characteristic impedance, Z_{os}, of 41 ohms. Solution:

(1) $l_d = \dfrac{2.734}{f_{Mc.}} = \dfrac{2.734}{52} = 0.0525$ feet/deg.

(2) $l_g = l_d \times 90 = 90 \times 0.0525 = 4.73$ feet

(3) $\theta_a = 73.16 + \dfrac{79.2}{\sqrt{Z_o}} = 73.16 + \dfrac{79.2}{\sqrt{70}} = 82.63°$

$l_a = \theta_a \times l_d = 82.63 \times 0.0525 = 4.34$ feet

(4) $R_a = 0.00529\theta_a^2 - 17.8 = (0.00529 \times 6828) - 17.8 = 36.2 - 17.8 = 18.4$ ohms

(5) $X_a = 5\theta_a - 445 = (5 \times 82.63) - 445 = 413 - 445 = -32$ ohms

(6) $X_s = \dfrac{R_a^2 + X_a^2}{X_a} = \dfrac{339 + 1024}{32} = \dfrac{1363}{32} = 42$ ohms

(7) Z_{os} assumed to be 41 ohms

(8) $\theta_s = \tan^{-1}\dfrac{X_s}{Z_{os}} = \tan^{-1}\dfrac{42}{41} = \tan^{-1} 1.024 = 45.7°$

$l_s = l_d \times \theta_s = 0.0525 \times 45.7 = 2.4$ feet

If we had desired to support this antenna on a quarter-wave stub and match it to the line with a quarter-wave matching section we would find the impedance of this matching stub by $Z_{om} = \sqrt{Z_a Z_o}$ which for the 70-ohm line assumed would be: $Z_{om} = \sqrt{24 \times 70} = \sqrt{1680} = 41$ ohms. (Since the antenna is naturally resonant when its length is 89° and has a value of $R_r = 24$ ohms).

The length of the ground radials will be 90 degrees as before and the length of the antenna will be:

$$l_a = l_d \times \theta_a = 0.0525 \times 89 = 4.67 \text{ feet}$$

The stub length would be:

$$\theta_s = 90$$

$$l_s = l_d \times 90 = 4.73 \text{ feet by (2)}$$

If desired, the antenna could be hauled up by attaching to the top of the antenna as previously mentioned, using the above matching section instead of the supporting stub, attaching the coaxial feed line at the bottom end of the matching section.

Generally, it is more desirable to match the antenna by stub and antenna shortening rather than by the "Q"-section method, since this eliminates the extra section, makes the mounting stub shorter, and permits mounting directly upon a metal flagpole.

In addition, as shown by curve *C* in Fig. 3, the stub length can be fixed, in practice, and adjustment of the antenna length will permit matching to lines of impedances ranging from 40 to 80 ohms. Also, this allows a wider frequency response, provided the characteristic impedance of the matching stub is properly chosen. The frequency response width will also be affected somewhat by the diameter of the elements used for the vertical section and ground-plane rods, being greater for the larger diameters.[5]

[5] Terman, *Radio Engineer's Handbook*, McGraw-Hill Book Co., Inc., 1st edition, p. 863, "Wide-Band Antennas."

About the Author

• It all started with John Truman McWatters' reading of the *Boy Scout's Handbook* back in 1917. There was a lag of a few years after this introduction to the hobby, but finally, in 1923, our author became 8BIG. Today Mac is signing W2CBK, mostly on 75-meter 'phone, an activity competing strongly with his work at Cornell University's WHCU. Although W2CBK makes no claim to holding a sheepskin from any of the higher institutions of learning, he admits to having been strongly influenced and encouraged by Cornell's kindly E.E. profs, with whom he is closely associated.

A Novel Ten-Meter Beam

Light Weight and Simple Construction Using Wire-Wound Elements

BY NEIL E. HANDEL,* W6WXW

• Lightness and ease of construction are something everybody wants in a rotatable beam antenna. Here's one that uses lightweight shortened elements with distributed loading, with the essentials obtainable at your sporting goods or hardware store. No special impedance-matching device or procedure is required, either.

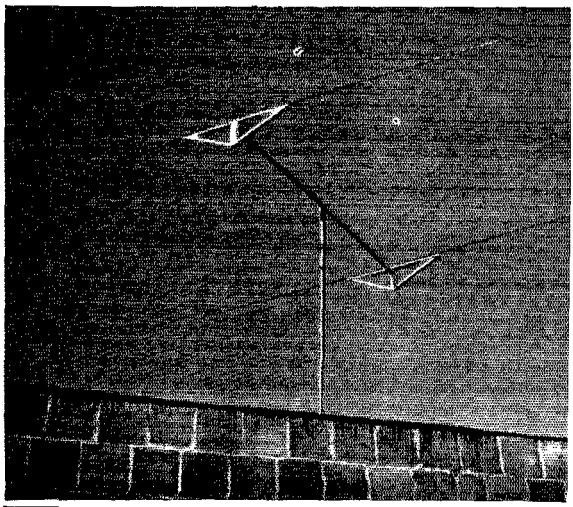
UNDOUBTEDLY many amateurs, like the author, have spent long hours designing beam antennas. The result, even for ten-meter beams, is often disappointing. Either the resulting structure is heavy and cumbersome to construct and handle, or the elements are so long that they will not be free to rotate in the only space available between the garage and the apple tree. The antenna to be described has proved itself effective even though it is simple in construction and very light in weight. It includes several unusual features which have not previously been used in beam-antenna construction.

It so happens that the author works for a plastics company which manufactures, among other things, plastic fish poles.[1] These poles are made by wrapping resin-impregnated glass cloth against a conical metal mandrel and curing or baking at a high temperature until the resin becomes hard and strong. The resulting pole is a hollow cone 6½ feet long, and has a diameter at the butt end of ¾ inch tapering to ¼ inch at the small end. The total weight per pole is only 6 ounces! Because the glass is of electrical quality and the resin is a phenolic type noted for its excellent electrical characteristics, the measured losses of the resulting material are quite low, even at very high frequencies.

To the eye of a ham, these poles immediately suggest antennas. However, in their original form they are excellent insulators and the problem of making them conductive arises. In addition, their length of 6½ feet does not fit in readily with the dimensions needed for any amateur frequency. Of course a wire could be passed through the center of the pole and a loading coil used to increase the electrical length. That method, however, would be inefficient and clumsy.

Instead, a pole was wrapped with a spiral of No. 14 wire. Cut-and-try methods revealed that 7 feet of wire spirally wrapped to extend just the full length of a 6½-foot pole was sufficient to resonate as a quarter wavelength at 29 Mc. Thus 7 feet of wire was made to appear electrically as 8 feet of wire, and all in a physical length of only 6½ feet. The reduction in the wire length results from the fact that the spiral wrap increases the inductance and thus gives us a distributed loading of the antenna. Two wire-wrapped poles were placed butt-to-butt to form a radiator 13 feet long, which appeared electrically as a radiator 16 feet long.

For a while this radiator was fed in the center with 72-ohm Amphenol cable and used on the air. Results were quite good for the 22 watts of power being used, and the antenna was fully equal to a conventional doublet that had been used previously. The question then came up, "Why not make a beam using the wrapped poles as elements?" We looked over the space available and it was evident that we would be unable to erect an elaborate supporting structure and as a consequence the beam would have to be a very light and simple affair. A look at the *A.R.R.L. Antenna Book* disclosed that a two-element beam would give approximately 5 db. forward gain over a simple dipole. Three- and four-element beams only add about 2 db. per element and hence the return on investment in additional elements drops off rapidly above a two-element beam. This convinced us that a two-element beam would be our best bet, considering our restrictions. Furthermore, the lightness of a two-element



The author's ten-meter two-element beam using wire-wound fish-pole elements.

* 1504 Ft. Stockton, San Diego, Calif.

[1] The poles are sold under the trade name "Conolon," both in blank form and as finished rods. Blanks sold to other manufacturers may be marketed as finished rods under other trade names.

beam made of the fish poles would allow us to use a very light "2 × 2" supporting structure.

At first we considered using a close-spaced parasitic element, but here again a look at the *Antenna Book* indicated that at the optimum reflector spacing of 0.15 wavelength there is a rather terrific effect on the radiation resistance of the radiator. Instead of the 72 ohms resistance exhibited by a doublet the addition of the reflector causes the radiation resistance to drop to about 20 ohms. At such a low resistance the No. 14 wire conductor becomes inadequate as its high-frequency resistance then becomes a large fraction of the radiation resistance, and as a consequence a large part of the power in the antenna is wasted in I^2R losses. Complicated stubs are needed for impedance matching and, in addition, it is necessary to adjust the length of a close-spaced reflector to make up for the phase shift lost in the close spacing.

However, this adjustment is relatively unnecessary if ¼-wavelength spacing is used, and the radiator and the reflector can be the same length. In addition, at the ¼-wavelength reflector spacing the radiation resistance of the radiator is relatively unaffected, dropping in this case to about 62 ohms — which is a fair match to 72-ohm Amphenol cable. This design would indeed make a simple array — two simple, light elements, identically constructed, spaced a quarter wavelength with one fed in the center by light, flexible 72-ohm plastic cable. At last we had found a combination that seemed to fit our needs and limitations.

A two-element beam of this type was constructed and put into use. No field-strength measurements were made, but tests with local stations indicated that the front-to-back discrimination was good and that at least some forward gain was being obtained. As supporting evidence, our average report from the East Coast stations increased from S6 to S8 (with quite a few S9 reports) as revealed by the log. Even more indicative is the fact that the log shows that the use of the beam more than doubled our number of contacts per call made.

The appearance of the array is shown in the accompanying photograph. As can be seen, it is neat and compact, and so simple that it can be constructed easily. In fact, at one time we considered calling it "The Lazy Man's Beam." Many will scoff at anything less than a multi-element plumber's delight, but there are hordes of amateurs who do not have the money or space to tackle the highly-complicated job of constructing such a beam and supporting towers, who could profit by the use of a simple efficient beam of this type. The poles used are stronger than aluminum tubes of equivalent weight. They will bend quite sharply without breaking and will not sag or take a permanent set.

ONE, two, three, five, ten . . . *twenty* transmitters, *ten* receivers, a *half-dozen* masts climbing as high as 200 feet, a special building complete with soundproof zinc-shielded operating rooms, workshop, generator room, storeroom, kitchenette and sleeping quarters — all these and a thousand-and-one other niceties of this May 1922 amateur world make up "3ZO — An Amateur Paradise," described in this month's leading *QST* article. ARRL Director Horace A. Beale, jr., of Parkesburg, Pa., has spared neither money nor talent in the building of his super station. Engineered by Thomas Appleby, jr., of Philadelphia, and constructed by Wynne Colman and Edward Sandrus, the deluxe 3ZO boasts a lavish assortment of 'phone, c.w. and spark transmitters. Among the station's half-score receivers are a Grebe CR-3, Aeriola Senior, and an immense Armstrong superheterodyne of 51 DeForest units stretching across the side of one room. Mr. Beale also operates 3XW and 3OI, the latter being a portable job mounted on a 5-ton truck. But now to return to everyday hamfare; let's find out how our state made out in the Governors-President Relay.

The smashing success of this first coöperative effort is fully recounted by the Editor. Messages were delivered to President Harding, via our ARRL stations, from the executives of 40 states, and the president has acknowledged with a letter of thanks. The Potomac end of the relay was capably upheld by the Washington Radio Club; however, messages from Colorado, Mississippi, New Mexico, New York, North and South Carolina, Wisconsin and Wyoming either never started or were lost en route to the Capital.

The Transatlantic story, from the British viewpoint, is told this month by Philip R. Coursey, assistant editor of England's *Wireless World* and *Radio Review*. Mr. Coursey provides a full picture of Great Britain's participation in the tests, and also a studied comparison of British receiving equipment to that used by Mr. Godley. He invites us to experiment with the British-preferred r.f. amplifiers and listen for the 10-watt transmissions of their stations. More ocean-hopping feats are announced in this issue: the University of Vermont spark, 1ARY, has been heard in Paris; 6ZAC, in Honolulu, daily is scheduling West Coast 6ZQ and 6ZAF!

For technical fare we have a mathematical discussion of "The Importance of Higher Voltages for Amateur Spark Transmission," by S. Kruse and D. W. Richardson. The authors conclude that the most effective rig for low-wave

(Continued on page 134)

The World Above 50 Mc.

CONDUCTED BY E. P. TILTON,* W1HDQ

THE Milwaukee Radio Club Cup has been won, at last! Offered in 1936 in what seemed to many, at that time, to be an overoptimistic move to promote interest in international v.h.f. DX effort, the beautiful gold trophy has waited at Headquarters for more than ten years for a claimant. Two-way intercontinental work on 50 Mc. from the mainland of the United States is now an accomplished fact, and only the formalities of written confirmation await the award of the cup to Glenn Harman, W4IUJ, of West Palm Beach, Florida, for his history-making 3000-mile QSO with Carroll S. Busby, OA4AE, of Lima, Peru, on Sunday, March 23rd.

That date was a heartbreaker for W4GJO, of Orlando, Florida. For months Grid had been working on OA4AE, CE3FV and other South American stations, to get them going on 50 Mc. Finally OA4AE was ready to go, and schedules were arranged for Saturday and Sunday afternoons, with W4GJO making 5-minute transmissions at 15-minute intervals, and OA4AE doing likewise for the following 5 minutes. This started on March 15th and 16th and was continued on the 22nd and 23rd.

The afternoon of the 23rd looked good at W4GJO. DX signals were heard in the old f.m. band, and by 3 P.M. three signals were coming through on the low end of 50 Mc. One of these turned out to be OA4AE — already in contact with W4IUJ. Glenn had called CQ, on what appeared to be a dead band, at 2:50 P.M., and hit the jackpot! They signed at 3:10, and W4GJO connected with OA4AE, the QSO lasting until 3:40. Signals were weak at both ends, peaking about S4. The two other signals heard by W4GJO were never identified, and W4IUJ heard an unidentified tone-modulated signal near 50 Mc. This signal peaked with the beam south-southeast, and it lasted until about 3:30, as did the signal of OA4AE.

The transmitter at W4IUJ runs 100 watts to a 35-TG, feeding a 4-element array which is stacked above a 10-meter beam in the same manner as the dual array used at W1HDQ in the November trans-Atlantic work. The rig at OA4AE was running 42 watts to an 807 doubler, feeding a 3-element array having two directors. His converter employed a 6AK5 untuned r.f. stage and a 6SA7 mixer-oscillator. W4GJO uses a pair of 35-TGs and a 3-element array only 9 feet above ground. The receiver is an S-36 with a 6AK5 preselector.

* V. H. F. Editor, *QST*.

RECORDS

Two-Way Work

50 Mc.: KH6DD — J9AAK
4600 Miles — January 25, 1947

144 Mc.: W3HWN — W1MNF
390 Miles — September 29, 1946

235 Mc.: W6OVK — W9OAW/6
186 Miles — March 2, 1947

420 Mc.: W6FZA/6 — W6UID/6
170 Miles — September 28, 1946

1215 Mc.: W1BBM — W1ARC
0.4 Mile — March 19, 1947

2300 Mc.: W1JSM/1 — W1ILS/1
1.6 Miles — June 23, 1946

5250 Mc.: W2LGF/2 — W7FQF/2
31 Miles — December 2, 1945

10,000 Mc.: W4HPJ/3 — W6IFE/3
7.65 Miles — July 11, 1946

21,000 Mc.: W1NVL/2 — W9SAD/2
800 Feet — May 18, 1946

Other intercontinental barriers were broken down for the first time during this eventful month of March. According to the prediction charts, one of the hottest places for 50-Mc. DX in the whole world is the Union of South Africa, but, unfortunately, the ZS stations are not permitted use of the 50-Mc. band. That has not kept ZS1T and ZS1P (the Rieder brothers), and ZS1AX and ZS1DJ, from trying. All have receivers capable of covering the 50-Mc. band, and they have made numerous tries with 50-Mc. stations in this and other countries. During late March they had been hearing evidence that 50 Mc. should be open, and tests were being run with PAØUN and PAØUM regularly. First concrete results were obtained on March 26th, when, at 1245 GCT, the automatic transmission of PAØUN was heard S9-plus by ZS1P, who promptly informed the others, and all four heard the 50-Mc. signal for a period of about one hour. This is probably the longest distance over which a v.h.f. signal has ever been heard; approximately 6000 miles. Crossband contact, PAØUN on 50 Mc., ZS1P on 28 Mc., was established on March 29th. Signals were S9 each way during a one-hour QSO, which started at 1:30 South African time.

This is not the most favorable path from ZS,

but it is one along which the prospects continue good through April, and fair in May. It is expected that more reports will be forthcoming from this part of the world in the near future. An especially interesting path is the one between ZS and YI, which should be open even for the 58.5-Mc. limit of the band used by the ZS stations. Now that YI2CA is actually ready to go on 50 Mc. it is hoped that this path will not long remain unbridged. The Rieder brothers have been hearing signals up almost to 60 Mc. on some days recently.

Out in the Hawaiian Islands, KH6DD and W7ACS/KH6 have been trying to duplicate their feat in working J9AAK, and also have been looking for other conquests, but without much success, except for some very brief exchanges between W7ACS/KH6 and VK4HR, of Brisbane, Australia. Daily schedules between these two were kept from Feb. 20th on, contact being established on 28 Mc. first, followed by tries both ways on 50 Mc. On Feb. 27th VK4HR heard W7ACS for just a few seconds two different times around 0353 GCT, and again the following day, also for a very brief flash, at 0400. On March 2nd it worked the other way around, and at 0213 GCT W7ACS/KH6 heard "W7ACS/KH6 de VK4HR" three times. As the two were working break-in, Gene broke on 28 Mc. and was acknowledged by a brief "OK OK — " before the 50-Mc. signal faded out. In each instance the reception periods were too brief to permit two-way work over this 5000-mile path. W7ACS is back in the States now but will be returning to the Islands in about a month and will resume his intensive 50-Mc. DX efforts at that time.

From the above may be seen the fascinating prospect of a 50-Mc. WAC. There is activity on all continents: Asia is represented by Iraq and Okinawa; Africa (on the receiving end) by several ZS stations who are eager to work crossband; South America by PZ1A and OA4AE; Europe by PAØUN and PAØUM, and several Gs who can receive on 50 Mc.; Australia and New Zealand by numerous VKs and ZLs; and the Hawaiian Islands by KH6DD, KH6DW, KH6BR and W7ACS/KH6. If the m.u.f. rises in 1947 even half as much as it did in 1946 as compared to 1945, there is a good possibility that all of these points will be workable from parts of North America. The fall of 1947 and spring of 1948 should give us the opportunity — will we be ready to seize it?

March was also notable for its aurora sessions. The ionospheric disturbance of Sunday, March 2nd, was a beauty. Starting around 3 P.M., the whole northeastern part of the country was treated with the best example of aurora effect yet experienced on 50 Mc. Contacts were made as far south as Richmond, Va., and as far west as Minnesota. The volume of reports received indicates that more contacts were made during this 6-hour splurge than in any previous aurora session, though the strength of the signals and the area which was workable from any one location were not equal to some of the prewar days on 56 Mc.

The band was open for aurora work again the following day at about the same time, and over most of the same area, and the same was true on Saturday, March 8th. This date was the occasion of some aurora work on 58.5 Mc. in England also. There was another short opening on the evening of March 17th, but this one took on more of the aspects of a spring *E*-layer opening, with skip contacts being reported from several quarters. WØPKD, Salina, Kansas, worked W5EVJ, W5ESZ, W5LZF and W5EGI, all of El Paso, Texas. W5ML, Oil City, La., reports that while he and W5IOP and W5ZS were in a three-way QSO the band opened slightly, and snatches of DX signals and diathermy were heard around 8:45 P.M. CST. A WØ was heard at 8:55, and at 8:59 W7SP was heard working another W7. Contact was made with him at 9:05, but he faded out before the others could make the grade. His signal was in and out for another 20 minutes, as was the diathermy interference.

Here and There on 6

"When in doubt, aim north" is good advice, but we shouldn't neglect the other directions at times of high m.u.f. W2BYM reports an interesting contact with W9PK at 10:10 on the morning of March 9th. Shortly before 10 A.M. signals started coming in just below 50 Mc. A station signing HOPE (Mel insists that he is certain of that call) was heard on 49 Mc., and a broadcast program was heard almost at 50 Mc. A "CQ DX 50 Mc." at 10:08 brought a reply from W9PK, whose very weak signal could be heard only with the 4-element array at W2BYM aimed *south*. The signal of W9PK was heard intermittently until about 11, but very weak, and always peaking from a southerly direction. The carrier was a good T9 note, indicating that no aurora was involved. Our guess is that it was a sharp-angle F_2 rebound, from the region of high m.u.f. on the route to South America, and that if there had been anyone on in the right places (PZ1A or OA4AE would have been fine) W2BYM or W9PK might have been the first to have negotiated that South American two-way! The prediction charts show evidence of a slight m.u.f. peak around 10:30 A.M. during March, but the best time in both March and April would appear to be midafternoon.

Another report, from W7QAP, Tucson, Ariz., indicates that the morning of March 9th was a good time for South American work. Bud was hearing TIV on about 45 Mc., and two unidentified signals above 48 Mc. TIV was heard between 9:38 and 10:00 MST, and the two other signals were in around 11:00. W9ALU, Metamora, Ill.,

heard Spanish language and music at 49.6 and 49.85 Mc. between 11:24 and 12:05 CST on March 4th. Noise level (and W9ALU doesn't have any man-made noise — we can vouch for that after a personal visit at his very neat shack) was up some 10 db. above normal during this time.

Things are rather quiet in KH6, with W7ACS/KH6 back in the States, but KH6DD reports that KH6BR has a pair of 807s, with a self-rectifying amplifier, on an interisland boat, and KH6BV, the station of the Camp Catlin Marine Radio Club is getting started on 6. They have a converted BC-640, and are putting up a 4-element rotary. KH6DD, a Marine flier, tried to stir up interest in 50 Mc. in China, on a recent trip there, but without much success. He is continuing skeds with J9AAK, but the only positive result since Jan. 24th was a few seconds of reception of J9AAK at 4:30 HST on the afternoon of Feb. 26th, by KH6DW.

You can never tell who's behind some of these new calls you hear on 6. Here are a few new calls of old hands: W1AF was W1ELP; W1CLS is ex-W1PFJ, W8CLS/1; W2EB worked plenty of 56-Mc. stuff as W8PK; his neighbor, W2RLV, was well known on 5 as W8PKJ; W2QVH was W3HOH; W2QKE is the alphabetical misfortune of W3AXU; W3ENZ was W9STX, W5ENZ; W4FJ, W4CYW, W4GLV and others are the W4 counterparts of well-known Virginia calls that were formerly W3s; W6HZ is ex-W6RVL. Here is one we'd all like to hear: KL7HQ, Adak, Alaska, was W3FQS of Reading, Pa. He is still interested in v.h.f. work, according to W1CLS, who worked him recently on 10.

The island of Malta should be a good spot for high m.u.f., particularly for work to the south. G6DH reports that ZB1AB and ZB1AC are already on, and ZB1L will soon be ready. Unfortunately, these stations must use the 58.5–60-Mc. assignment, but even this frequency should be open to ZS on peak days.

We're still hoping to hear something from VE1, but the closest we've come is the report of W2RLV that, on the evening of March 3rd, a VE1 was heard on 28 Mc. calling for a crossband contact. He was hearing W1CLS, W2BYM, W3OMY, W2AMJ, W3CIR/1 and W1LLL.

Anyone who has been worrying because he cannot achieve great height above ground for his 50-Mc. beam can take heart from the experience of W4GJO. Grid has been an outstanding performer on 50 Mc. in the State of Florida ever since he went back down there about a year ago, yet in all this time he has been working with a 3-element array just *nine* feet above ground! He is now working W4EID at Jacksonville, about 130 miles to the north, his first out-of-town contact made without the aid of skip. The signal from W4EID should come up quite a bit with some increase in antenna height at W4GJO. We don't intend to imply that a half wave above ground is an ideal height for working skip DX, either, but the excellent work done by W4GJO in the past year demonstrates that it is not necessary for a beam to be 100 feet in the air to be effective. Grid is interested in getting the Jacksonville skeds running in good shape, as he feels that reliable contacts over that distance would do much more to sell the Florida gang on 6 than hundreds of sporadic-skip contacts. Almost all

V.H.F. MARATHON

Contacts Through March 15th (Incomplete)

Call	50 Mc.	144 Mc.	235 Mc.	Score	States Worked 50 Mc.	144 Mc.	50-Mc. WAS
W1AF	33			98	4		4
W1BCT[1]		49	3	240		3	
W1CLS	53			383	11		27
W1CGY	17			147	5		5
W1EH*		25		99		2	
W1FRK		14		60		1	
W1HDQ*	36	18		372	8	2	26
W1KLR		49		190		2	
W1LLL	35			425	8		29
W1LMU		11		22		1	
W1PLQ		57		192		1	
W2AMJ	34			170	6		24
W2BYM	48			366	10		25
W2COT	23	54		214	3	3	7
W2DZA		47	3	188		2	
W2QVH	49	44		354	7	2	7
W2RSO		49		404		3	
W2ZD[2]		153		750		3	
W3CGV	29	5		195	6	2	9
W3GKP	4	22		159	1	2	1
W3HWN		38		305		3	
W3IUN	30			216	5		5
W3MHW		33		228		2	
W3MNA		37		190		3	
W3RUE	20	25		477	9	1	19
W1KMZ/3	33			296	8		8
W4FJ	15	3		263	8	1	8
W4JAZ	17	78			2		
W4LNG		11		57		1	
W6BWG	53			146	1		2
W6HZ	36	101		385	1	1	5
W6OVK	3	61	4	435	1	1	6
W6WNN	7	5		73	1	1	
W7ACS/KH6	6	123	0				
W8QQS	18			239	6		6
W8UKS		43		362		3	
W8TDJ	6			112	6		6
W9AB	18	1		173	8		12
W9AGV		8		22		2	
W9ALU	8	6		119	2	1	3
W9DWU							17
W9CZD	5			59	1		
W9JMS	13			137	3		3
W9MBL	5			28	2		
W9PK[2]	45			612	19		26
W9ZHL	23			275	7		7
W9ZHB							28
WØDZM							21
WØHXY							15
WØJHS							15
WØQIN	21			320	6		17
WØSV							17

*Not eligible for award.

[1] In the final summary of 1946 Marathon results, W1BCT should have been mentioned as winner of the Section Award for Western Mass., instead of W1AEP.

[2] Monthly winner, first period: W2ZD, 620 points. Second period winner: W9PK, 504 points.

the boys would like regular state-wide contacts, and the lower frequencies are not too satisfactory, what with the QRM and high static level. It should be possible to cover most of Florida quite nicely on 6 from the region around Orlando.

Activity is developing nicely in Terre Haute, Ind., and vicinity, according to W9ZHL, who lists W9s CZD, IKI, JMS, ANH, JPB, UNS, OMR, ET and ZHL as among the more active stations. Contacts with W8QYD have been quite regular, despite the 200 miles between Dayton and Terre Haute.

Those boys who work maritime-mobile in the South Atlantic should be nice prospects for v.h.f. DX, if they could be talked into it. ZS1T interested W6NSQ/MM in the 50-Mc. band when the latter was stopping at Capetown. The ship was laid up there for some time, during which W6NSQ built up some gear for 50 Mc. A crossband contact was made, with W6NSQ/MM on 50 Mc., when the ship left Capetown. The vessel will be coming across to South America soon.

First Postwar V.H.F. Relay, May 17th & 18th!

The handling of messages can be a fine medium for promotion of v.h.f. activity and extending the regular operating range. In the years before the war the V.H.F. Relay idea became very popular, and these contests never failed to provide new contacts and lots of fun for all concerned. With the considerable increase in v.h.f. activity and the improvement in techniques, the first postwar V.H.F. Relay, announced elsewhere in this issue, should be the best yet. Plan now to be on, and let's get those messages across the country on both 6 and 2!

C.W. on 144 Mc.?

The trend to crystal-controlled transmitters, selective receivers and c.w. technique, first in evidence in v.h.f. work back in the late '30s, was largely responsible for the rapid strides made in extending the range of operation on the old 5-meter band. Listening with the b.f.o. on soon showed us that there were many signals to be heard by this means which were totally inaudible by other methods. The use of c.w. technique also brought to our attention such peculiar propagation effects as aurora reflection, reflections from meteors and other forms of multipath propagation. How about the same technique applied to 144 Mc.?

In most sections of the country there are enough crystal-controlled transmitters so that the users of selective receivers can employ b.f.o. reception effectively, and its limited use has already demonstrated that it is the key to greater operating ranges on 144 Mc., just as well as on lower frequencies. We strongly urge that serious workers interested in extending their 2-meter horizons employ straight c.w., particularly in keeping schedules with stations beyond their normal working range. There has been quite a bit of talk recently about the possibility of a 144-Mc. relay from the East Coast to the Middle West. Some concentrated c.w. effort might turn the trick — how about it, W3HWN, W3QKI, W8UKS and others?

An example from your conductor's book: At W1HDQ we've found that it is a cinch to work the Boston area, some 100 miles to the east, now and then, but even with 16-element beams we have not been able to make this hop regularly as long as superregenerative receivers were used. With a converter working into our NHU there are numerous weak whistles from distant stations in evidence when we tune the band carefully with the b.f.o. on. If they were keyed they'd be 100-per-cent readable. The converter-NHU combination is 5 or 6 db. better than the best superregen we've yet seen, in reception of 'phone signals, and on c.w. it is much better still. When we consider that reception of the 144-Mc. signals of W3HWN by W1MNF was done with a superregen, at nearly 400 miles, how much farther could the range be extended if c.w. techniques were employed in DX work when conditions are good?

On our recent swing through Illinois, Iowa and Wisconsin, we had ample opportunity to see that advanced technique has become almost standard for 144 Mc. in that part of the Middle West. It was something of a revelation to sit in the famous W9ZHB log cabin and hear crystal-controlled signals rolling in on 144 Mc. from W9ALU, about 50 miles, W9RGH, slightly farther, WØHAQ, 65 miles, and WØNFM and WØIFB, more than 110 miles distant. The 522 transmitter is almost standard equipment for 144-Mc. work in this area, but many of the boys are not satisfied with this unit alone. In several stations we saw the 522 operating as an exciter, with 829s and higher-powered stages following. One line-up, in use at several stations, is a 100-per-cent surplus proposition, available at low cost and consisting of the 522 driving an 829 buffer stage, followed by a pair of VT-127-As, running up to 600 watts input. High-gain arrays, horizontal, of course, mounted atop windmill towers, help to make 100-mile coverage a routine matter. W9ZHB has four states — Illinois, Iowa, Indiana and Wisconsin — on 144 Mc., no mean feat from North-Central Illinois, where the nearest state line is more than 50 miles away. Such work is not done with modulated oscillators, superregenerative receivers, and folded dipoles in the attic.

Consistent effort through the difficult winter period has demonstrated that work over a 100-mile radius is possible almost anywhere in the country. Already, with the coming of spring, the range is stretching out. The good nights are just beginning to be in evidence. What will we be able

to do on 2 this summer? Our gear is vastly improved over that in use at this time last year, and the population of the band has grown by leaps and bounds. It's going to be a great year for v.h.f. enthusiasts, and we want to report the whole interesting story in *QST*. We can do it only if you, the fellows who make the contacts, write in and tell us about it. Be sure to keep us informed as to how you are making out!

Following are examples of the sort of stuff you can tell us, which the rest of the gang, in other sections of the country, would like to know: From W3QKI, Erie, Penna., we learn that steady signals are being heard from Ohio stations including W8UKS at Lorain, W8VVY, Lakewood, W8WJC, near Cleveland, and W8VO, Akron, all near the 100-mile mark. He has worked these fellows almost nightly, right through the winter, and what started out as seemingly overoptimistic schedules have turned into nightly rag-chews. Buffalo, a somewhat shorter hop along the lake in the opposite direction, has not been worked regularly, and the Erie gang believe that horizontal beams are needed in Buffalo to turn the trick. Youngstown, Ohio, only 75 miles distant, and Sharon, Penna., somewhat nearer, are yet to be heard from. The Mercer County Radio Club there is offering a prize for the first station to work Erie on 144 Mc.

Equipment at W3QKI consists of a crystal rig ending in an 829, running 120 watts input. The receiver is an SCR-522, with a 12-Mc. crystal filter and a 6J4 grounded-grid r.f. stage added. An r.f. amplifier using a 2C40 lighthouse tube is under construction. The billboard array formerly used came down in recent high winds, and has been replaced by a temporary square-corner array. A new billboard with 8 elements and a plane reflector is going back up when weather permits. Tests have been run with the Ohio stations, running inputs as low as 2 watts at W3QKI, indicating that the antenna system is far more important than the power input used. The 144-Mc. gang in Ohio and Western Pennsylvania are hoping that some signals will break through from the East Coast this summer. The V.H.F. Relay of May 17th should be a start in effort along this line.

Quite a few stations are using 829 triplers as an easy means of obtaining crystal control on 144 Mc., and this is a natural for the fellows who want to work both 6 and 2. Just change the final plate coil and crystal, and retune slightly, and there you are. W1LJT, Brockton, Mass., reports that his 829 tripler shows only 65 ma. unloaded, and the plate current rises to 180 ma. with no detuning when the antenna is connected. He works from New Hampshire to Nantucket with good signal reports, and finds that the use of n.f.m. keeps him from having "neighbor trouble" during the early evening hours.

From Johnstown to Pittsburgh is just under 60 miles, which may not sound like DX to some, but W3LSE and W3RUE feel pretty good about making it on 144 Mc. There is plenty of mountainous country in between, but they have been working on schedule during March. W3RUE runs 100 watts to a pair of 24-Gs, feeding a 6-element vertical array. W3LSE uses a 6C4-6C4-815 MOPA, running 50 watts input. Other stations in Johnstown include W3EHR (815 MOPA, 3-element beam), W3LPX (832 MOPA, 4-element and 16-element arrays), W3DSV, W3LUO, W3LQC and W3MSO. Operation starts nightly at 6:30, and anyone desiring to arrange schedules is requested to get in touch with W3LSE. W3KWD of Duquesne has been heard by several of the Johnstown stations, but no contacts had been made at last report. These stations look like the makings of a 144-Mc. relay route to the Middle West, since it is only a little more than 100 miles to Mechanicsburg and W3HWN from Johnstown.

Who's Where on Six?

W1MEP	Bennington, Vt.	50.83 Mc.
W1ZE	Mattapoiset, Mass.	50.75
W4EID	Jacksonville, Fla.	50.6
W4FLH	Miami, Fla.	50.8
W4JEP	Miami, Fla.	50.6
W5ELL	Albuquerque, N. M.	50.07
W5EGI	El Paso, Texas	50.1
W5ESZ	El Paso, Texas	50.16
W5EVJ	El Paso, Texas	50.04
W6ON	Baldwin Park, Calif.	52.3
W6QUK	San Bernardino, Cal.	50.72
W7OWX	Tucson, Ariz.	52.66
W8RFW	Grand Rapids, Mich.	51.2
OA4AE	Lima, Peru	50.0

It isn't often that we get a chance to report v.h.f. activity of any sort from Utah, so we are glad to hear from W7MQL at Ogden that he and W7UPI are on 144 Mc., attempting to work into Salt Lake City. Signals have been heard over this path, 40 miles over intervening hills, but no two-way work has yet been accomplished.

186 Miles on 235 Mc.!

Crystal control, superhet receivers and beam antennas can turn some interesting tricks on 235 Mc., too. For some time, as reported previously, W6OVK, W6WQN and W9OAW/6 have been experimenting along these lines, and on March 2nd they decided to find out what could be done at greater distances. W6WQN/6 operated from Mt. Diablo, with W9OAW/6 driving to General Grant Grove, and W6OVK remaining at his home location in Redwood City. At 12:00 noon contact was established between the two mobile stations, separated by 180 miles, with signals S9 each way. Then, at 12:05 P.M., W9OAW/6 contacted W6OVK, a distance of 186 miles, with signals running about S4. In an effort to stretch the record still more, W6WQN/6 left Mt. Diablo

(Continued on page 136)

Spurious Transmitter Radiations

Some Causes and Possible Remedies

BY E. H. CONKLIN,* W3VQ

• With the return of the full amateur bands the problem of confining radiations to the desired operating frequency becomes increasingly important. W3VQ points out that harmonic radiations are not the only radiations of a spurious nature to be expected from a transmitter, especially multistage v.h.f. rigs. He shows how these may be reduced by taking suitable precautions.

It has long been generally recognized and accepted that radio transmitters will radiate at frequencies which are harmonics of the final output frequency of the transmitter. But often there are other spurious radiations from a transmitter — and responses in a receiver — which are not generally recognized. These radiations may be caused by harmonics of the oscillator, and their frequencies are usually close to or actually below the desired operating frequency. When an oscillator frequency is multiplied in order to arrive at the correct final frequency, it is easily possible that some harmonics of the master-oscillator frequency will be produced which fall outside amateur bands, both above and below the desired output frequency.

When the final amplifier is modulated, it is not always possible to identify the station which is radiating on spurious frequencies. Transmitters in which the oscillator is keyed, however, are frequently cited by FCC for radiating on incorrect frequencies. A recent test of a well-constructed transmitter incorporating the latest engineering developments indicated that the harmonic output of the last tripler stage on 2/3, 4/3, and 5/3 of the operating frequency is only about 30 db. below the strength of the desired carrier.

It is widely assumed that frequency multiplication produces only the desired output from each stage. This is an incorrect assumption which makes no allowance for the possibility that new frequencies, not expected to be produced by the multiplier, may appear in the output of the final stage. This may be the result of undesired coupling between the oscillator and final amplifier, or between other stages. To illustrate this point, consider a transmitter having a total frequency multiplication of 16 (that is, $2 \times 2 \times 2 \times 2$). It would be possible for the adjacent 17th harmonic of the master oscillator to appear in the output, although it might not be expected because it can be obtained only by a large multiplication of the frequency of the master oscillator (1×17). However, if r.f. energy from the master oscillator leaks into the final amplifier, it may very possibly modulate the output of the final amplifier. This would produce an output on both the adjacent master-oscillator harmonics which would be the 15th and 17th.

* Cmdr., USN, 6800 Clarendon Road, Bethesda 14, Md.

Harmonic Spacing

An investigation of some of the characteristics of frequency multipliers may help to understand this situation better. If the frequency multiplication in a stage is greater than *two*, undesired harmonics of the driving stage are relatively close to the desired frequency and the tuned circuit presents sufficient impedance to enable the generation of appreciable power. If a multiplier doubles, the nearest undesired harmonic is the 3rd, which is 50 per cent higher in frequency, and the fundamental, which is 50 per cent lower. If a total multiplication of 6 is desired, this doubler might be followed by a tripler. The doubled output of the first tube is then amplified in the second tube whose output circuit is tuned to present a high impedance to the 6th harmonic of the master oscillator. Close study will show that the tripler may also have in its output the 4th and 8th harmonics of the master oscillator by also doubling and quadrupling its input.

The grid of the tube following the tripler will receive the output of the second multiplier, together with any of the second-harmonic input which reaches it. These may intermodulate, just as in a mixer tube, to produce the 6th harmonic plus and minus the 2nd harmonic, creating 4th- and 8th-harmonic power.

Before going further, let us examine the harmonic spectrum from the doubler. Its 5th harmonic relative to the oscillator frequency should have been greatly attenuated by its tuned circuit. However, the second tube is a relatively-efficient straight-through amplifier for this frequency inasmuch as its plate circuit, tuned to the 6th harmonic, is resonant at a frequency which is only 20 per cent higher than this 5th harmonic.

The result is that multipliers produce power of different amounts at essentially all harmonics of the original oscillator frequency. This is illustrated in Fig. 1, which shows that harmonics present in the oscillator itself may also reach the final output circuit by spurious coupling or

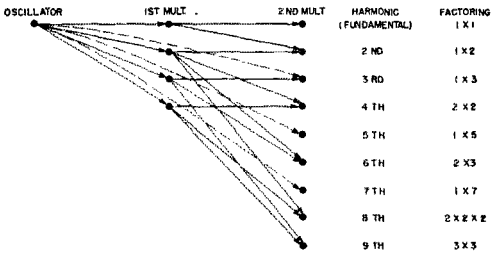


Fig. 1 — Diagram showing how harmonics of the oscillator may reach the output circuit through stray coupling.

through the multipliers. The oscillator harmonics may be amplified, and appear through more than one combination of multiplications. Obviously, the 5th and 7th harmonics should be weak since they are either leakage products of the harmonics of the oscillator, or are generated in the final output by the modulation of the 4th, 6th, or 8th harmonics by oscillator-frequency energy which has reached the circuit through spurious coupling.

Reducing Unwanted Radiation

Several means of reducing the power developed at the undesired frequency can be applied during the design of the equipment. In general, it would appear to be best to select an arrangement in which the output frequency may be factored into a number of small digits. That is, multiplications to 16 or 32 might be desirable because they may be reached by successive multiplications by two, without requiring multiplication by three or a larger number. For example, a multiplication of 15 could be obtained by 5×3, but probably would be less desirable than 16 which could be reached by $2 \times 2 \times 2 \times 2$, especially since the output at the desired frequency would be better in the latter case.

Ordinarily, multipliers are designed for the production of maximum power at the desired output frequency. Where the production of spurious frequencies is to be reduced to a minimum, however, the number of tuned circuits, loading, and selectivity also become important because they control the power produced by undesired multiplications. Unfortunately, inasmuch as all harmonics of the oscillator may appear in the multiplied output, large multiplications are undesirable because they offer less opportunity to suppress all but the intended output frequency. This is because, on a percentage basis, adjacent harmonics are close in the case of a multiplier of higher order. For example, if the 4th harmonic of the oscillator is desired as the output frequency, the adjacent 3rd and 5th are 25 per cent away in frequency. On the other hand, if the 32nd harmonic of the oscillator is desired, the 31st and 33rd are only about 3 per cent removed in frequency. Also, large multiplications in individual stages limit the number of selective circuits available to suppress the undesired harmonics.

Table I shows the measured output from an Army frequency-modulated v.h.f. transmitter which uses high multiplication of a low-frequency oscillator. In attempting to improve the situation, the first step was to use a much higher oscillator frequency, with less multiplication. This provided a wider separation between the desired harmonics and those next adjacent above and below the output frequency, as shown in the third column, and this resulted in improved attenuation through the normal selectivity of the multiplier tuned circuits. The table also shows in the last three columns the measured attenuation of the undesired harmonics using several types of multipliers. In this instance, $4 \times 1 \times 2$ produced better attenuation than $2 \times 2 \times 2$, presumably because the straight-through or buffer stage allowed the use of the same number of tuned circuits and was not overbiased, which may have tended to reduce the harmonic content of the power passing through it. Undesired coupling in the set will account for other peculiarities.

TABLE I

Frequency	*Harmonics in Original Trans. with 1.85-Mc. Crystal*	*Harmonics in Revised Trans. with 5-Mc. Crystal*	*Harmonic Output from Original Trans.*	*Harmonic Output from Revised Transmitter with*		
				4 × 2 Multiplying	*4 × 1 × 2 Multiplying*	*2 × 2 × 2 Multiplying*
33.75	27th		62 db.			
35.	28th	7th	51	60 db.	76 db.	70 db.
36.25	29th		52			
37.5	30th		45			
38.75	31st		28			
*40.	32nd	8th	0	0	0	0
41 25	33rd		33			
42 5	34th		53			
43.75	35th		56			
45.	36th	9th	59	71	84	72
46.25	37th		75			

* Desired output frequency

Table showing spurious-frequency output from experimental transmitter (resistive termination) in db. below carrier.

Push-Push & Push-Pull

It is generally expected that the harmonics of the final amplifier or last multiplier stage will be relatively strong. Other expected harmonics of the oscillator may or may not be strong, depending upon the stray coupling within the multiplier; some expected frequencies may be very strong whereas others may be weak, depending on whether the stray coupling aids or bucks the power coming through the multiplier tubes.

(Continued on page 136)

Relax, Men! Use Haywire

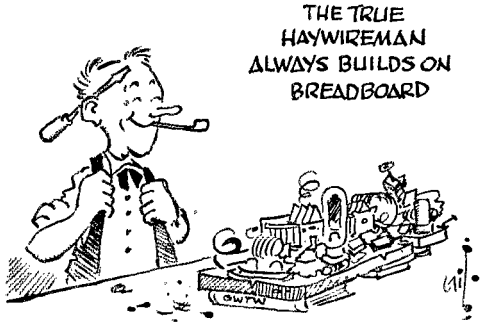
An Old-Timer Debunks the Present Order of Things

BY KEITH S. WILLIAMS,* W6DTY

WE (referring to myself, of course; there's nobody here but me), view with alarm the ever-increasing neatness and efficiency that is becoming evident in the construction of amateur radio station equipment. Just look at any radio magazine or handbook. Look at those illustrations and you will see what we mean. Joe Gink, for example, has written up the dope on his latest ten-band two-tube exciter and illustrated the write-up with top, bottom and side views of the finished product. It looks good. That's what chills our blood . . . it looks like a piece of stuff sawed out of a broadcast transmitter and you can see at a glance that Joe spent a great deal of time and effort in laying out and mounting the parts and in doing a neat wiring job. And it's true that the gadget works just dandy, but is that everything?

It is a sad fact that the art of haywire in radio construction is rapidly becoming extinct. Nowadays most anyone, even the newest addition to the ranks, sits down and carelessly and without thought builds a transmitter that looks and operates like a commercial product. This is because of, no doubt, the flood of propaganda, both written and photographic, that has permeated the radio publications for a good many years.

In order to assist the newcomers to ham radio we will set down here a few pointers on the construction of amateur equipment. Please note that unless our instructions are reasonably well followed your results will not be as poor as ours have been.



First, the tool situation. For doing a good haywire job only a few tools are necessary but they should be selected with care. You will need only a soldering iron, one pair of gas pliers, a small hand drill with two sizes of drills (one big, one little), a screwdriver (universal size), a hammer, and whatever can be found in the odds-and-ends drawer in the kitchen. Auto-supply or fifteen-cent stores generally have these tools in stock. The soldering iron we have found best over a period of years cost only fifty-nine cents in an auto-supply store in 1935. It has improved with

OUR 59¢ IRON GETS SO HOT SOLDER APPLIED TO THE TIP IS ALMOST INSTANTLY VAPORIZED

age, the cord now being in an excellent moth-eaten condition with the insulation in shreds. It gets so hot that solder applied to the tip is almost instantly vaporized; this is an invaluable aid to the proper haywiring of radio parts. We consider two drill sizes really necessary although some haywiremen insist that one size is plenty. We have found that being able to drill two sizes of holes doesn't detract much from the appearance of the work. Anyway, the one-drill men usually have a small rat-tail file which they use to ream (or gnaw) out holes and in our opinion this amounts to the same thing as having two drills. The drills only come into play when the constructor goes high-class and uses a metal chassis or panel and we believe this is coming dangerously close to being neat and efficient. The true haywireman always builds on breadboard, which means any old piece of wood obtainable without too much trouble, and it is a simple matter to nail the parts to the board using the hammer mentioned in our tool list.

In building up a haywire transmitter it is perfectly permissible to begin in a neat, workmanlike manner. This is of no consequence, however, because using the tools we have specified, it won't be long before you have whipped yourself

(*Continued on page 140*)

* 244 Magnolia Ave., Oxnard, Calif.

Foreign Notes

QSL BUREAUS

Here's how to get best service on delivery of your QSLs to foreign stations: simply mail cards direct to the bureau of the proper country, as listed below. Do not send foreign cards via ARRL except those for which no bureau is here listed.

Alaska: J. W. McKinley, Box 1533, Juneau.
Algeria: Via France.
Antigua: A. Tibbits, 27 St. Mary's St., St. Johns.
Argentina: R.C.A., Av. Alvear 2750, Buenos Aires.
Australia: W.I.A., Box 2611 W, G.P.O., Melbourne.
Austria: O.V.S.V., Kierlingerstrasse 10, Klosterneuberg.
Azores: Via Portugal.
Belgium: U.B.A., Postbox 634, Brussels.
Bermuda: J. A. Mann, R.N., W/T Station, Daniel's Head, Somerset.
Bolivia: R.C.B., Casilla 15, Cochabamba.
Brazil: L.A.B.R.E., Caixa Postal 2353, Rio de Janeiro.
British Honduras: D. Hunter, Box 178, Belize.
Burma: Via Great Britain.
Canal Zone: Signal Officer, KZ5AA, Quarry Heights.
Chile: Luis M. Desmaras, Casilla 761, Santiago.
China: K. L. Koo, P.O. Box 409, Shanghai.
Colombia: L.C.R.A., P.O. Box 584, Bogotá.
Costa Rica: F. Gonzalez, Box 365, San José.
Cuba: James D. Bourne, Lealtad 660, Habana.
Czechoslovakia: C.A.V., P.O. Box 69, Prague I.
Denmark: E.D.R., Box 79, Copenhagen K.
Egypt: Box 360, Cairo.
Eire: R. Mooney, Aughnacloy, Killiney, Co. Dublin,
Finland: Tatu Kolehmainen, Kasarminkatu 25 C. 12, Helsinki.
France: Service QSL, R.E.F., 48 Rue St. Laurent, Lagny (S & M).
Germany: (D2 calls only) Capt. J. Blackwood, R. Signals, P & T Section, Hq. Mil. Govt., Hamburg, BAOR.
Germany: (D4 calls only) Signal Division, Hq. USFET, APO 757, c/o Postmaster, New York, N. Y.
Great Britain (and British Empire): A. Milne, 29 Kechill Gardens, Hayes, Bromley, Kent.
Greece: C. Tavaniotis, 17-A Bucharest St., Athens.
Guam: Box 20, Staff Com. Marianas, c/o FPO, San Francisco.
Haiti: Roger Lanoix, c/o RCA, P.O. Box A-153, Port-au-Prince.
Hawaii: A. H. Fuchikami, 2543 Namauu Dr., Honolulu.
Hungary: M.R.R.E., Postbox 185, Budapest 4.
India: Via Great Britain.
Italy: A.R.I., Viale Bianca Maria 24, Milan.
Jamaica: Thomas Meyers, 122 Tower St., Kingston.
Japan: Maj. Lloyd D. Colvin, Hq. 71 Sig. Ser. Bn., APO 500, c/o Postmaster, San Francisco.
Luxemburg: W. Berger, 20 Louvigny St., Luxemburg.
Malta: Via Great Britain.
Mexico: L.M.R.E., Apartado Postal 907, Mexico, D.F.
Morocco: C. Grangier, Box 50, Casablanca.
Netherlands: V.E.R.O.N., Postbox 400, Rotterdam.
Netherlands Indies: Via Netherlands.
Newfoundland: N.A.R.A., Box 660, St. Johns.
New Zealand: N.Z.A.R.T., P.O. Box 489, Wellington C1.
Nicaragua: R. Argenal, P.O. Box 78, Managua.
Norway: N.R.R.L., P.O. Box 898, Oslo.
Panama: R. D. Prescott, P.O. Box 32, Panama City.
Paraguay: R.C.P., Palma 310, Asuncion.
Peru: R.C.P., Box 538, Lima.
Philippine Islands: G. L. Rickard, 48 Ortega, San Juan, Rizal.
Porto Rico: E. W. Mayer, P.O. Box 1061, San Juan.
Portugal: R.E.P., Travessa Nova de S. Domingos, 34-1°, Lisbon.
Salvador: J. F. Mejia, 7ª Calle Poniente No. 76, San Salvador.
South Africa: S.A.R.R.L., P.O. Box 3037, Capetown.
Sweden: S.S.A., Stockholm 8.
Switzerland: U.S.K.A., Postbox, Berne.
Uruguay: R.C.U., Casilla 37, Montevideo.
U.S.S.R.: Central Radio Club, Postbox N-88, Moscow.
Venezuela: R.C.V., Apartado 1247, Caracas.

Following usual custom, the May and October issues of *QST* each year will carry the above list, with revisions and additions as necessary.

NEW ZEALAND

From approximately 400 at the beginning of 1946, the membership of N.Z.A.R.T. has grown to 1500. There are thirty branches or local groups throughout the territory. At present the society is engaged in revising its constitution to provide an elected council to govern policy of the association. This council will elect a management committee that will be responsible for carrying out the set policies. The association has excellent relations with the post office authorities. Both government delegates to the telecommunications conference are association members, and one is an active amateur (ZL2AZ).

(Continued on page 144)

Andre Auger, F8EF, honorary president of the *Reseau des Emetteurs Français.*

V.H.F. Relay and QSO Party

May 17th–18th — Multipliers Credit Multiband Work and Field Operation

With v.h.f. activity at an all-time high, and the interesting spring-summer season just around the corner, we again introduce the popular V.H.F. Relay and QSO Party. In 29 hours of concentrated activity how many stations can be worked? How great will be our coverage of states? How far can we relay a message? What will be our maximum reliable range? The weekend of May 17th–18th will give us the answers and provide the opportunity to test our equipment and the effectiveness of bands above 30 Mc.

You will QSO new stations, work additional states and improve your standing in the V.H.F. Marathon. You will enjoy the operating fun. A report of individual work and contest results will appear in *QST*. Special awards will be made to the three highest scorers. All participants will receive certificates in recognition of their efforts.

Contest Period: May 17th (Saturday), 3 P.M. local time to May 18th (Sunday), 7:59 P.M. local time.

Scoring of Contacts: List all different stations worked in the contest period, together with their *locations*. In a given band, a fixed or portable station may be worked but *once* for contact credit regardless of location. Contact points depend on the transmitter frequency of your station and the distance covered, in line with the table below:

Distance of Station Worked	*Number of Points to Score for Contacts Using Transmitter on*		
	50 Mc.	*144 Mc.*	*Above 235 Mc.*
Under 25 Miles.....	1	2	10
25 to 75 Miles.....	2	4	20
75 to 250 Miles.....	5	10	50
Over 250 Miles.....	10	20	100

Scoring Message Credits: To the contact points computed as above add points for message copies submitted. *If these show handling data* — the call of the station *from which* message was received, call of station *to which* the message was sent by radio, and the time and date of acknowledgment of receipt between stations — the claim to points will be allowed. Your call should be written on each message for identification.

Send messages to those known active or *likely* to be active on v.h.f. in the contest. *For originating* and sending a test message of approximately five to ten words, specifically addressed or "to any amateur" in remote sections of the country, and for submitting copy with handling data (but one such message per station will be credited) — count 10 points. Start your test message as soon as possible.

For *relaying* such messages away from the starting point toward destination and submitting full copies score 3 points (1 for receiving by radio, 2 for relay onward). Reply messages relayed, with copies submitted, also count as just explained. For originating a reply message 1 point may be claimed.

Multipliers: Points may be multiplied in turn by multipliers designed to credit (a) ability to work from field locations under portable designation; (b) ability to use more than one very-high-frequency band. Stations under portable indicator (as in *a*) may multiply by two all points made while actually operating portable or portable-mobile. The sum of all points (in *b*) may be multiplied by the number of bands on which contacts are made.

If crossband work occurs, consider the band your *transmitter* is on as the band on which the contact is counted in your report.

C.w. is recommended for accurate copy on the message and to insure identification of your signal under difficulties at distant points. Scoring is the same for either 'phone or c.w. The aim is to work as many stations as possible. Push test messages on their way in a responsible manner.

The same station may be worked once on each band.

Mail your report, with claimed score and message copies, promptly. Marathon forms must not be used in reporting results of the relay. All entries should be postmarked no later than May 31st.

— *F.E.H.*

Strays

First to report WAC on 10-meter n.f.m. is W1UC, who accomplished the feat in mid-January.

— ··· —

"New Electronic Terms" Department

Tarrytown (N. Y.) *Daily News:* ". . . two radio stations use the same frequency and a layer of *basses* . . . deflects the . . . broadcasts." — *W2PEX, W2SPR.*

Hollywood *Citizen-News:* ". . . Crescent Bay Broadcasting Co. . . . has applied for permission to operate a 1460 *kilowatt* radio station on 250 watts. . . ." — *W6OYY*

(Italics ours.)

A Useful Formula for Solenoid-Inductor Design

Determining Coil Dimensions with Known Capacitance

BY JAMES B. RICKS,* W9TO

THE design of inductors for radio work is usually straightforward, thanks to the work of Nagaoka and Wheeler and others who have developed accurate inductance formulas for almost every conceivable wire configuration. Most often the inductor is to be a solenoid of dimensions mechanically suited to its application. The mean diameter and the approximate winding length are known, and the problem becomes that of finding N, the number of turns necessary to resonate at f megacycles, when in circuit with C micromicrofarads. The inductance value for the winding, usually determined in the design, often has no immediate significance in itself.

A convenient formula is derived by substituting resonant-circuit parameters for L in Wheeler's solenoid-inductance formula and then solving for N, the number of turns required, in terms of winding dimensions, frequency, and circuit capacitance:

$$L = \frac{d^2N^2}{18d + 40l} \qquad (1)$$

where: d = mean diameter, inches
l = winding length, inches
N = turns
L = inductance in microhenries

Solving for N,

$$N = \frac{\sqrt{L}\ \sqrt{18d + 40l}}{d} \qquad (2)$$

The formula for frequency in terms of inductance and capacitance is

$$f = \frac{1}{2\pi\sqrt{LC}} \qquad (3)$$

Solving for L,

$$L = \left(\frac{159}{f\sqrt{C}}\right)^2 \qquad (4)$$

where f = frequency in Mc.
C = capacitance in $\mu\mu$fd.

Substituting in (2),

$$N = \frac{\frac{159}{f\sqrt{C}}\sqrt{18d + 40l}}{d} \qquad (5)$$

$$N = \frac{675}{df\sqrt{C}}\sqrt{d + 2.2l} \qquad (6)$$

To avoid decimal difficulties in calculation, C is not placed in the denominator of the radical form-factor term.

Example

In illustration, let us design a solenoid to be wound on a 1-inch form in 1½ inches winding space that will resonate at 7 Mc. with 100 $\mu\mu$fd. of total capacitance.

$$N = \frac{675}{df\sqrt{C}}\sqrt{d + 2.2l}$$

$$N = \frac{675}{1 \times 7 \times \sqrt{100}}\sqrt{1 + 2.2\ (1.5)}$$

$$N = \frac{675}{70}\sqrt{4.3} = 20 \text{ turns}$$

If a solenoid is to be wound at a winding pitch of P turns per inch, N/P might be substituted for l in this formula and a solution again found for N, but unfortunately the expression and its calculation become lengthy. It is more expedient to arrive at N by assigning an estimated value to l in the formula, finding N by a rough calculation and then redetermining l from N so obtained and the stipulated winding pitch.

Wheeler's formula and this modification of it are accurate for all inductor form factors usually encountered in solenoid design. Some small error may be introduced in estimating distributed circuit capacitances that will parallel the lumped capacitance of the resonant circuit.

* 1236 Forest Ave., Wilmette, Ill.

Strays

Announcing — music and flowers for the well-equipped postwar ham shack!

W2ASA, P. E. Smay, and ex-W9PMH have sent in a descriptive folder on the new B-45 Signal Generator which reads, ". . . Generates R. F. frequencies . . . from 11 Mc. to 50 Mc. on *Harmonicas.*"

W8NDX culled this one from his home-town 'paper: ". . . Western Electric type 1N24 *Geranium* crystals."

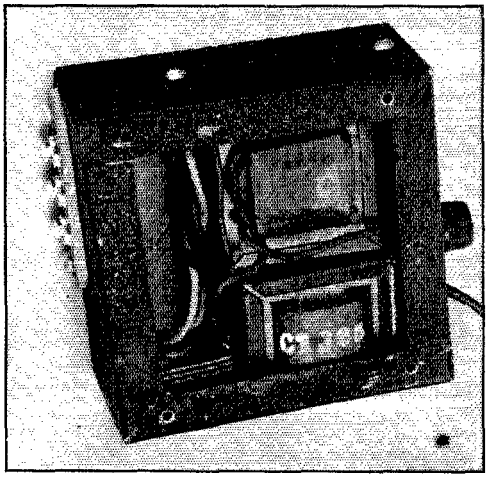
(Italics ours.)

Hints and Kinks For the Experimenter

POWER SUPPLY FOR THE SCR-211 FREQUENCY METER

A COMPACT power supply for the SCR-211 frequency meter is shown in the accompanying photograph and in Fig. 1. The unit, which is capable of delivering 140 volts under the full load (18 ma.) required by the 211, can be built for $5 or less, depending upon how much can be found in the junk box. It has excellent voltage regulation, is small enough to fit into the battery compartment without requiring removal of the batteries, generates very little heat, and requires no changes in the circuit of the 211.

As shown in the diagram, one of the new 100-ma. selenium rectifiers is used to rectify the line voltage, which is then filtered by a midget 50-ma. choke and a dual 40-μfd. condenser. Filament voltage for the tubes within the frequency meter is supplied by a small transformer rated at 6.3 volts, 1.5 amperes.



Side view of the miniature power supply designed for use with an SCR-211 frequency meter. One side plate has been removed to show arrangement of the parts within the 4 × 4 × 2 utility box. The output terminals are on the rear wall of the box, and the a.c. input cord and the fuse mounting post are on the front.

The entire unit is constructed within a standard 4 × 4 × 2 utility box. By careful arrangement of the parts, all fit nicely inside the box. The use of this gadget is not limited to the SCR-211, of course, and being extremely compact and portable, it can serve numerous duties around the ham station. Among its several advantages over

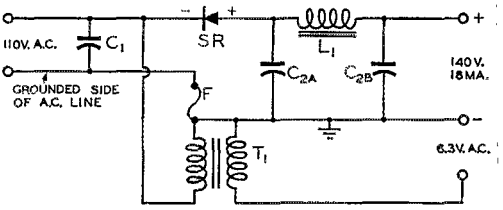


Fig. 1 — Schematic diagram of the 140-volt 18-ma. power supply.
C_1 — 0.01-μfd. 600-volt paper.
C_2 — Dual 40-μfd.-per-section 150-volt electrolytic.
L_1 — Midget 15-hy. 50-ma. filter choke (Stancor C-1325).
F — 1-amp. fuse.
SR — 100-ma. midget selenium rectifier (Federal).
T_1 — 6.3-volt 1.5-amp. filament transformer.

tube power packs is the fact that the heat generated is negligible, permitting maximum frequency stability in the test instrument for which it was designed.

— *Al Jackson, W1NI*

HOME-BUILT MULTIPLE CRYSTAL HOLDER

AN easy-to-build gadget that will permit a crystal-switching system to be installed in almost any existing transmitter is shown in Fig. 2. Construction details are self-evident from the drawing. The plug-in base is obtained from a National Type PB-10 base-and-shield-can assembly. The top, on which six ceramic crystal holders are mounted, is a sheet of transparent insulating material. (Plexiglas, Lucite or polystyrene will do.) It is held in position by four threaded brass rods, which are bolted to the 5-prong plug-in base as shown. The selector switch is mounted on another piece of similar material. This piece has grooved ends which slide in between the brass rods. The grooving is done with a small rat-rail file, and eliminates the need for drilling through the sheet edgewise.

The ceramic crystal sockets used are of the model that accommodates the new Type FT-243 crystal holders. Six of these fit into the upper "deck" without crowding. If desired, one of the sockets could be of the type that takes the old-style holder. By extending the brass rods, another deck may be added to permit use of twelve crystals. In this case, however, the shield can that comes with the unit cannot be used.

(Continued on page 148)

Correspondence From Members-

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

OPERATING

468/22 Ave., Nillieria, Pretoria, South Africa

Editor, *QST:*

I would like to complain about the very bad manners of *some* of the W stations, and hope they will cease their bad practices and so assist in clearing some of the QRM on the DX bands.

Needing a few more countries for the DXCC, I sit up late at night (afternoon your time) to try and raise them. I hear VP2AD calling CQ and call him on his own freq. He is only RST 44/58 by me. I sign and who answers me? Perhaps VP2AD did — but I'll never know, because a full-blooded gallon chimes in my ear for a full two minutes, calling me, and signs W4- - - . VP2AD is calling CQ again and maybe I'll raise him this time. But no, the same thing happens again, only now there are two gallon guys calling me. After 90 minutes of this kind of thing I pull the switches in disgust and think of all the pretty sleep I have lost without a VP2 to my credit. Thank goodness for conditions on 28 Mc. that these guys cannot sometimes hear the station you are trying to contact. . . .

— *A. M. Smuts, ZS6GO*

---

745 W. Cooke Ave., Glenolden, Pa.

Editor, *QST:*

Just contacted W9- - - after his CQ. He came back after I gave him a short call at about 20 w.p.m. His reply was at about 50 w.p.m. — a very fine showing with a bug; but I hope he isn't a League member: I politely requested a QRS 20 and received a snappy "sorri OM, too bad" then followed another CQ. Do you think he is a good amateur?

— *Julius J. Willa, jr., W8IXS*

Rome, Italy

Editor, *QST:*

Just fell heir to December *QST* and of course read it from "kiver to kiver" and took special note of the S.S.L.C.W.S. (Society for the Suppression of Long Calls Without Signatures). I became eligible for membership many times while operating on 10 and 20 from EA1D. . . .

It would probably surprise a lot of the DX boys to know that many times I tuned them in S9 and, even as much as I would have liked to work them, turned to another station after listening to them chant my call unnecessarily long without signing. There are a lot of G stations guilty of the same thing and as far as I was concerned had the same luck.

— *John Mohn, ex-EA1D, W6?*

---

44 Tapton Hill Rd., Sheffield 10, England

Editor, *QST:*

During the last few weeks I have had three 'phone contacts with W stations wasted because the American hams in question would not carry on because QRM had prevented their hearing my "handle."

Is the handle such an important adjunct to the successful QSO? Who started the ridiculous business anyway? In the old days "OM" or "OB" used to be the signs of the friendly spirit of ham radio, and I can see no reason for discontinuing their use. But nowadays one must expect anything from some of the American 'phones, even to the extent of being addressed as "feller" or "ma friend."

If the handle is such an important thing, why not petition FCC to change all call letters to the Christian name of the station owner? Then we should have W2HANK and W3ART and know who they were. I might even become G2JACK and thus save many a headache for the Ws who couldn't read my name for QRM.

Seriously though, don't you think it's high time some of the handle merchants started acting like real radio operators? More power to you in your endeavors to stamp out the handle child's-play.

— *W. J. Crawley, G2IQ*

1708 6th Ave., N.W., Calgary, Alta., Canada

Editor, *QST:*

"And tuning the band. . . ." How often do we hear this cry on ten and how utterly defeated many ham listeners must feel, unless the station making the call happens to be at one end or the other?

. . . My CQs are made thusly: "CQ 28–28,500," or "CQ 28,700–29,700," or "CQ 29,700–29,000." The point is just this: I spot call my CQs. You will note too, with malice aforethought, I seldom if ever call a CQ that includes the frequencies of 28,500–28,700. In my own way I am trying to get the fellows from crowding down into 28,500–28,700 kc. If as a whole the operators of 'phone on ten would adopt this or possibly some better system we could begin to get some much better operating and more satisfactory QSOs. . . .

— *Frank Meadows, jr., VE6AC*

WANTS REAL AMATEURS

2949 Midway, Shreveport 51, La.

Editor, *QST:*

. . . Many of us old-timers have lost sight of "emergency-operation readiness," a prerequisite of operation "in the public interest, convenience, and necessity." Many new licensees have never heard of it. How many of us get our emergency rig going before we start on the big kilowatt? Are we interested in net operations and good operating procedure?

Amateur radio needs the availability of commercial stuff, but before buying the nickel-plated kilowatt every ham should build and air-test a complete receiver and transmitter unit. Preferably this unit should be capable of emergency operation. A person definitely gets out of anything just what he puts into it. If you build a small rig and get S9 in Timbuctoo, it looks like S9. But if you go to the local ham emporium and lay a chunk of dough on the line for a super, shiny, nickel-plated what-you-may-call-it and get an S9 report, you are sore because it should have been an S11 report. Why? Because you own a super-junkbox guaranteed to give a 12-db. gain over anything that walks, flies, or swims. Besides, with all that heavy metal you could get selfish and be an air hog with no patience for the kid in the next block who is trying to get on the air with something he built with his own two hands.

Personally, I don't care how many licensed amateurs there are; whether they work 'phone, c.w., or whatnot, as long as they are real amateurs with a deep-rooted appreciation of amateur radio — an appreciation that can only be obtained by their own efforts, not by a visit to their local gadget emporium. Suppose we got our amateur licenses this way: I'll be Jimmy, a kid down the street with a paper route so he can buy his set, or Jimmy of the super-xmitting family on the proper side of the track. I am going after a Class C license. I think I can do 13 per, and answer the questions, so I write Uncle Dudley. He sends out the papers which I take to a friendly guy across town who holds a Class A license. I pass the code test OK and take the written examination; then I send the papers off to Washington. In due

(*Continued on page 148*)

Operating News

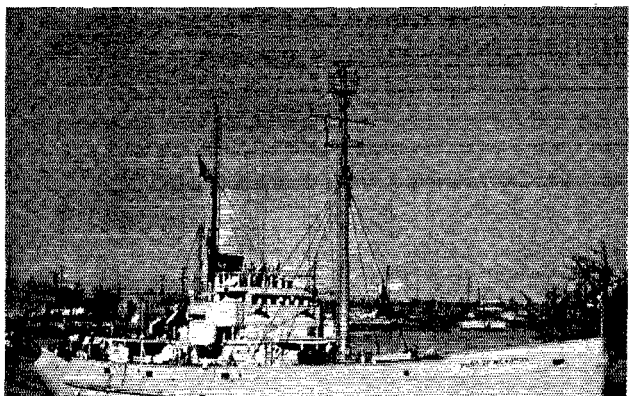
F. E. HANDY, W1BDI, Communications Mgr.
J. A. MOSKEY, W1JMY, Asst. Comm. Mgr.

GEORGE HART, W1NJM, Communications Asst.
LILLIAN M. SALTER, Communications Asst.

The New BCI Circulars. The ARRL Communications Department has available, on request, two types of circulars, to assist individual amateurs in handling their public-relations problems whenever such arise in connection with broadcast-listener complaints relative to interference. (1) A one-page mimeograph explains the many possible sources of interference to any complainant. It covers the steps that can be taken to identify amateur interference, and suggests simple tests to determine how the difficulty is occurring in those cases that can be identified as resulting from amateur operation. (2) An additional two-page mimeograph on "Typical Solutions to BCI" describes line filters, treatment of a.c.-d.c. sets, wavetrap remedies and a wide variety of other approaches that amateurs have found applicable to the completely successful handling of this problem, which is the responsibility of each amateur. Besides these circulars, advice is separately available on replying to newspaper mention of amateurs in connection with interference problems. Proper advance attention to local relations will solve difficulties and will ordinarily keep any situation from deteriorating to the stage involving publicity in the local newspapers or letters to FCC. There is no charge to League members for this Communications Department service.

The *first* circular mentioned is designed as an "ice breaker" in handling the BCL who doesn't understand the need for coöperation of *both* parties to effect the best engineering solution. It is an excellent enclosure to that letter that you would like to write your neighbor, keeping a carbon for yourself to make it a matter of record that you offered coöperation. Tell us how many nearby listeners you want to send this educational bulletin to; we'll send you more than one, if desired, for the good of the Amateur Service. The *second* circular is for your *own* station use. "Typical Solutions" is written in terms too technical for broadcast-listener understanding. By review of different situations, by diagramming of the most common solutions and by giving a suggested engineering approach to a variety of typical problems, any amateur has a guide for attacking the common interference problems incident to the distribution of a variety of broadcast receivers in the hands of the listening public.

The CD will send either or both sets of mimeographed sheets gratis to members who describe their interference difficulty and ask for such assistance. Once the installation of simple remedies has been satisfactorily completed for a complainant "next door," this will serve as an example of what may be readily accomplished. Maintenance of one's own satisfactory public relations is an individual responsibility, a neces-



The *Port of Beaumont* leaving the turning basin, Pennsylvania Shipyards, Beaumont, Texas, on the afternoon of January 25th. Aboard is the Ronne Antarctic Research Expedition, led by Commander Finn Ronne, USNR. The crew of 22 men includes L. D. Kelsey, W3LYK, radio operator. The expedition is on a 7000-mile journey to the Antarctic, and will base at Palmer Land, approximately 1000 miles south of Cape Horn. Latest schedule for contact with amateurs is as follows: At 0400 GCT, the expedition station AYZH calls CQ on 12,480 kc. and listens for answers in the 14-Mc. band. At 0430 GCT, AYZH transmits on 8330 kc. and listens on 7 Mc. W3LYK/MM also plans to engage in amateur contacts on 10 and 11 meters. W5KTF, W5GEA and W4BIZ, operating on 7263 kc., are maintaining regular schedules with the expedition.

sity for one's own peace of mind as well as for the Amateur Service.

Your Radio Serviceman May Help. Some amateurs, instead of working out all different cases individually, have found it desirable to enlist the coöperation of the neighborhood radio serviceman, especially after first having completed a successful next-door pilot installation for demonstration of what *can* be done. But many good servicemen prefer not to tackle specialized interference-shooting and set modifications unless given some assisting information and encouragement. With tips on how to proceed, most of these men would just as soon tackle the broadcast-receiver side of the problem as not. It is our opinion that it is *highly advantageous for any amateur* who operates using bands, modes and power levels capable of causing interference, to make friends with one or more of the local radio-service people. This is, of course, so they will be working with you instead of against you, as becomes the tendency when dealing with a specialized problem not strictly like their usual repair job. They have contact with many broadcast listeners. For one thing, the repairman who gets around can put in many a good lick (or otherwise) for you, depending on his background knowledge. He can advise you *first* instead of suggesting a listener write the FCC or his newspaper! So it may be wise to enlist his assistance in some work and make him a friend instead of leaving him a stranger who runs headlong into your problem. ARRL will furnish to any member, on request, an *extra* copy of "Typical Solutions," to be passed along to his serviceman. Since this form is written primarily for amateurs, some radio-shop personnel will require interpretation of terms such as BCI. The approach we recommend is an informal visit to your serviceman, one in which you can tell him something of your problems, leaving our detailed information as a little present dedicated to his coöperation in making use of the data you have supplied.

Radio Club Interference Committees are also invited to write us for copies of the two types of forms described above. Each radio club can probably best give top assistance to its members by maintaining an active interference committee, to arrange recurrent publicity and solicit interference reports, filtering out the percentage which may be attributable to stations of our service. A committee of five men — two prominent listeners, two technically-skilled amateurs, and one member who maintains contact with the local press for necessary notices — makes a nicely balanced group.

Kon-Tiki. By the time you read these paragraphs another expedition placing main reliance on amateurs for communications during months at sea will be under way. See details on page 71, March *QST*, and elsewhere in these columns. Radio amateurs to serve as key stations now have been lined up at the request of Captain Rorholt representing the Norwegian government and the expedition sponsor in this matter. Conferences at ARRL have covered the scientific program of the expeditioners and assisted in crystallizing the communications plans. Of special interest to amateurs will be plans for regular use of six and ten meters, and the assignment of lower frequencies. All amateurs who can do so should listen on 49,980, 27,980, 28,248, 14,124 and 7062 kc., reporting the signals (strength, time, day, distance, etc.) to ARRL. At the beginning of every full- and half-hour, Kon-Tiki expects to transmit its call, LI2B, for a short period, on the first two frequencies listed above. At noon and midnight, GCT, LI2B expects to work key stations with traffic and exchange signal reports. Your assistance by listening often and submitting a full log of LI2B signals via ARRL will be appreciated.

ARRL Field Day—June 14th & 15th. The time is almost here for the biggest League activity of them all, the annual "FD." Informal inquiries concerning the dates already have been made. Mark your calendar and start planning now.

Many radio clubs and Emergency Coördinators' groups are already engaged in activities leading up to organized participation! Several clubs are holding contests for building the *ideal* portable equipment for the emergency and FD job! When the winners have been selected additional duplicate units are to be built as part of general club emergency preparedness. Other clubs are busy investigating sites, building portable masts and testing auxiliary power supplies. Better tell your family that the weekend of June 14th-15th is dedicated to emergency testing and the ARRL FD. Plan and build now. BCNU in the FD.

— *F. E. H.*

BRASS POUNDERS' LEAGUE

(February Traffic)

Call	*Orig.*	*Del.*	*Rel.*	*Extra Del. Credit*	*Total*
W4DUG	2298	–	20	–	2318
W4DQW	1	20	980	18	1019
W5IGW	6	11	802	1	820
W9RCB	12	17	693	14	736
W8SCW	19	117	432	103	671
W3MJK	6	23	580	17	626
W4FWZ	1	6	564	–	571
W5WZ	3	2	542	2	549
W2CGG	14	62	378	56	510
W2LFR	53	26	410	17	506

The following make the BPL with over 100 "deliveries plus extra delivery credits":

W9DXL	184	W3TWI	108
W9NH	178	WØZVS	105
W1UE	115	W9LFK	102
W3LVY	113	W3KWA	100
VE3HP	113		

A message total of 500 or more, or 100 "deliveries plus extra delivery credits," will put *you* in line for a place in the BPL. The Brass Pounders' League listing is open to all operators who qualify for this monthly "honor roll."

MEET THE SCMs

James W. Watkins, W4FLS, present SCM of the Tennessee section, was born in Jackson, Mississippi, on September 22, 1904.

Upon graduating from high school, he attended the University of Chattanooga, where he took special courses in radio and electronics. Before accepting his present position as Electrical Engineer II for the Tennessee Valley Authority, he was a salesman of office machines and equipment.

His initial interest in amateur radio dates from 1930, but it was not until eight years later that he took the amateur examination and obtained the call W4FLS, which he still holds. He has participated in OPS Parties, Field Days, Sweepstakes (in which he was highest Tennessee 'phone station in 1941), and has a WAS certificate. In prewar days he held appointment as ORS, OPS and Emergency Coördinator, but now is devoting all his time to his duties as SCM and as president of the Chattanooga Radio Club.

His layout consists of the following: transmitter — 6L6 crystal oscillator, VFO, 6L6 doublers for operation from 7 through 28 Mc., 811 buffer, p.p. 810s final, modulated by 203As in Class B; receiver — SX-28A; antenna — folded dipole (a three-element 14-Mc. beam is under construction). W4FLS is located in a spare room inside the house, but Jim is planning an outside shack to be ready in the very near future.

Amateur radio is his only hobby, although in his spare time he indulges in a bit of golf, in which he is better-than-average, and in hunting and fishing. Jim has already demonstrated his ability to direct the affairs of the Tennessee section, which should forge ahead rapidly under his leadership.

BRIEF

Getting your QTH over to a DX station is often a difficult matter. W3BES reports that the Frankford Radio Club of Philadelphia has solved the problem by renting a post office box for use of members. Unable to get No. 73 or No. 88, they settled for P.O. Box 34, Philadelphia.

GET-ACQUAINTED PARTY RESULTS

The weekend of September 21-23, 1946, was devoted to a special welcome to amateur radio for those operators who received their first station licenses postwar. The ARRL Get-Acquainted Party held on those dates enabled old-timers to extend the hand of good fellowship to newcomers, and gave the LSPH licensees an opportunity to get better acquainted with prewar operators.

Prewar licensees worked only postwar licensees, and vice versa. Scores consisted of number of contacts multiplied by number of ARRL Sections, further multiplied by the number of fifteen-minute-or-longer QSOs. Information of general interest was exchanged in each contact: (a) signal report, (b) operator's name or personal "sine," (c) operator's age, (d) month and year first amateur station license was received, and (e) ARRL Section in which located. Prewar licensees competed only with other prewar amateurs, postwar licensees with postwar ops.

WØEHR/3 led the postwar group, head-and-shoulders above his nearest competitor. "Fos" worked 58 stations in 25 Sections, with 47 fifteen-minute-or-longer contacts. Result: 68,150 points. W2QBO made second place with a score of 24,624 (38 QSOs, 18 Sections, 36 long contacts). W3KCI placed a strong third, 23,120 points from 34 contacts, all fifteen-minute-or-longer, and 20 Sections. Congratulations to all three!

It was not surprising to find contest-ace W3BES heading the prewar list. Jerry rolled up 28,749 points, from 37 fifteen-minute-or-longer QSOs with 21 Sections. W4JIZ (now W4KFC) was next in line with 21,780 (33 QSOs, 20 Sections, all long contacts). Third high was W3BXE who made 31 contacts in 11 Sections for a score of 10,571. It is apparent from the calls of these leaders that the newcomers received a first-class send-off in contest participation. FB, old-timers!

There were two notable deficiencies in the contest. One was the bad break on radio conditions, which were extremely poor. The other was the lack of newcomers taking part. There were many postwar licensees on the air (202 were worked by contestants) but comparatively few entered the affair in a serious manner. Those who did take advantage of the opportunity found the old-timers ready and willing to slow down in speed, or overlook any rough spots in operating technique. As one participant put it, "We were all beginners once, and it was a pleasure to offer encouragement to the new brothers."

Some interesting statistics were gleaned from reports. The average age of the prewar participant was 34, of the postwar participant, 23. The ages of prewar operators worked by contestants ranged from 20 to 66, while ages of postwar operators ranged from 14 to 48. The earliest licensees participating gave date of first ticket as 1912. The most recent licensees had

received tickets in September, 1946, a few days before the contest. — *E. L. B.*

The Participants' Viewpoints

From the postwar gang: "I surely did enjoy the party. Conditions were poor, but still it was great fun."—*W4IRL.* . . . "The sunspots didn't help any, making contacts well-earned."—*W5LIU.* . . . "Thanks very much for nice start in amateur radio."—*W4JVJ.* . . . "QRN terrific!"—*W9FNU.* . . . "What I liked most about the affair was the genuine friendly attitude of most of the old-timers toward the newcomers. The older the hams, the friendlier they were. With just the few hours I devoted to it, the contest taught me much. I recommend contest participation to everyone for operating knowledge gained and familiarization with equipment capabilities."—*W2QJY.* . . . "I had been on the air only one week. Entered the contest just for fun and I wasn't disappointed."—*W2SGC.* . . . "I heard several old chaps (esp. W3BXE) giving a fine welcome to us newcomers."—*VE3BGW.*

From the prewar gang: "I believe the participating neophytes got a kick out of it. Most of the fellows I recruited into the party seemed to feel a little 'contest-shy' because of real or imagined operating deficiencies. It was interesting to note the marked improvement in operating technique displayed over the period of the contest. W1OIJ, W3KKB and others were knocking them off like veterans on Sunday afternoon and evening."—*W4JIZ.* . . . "It was good to meet the new gang. They had to be broken in carefully, and the old-timers did all they could to make it a pleasure for them. Nervousness was the sign of a newcomer when I started, and still is. Some had received their licenses as late as two days before the contest."—*W6AM.* . . . "There seemed to be plenty of old hams on, but a great dearth of LSPH stations."—*W3ECP.* . . . "This was a fine contest. It made the newcomers feel the way DX stations feel whenever the band was open."—*W3LVY.* . . . "I believe this was one of the best ideas yet in the way of contests. It is unfortunate conditions were so bad."—*VE3WY.* . . . "Seemed odd to ignore all the old contest hounds because they were on 'my side'!"—*W1GKJ.* . . . "Did you notice how many fine operators there are with such recent calls?"—*W2NAZ.* . . . "The newer hams did not seem to be very 'party' conscious. The few contacts were enjoyable and long enough to get acquainted. I have been making it a point to work members of the LSPH gang right along and get a big kick out of it, remembering my own experiences of 25 years ago."—*W8AQ.*

SCORES—POSTWAR LICENSEES

WØEHR/3	68150	W3KZS	1372	W3KRE	245
W2QBO	24624	W4JVJ	990	W2SGC	125
W3KCI	23120	W2QOS	880	W6WTL	27
W4IRL	13300	W4IMH	648	VE3BGW	27
W3KQR	10608	W9FNU	605	W3LDV	24
W8WXV	9200	W2QJY	594	W2PGZ	1
W9LVR	6936	W1NXX	448	W5LDE	1
W3KKB	2550	W1OCD	448	W6WOO	1
W5LIU	2040	WØPNQ	364	W8YBI	1
W9WEI	1452	W2PRE	336		
WØMFX	1452	VE1RP	288		

SCORES—PREWAR LICENSEES

W3BES	28749	W2PPA	648	W2NWA	75
W4JIZ	21780	W1GKJ	567	W3ISF	48
W3BXE	10571	W2GNW	550	W8AQ	48
W6AM	6552	W2KEL	512	W2BO	32
W1UE	5670	W2DRV	343	W6SIG	32
W6DBP	3744	W2RDK	320	W9LFK	30
WØBQJ	3584	W9GHD	256	W3ECP	27
W2EQS	1584	W3FDJ	252	W3GOL	8
W2PGT	1440	W5ARV	245	WØQVA	8
W3LVY	1320	W1AW	216	W2GVZ	6
W8ZFA	1320	W3IDO	216	W7BOH	4
W2KTF	968	W4HJR	150	W4GIV	2
W2NIY	770	W2NAZ	144	W2ADV	1
VE3WY	729	W9OUH	100	W2BGO	1
W2KJO	648	VE3APF	100	W3ADE	1

TRAINING AIDS

Eight new 16-mm. sound motion-picture films have been added to the ARRL Film Library and are now available for distribution among affiliated clubs. These films are from the U. S. Navy's Radio Technician Training series (RTT). ARRL staff reviews of these films are available upon request. Titles and presentation times:

F8: "The Cathode Ray Tube — How It Works" — 15 minutes.
F9: "RTT: Volt Ohmmeter Operation" — 15 minutes.
F10: "RTT: Oscillators" — 13 minutes.
F11: "RTT: Elementary Electricity — Amperes, Volts & Ohms" — 8 minutes.
F12: "RTT: Elementary Electricity — Current and Electromotive Force" — 10 minutes.
F13: "RTT: Audio Oscillator Operation" — 9 minutes.
F14: "RTT: RCL — Resistance Capacitance" — 34 minutes.
F15: "RTT: Inductance" — 35 minutes.

Eight additional films which are *not* available in the ARRL Film Library were also reviewed by the ARRL staff and these reviews are also available upon request:

1) "Sightseeing at Home" — General Electric; 15 minutes.
2) "Principles of Electricity" — General Electric; 20 minutes; color.
3) "The Story of FM" — General Electric; 17 minutes; color.
4) "Excursions in Science . . . No. 4" — General Electric; 9 minutes.
5) "Crystal Gazers (Excursions in Science . . . No. 7)" — General Electric; 10 minutes.
6) "When You Can Measure" — General Electric; 35 minutes.
7) "Electrostatics" — Encyclopaedia-Britannica Films; 10 minutes.
8) "Electronics at Work" — Westinghouse; 20 minutes.

Nine additional motion-picture films and sixteen additional film strips are on order and will be added to the library as soon as they have been received, reviewed, and lecture outlines written. An ARRL-produced slide program entitled "Your Headquarters Station" is in the works and should be ready for distribution about the time this report reaches you.

Films and film strips from the ARRL Film Library are already in wide distribution among affiliated clubs. We suggest orders be placed early in order to make sure you get the film you want.

BRIEF

Operator "JE" at W1AW recommends that DX hounds try "CQ Detroit" or "CQ Mich." if they wish to raise some good stuff. With a message for Detroit during the morning shift at AW, "JE" called "CQ Detroit" on 14 Mc. ZL4GA answered! After that QSO, another attempt to raise Detroit was made, but I1ZZ came back. When "JR" took over the afternoon "watch" he tried a "CQ Mich." on 7 Mc. and was rewarded by an answer from a G2. Perhaps they should have saved the message for the 80-meter traffic nets!

A.R.R.L. ACTIVITIES CALENDAR

May 14th: CP Qualifying Run
May 17th: V.H.F. Relay and QSO Party
June 14th–15th: ARRL Field Day
June 19th: CP Qualifying Run
July 14th: CP Qualifying Run
July 26th–27th: CD QSO Party

—...—

Jan. 16th–Dec. 15th: 1947 V.H.F. Marathon
Jan. 1st–Dec. 31st: Most-States V.H.F. Contest
First Saturday night each month: ARRL Officials Nite (Get-together for SCMs, RMs, SECs, ECs, PAMs, Hq. Staff, Directors, Alt. and Asst. Dirs.)

BRIEFS

Among those to benefit from the FCC's practice of making two-letter calls available to any amateur who ever held one is W1FPP. One-time holder of 9LV, he now signs W1LV. The interesting part about it, however, is that his daughter's name is Lila and his wife's is Vera, making LV quite an appropriate call. W1KKS adds that "LV," when sent in the Japanese code, comes out as our "CQ"!

—...—

QSO record? For the period April 22, 1923, to February 8, 1947, B. F. Piper, WØCRM, claims 104,962 QSOs! He always has numbered each contact and has a stack of logbooks and a cross-index system to substantiate his claim. QSL cards number over 12,000. All QSOs were by c.w. and most all work was with low power (5–10 watts). The present rig uses a pair of 807s with 75 watts input on 7 Mc.

—...—

Lt. Col. A. D. Stephenson, W3IYZ, is commandant of the Signal Corps Training School in Manila. An amateur radio club has been organized, with a station operating under the call KA1SS. Among the operators are W8KNP/KA1AA and W3IED. Many of the Signal Corps students are interested in becoming radio amateurs and each radio repair class and radio operator class is given a short orientation period in the ham shack.

The Cadet Radio Club, United States Military Academy, West Point, New York, has a membership of 107. Shown here in the club's station, W2KGY, are, left to right, front, S. A. Meyerhoff and B. Shebat; standing, W. L. Schlosser, W9SYA, W. O. Enderle, vice-president, Lieut. Col. I. R. Obenchain, W2SMA (officer in charge of the club), P. J. Mueller, and F. L. McClaflin, treasurer. W2KGY is well equipped with two BC-610-Bs, a 300-watt dual-channel 75-meter transmitter, Collins 260-watt 7-Mc. c.w. rig, two 50-watt all-band transmitters, three Super-Pros, a Sky Buddy, two SCR-211 frequency meters, and Army panadapter.

CODE PROFICIENCY AWARDS

ARRL's Code Proficiency Program provides certificate awards for those proving ability to copy code at any of five speeds, 15 through 35 w.p.m. Endorsement stickers for the certificates are awarded later, if first qualification is at less than 35 w.p.m.

The next opportunity to qualify for a certificate or endorsement sticker is on May 14th. At 10:00 P.M. EST that date, W1AW transmits the monthly qualifying run of speeds of 15, 20, 25, 30 and 35 words per minute. Frequencies: 3555, 7145, 14,150, 28,060 and 52,000 kc., simultaneously.

The text copied, received successfully by ear at the highest speed you can copy, should be sent to ARRL for checking. To avoid errors in recopying, send your original copy. *Attach a statement certifying over your signature that the copy submitted is direct copy made from reception of W1AW by ear, without any kind of assistance, personal or mechanical.* If you qualify, you will receive your certificate or appropriate endorsement sticker for certificate you already hold. Those who qualified in the past should submit copy only if speed is higher than indicated on certificate or endorsement sticker.

Each night, Monday through Friday, at 10:00 P.M. EST, on the frequencies mentioned above, W1AW transmits practice material. References to text to be used on several of the practice runs appear below. This makes it possible to check your own copy. It also provides a means of obtaining sending practice since it permits direct comparison of one's fist and tape sending. To get sending help hook up your own key and buzzer and attempt to send right in step with the tape transmissions. Adjust your spacing in the manner indicated as necessary for self-improvement.

Date	Subject of Practice Text from March *QST*
May 1st:	*Low-Cost Six-Meter 'Phone*, p. 13
May 6th:	*More on Speech Clipping*, p. 18
May 9th:	*Fundamental Beam Patterns*, p. 23
May 12th:	*Clean-Cut Break-In Keying*, p. 27
May 14th:	Qualifying Run, 10:00 P.M. EST
May 16th:	*N.F.M. Reception*, p. 30
May 20th:	*An Improved Receiver for Two Meters*, p. 35
May 22nd:	*The BC-221 Frequency Meter as a VFO*, p. 43
May 26th:	*Rotten 'Phones*, p. 48
May 28th:	*Finding the Inductance of R.F. Coils*, p. 54

♦

Among the radio amateurs with the Byrd 1947 Antarctic Expedition were those in this group. The photo was taken aboard the flagship *U.S.S. Mt. Olympus*, en route to Little America. Left to right, front: P. J. Stevens, W8WMY; Owen M. Perry, CETM, ex-W1HVM; Lt. Robert L. Nichols, W9KXU; and Lt. Comdr. J. C. McCoy, part-time operator of KC4USA during the 1939–41 U.S. Antarctic Service Expedition. Rear: A. H. (Bud) Waite, jr., W2ZK, ex-W1TR, 1DTL, 3HKO, 2OAI; William K. Snow, ACETM, W1MUF; Paul Saylor, ACETM, W5AYR; and Capt. Vernon M. Boyd, USMC, who will be remembered as operator "Buck" at KC4USA, 1939–41.

♦

OFFICIAL BROADCASTING STATIONS

The following listed stations transmit ARRL Official Bulletins to *all radio amateurs*. If you are interested in the schedules of a particular station in order to receive regulatory, conference and other information, you may drop a card to Headquarters for more explicit information on the frequencies, days of the week, and times and modes of transmission of the station nearest you.

These stations all supplement the efforts of W1AW to cover the entire country by radio with the latest reports on all matters of interest to radio amateurs. The listed stations are pledged to repeat Official Bulletins several times per week and since they cover each ARRL division they can normally be received through even the most difficult transmission conditions. Western stations in the list receive data for transmission by air mail. In addition, all stations endeavor to copy new bulletins and special information direct from W1AW to be repeated on their schedules.

W1AAR ALP GZL HKK HUV HXK IDY JQD KAT LKP LMB LMU MEG MON MXT NLO ONZ RP TD WR.

W2ASG BAQ BO BRC FI GFH HX IOP NKD ORS OXX PAU PJF QHM RM.

W3AQN BWP CDQ EKZ FJU IOU KSC LIK LJI LVY MPO NDE PJJ PV PY RAT.

W4ACZ AXP AZT BA BQU BYF DGS/1 EEE FUM GAA GBR GJW HMG HYW JLB MP.

W5BSR BYX CEW CJJ CQJ DAQ DAS ECE FAB GHF HEF HFQ HIF JJF KHH LDD.

W6AF AKB ANN AOA ASW DJI GZZ JQB KEI LRU LV OGM OJW OMC ON PVV REB RMM RP SMK SYP VEN VJQ ZM.

W7CKZ DXQ EKT FST FWD GVX IYG RLC STB SYD TMK UOM.

W8CSF CXU DED DZO EFW EQ FGV FMU PUN QFF SWF TIH VAN.

W9AND ARE CLF EDW GPI IDZ JMG QBH QLZ RH VOA.

WØDDF DEA DUD EKK FP GZD IQZ KEI KOH NCS OZN RIL WFK.

KH6ET.

KL7DB.

VE2DX 2TH VE5MW VE6MJ VE7AEU.

Some OBS appointed since February 1st may not appear in the above listing. Every station in the above list has certified its present schedules and activity. Additional OBS appointees of longer standing who received the semiannual "survey" form but have not yet returned the card are under consideration by SCMs for cancellation of appointment. Those who reply certifying their intent to assist amateurs by carrying three or more schedules per week will be returned to the active file for dissemination of official information and their calls will appear in a future *QST* listing.

BRIEF

The first postwar report of truly *low*-power work comes from W5KZG, Corpus Christi, Texas. Using a Type 30 tube in a crystal oscillator, with 0.045-watt input, he worked W5KIY in Austin, Texas. Increasing (!) power to 0.180 watt, he raised W5MAK, San Antonio. Contacts were successful, and through 7-Mc. QRM at that!

HAMS AT HEADQUARTERS

W1AW, ARRL Headquarters Station

The following calls and personal sines belong to members of the Headquarters gang:

W1BAW	R. T. Beaudin, "rb"
W1BDI	F. E. Handy, "fh"
W1BUD	A. L. Budlong, "bud"
W1CEG	H. M. McKean, "mac"
W1DF	George Grammer, "gg"
W1DX	Byron Goodman, "by"
W1EH	K. B. Warner, "ken"
W1FTX	R. M. Smith, "rs"
W1FWH	W. E. Bradley, "wb"
W1GS	F. C. Beekley, "beek"
W1HDQ	E. P. Tilton, "ed"
W1JEQ	C. V. Chambers, "vc"
W1JJR	J. T. Rameika, "jr"
W1JMY	J. A. Moskey, "joe"
W1KKS	Wm. H. Matchett, "bm"
W1LVQ	John Huntoon, "jh"
W1MFA	H. K. Isham, "hk"
W1NJM	George Hart, "geo"
W1ODY	E. E. Miner, "em"
W1PEK	L. T. Waggoner, "roy"
W1PHW	J. E. White, "je"
W1TS	D. H. Mix, "don"
W1VG	L. A. Morrow, "pete"
VE3BLZ	J. W. Paddon, "jack"

BRIEF

A recent four-way QSO between W2KG, W2KH, W2KR and W2KW was a royal event — King George, King Henry, King Robert and King William!

—···—

F.M.T. RESULTS

Clock Winners Made Good to 1 Part in Million!

Frequency-measuring ability is highly prized by the 1947-variety amateur. ARRL's first postwar Frequency Measuring Test brought reports from 256 different persons.

Over 50 of the entrants were using war-surplus frequency meters such as those of the SCR-211, BC-221 and LM types. Of this group, 75 per cent were able to qualify for a Class I ARRL OO rating, with most of the rest in the Class II category. A total of 71 entrants was received in the Observers group, while 185 non-Observers took part.

Individual reports of results have been sent to every participant. A commercial frequency-measuring bureau was retained to establish the "official" transmission frequencies which were sent from W1AW on Jan. 10th, Jan. 24th and Feb. 4th. These frequencies (kilocycles) were as follows:

3790.782	3564.349	3705.826
7213.540	7252.541	7059.562
14,096.000	14,004.036	14,030.091
28,000.836	28,487.320	28,057.098

Most of the readings were submitted on the transmissions made on the two lower-frequency bands, but all were useful to permit measurement at distances when interference or spotty propagation conditions blocked work on certain bands. Class I observers are those who can measure, at 14 Mc., to one kilocycle or better (71.0 parts per million), and Class II OOs are those measuring within ±5 kc. in the same range (374.0 parts per million).

After classifying all reports into OO and non-OO competing groups, establishing the cycles low or high for each reading, and working out the "parts-per-million error," the standings of the leading participants can be presented.

The leader in *each* of the two groups was awarded an item which has been extremely scarce . . . a G.E. Type 8H58 Select-O-Switch clock with Telechron-type motor. Besides keeping perfect time, it is capable of controlling 1600-watt circuits, the advance warming-up of frequency meters, the selecting of radio programs at 15-minute intervals, etc.

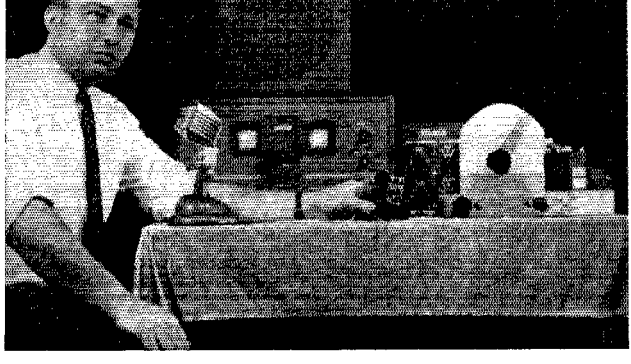
THE WINNERS

OO—L. W. Franklin, W2BF, 1.259 parts per million (6.6 cycles error) (3 readings)

Non-OO—J. R. Johnson, W2BDL, 0.264 part per million (3 cycles error) (1 reading)

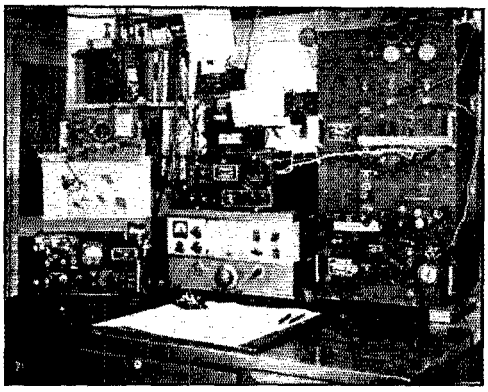
OTHER LEADERS

Observers	*Parts per Million*	*Non-Observers*	*Parts per Million*
W2RCK	3.96	W1MTC	0.79
WØYHZ	4.63	W2MRG	2.25
W7CQE	6.60	W9IIJ	2.36
W2RFT/4	10.09	W4KDV	2.37
W6IWW	11.42	W9NUX	2.67
W6DFO	13.99	W4WMI	3.23
W1DWO	14.00	W3MFO	3.31
W5CDU	16.19	W3IUD	4.75
W9DHT	16.27	W3KHJ	5.15
W4ENL	16.30	W9GFF	6.48
W4IKJ	17.64	W6AQY	7.21
W2ALH	17.95	W9GY	8.40
W5AIR	19.12	W2TAT	9.06
W9CIH	20.47	W8UGG	9.45
W6KW	21.09	W7JSG	9.55
W7JU	25 92	W1ETC	9.94
W1ITI	26.00	W9LJI	10.14
W6AK	26.39	W1JVE	10.25
W2KJY	28.50	W6AFH	10.47
W6GC	28.74	W3BWH	10.84
W7TMK	29.68	W6AXV	10.93
W4WO	32.10	W2QKE	11.37
W9KA	33.21	W9SGL	11.43
W2EET	32.31	VE1TL	11.63
W1AJQ	33.64	W2PAT	11.87
W5ELC	34.37	W6GTE	11.90
W1LVQ	38.17	W9RAB/2	12.04
W1VW	38.23	W8PBH	12.66
CM-CO2WW	38.83	W3ASW	13.88
W9GMV	43.70	W6EC	14.32



♦

Top accuracy in frequency measurement was demonstrated by Dick Johnson, W2BDL, who led all other participants in ARRL's first postwar Frequency Measuring Test. The unit at the right, used in conjunction with the Telrad frequency standard, is a homemade audio oscillator of the *RC* type, using a 6SG7, 6J5 and 6V6, and including VR-150 and VR-105 voltage regulators. Frequency range is from 35 cycles to 27 kc. Calibration was accomplished by noting harmonics of 60 cycles on an oscilloscope using the power line as a standard, and 440 and 4000 cycles from WWV. The oscillator output is in parallel with the 'speaker output and can thus be zero-beat with signals from the receiver. Dick is holding a small oscillator using a 1000-kc. crystal, which he uses for rough checks and as a band-marker.



W2BF, station of L. W. Franklin, leading Official Observer in the early-'47 Frequency Measuring Test. At the left, top to bottom, are the BC-221 frequency meter, loudspeaker, and speech amplifier for BC-610 transmitter. Atop the NC-200 are a Panoramic receiver and the clock which Franklin won in a 1940 FMT under his old call, W2GRG. At the right is a modified GR frequency measuring unit, and above this a CW-3 receiver tuned to 5 Mc. W2BF writes, "My methods of measurement are mainly conventional, although I do use a few tricks. I first get a rough measurement with the BC-221, then cut in the 10 kc. and compare 'x' to the b.f.o., both audibly and on the scope. Then I mix WWV's 440 cycles via Lissajous with the b.f.o., getting check-points just above and below the unknown, for minimum interpolation error. If WWV is fading too much, I use the local fixed-frequency 440-cycle oscillator instead. An output meter on the CW-3 receiver gives me a correction of my 100-kc. accuracy, if necessary."

BRIEFS

Bruce P. Johns, W6QDC, has the walls of his shack papered with an attractive world wall map showing all continents. The "wall-map paper" is produced in two sections that trim to 40 inches wide by 60 inches high each, making a complete map 5 ft. high by 6 ft., 8 inches long. Three or more sections may be used together to cover as long a wall area as desired. The paper is priced at $3.50 per section (sepia on wood grain, varnished), and may be obtained mail order from C. W. Stockwell Co., Ltd., 3262 Wiltshire Blvd., Los Angeles, Calif., if not available through your local wallpaper dealer. W6QDC also put a magnetic north segment in the center section of his linoleum flooring.

—···—

At 7:10 P.M., January 31st last, Miss Bobbe Farman of Oakland, California, filed a message with SCM Greer, W6TI, to her brother, Brigadier General Ivan Farman, J2ATC, commanding officer of the Western Pacific Wing, ATC, Tokyo. The radiogram was of an urgent nature and required fast handling. Immediate routing by other services was found to be impossible. W6TI passed the message to W6CQZ (14-Mc. 'phone) who sent it to a GI station in Japan. It was 'phoned to General Farman's office at 7:20 P.M. Oakland to Tokyo in 20 minutes!

W1AW OPERATING SCHEDULE

Operating-Visiting Hours

Monday through Friday, 8:30 A.M.–1:00 A.M.
Saturday, 7:00 P.M.–2:30 A.M.
Sunday, 3:00 P.M.–9:00 P.M.

A mimeographed local map showing how to get from main state highways (or from Hq. office) to W1AW will be sent to amateurs advising their intention to visit the station.

Official ARRL Bulletins containing latest information on matters of general amateur interest are transmitted on regular schedules:

Frequencies: 3555, 7145, 14,150, 28,060 and 52,000 kc. (voice — 3950, 14,280, 52,000 kc.)
Times: Monday through Friday, 8:00 and 11:30 P.M EST (0100 and 0430 GCT, Tuesday through Saturday)
Sunday, 1:00 A.M. and 8:00 P.M. EST (0600 Sun. and 0100 Mon., GCT)

Bulletins are sent simultaneously, first at 25 w.p.m. and then repeated at 15 w.p.m., on all frequencies during the early schedule to facilitate code practice. Telegraph bulletins are followed, in turn, by voice transmissions on 3950 kc. and 52,000 kc. simultaneously, and then on 14,280 kc. Any changes from this schedule will be announced.

Code Proficiency Program: Practice transmissions at five speeds, 15 through 35 w.p.m., are made Monday through Friday on the above-listed frequencies, starting at 10:00 P.M. EST (0300 GCT, Tuesday through Saturday). Approximately ten minutes practice is given at each speed. Next certificate qualification run is scheduled for Wednesday, May 14th.

General Operation: W1AW engages in two-way work with amateurs, as follows:

Monday through Friday, all times EST —

11:00 A.M.–11:30 A.M.	28,060-kc. c.w.
11:30 A.M.–12 noon	29,150-kc. voice
3:00 P.M.–3:30 P.M.	14,280-kc. voice
3:30 P.M.–4:00 P.M.	14,150-kc. c.w.
4:30 P.M.–5:00 P.M.	3850–4000-kc. voice
6:00 P.M.–7:00 P.M.	7210-kc. c.w.
7:00 P.M.–8:00 P.M.	3555-kc. c.w.
9:30 P.M.–10:00 P.M.	3555-kc. c.w.
12:15 A.M.–1:00 A.M. (Tues. through Sat.)	7210-kc. c.w.

Saturday and Sunday (excepting dates of official ARRL activities).

Saturday: Midnight–1:00 A.M. (Sun.)	3555-kc. c.w.
Sunday: 1:45 A.M.–2:30 A.M.	7210-kc. c.w.
6:00 P.M.–7:00 P.M.	3850–4000-kc. voice
7:00 P.M.–8:00 P.M.	7210-kc. c.w.

BRIEF

A QSO party for amateurs formerly associated with the M.I.T. Radiation Laboratory will be held on May 3rd and 4th. Here is an opportunity to renew acquaintance with many of your wartime co-workers. See December 1945 *QST* for partial list of Rad. Lab. amateurs. General call: "CQ RL." Use any or all bands, 'phone or c.w. Send list of stations worked and heard, and bands used, to Frank L. Baker, W1ALP, 91 Atlantic St., North Quincy 71, Mass.; enclose self-addressed envelope for report of results and news about activities of former Lab. members.

Station Activities

• All operating amateurs are invited to report to the SCM on the first of each month, covering station activities for the preceding month. Radio Club news is also desired by SCMs for inclusion in these columns. The addresses of all SCMs will be found on page 6.

ATLANTIC DIVISION

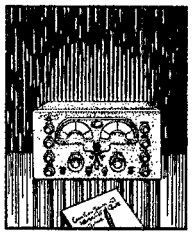
EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3BES— By the time you read this the Eastern Pennsylvania Traffic Net will be in full operation. GMK is the RM and NCS. The frequency of 3785 kc. is used and the time is from 6:30 P.M. to 7:30 P.M. GMK urges general use of the net and invites all E. Pa. stations to help out. He points out that it need not take much time and it is not necessary to be on every night. Just call CQ E. Pa. on 3785 kc. at the above time and you are in. The net is in need of contacts in the area north of Harrisburg. KT has been doing a little 28- and 14-Mc. 'phone operation and finds the going a bit rough. CAU likes his new frequency standard. Our old friend, DPU, now signs his ancient call, PN. Termites chewed EU's antenna mast into three pieces. KMS bemoans the lack of traffic on 7 Mc. QEW handled a fine lot of traffic from the Tampa, Fla., fair. KLZ is working out well with 125 watts to an 811. The York AEC Net drills the second and last Mondays of each month on 146 Mc. with 15 stations active. The York Radio Club coöperates. The Schuylkill Amateur Radio Club has joined the ARRL affiliated ranks. Its code practice net has been moved to 3799 kc. because of interference with TLC on the old frequency. VMF sends most of the code practice. ADE is DXing on 14, 7, and 3.5 Mc. He will be on 28- and 27-Mc. 'phone soon with his new HQ-129X. The Harrisburg Radio Amateur Club is coming alone fine. Old 8FLA, now with FCC in Allegan, Mich., reads the section report in vain looking for news of his old buddies, 8VD, 8BQ, 8AVK, and 8HKS. He is on 3649 kc. looking for contacts back home. In response to an appeal from the Red Cross, the Wayne County Emergency Net has been formed by the following: KBV, QQC, QLW, GPY, CFD, MLW, QXY, and MLB. LAU and LEQ have moved to Philadelphia from Mahanoy City. GHM has a new 10/20 rotary beam. QV is putting up some Sterba curtains which he found most effective when operating from China. The E. Pa. lads turned out for the FMT in fine style. Traffic: W3QEW 90, GMK 80, EU 67, KT 26, KMS 6, BES 4, CAU 4, AQN 3, OML 1, QLW 1.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — Acting SCM, Eppa W. Darne, W3BWT — The Baltimore Amateur Radio Communications Society's application for ARRL affiliation has been approved and Charter received. Officers of the club are GWV, pres.; JVI, vice-pres.; JCL, secy.; and CAQ, treas. Meetings are held on the first and third Mondays of each month in Sears Community House at 7:30 P.M. Recent speakers were Charlie Ellert, former FCC inspector, and Doc Hayes, LVY. A recent visitor was LU5DB, who extended greetings of the Argentine Radio Club and presented the BARCS with the Argentine Club banner. At its Feb. 7th meeting the Metropolitan Radio Club of Prince George County officially accepted its final charter and by-laws, and also nominated permanent officers. Meetings are held in Berwyn School, Berwyn, Md. Full information on this club is wanted by the SCM. The Washington Radio Club conducted an auction of spare ham parts at its February meeting. Parts and gear of every description were brought in by members and sold to the highest bidder, the club treasury taking a 10 per cent fee of all sale prices. FVD, as usual, held forth as genial auctioneer. The second February meeting was "movie night." More Field Day movies and an A.T.&T. subject regarding land wire transmission of broadcast programs were shown. CEK has received a special Congressional Medal for achievements in U. S. Antarctic Expedition. KBE and his XYL are visiting their son, KP4CD, in Puerto Rico. JJD is on 28-Mc. 'phone. EQK is very active on 14-Mc. 'phone with VFO. KKH gets out well on 28 Mc. KOU, KCA, KBF, LFF, BEJ, MWE, HDZ, and LZZ are active on the ultra-highs in Baltimore area. CDQ attended IRE Convention in New York. Liz is on 14 and 7 Mc. with temporary antenna. ECP and LVY are new RMs for Washington and Baltimore areas, respectively. ISF and WU are newly-appointed ORS. EZN reports a brand-new jr. YL operator. KMR is on 3.5-, 7-, and 14-Mc. c.w. getting lots of contacts. CAB is on 3.5- and 7- Mc. c.w. handling some traffic. JYS made the grade on RCC Certificate. He now is chief television instructor at C.R.E.I. BKZ is active on 28 and 14 Mc. Traffic: W3ECP 411, LVY 329, QL 20, BWT 10, MRM 4, JJD 3, ISF 2.

SOUTHERN NEW JERSEY — SCM, Ray Tomlinson. W2GCU — The following OOs qualified in the ARRL FMT for Class I: EEQ, WI, BEI, BDL, TAT, QKE, RDK. FXN qualified for Class II. RLY has a swell signal from his BC-375E. RSP is sporting a brand-new Super Pro. SVV snapped up Frank's HQ-129X. The Hamilton Township Radio Association has started publication of its new paper, *Scuttlebutt*. At the February meeting of the South Jersey Radio Assn. everyone enjoyed the talk by 3QL and the demonstration of a new tape recorder by EH. The newly-organized Hunterdon County Amateur Radio Society holds meetings at Flemington. PKE has new 144 Mc. superhet. RPH is new ORS. UKS, an old-timer, is heard on 3.5-, 7-, and 14-Mc. c.w. and 28-Mc. 'phone. OSB is operating aboard the SS *Cottonwood Creek*, ANBZ, on 28,560 and 28,657 kc., 'phone and c.w. Ed is running 50 watts to parallel 6L6s using half-wave single-wire antenna, and would especially like to hear from JAG, PWP, JRO, and 3BNU. Two new calls in Trenton are USE and SIT. SAK reports the Somerset/Hunterdon Co. 144-Mc. emergency net is planning new drills. RXL has new 100-watt rig for 3.5, 7, and 14 Mc. under construction. Karl is maintaining code practice transmissions on 28,960 kc. ORS finally worked a KL7 — KL7GG on 14 Mc. ZI snagged 15 countries during the recent DX Contest. SIP is building test equipment. BAQ, our SEC, is reorganizing the SNJ AEC. All ECs are urged to make monthly reports to Ted at 1402 No. Olden Ave., Trenton. Traffic: W2RG 60, BAQ/2 43, QUH 61, ZI 19, BEI 12, CFB 11, ORS 4.

WESTERN NEW YORK — SCM, Charles I. Otero, W2UPH — The organization of the NYS Net has been a success. At this writing 18 stations now belong and lots of traffic is being handled. ITX is NCS and SAG is alternate for the combination. Prominent in the net are RUF, PGT, NHY, NNK, FCG, and AOR. The complete list will appear in the next column. The net has a monthly bulletin called *QNC NYS*, which is published by ITX. SAG made the BPL for February. The Central New York Radio Club has been dissolved and in its place the Syracuse Amateur Radio Club has been formed. Meetings are held on the 2nd and 4th Thurs. of the month at 8 P.M. in the WOLF Studios in the Chimes Bldg. All licensed radio amateurs and persons interested in amateur radio are invited to attend the meetings. Officers are: PGT, chairman; PTD, secy.-treas. SJV reports new officers of RAWNY are: ROQ, pres.; FSB, vice-pres.; JR, rec. secy.; CUU, corr. secy.; OZR, treas. RCK has a new harmonic. Incidentally, the report recently that TXB had a harmonic is *wrong*, the report should have read WOW, his XYL. Capt. Zimmerman, AAF, Major Doyle, and Major Theil, CAP, explained the CAP at a RAWNY meeting. KBT has a net on 29.3 Mc. RUF, ex-8KYR, is very active in NYS net. The Niagara Falls Radio Club visited the physics lab. of BAG. UOH will be remembered as old NTZ. ROQ is on 28 Mc. PZL has an SCR-522 and also a new harmonic. WHK has 810s in the final. TPW is on 144 Mc. with a TR-4. OUJ is portable-mobile on 28 and 144 Mc. 8EBF, radio aide for Erie County, is back in Buffalo. RXM has an HRO and a rotary beam. SZK takes traffic for

(*Continued on page 84*)



IN A PREVIOUS ARTICLE on this page, we talked a little about S-meter scale calibration and the interrelation between the S-meter and automatic volume control. In addition to these data, we want to chat about another pair of receiver characteristics that are interrelated in hopes that a clearer insight into the design of your receiver will result in your obtaining optimum receiver performance and greater operating pleasure.

Probably the most common of the undesired characteristics in a communications receiver is image response. Obviously, the designer tries to keep this to a minimum by careful design. This task is most difficult on the higher frequencies. When Automatic Volume Control is in use, the receiver AVC system attempts to hold all signals to the same level including the real and image signal output. Under these conditions we may experience the illusion of having poor image rejection and accuse the designer of having done a poor job.

Actually, if the image rejection appears to be poor it may mean only that the designer has done a good job on the AVC system. An actual check will tell how good the image rejection is. Turn off the AVC and listen to the real and image signal volume levels without changing anything but the tuning control. If it is desired to make a test with AVC turned on, the actual real signal to image signal response ratio can be checked roughly by reading the S-meter when tuned to the real and image signals. The difference in db. between these two S-meter readings is the desired figure. It will usually be necessary to convert S units into decibels in order to make this comparison. Our S-meters are calibrated so that one S unit equals 5 decibels.

Unfortunately, when AVC is turned on, there is very little that can be done about the illusion of poor image rejection as we have not found an AVC circuit which will recognize the difference between the real and image signals. It, therefore, becomes important that we recognize image signals when they are encountered so that we won't accuse anyone of off frequency operation or blame the receiver for providing a lot of image signals which are actually not present.

The image and the real signal tuning points are separated on the dial in frequency by twice the receiver's intermediate frequency. With most of our receivers the intermediate frequency is 455 kc. so the real and image signal tuning points will be 910 kc. (or 0.910 mc.) apart on the dial. Also, in our receivers the local high frequency oscillator is operated at a frequency 455 kc. *higher* than the frequency indicated on the dial. This means that the image signal response will appear at an indicated dial frequency 910 kc. lower than the real signal indicated dial frequency. These facts enable us to identify an image and a real signal.

If your receiver has a panel trimmer on the R.F. stage, it is very likely that this trimmer will have sufficient range so that on the higher frequency bands it will be possible to tune the R.F. stage to a frequency 910 kc. higher than the indicated dial frequency. This wide trimmer range is necessary in order to insure that the R.F. stage can be tuned properly on all bands with a wide variety of antennas. Tuning the R.F. stage to the wrong point will, of course, spoil the image rejection. This control could be tuned to the wrong spot by peaking on an image signal. A sure way of getting the proper setting is to peak the R.F. trimmer when tuned to what you are sure is a real signal. Another way is to peak on background noise.

Additional R.F. stages, better R.F. shielding, and higher-Q R.F. coils all tend to improve image rejection. We hope you will make comparative tests on National Receivers — but if the test is a listening test do it on MVC.

RALPH S. HAWKINS

Buffalo in NYS Net. At a joint meeting of KBT and RAWNY, PXH, chief operator, American Airlines, spoke on Airline Communications. HVJ, ex-8TST, would like to hear from ex-8MBZ. A message received by QCP on 14 Mc. from EL5B, Liberia, for Syracuse was relayed to UPH on 3.85 Mc., who relayed it to PJF, who relayed it to DNB, all in 20 minutes. QAA's 28-Mc. beam was changed to a strong and sturdy 14-Mc. beam. QHH worked KH6IJ using his 14-watter to complete postwar WAC. Now he has four continents on 3.5 Mc. He also worked ZB2A, FF8FP, I6USA, YR5V, I1JA, and PZ1WK with his 20-watter on 14 Mc. to bring all-time country total to 104 and postwar to 45 with that power! AOR belongs also to TO Net. He is looking for traffic on 3720 kc. every night at 6 P.M. Traffic: W2SAG 205, PGT 74, AOR 60, QHH 36, RUF 27.

WESTERN PENNSYLVANIA — SCM, R. R. Rosenberg, W3NCJ — SEC: AVY. New OO; MHE. We regret to report the death of RBI on Feb. 24th. MJK, the NCS, would like to see more of the gang taking part in the new 8:30 P.M. Western Pennsylvania ORS net. OAJ and KXI passed their examinations for radiotelephone 1st-class licenses. KQA and SFG have new VHF-152 converters and together with KIL are active on the 144-, 50- and 28-Mc. bands. KUR worked a GM with 807 exciter for his first 28-Mc. contact. QCN, GEG, and KQA are the most active 144-Mc. stations in Mercer area. CBJ is working nice DX on 3.5-Mc. band with 750 watts. BVP contacted 14 countries on 14- and 28-Mc. 'phone during DX Contest. LIF is experimenting with new three-element 28-Mc. beam antenna. LNN worked several Js and XUs in the DX Contest. MQW operates on 3.5 Mc. QHS works into the Midwest with flea power 'phone rig. KWL made 45 contacts in 22 countries on 14-Mc. c.w. during DX Contest. LIE has new RME-84 receiver. MHE is active on 3.5 and 7 Mc. VNE and BWP have new BC-221 frequency meters and will be glad to give frequency checks. BWP is building new modulator using pair of 810s and will run 450 watts to final on 14 Mc. GRZ has erected 7-Mc. vertical antenna. TWI worked G8TK on 3540 kc. and CN8MZ on 7 Mc. during the DX Contest. RAT and RAP are erecting three-element rotaries for 28 Mc. MQA has made 42 contacts with his 809 final, and has crystals for 7050 and 7240 kc. KEW now totals 18 countries worked on 7 Mc. UVM is building new antenna tuner for 14-Mc. 'phone transmitter. LJF/NMP are running around 400 watts to a pair of new GL-592 tubes on 28-Mc. 'phone. Erie 144-Mc. activity continues at a high level. Stations with crystal-controlled transmitters include: GV, LTN, NBV, QKI, and WBM. Erie County AEC drills are held every Monday evening on this band with EC WBM acting as NCS. Asst. NCS are NHD and MOM. I want to thank all the amateurs in this section for their splendid coöperation during my term of office. Success and best wishes to our new SCM, W3KWL. Traffic: W3MJK 626, KWA 438, KWL 406, TWI 207, GEG 25, YA 25, RAT 23, NCJ 21, LOD 20, UVD 13, LQQ 9, BWP 5.

CENTRAL DIVISION

ILLINOIS — SCM, Wesley E. Marriner, W9AND — RMs: Northern, EVJ; Central, SXL; Southern, JTX. The Illinois Central Railroad writes the following letter to ILN Net, "I want to thank you for the help you rendered us recently when we had our wires down on the Amboy District between Minonk and Mendota. Needless to say we were having a lot of difficulty getting information about the movement of trains and the general situation. This is the first time we have ever made use of this division of radio operators and, therefore, you have something of a distinction in having contributed this type of help to us." FB. Swell work, fellows. CRR tried to beat the flu and it nearly beat him. FXB has something big lined up for emergency work in Cook County. More about that when Art gives the green light. Let's have some applications in for EC appointment. What about Southern Illinois? FUR threw a hamfest at his home. ARE, QLZ, and AND were at Kickapoo Club meeting at Bloomington. AND and AWA attended Starved Rock Club meeting at Tonica. NIU has 6L6 on 3.5 Mc. KMS made WAS, 35 w.p.m. certificate, RCC, all-Canada and worked 6 DX stations since receiving Class B ticket nine months ago. ODT, Will County EC, is worki-ng on emergency set-up. There are ten stations on 144 Mc now. VE3DU, Ontario SCM, wants to attend National ARRL Convention in Chicago. Sorry but there will be none this year, although our director, ARE, says there will be one next year. 3NF/9 has applied for W9 call. NRB has worked 104 countries on c.w. with 150 watts since July. DNP has 18 watts on 28-Mc. 'phone. QBH sent in OBS schedule and forgot to keep a copy himself. 3FZA writes to say that the Chicago Technical College Radio Club, 100 strong, has its station, RJA, on 14-Mc. 'phone. L. Herndon, reg. mgr. of field engineering, FCC, spoke at the Feb. 20th meeting. QKJ/D4, who also is D4AON, sends in traffic report from Wiesbaden, Germany. He also sends his regards to all in Illinois. MUX is losing sleep because of radio activities. UPW is working on code and theory for commercial ticket. 3940 kc. is the Illinois Emergency Net frequency. 1IOW now is ERC at Springfield. 1PTK/9 is on 3.5 Mc. from Waukegan. 6TDT/9 is on 7 Mc. at Polo. AUU is on 3.85-Mc. 'phone. 9QKJ/D4AON, our ORS in Germany, made 133 contacts on 14 Mc. the first half of the DX Contest. The following stations were in ARRL Frequency Measurement Tests: DHT, KA, GMV, BRX, IIJ, NUX, GFF, GY, SGL, NUF, BON, ERU, BWZ, HV, and BBZ. HOC is on 28-Mc. 'phone now. EVJ is getting BC-348 receiver. BRX now has 750 watts and a Bliley FM6-S 100-kc. standard. The Centralia Radio Club held a contest Jan. 9th to Jan. 24th to work the most verified contacts. QKF was judge. Winners: First prize of $10 was won by HNL with 53 contacts, 24 states, 3 DX, 2862 points. Second prize of $5 went to QEQ with 16 states, 33 contacts, 1056 points. Third prize of $2.50 was taken by EPD with 11 states, 1 DX, 480 points. GBT has been waiting months for big plate transformer. New OBS: HAB and VOA. How about applications for OPS, ORS, or OBS appointment. ECs and AEC members are needed. If interested in v.h.f. experimental work why not inquire about OES appointment? GNU now has his kw. going. TMW sends in daytime 14-Mc. traffic report. Traffic: (Jan.) W3NF/9 202, W9JVC 32, ACU 6, D4AON/W9QKJ 1, (Feb.) W9JTX 321, EVJ 253, DXL 243, FKI 122, YTV 81, SXL 63, QLZ 35, KQL 32, BGC 15, AND 14, TMW 14, CZB 12, D4AON/W9QKJ 12, EBX 8, KMN 7, SYZ 5.

INDIANA — SCM, Ted K. Clifton, W9SWH — The Richmond Amateur Radio Association new officers are GOS, pres.; ZUP, vice-pres.; and PSD, secy. NH is new call of ENH. Groundwork to re-form the Evansville Radio Club was laid at a recent meeting in the Spaghetti Bowl basement. Morton Silverman presided as temporary chairman and DGA acted as secretary. Those present were MOK, BBC, ENZ, DGA, JEU, HC, ex-AAY, KVE, MDX, UMS, WNM, MWM, GFS, NEC, GZB, GFO, UNT, and FJI. Bob Decker is directing the building of the 250-watt transmitter for the Electronics Club station, NVN. LZP got his 58th and 59th with a YL and HB. ZNZ schedules LSX and LZP every Sunday on 3625 kc. EGQ has 300 watts to a 100TH on 3.85 and 3.5 Mc. YGH, of Highland, now has Class A license and is working all bands with 600 watts. JSR is new ham in Gary. SNF has a new portable-mobile. PUB is new Class A with 300 watts on 14-Mc. 'phone. PBS, blind Gary ham, is at radio school in Omaha, Neb. Johnny is looking for Indiana contacts. MVZ has new rig with pair of 8005s using 550 watts. The Gary CQ Club is planning for the Field Day. Evansville now has a K9 call, K9AAB. VJU is on with 6L6, 807 with 30 watts using a folded dipole. BLF is working at the IHC. New at Crown Point are PYH and SQN. UNS has a new YL. Ex-4DWB, now 9SRN, is taking postgraduate work at I.U. DGA has n.f.m. and also has checked back in the QIN. MHE is the first member of Atomic Radio Club of New Haven to use f.m. K9AAY, of Aurora, received his ticket in January and is on 28-Mc. 'phone with 30 watts to a pair of 807s. OUN, of Marion, gave a talk on the Caphart Tuner at the Delaware Amateur Radio Club. New at Muncie is LNX on 7 Mc. RE is moving to South Bend from Peru. PZR is president of the Purdue Radio Club. UKT is new ORS. NZZ is back with QIN. BBC of Evansville, made WAC in 5 hours and 39 minutes on 28 Mc. MBL heard c.w. call of VFC8M on 51.1 Mc. The Michiana Amateur Radio Club had 70 members at a meeting addressed by Fritz Franke of Hallicrafters. AB worked 9HXY, 8AZZ, 8QYD, and 9UNS, and heard about as many more on 50 Mc. Traffic: W9RCB 736, NH 282, DHJ 41, ENB 28, SWH 21, FMJ 18, UKT 17, HUV 16.

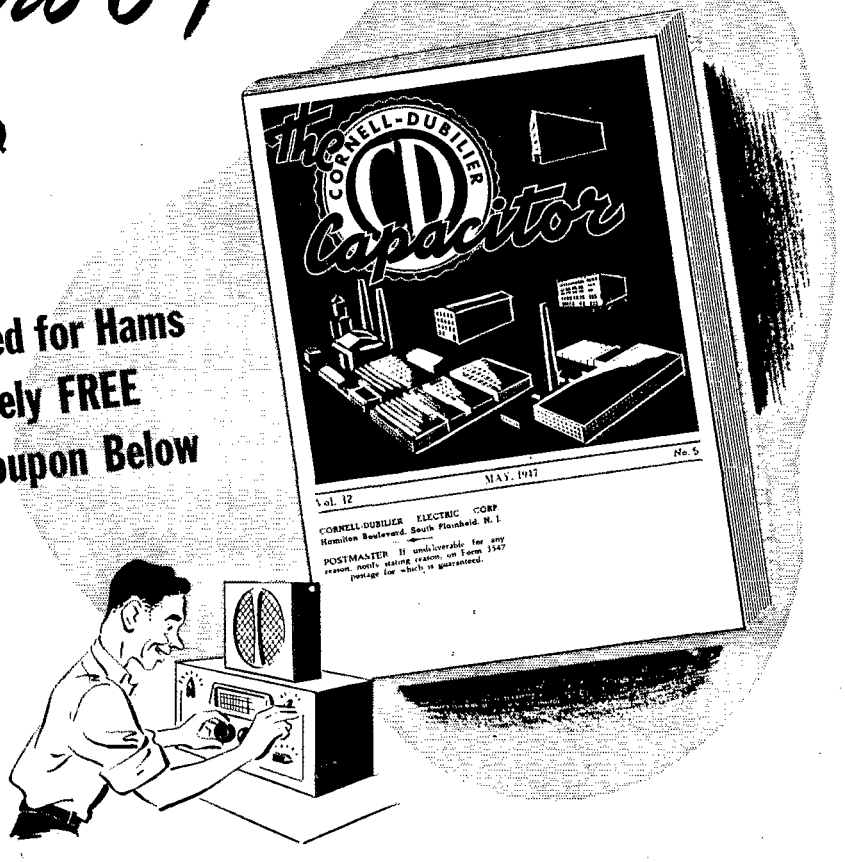
WISCONSIN — Acting SCM, R. G. Klein, W9DKH — The Wisconsin QSO Party on 3.5 to 4 Mc. was a big success. Although convalescing from a serious operation, EWC found time to get his rig going on 3903 kc. after being firmly entrenched on 28 Mc. RQM was active in c.w. DX Contest and all his spare time was spent on construction of new beam and supporting structure. ZIE reports that the supreme grand chief ground-hog, QHR, made over 50 contacts on

(Continued on page 86)

Meet "The Capacitor"

C-D's QSL to Your CQ

- Published for Hams
- Absolutely FREE
- Mail Coupon Below



Yes, OM and YL, — "The Capacitor" is YOUR magazine — published by Cornell-Dubilier to repay you for the loyalty which has made C-D's the most widely used capacitors in the world. Its articles are packed with hints for squeezing all you can get out of your rig. *The Trading Post* — in every month's issue — carries your buy, sell and swap ads without charge. Put "The Capacitor" to work in your shack — building your DX record — NOW.

1910 CD 1947

CORNELL-DUBILIER

WORLD'S LARGEST MANUFACTURER OF

CAPACITORS

MICA • DYKANOL • PAPER
ELECTROLYTIC

Mail coupon today — your free subscription will start at once. Cornell-Dublilier Electric Corp., Dept., JA 5, South Plainfield, N. J.

CORNELL-DUBILIER ELECTRIC CORPORATION

Dept. JA5, South Plainfield, New Jersey

Please start my free subscription to "The Capacitor" at once.

Name.....

Address.....

City.....Zone.....State.....

Station Call.....

Ground-hog Day. DIG is on at Waterloo. BCV's beam came down in the big wind. BDU is on with a full gallon. VLG is going nice with BC-610E. RCP is receiver shopping. ADK is trying to get on at Lowell. IZG is on high end of 28 Mc. with f.m. and NJT is on Wisconsin Net. Our able director, ARE, is kept busy making the round of clubs, but reports working D4AMX in Frankfort, Germany, from his mobile rig while en route to Milwaukee. Rich says, "It is one of the biggest kicks I've gotten out of ham radio in a long time." Who wouldn't after getting a Q5 S7 report and having your transmissions played back to you? HUJ is active on QMW Net. IQW is rebuilding but still finds time to report into the State net. OO CIH is doing a very nice job on 14 Mc. RXN, of Madison, took part in Frequency Measuring Test and did very well. AWO reports the following: LNM has 68 countries. RNX was saved by the bell from going on c.w. HCR, HZS, and QKT are all on f.m. MRY is on with new beam. NAK finally works out of town and will get his WOS certificate (Worked One Station). CO2JV, ex-W2JRE, is on the lookout for Wisconsin friends. HCR and FVX are fighting for the presidency of the long-winded club. GIS was worked by most of the Madison gang on the way to Pt. Isabel, Tex. TVA, at Two Rivers, is on 3.5 Mc. with 6L6. Traffic: W9LFK 213, DKH 40, ARE 26, MUM 16, IQW 9, HUJ 3. RQM 1.

DAKOTA DIVISION

NORTH DAKOTA — SCM, Raymond V. Barnett, WØEVP — Army engineers are making a survey of North Dakota, particularly the Missouri River Valley and tributaries, with respect to amateur personnel and equipment available for emergency use during flood conditions. RBS has completed his portable-mobile rig and with his new Gon-Set he now has FB emergency set-up in addition to the home station. JPW also is new owner and booster for Gon-Set. New official appointments include GEH and OUH as ECs and PPK and GEH as ORS. We need more appointees and need your report for credit in this column. CJB is new operator at KGCU. North Dakota Net schedule time has been changed to 8:00 P.M. CST. Traffic: WØPDN 28, SSW 15, EVP 10.

SOUTH DAKOTA — SCM, P. H. Schultz, WØQVY — RNP is the call of Mrs. Lola Atkinson, who received her Class B license in February at the age of 58. The Sioux Falls Club claims her and believes it's a record of some kind. RRN is new Sioux Falls call. ZRA worked ORE on 28 Mc. at the same time that Asiatics were coming in. HON is putting finishing touches on kw. rig. The club holds auctions regularly to bolster treasury. ZBU and FAX report emergency progress. Where's the rest of the gang I contacted for emergency? The Rapid City gang is on 27.32 Mc. RMK and SKM are new calls in Rapid City. YOB and GLA are Asst. ECs under ADJ. The BHARC now has over 40 members. Our c.w. net spot frequency is 3720 kc. Give the old 3717-kc. rock a few swipes and get going. GCP and SDE are now at Mitchell. BJV has torn down his 50-Mc. rig and is moving into 144 Mc.

MINNESOTA — Acting SCM, Norman Beck, WØEPJ — First issue of the *Minnesota State Emergency Net Bulletin* was published by JIE and HKF. It's an FB job and deserves the support of both the c.w. and 'phone nets. Send in your contributions to either of those two boys. DNY leads the section in traffic for the second month. IBD was surprised when a bunch of St. Paul hams dropped in on him and presented him with a large floor lamp. OPA had the misfortune to lose his 28-Mc. beam in a storm, so FEW and the gang fixed him up another. YCR is leading in DX Contest sponsored by St. Paul Radio Club. Ex-QDE is now 5MMT, at Ft. Worth. He is lieutenant in AACS. The Winona Radio Club now is affiliated with ARRL and officers are PPZ, pres.; DIH, vice-pres.; ZSA, secy.; IIK, treas.; UWG, activity chairman; who has that kw. 'phone rig going. YPN and RPT are proud possessors of Class A licenses. NCS has gone and got himself engaged and will be married in September. The Arrowhead Radio Club is doing a lot of 144-Mc. work. BBL is a proud pappy now! The Fairmont Radio Club is sponsoring a hamfest to be held the latter part of June. Watch for further details. YLZ got himself written up in a Minneapolis paper, on his 28 Mc. mobile job in his car with 10 watts input which works out all over. OMC is plenty QRL but is whipping a 28-Mc. 'phone rig into shape. EPJ maintains schedule on 27-Mc. 'phone with KL7HH. Reports will go to new SCM. Watch on c.w. and 'phone nets for announcement. Thanks for coöperation, fellows. Traffic: WØDNY 324, EPJ 58, NCS 28, CWB 25, NQD 23, EHO 21, ITQ 21, RPT 16, BBL 15, HEO 15, KIS 15, BHY 8, UTR 8, CLU 7, AQU 1, PNQ 1, PPZ 1.

DELTA DIVISION

ARKANSAS — SCM, Marshall Riggs, W5JIC — IYW has new three-element beam on 28 Mc. and a new rig with 812 in final. ICS has new T40s in final. CNK has new kw. on 28 Mc. with three-element beam. GTS is assembling a new kw. with VT127As in final. KHT is building new rig. LVO has 807s on 7 and 14 Mc. with vertical antenna. LPY has 20 watts on 28-Mc. 'phone. KIP has 300 watts T40s on 7 Mc. FRV has 25 watts all bands c.w. HDR is on 7 Mc. with p.p. T20s. KVN has new mobile on 28 Mc. MAX is building new final. KKM has new modulator and microphone. MJC is rebuilding. MNJ is new call on 28-Mc. c.w. GVK and AVH have new beams. MED is getting on soon from home QTH. Any of you boys that would like to have ORS, OPS, or other appointments should drop me a line. How about a state net, boys? Who is interested? DYS is on with two rigs, 28-Mc. 'phone 110 watts TZ20s, 14-Mc. c.w. 400 watts p.p. T55. Traffic: W5EA 21, ICS 8, JIC 4, IYW 2.

LOUISIANA — SCM, W. J. Wilkinson, jr., W5VT — KTE is State EC. RM: KUG. PAM: CEW. ANA is building with pair of 805s in final. MRS, MRT, and MRU are all assigned to members of same family. MQE is new call in Monroe. ILF is on 7 Mc. JVT is on 7-Mc. c.w. HOS works HEJ and HEK regularly. IVF keeps schedules on 3.85-Mc. net. FJW has rig on 7 Mc. EKY has new BC-610. GMO is on 'phone. EKY says ACY has a beautiful 3.85-Mc. 'phone signal. KZM is active on 'phone and c.w. FVK is being assisted on 3.85 Mc. by his XYL. BV operates AOO when home in Abbeville. JWI gets out with 6L6 on 3.85 Mc. The Delta 75 'Phone Net operates on 3905 kc. each Sunday at 8 A.M. GEA handled traffic from Ronne Expedition. The XYL, HUK, spends most of her time on 14 and 7 Mc. KTE is emphasizing EC work at ham clubs in New Orleans. KUG is building the Pelican Net on 3550 kc. FPX reports on the activity of KB, the Southwest Louisiana Institute station. KJE works DX on 28 Mc. LDH conducts code classes on 28 Mc. OY is ex-GDU. KXP has new four-element beam. YU has schedules with other university club stations. LVG recently worked a dozen Gs on 14-Mc. c.w. KXU has 100 watts to pair of TZ40s. LAE says Gon-Set converter brings in DX better. IXL worked CX4CS with three watts input. JFZ is active on 27 Mc. KTF is active on 3.5, 7, and 14 Mc. and handles traffic from Ronne Expedition. The Caddo Amateur Radio Club is planning quite a lot of activity. VT is active on LSN. Traffic: W5KUG 151, VT 77, IYL 57, GEA 54, DAQ 39, KTE 34, JPJ 30, FYS 10, BSR 8, FPX 8, KWY 3.

MISSISSIPPI — SCM, Harold J. Day, W5IGW — JUJ is new EC at Natchez. VJ is PAM. BNW is only OES appointee in the State. BDQ has new 14-Mc. beam. HFQ has new SP-400X and new 14-Mc. beam. CO has new BC-610 and 14-Mc beam. ELS has BC-610 and new QYH in Clarksdale. AUB is running kw. 'phone and kw. c.w. jobs with Super Pro receiver. LAK now has 20 countries. AGZ, LMB, KUT, and HYV are active on 7-Mc. c.w. JZK is on 28-Mc. 'phone. HEK is working 7-Mc. c.w. with four watts. HEJ is with Rebel Net. KHB has Gon-Set converter mobile on 28 Mc. HEF is handling traffic on 3.85 Mc. IGD has new modulator. DNS is new EC for Meridian area. ORS in the State are DEJ, DNS, LAK, IGW, and WZ. OPS are HKJ, LN. OBS are HEF, HFQ, HQC, CQJ, IGD. HGL is OO. Flowers go to the officials of the Mississippi Amateur Radio Club at Jackson for a well-planned, well-carried-out statewide meeting Feb. 9th. Traffic: W5IGW 820, WZ 549, EGE 436, LAK 92, DNS 8, DEJ 6.

GREAT LAKES DIVISION

MICHIGAN — SCM, Harold C. Bird, W8DPE — DED attended meeting at Grand Rapids. UKV reports attendance at 5 P.M. on QMN not very good and he would like to see more of the gang originate traffic and get on the net. YKS sends in a nice report. UCG says the MEN Net meets regularly again on 3930 Kc. HEX sends his first report and can be found on 3640 kc. at present. NQ got his 450 watts working but cannot find any traffic to handle. SWF reports the QMT Net is picking up members and is heard on 28.8 Mc. nearly every night after the band folds up. GJX sends in fine traffic report. FX says that club

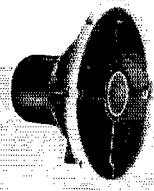
(*Continued on page 88*)

Listen ...IT'S A Jensen SPEAKER!

Model HNP-51
(15-inch)

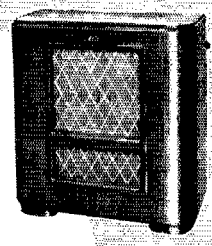
Model JAP-60
(15-inch)

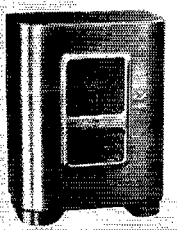
Model JHP-52
(15-inch)



Model JCP-40
(12-inch)

JENSEN BASS REFLEX* REPRODUCERS with COAXIAL SPEAKERS





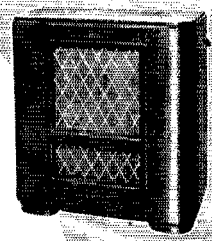
TYPE "RD"

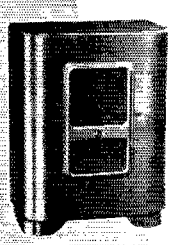
REPRODUCER NO.	STOCK NO	CABINET NO.	SPEAKER NO.	IMPEDANCE, OHMS	LIST PRICE
RD-122	ST-159	D-121	JCP-40	6-8	$120.00
RD-151	ST-160	D-151	HNP-51	500-600	212.00
RD-152	ST-161	D-151	JAP-60	500-600	164.00
RD-153	ST-162	D-151	JHP-52	500-600	151.00

TYPE "RA"

RA-124	ST-134	A-121	JCP-40	6-8	$ 76.45
RA-151	ST-136	A-151	HNP-51	500-600	177.40
RA-153	ST-138	A-151	JAP-60	500-600	128.90
RA-154	ST-139	A-151	JHP-52	500-600	115.90

JENSEN BASS REFLEX* CABINETS





TYPE "D"

MODEL NO.	STOCK NO.	SPEAKER SIZE	DIMENSIONS			LIST PRICE
			HEIGHT	WIDTH	DEPTH	
D-121	ST-156	12"	27⅞"	31⅜"	13⅜"	$75.00
D-151	ST-157	15"	27⅞"	31⅜"	13⅜"	75.00

TYPE "A" (Finished)

A- 81	ST-123	8"	24"	18"	9¼"	$24.55
A-121	ST-124	12"	27"	24¾"	13½"	34.05
A-151	ST-125	15"	32⅜"	27¾"	13½"	42.15

TYPE "A" (Unfinished)

A- 82	ST-145	8"	24"	18"	9¼"	$24.55
A-122	ST-146	12"	27"	24¾"	13½"	34.05
A-152	ST-147	15"	32⅜"	27¾"	13½"	42.15

Designers and Manufacturers of Fine Acoustic Equipment

JENSEN MANUFACTURING COMPANY
6611 SOUTH LARAMIE AVE., CHICAGO 38, U. S. A.
IN CANADA: Copper Wire Products Ltd., 11 King St. W., Toronto, Ont.

*Trade Mark Registered

Jensen
SPEAKERS
WITH ALNICO 5

work has gotten to the point where it takes all his spare time. FWU can be neard on 3663, 3613, and 3708 kc. WWL is working on frequency-measuring gear. He has 750-kc. rig now and is starting on 28 Mc. next. UGR has had many fine contacts since changing frequency. KNP is on 7006 kc. with about 7½ watts. YCD reports working KZ5AH on 7 Mc. RJC can be heard on 7 Mc. a good part of the time. ONK is doing a swell job as NCS on QMN. EGT sends us a nice card. KZO is new reporter on QMN from Mt. Clemens. The following report via radio: TYE, KZO, PVB, JUQ, ABH, and SCW. NOH reports that the gang at Grand Rapids meets every Monday night on 28 Mc. and about 20 answer the roll call. The gang has about four mobile rigs, and also holds hidden transmitter hunts. AW is working 'phone on 3.85 and 14 Mc. AZZ is NCS of Edison Club Net on 50 Mc. CUP is working 3.5 Mc. with four watts while building big rig. He also is working on 25-tube television receiver. CYX uses 50-Mc. converter. EMP gave nice talk on Japan at club meeting. ILP is trying to get rig on 50 Mc. IWG is working DX on 28-Mc. 'phone and worked 40 countries. KSL has fine "V" beam for 28 Mc. MTH is working 3.5-Mc. c.w. while looking for 50-Mc. equipment. WEL took beam out of basement and now is getting out on 28 Mc. YIW is building code oscillator. ZSI is on 3.5-Mc. c.w. and is working on new final using 807s. IM has f.m. antenna on 80-foot mast for checking f.m. broadcasts. PTD worked 6VIB/C7 in China; he now has 87 countries. URM sends us nice report. MGQ made Class I in Frequency Measuring Test. Your reporter would like to thank each and every one of you for the fine letters and telegrams. It would be impossible to answer all of them personally but they certainly are appreciated. Traffic: W8SCW 671, ONK 407, PVB 381, GJX 243, DPE 31, URM 31, UKV 25, RJC 23, SWF 20, TYE 17, ABH 12, DNM 12, JUQ 11, UGR 11, TRP 10, WWL 10, FWU 6, FX 6, YCD 6, YKS 6.

OHIO — SCM, William D. Montgomery, W8PNQ — Ohio had a total reported traffic score of 1299 for February. EBJ, with 175 points, had the highest individual score. Close behind him were ZAU, RN, UPB, PIH, and CBI, all over 100. Recent appointments include: ORS — FFK, TMA, EBJ; OPS — BCJ; OO Class II — JFC and OGK. How about more OES and OO appointments, boys? NN and EQ have already started plans for their joint "25 years in ham radio" celebration, which will take place on Sept. 13th. RN reports that the Buckeye Net is having good results with a different NCS for each night. That saves wear and tear on any one guy. RN also says he finally got his Meissner 150-B, and sure likes it. WYN reports from the Intercity Radio Club that JWT now is engineer for the new f.m. station at Ashland, that 144-Mc. activity is booming in the vicinity with TIH, WPF, YCV, and WXV among the known active, and that KUW now is back on the air after a seven-years' layoff. UKS is working with 3QKI in an effort to determine the feasibility of consistent 100-mile contacts on 144 Mc. WDQ reports plans are progressing nicely on the newly-formed Coast Guard net on 7010 kc. All former Coast Guardsmen are invited to work into this net. WDQ goes on to say that the Northeast Amateur Club of Cleveland is going once again, with meetings on the 2nd and 4th Thurs. of each month at the Rainey Inst., East 55th and Superior. ZFA, while recovering from his operation, worked his station from his bedside. He says his first contact on arrival from the hospital was CR9AN, which made his WAC. DAE is reported to have worked six Russian stations in one evening. From THJ we learn that he has appointed QHV and JDQ as Assistant ECs for the Piqua Radio Club. Together with TEH, they are drilling the Piqua Emergency Net each Wednesday night on 3570 kc. Average power per station participating is 6 watts, which is OK for emergency-powered rigs. The club secretary, PFC, is putting out *The "B" Slinger* every couple of weeks. It looks interesting and probably will develop into a big paper if the club members will coöperate by sending material to PFC. Dayton 144-Mc. station activity is growing with the addition of ZKW, YEV, and ZFO. How about you Dayton boys listening for Cincinnati 144-Mc. stations, especially on Monday nights from 7:45 to 8:45? New officers of the Toledo Radio Club are: PNY, pres., RRZ, vice-pres.; W. Schnell, rec. secy.; TKS, corr. secy.; BGU, treas.; and WEW, sgt. at arms. Cuyahoga Radio Assn. new officers are: EBJ, pres.; QV, vice-pres.; CRA, secy.; and GD, treas. The GCARA held an "Old Timers Night" at the February meeting. You should have seen the weird assortment of prizes that ALW dug up. 1947 officers of the GCARA are: ALW, pres.; BCJ, vice-pres.; 4HAV, secy.; NDN, treas. SEZ was persuaded to continue his efforts in publishing the *Mike and Key*. JIN reports what he considers a good DX contest score — that of XE1A, who worked 1400 stations during the first half of the c.w. portion. MGR and his XYL entertained the 75 Meter Breakfast Club of the Air on Feb. 23rd, with the help of the BCJs. The QCEN is sponsoring emergency net drills each Monday evening on 144 and 28 Mc. The 28-Mc. net meets at 8:00 P.M. on 29,650 kc. and the 144-Mc. net at 7:45 P.M. on 144.8 Mc. It looks like the 144-Mc. net will outdo the 28-Mc. net in attendance, although the 28-Mc. boys deny this vigorously. PBX is finding that HY75s work as well on 28 Mc. as on 144-Mc. TR4s. Traffic: W8EBJ 175, ZAU 169, RN 130, UPB 120, CBI 116, PIH 112, PMJ 92, PZA 90, IVC 53, TKS 36, UZJ 35, VWX 31, WE 28, MPG 23, PUN 16, GVL 11, PNQ 11, DAE 8, QIE 7, BUM 6, AQ 4, KNP 3, ATK 2, EFW 2, JFC 2, PSE 2, WSC 2.

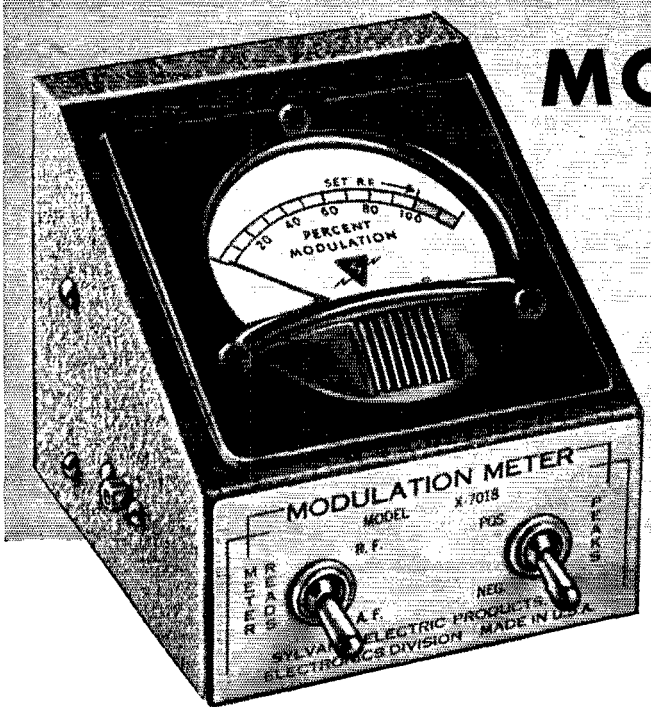
HUDSON DIVISION

EASTERN NEW YORK — SCM, Ernest E. George, W2HZL — The New York State net is growing in leaps and bounds. As of this report 18 members are registered. *QNC NYS*, Vol. 1, No. 2, a seven-page edition by ITX, should be read by all interested in joining the net. GYV is busy disproving line of sight transmission from the bottom of the valley in the Mohawk-Hudson area. He has worked AMJ, EUI, 1HDQ, 1LLL, 1PFJ, 1AEP, and 3CIR/1 on 50 Mc. using 450 watts into a four-element beam. 144 Mc. in Troy and Schnectady area is really hot. NHS reports JHQ, ODC, OVN, QUC, SFK, ZSX, 1KNC, 1KLN, and 3KWT are on with another dozen coming on soon in Troy. About eight more are active on Thursday evenings in Schnectady. Listen for signals from these hams. New signals are emanating from USH, at Beacon. KSY, ex-CM2FN, reports activity from White Plains on 7-Mc. c.w. He worked all districts and 16 states with 35 watts this month. WARA *Bandspread*, published by Westchester gang, needs more volunteers to help in editing. Your SCM is on the air again using a new (No. 13) Collins 30K transmitter. Calls and reports now will be accepted over the air. Traffic: W2ITX 147, EQD 40, QUJ 39, NHY 25.

NEW YORK CITY AND LONG ISLAND — SCM, Charles M. Ham, Jr., W2KDC — A get-together on Feb. 14th resulted in the Western Suffolk gang planning a club. Those in attendance were LCU, HWR, FSK, PIA, MZB, EGK, SAH, ADW, IIB, OQI, CJZ, LWE, CTW, JHH, JWO, NJB, OKK, JI, EDF, MIA, AJF, LCK, UJK, JFU, and PDU. CRZ can be heard on 144 and 3.5 Mc. OKK has 200 watts to a pair of 808s on 28-Mc. 'phone. IIB has a four-element beam on 28 Mc. KOA is on 3.5 Mc. with a signal that comes through. UJK is on 144 Mc. with an HY75 and three half-waves in phase. UML, an old-timer, operates on 7-Mc. c.w. PIA has changed his 28-Mc. rig and now uses p.p. 813s. NXZ has almost reached the half-way mark for the Century Club. OQI is doing a swell job as EC for Suffolk County. The gang is requested to coöperate with him. BSP reports 21 stations active in the Queens EC Net with regular weekly drills continuing. Every fourth Monday night drill brings a simulated emergency. CIQ will handle the 3.5-Mc. c.w. net for the time being. Nineteen stations are now included in the 3.5-Mc. c.w. net. EBT, KOA, and LCK are the most recent members. Sunday drills, which are held at 3 P.M. on 3600 kc., continue regularly with a good attendance. Richmond and Manhattan are the only two counties not represented. 3600 kc. is so crowded at drill time with 3.5-Mc. c.w. stations that we are forced to break down the net into sections operating on different frequencies. The first issue of the *New York City-Long Island Net News Bulletin* is out and contains a wealth of information, including calls of stations operating on 3710 kc. Mon. through Fri. at 8:30 P.M., and lists of other net contacts covering the entire country. All stations operating on 3.5 Mc. c.w. are invited to join the net to help handle the volume of traffic coming into our area from all over the world. Call OBU on net frequency or land line. He is particularly interested in coverage for Manhattan, Bronx, and Staten Island. LYH is heard on 3.5-Mc. c.w. JWO has a heavy sock on 144 Mc. JBP suggests a monthly get-together of (for instance) N.Y.C.-L.I. net members, either on the air or at some local emporium. How about it, gang? BO heard J3AAD, VR5PL, and VS2BC on 7 Mc. MZB worked PAØDC on 3.5 Mc. using 60 watts. PWJ continues to work on VFO. PF is looking for organized traffic net on 7 Mc. The Trylon Radio Club has a fine announcement system to tell of planned

(*Continued on page 90*)

The SYLVANIA MODMETER



Easy-to-use! Low-cost!

Now you can monitor your modulation percentage and speech quality with the new Sylvania Model X-7018 Modulation Meter.

Compactly styled to fit the most cramped operating tables, this new instrument offers you these features:

1. Elimination of battery or A. C. power supply, with consequent freedom from hum or distortion. These advantages result from the use of the Sylvania 1N34 Germanium Crystal Diode — the circuit element that's already proved itself in many applications.

2. Direct, accurate readings of modulation percentage with carrier frequencies up to 54 mc. Convenient switch permits checking positive or negative peaks and carrier shifts.

3. Phone jack provided to allow amateur to hear his modulation with complete clarity.

4. Hermetically-sealed meter with easily-read, three-color scale indicating from 0 to 120% modulation.

5. Completely shielded, crackle-gray metal case with etched aluminum nameplate. Terminal strip in rear for external link.

You'll find the Sylvania X-7018 of great assistance in complying with FCC regulations on overmodulation. Equally important, it will help you keep your average percentage up in the effective region between 60% and 90%.

With its rugged, compact construction, the Sylvania X-7018 is also ideally suited for police, fire, marine and forestry radio stations.

Now available at distributors!

SPECIAL ANNOUNCEMENT

The final three winners of the 1N34 Modmeter Contest will be announced in a future issue of QST.

SYLVANIA ELECTRIC

Electronics Division . . . 500 Fifth Avenue, New York 18, N. Y.

MAKERS OF ELECTRONIC DEVICES; RADIO TUBES; CATHODE RAY TUBES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS

(*Continued from page 88*)

meetings. RQJ eliminated bad key clicks with tube keyer; he also worked some nice DX, including U3, CN8, and UA3. PZE is on 3.5 Mc. and worked 12 countries in 5 hours during the contest. EC suggests that all stations study net frequencies in Feb. *QST* and avoid them during traffic periods. ECK has an HQ-120 and 100 watts to 809s. LBI is very regular in net attendance. The Net pleads for new blood in the ranks. Come on in Bronx, Manhattan, and Staten Island; you're part of N.Y.C.-L.I., too. PRE runs 30 watts to an 807 and has e.c.o. on 3.5, 7, and 14 Mc. OUT is applying for OO appointment. MHD handled some traffic and also some DX. The Triboro Radio Club Net meets every Sunday at 11 A.M. on 3813 kc. QYZ is installing Meissner transmitter, an ex-mobile tank rig. JIL is desperate for QSLs. OBU coöperated with QYZ on the bulletin. BGO was right on time with report as SEC. LGK is on N.Y.C.-L.I. Net daily but has QRM trouble. HXT keeps a schedule with ZS1CN and HZ1AB. In the recent Frequency Measuring Tests, JLH, ALH, RXO, SKV, and KJY qualified for Class I, while JBP, SIJ, AIQ, QZ, and CKR reached Class II accuracy. Traffic: W2BO 213, LR 140, OBU 125, EC 101; QYZ 92, LBI 42, BGO 12, MHD 12, PRE 11, OUT 10, PWJ 4, RQJ 3, PF 1.

NORTHERN NEW JERSEY — SCM, John J. Vitale, W2IIN — Asst. SCM, T. J. Ryan, 2NKD. SEC: GMN. NNJ Net is active on 3630 kc. at 7:00 P.M. every night except Sunday. NCS are LFR, BZJ, and CGG. NCY, with 75GA and SP-400X, uses 3.5- and 7-Mc. folded dipole, vertical on 14 Mc., and three-element beam on 28 Mc. *JSARA News* ran an article on traffic. MLW is preparing a training schedule on traffic handling, procedure and net operations as part of NNJ Net and QSP Club program. That club meets the third Wed. of every second month at 8:00 P.M. in Elizabeth YMCA. GGZ, on 28 Mc., has 250 watts with three-element beam in Clifton. NNJ Radio Assn., Hackensack, meets at YMCA every other Mon. night. Hudson County ARA has had its first meeting in Jersey City. APL is EC for Jersey City and heads the Jersey City Emergency Brigade. If interested, contact him on 7 Mc. In a recent test Jersey City emergency equipment with dynamotor and 12-volt battery got S8 in the Middle West. ANW is NNJ link to Trunk Line "C." BZJ, of NNJ Net, maintains schedules with SNJ and Traffic Outlet Net. Ex-W2LAO/3 now is 4KXE in Portsmouth, Va. LFR is NNJ Net member in TLAP. CGG is in Hit and Bounce Net. NKD is link to New England, Connecticut, and New York State Nets. Recent test messages sent from 1UE to the SCM requesting time of delivery and answer showed that NNJ had fastest service. Four minutes were required to take traffic from 1UE, deliver to SCM, and return message to 1UE. HMN is on 14 Mc. with p.p. T40s. DOE is on 7, 14, and 144 Mc. FNT is working DX on 14 Mc. with 813 final. IBR is on 144 Mc. and is building for 28 Mc. The old gang wishes LAP, Asbury Park, would look them up. Contact number 13 was unlucky for SRD; filter shorted in power supply. SLK is on 7 Mc. with 60 watts and also is on 144 Mc. SLI is on 7 Mc. with 60 watts. SVX has 300 watts on 7 and 3.5 Mc. BRC has QIT for new neighbor. At NNJ QSP meeting NIY reunited with CGG after ten years. BUT has undercover 10-watt rig on 3.85-Mc. 'phone. CQB is NNJ net link to QMN Net. LFR is member of Old Timers Club. CVF pounded brass with a 1-kw. spark transmitter. ZD has built his f.m. 144-Mc. transmitter phase-modulated crystal-controlled superhet 90–165 Mc. with 12-tube sixteen-element broadside array with flat screen reflector having db. gain of 18. OR has seventy-one countries on 28-Mc. 'phone with 650 watts and four-element beam. PRF is operating portable marine on an oil tanker with 25 watts on 28-Mc. 'phone. TAA has four-element beam 150 watts on 28-Mc. 'phone. QKM is building a 65-foot steel tower. TWA has 500 watts on 7 Mc. 1LVQ was guest speaker at UCARA meeting. BFB is conducting tests with special FCC permission on narrow-band f.m. carrier-shift c.w. keying on 14 Mc. with CX2CO and CX1CX. Bloomfield Radio Club new officers are HZU, pres.; OST, vice-pres.; OYD, treas.; JTM, secy.; JIB, corr. secy.; MYY, chief operator of 2JC. The New Jersey State Net, with ten members, is on 3900 kc. every Sunday morning. QEM is the NCS. Traffic: W2CGG 510, LFR 506, ANW 250, CQB 113, NKD 110, LTP 84, GVZ 49, NCY 30, QEM 29, BZJ 26, NIY 19, APL 17, LX 13, CJX 10, ANG 9, HZY 9, BRC 6, PQS 2.

(*Continued on page 98*)

Mono-Sequence Tuning in the

FOUR·20

TRANSMITTER

With MONO-SEQUENCE tuning you can tune four circuits to four different frequencies WITH ONE CONTROL. It's a patented Hammarlund invention which gives you highly efficient tuning and ease of control. The Four-20 is a complete CW rig for 80, 40, 20, or 10 meters. Plug in a crystal and a key and you're ON THE AIR.

FOUR·11

MODULATOR

For years the name HAMMARLUND has stood for the finest in communications receivers. The same engineering skill and precision methods which produced the Super-Pro and the HQ-129-X, now bring you an entirely new transmitter. Combine the Four-11 Modulator with the Four-20 and you have a complete phone transmitter ready to go on any band. When you build that high power final, the Four-20 will make a perfect exciter and the Four-11 a fine speech amplifier.

BACKED BY **37** YEARS OF KNOW-HOW

write for Descriptive Booklet

THE SIGN OF QUALITY — ESTABLISHED 1910

HAMMARLUND

THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., NEW YORK 1, N.Y.

MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

(*Continued from page 90*)

MIDWEST DIVISION

KANSAS — SCM, Alvin B. Unruh, WØAWP — New ECs are: ESL, Zone 1, Doniphan and Atchison Counties; ICV, Zone 3, Shawnee, Wabaunsee, Pottawatomie, and Jackson Counties; YUQ, Zone 19, Riley, Clay, and Geary Counties; IFR, Zone 11, Allen and Neosho Counties; KPJ, Zone 32, Norton, Graham, Decatur, and Sheridan Counties; and ZUA, Zone 27, Pratt, Kiowa, Comanche, Barber, and Harper Counties. If interested in emergency work, write the SEC, PAH. YOS has new tube keyer. ISZ is active at Winfield. NJS has new e.c.o. LQS has new 29-Mc. mobile at Coffeyville, and is building an all-band final using 813. PZP and WKA are new stations in QKS Net. VBQ worked in DX Contest. IJK is testing 50-Mc. rig. ZAT has plumber's delight beam. OZN has 8JK beam. LYF has p.p. 24Gs on 3.85 Mc. TXY is on 3.85-Mc. 'phone and 7-Mc. c.w. KPU is on 7-Mc. c.w. PKD has daily schedules on 50 Mc. with JCQ and YUQ. He built new 144-Mc. converter and beam. BQJ and SKF report from Hutchinson, where BQJ is building new p.p. 812 final to follow his e.c.o. and exciter. 7OWZ is ex-9OWZ of Topeka. YUS, at Cherryvale, is ex-2ECT and 5KEY. He is interested in QKS Net and 50-Mc. work. UUS has HF-152 converter and is building 50-Mc. beam. OKD built new VFO. BXZ is on n.f.m. LSY has BC-610 and Panadaptor. At WARC meeting DJL demonstrated proper methods of tuning and matching two-, three-, and four-element beams using 50-Mc. transmitter. WKA and PZP are new ORS. Traffic: WØKSY 94, NJS 83, YOS 46, AWP 40, KPJ 33, DWC 30, AVW 20, ZUA 15, PZP 11, EPX 10, OZN 9, IFR 8, VBQ 8, OAQ 7, TVU 7, WKA 5, BPL 2.

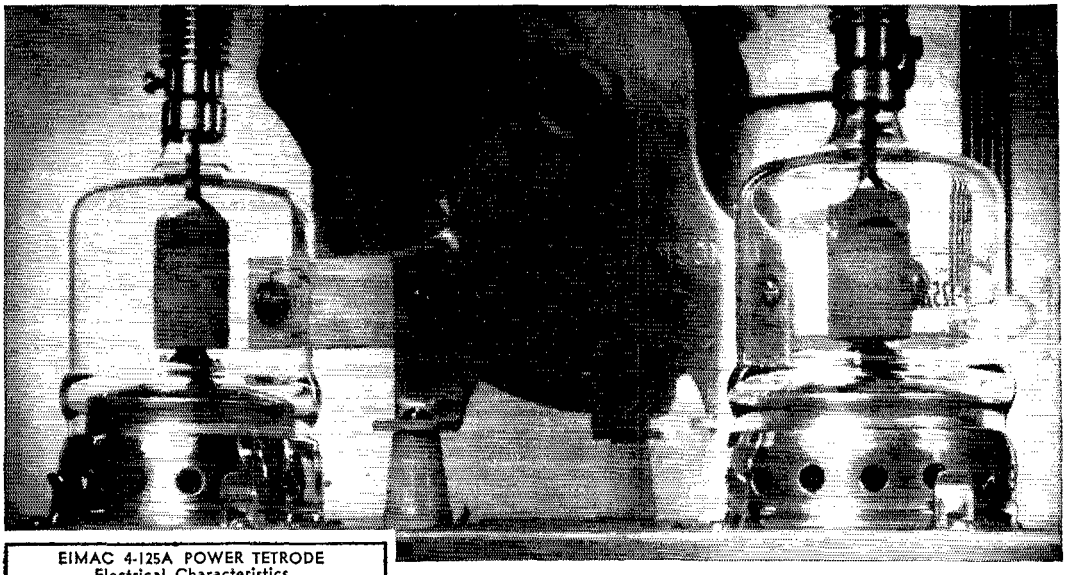
MISSOURI — SCM, Mrs. Letha A. Dangerfield, WØOUD — Only one report on 7-Mc. operation — ZZW is using fixed portable while attending M.U. and says a college net is working on 7114 kc. at 1300 each Saturday with as many as 14 stations represented. UHR, home call ZXX, at M.U., is on 3.5-Mc. 'phone and c.w. JHI and CKS, whose first operating was from D4AHO, are roommates at the university and keep schedules on 3.85 Mc. for students with FB signal reports. The M.U. Amateur Radio Club is new, and the old Central Missouri Radio Club, also in Columbia, has been revived. QXO again leads in traffic with ZVS a close second with his new TZ40s running 380 watts. YHZ, an OO, rated third among all those participating in Frequency Measuring Test. ZOA, also OO, reports a number of poor and out-of-band signals checked and notified. PYE and SKA have applied for AEC membership. The latter is a new ham and has joined MON. GCL found too much QRM on 14-Mc. 'phone and bought 813 and power transformer for new rig. ROA worked the Canal Zone with a pair of 6L6s. ENP took part in ARRL and CD Parties on 3.5, 7, and 14 Mc. ARH worked PAØ and VK5 on 28 Mc. ZKY has a new VFO. GBJ is looking for DX on 14 and 28 Mc. and says the Springfield Radio Club is going FB. QJP says the same of the Joplin Club, and adds modestly that in five hours he worked 28 stations in 13 countries in DX Contest. DHN has a new beam on 28 Mc. KIK's signal is much better on MON. OUD is working 3.5 Mc. only, rag-chewing and handling traffic. The traffic net and Emergency Corps are growing but need more members. How about some AEC action before the spring floods? 9IAJ, of Moline, Ill., extends an invitation to the Quad City Amateur Radio Club's Hamfest April 27th. Thanks for the fine reports. Traffic: WØQXO 197, ZVS 178, OUD 22, ENP 18, ARH 12, KIK 9, GBJ 2.

NEW ENGLAND DIVISION

CONNECTICUT — SCM, Edmund R. Fraser, W1KQY — Glad to see CH, DX editor, and FH, new QSL Mgr. We much regret the departure of UE, long considered one of the section's mainstays. We wish Ev the best of luck and success and hope to hear from him regularly from Washington, D. C. One hundred hams from Connecticut and neighboring states attended a hamfest and DX roundup at Poquonock Bridge Fire Dept. PQF, DX, CH, LVQ, KQY, and DET were speakers, with the latter giving a detailed description of the Mark 2 flush-ball antenna. QV served as auctioneer and FH passed out "QSL" cards. Refreshments were served. ETC led the section in frequency measuring transmission of AW, closely followed by JVE, EH, ARI, ITI, BDI, LVQ, VW, CMP, and PGJ, all of whom made readings in Class I OO limits. NVT, KUK, KKS, and ON

(*Continued on page 94*)

JUST ANY TETRODE WON'T DO

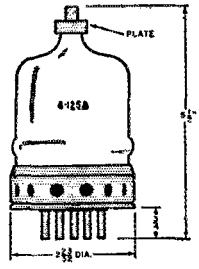


EIMAC 4-125A POWER TETRODE Electrical Characteristics	
Filament: Thoriated tungsten	
Voltage	5.0 volt
Current	6.5 amp
Grid-Screen Amplification Factor (Average)	6.2
Direct Interelectrode Capacitances (Average)	
Grid-Plate (Without shielding, base grounded)	0.05 μμf
Input	10.8 μμf
Output	3.1 μμf
Transconductance (i_b = 50 ma., E_b = 2500 v., E_{c2} = 400 v.)	2450 μmhos
Maximum Ratings (Class-C FM or Telegraphy, key-down conditions, 1 tube)	
Plate voltage, d-c	3000 volts
Plate current, dc-	225 ma.
Screen voltage, d-c	400 volts
Grid voltage, d-c	-500 volts
Plate dissipation	125 watts
Screen dissipation	20 watts
Grid dissipation	5 watts

The Eimac 4-125A is the power tube that revolutionized transmitter design, a tube specificially designed with your problems in mind. Here is a stable, ruggedly built tetrode rated at a maximum plate input of 500 watts, and requiring less than three watts of grid drive.

Excellent characteristics of the 4-125A permit operation at full input up to 120 Mc. In the two-meter band an output power of over 350 watts per tube may be obtained.

Features of the 4-125A contribute to good progressive transmitter design.



EQUIPMENT ECONOMY — Drive the final directly from your vfo.

BANDSWITCHING — Be able to change bands quickly, easily, and simply — as neutralizing circuits are not required.

MODULATE EASILY — Use circuits shown on the 4-125A data sheet—no screen winding is required on the modulation transformer.

AUDIO DRIVE — Two 4-125As in AB$_1$ give 330 audio watts with zero drive.

Follow the Leaders to

Eimac TUBES

Eimac engineering makes Eimac tetrodes better . . . Data sheets and application notes on the 4-125A are available upon request.

EITEL-McCULLOUGH, INC.
1666 San Mateo Avenue, San Bruno, California

Export Agents: Frazar & Hansen, 301 Clay St., San Francisco 11, California

(*Continued from page 93*)

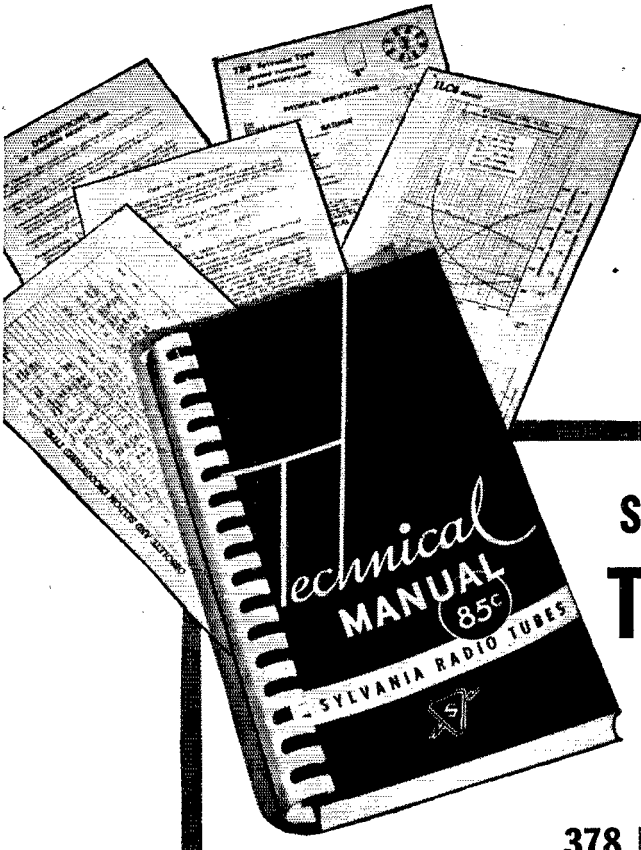
qualified as Class II. Congrats to EFW, LZM, and PHX, who are passing around cigars. DAV is EFW's alternate on TL C2. MCT has new 813 final on all bands. IQE schedules CARA members on 28 Mc. FTX is rebuilding. BEQ and his XYL are still running up the DX total. KKS visited Philadelphia and talked to 3BES over the land wire. Club news: BARA — FC reports ARRL films on "Receiver Principles and Capacitance" were shown at club before large gathering. FC worked KL7AD and CR7KS for new countries. OPG is running 1 kw. on p.p. 810 final. KUH is recuperating from illness. KAB is back from Florida. NHARA — AMM has outlined nice program of speakers at club and is conducting code and theory classes. JHN is attending Tel. Co. radio school in New London. MVE visited 2NOC while in Catskills. MVH is back at b.c. station WELI. BHM added PK2, 3, 6, KP6, and HZ for 65 countries postwar. MVH, KAT, and EUG are scrambling for club No. 1 DX man. MEF opened his window and worked a G. SARA — Newly-elected officials are Joe Dietz, pres.; AZP, vice-pres.; Hughli, financial secy.; and ASO, communications officer. The jr. club group, composed of school children, is proving very popular. ETC is Class I OO and NYC is OES. Traffic: (Jan.) W1LOP 36. (Feb.) W1UE 217, ORP 117, AW 102, BDI 42, DAV 38, LOP 13, ITI 10, KQY 4.

MAINE — SCM, G. C. Brown, W1AQL — CBV and OLQ worked most of one day and night handling traffic with POY for the *Bangor Daily News* and KOB handled traffic for the New England Tel. and Tel. Co. after a heavy wet snow had crippled all communications north of Bangor. HH2CW/W1LHA sent a nice letter this month in which he reported an FB QSO with his home town, Kennebunk, with 8 watts to an 807. He also has worked 37 states, a few Gs, HK, KV, KP, YV, CO, F, and KH6. TO reports being on 3900/4000 kc. ACW is in on the Frequency Measuring Tests. BEU is on all bands with an HT-9. HUT has acquired a BC221-J frequency meter and a BC1030-A Panadaptor and plans to have a 60-foot tower for a four-element beam. PSK has returned from Germany, and is on 28 Mc. with 50 watts. PIX is converting a BC-375. LOZ is still the pace-maker on 28 Mc. around Auburn. GPJ, HUT, GXF, and LOZ are on 144 Mc. IGW and LPA have mobile rigs in their cars. DLC has a pair of 807s running at 100 watts. IMW has moved from Bangor to Waterville and is on 3.5 Mc. Through the courtesy of Major Francis Brouphy the Eastern Maine Amateur Radio Club visited the Signal Corp Lab. at the U. of M. after an hour's fun with walkie-talkies, whip antennas, switchboards, teletypes, etc. Sgt. Jones showed some very interesting moving pictures after which the gang went on a tour of inspection through the power lab. Pres. Meade, of the U. of M. Radio Club, assisted in the entertainment. Traffic: W1OLQ 10.

EASTERN MASSACHUSETTS — Frank L. Baker, jr., W1ALP — AXR, of Quincy, passed away recently. PLQ is EC for Watertown. RCQ is ORS. JXH, LSD, HSB, and MZR have renewed EC appointments. HOB is back as OPS. WN is on 28 Mc. 2MNE, in Dorchester, is on 144 Mc. KRA has been on 144 Mc. DW, ex-GGE, is on 144 Mc. in Islington. BL is ex-FVL. KZT now is GI. MQ is ex-8BHY in Dover. OHR has moved to Barrington, R. I. New officers of Brockton Radio Club are: MQH, pres.; ECX, vice-pres.; OEG, secy.; IZB, treas. New officers of Parkway Radio Club: KTE, pres.; JRN, vice-pres.; HYG, secy.-treas. The Framingham Radio Club publishes a monthly paper, *Hi Mu*. The Yankee Radio Club held a raffle and presented a collapsible wheel chair to LVZ. PYD is in Milton. PXH is in Dorchester. PWP, ex-4FTS, is on 3.85-Mc. 'phone. PCJ, of Needham has taken on the EC job again. The T9 Club held a meeting at HBG's. MRQ is busy at b.c. station. OBK, Chelsea EC is getting started in AEC work. MGP keeps schedules with VO4N and 6RNN. MP was speaker at Brockton Club meeting. ERH is putting up inverted "V" beam for DX Contest. BSY has new e.c.o. CZV has SX-17. LTC is back on the air. LMB lost another antenna. HIL is working on a rig for 50 Mc. NXM gave a talk before South Shore and Eastern Mass. Clubs. A new net on 144 Mc. is known as Master Oscillator. HWE has a rig on 3.5-Mc. c.w. BB has rotary beams for 144, 50, and 14 Mc. MDU has new VFO. RCQ took part in DX Contest. PKW has worked sixteen countries on 7 Mc. with 20 watts. IXI has a 1-kw. rig on all bands and is working on new 28- and 14-Mc. beam. WI is trying to get an RK-28 on 3.5 Mc. LMU has new

(*Continued on page 96*)

GET YOURS NOW!



SYLVANIA'S NEW TECHNICAL MANUAL

DESCRIBING

378 RADIO RECEIVING TUBES

Bigger, better-than-ever—the new Sylvania Technical Manual is available now.

The large number of tube types listed (old and new) — almost four hundred — has been made available as a result of the solution of extensive and elaborate tube engineering problems.

Contents of this descriptive manual include: Fundamental Properties of Vacuum Tubes; The Characteristic Curves; General Tube and Circuit Information; Typical Radio Receiver and Amplifier Circuits; Interchangeable Tube Chart — and many more.

We urge you to get a copy right away — because we know you'll find this volume chock-full of invaluable information.

Available from your Sylvania Tube Distributor or direct from Radio Tube Division, Emporium, Pa.

SYLVANIA ELECTRIC

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS

(*Continued from page 94*)

Workshop beam for 28 Mc. and QSOed PA0MO. The Newton gang had a drill with OMU, RM, BL, LIO, NXO, and LMU reporting in. NBV has a rig for 28 Mc. given to him by hams in Denmark. NYH is on 3.5 Mc. with a Meissner Signal Shifter. EL has new mast on garage for 28-Mc. beam. ILP will be on 144 Mc. with a TR4A. NVB has new four-element beam for 28 Mc. JNE has thirty-six countries on 28 Mc. DKS is busy on 28 Mc. NLU has three-element beam. GRV and SI are on at night working DX. CTD has 50-Mc. beam. IBS has 1 kw. for 3.9 Mc. OBN and OUM are on 7- and 3.5-Mc. c.w. UX is secretary of the Southeastern Mass. Amateur Radio Club of New Bedford. Active down that way on 28 Mc. are: AER, ONK, PIV, AEC, CTZ, LAZ, BMQ, KVU, and WU. AER is building high-power rig. ME is working DX. AIQ is on 28 Mc. and 14-Mc. 'phone. MHN is on 3.5-Mc. c.w. ALP has been on 3.5-Mc. c.w. and worked a lot of VEs with an 809 in final. DDC is on 144 and 14 Mc. AAL is handling a lot of traffic on 28 Mc. from West Coast 4 to 6 P.M. OUD has schedule with VE1EY in P.E.I. FVD is on 28 Mc. MIT is active as an OO. HHU, AKY, WK, and EKG gave a talk on beams before the South Shore Club. NAV and BDS, on 14 Mc., and ALA, on 28 Mc., all live in Needham. PSC, PED, OLF, and IVT are on 144 Mc. Traffic: (Jan.) W1KKJ 160, MDV 65. (Feb.) BDU 271, KKJ 169, LML 122, EMG 81, MDV 56, AAL 52, LM 36, MTQ 26, OUD 20, RM 18, RCQ 14, WI 12, TY 10, KTE 9, PKW 9, JDP 8, BB 7, HWE 7, AGX 5, MDU 4, AAR 3, IXI 1.

WESTERN MASSACHUSETTS — SCM, Prentiss M. Bailey, W1AZW — RM: BVR. SEC: UD. BVR wants some new blood in the Western Massachusetts Net. How about some of the newer hams coming in for some traffic work? All control signals will be sent at 15 w.p.m. and messages will be handled at the speed of the receiving operator. Let's hear you newer fellows on 3760 kc. Mon., Wed., and Friday at 7 P.M. Perce made WAC on 14 Mc. MIV is new ORS. Charlie is also fooling around with 3.9-Mc. 'phone. LBQ, who has been off the air for six years, is back on 144 Mc. ONB is one of the new members of the Fitchburg Club. MND has a new Super Pro. MND and EAX are training new operators at the Fitchburg Club. The club station, LXT, is back on the air. Code and theory classes are held every Monday night with growing interest. UD has appointed NLE as EC of Hampden County to replace CKJ, who resigned. Bob Atwood, who did a wonderful job in the WERS during the war, has taken over the EC duties in Worcester County. Bob has a call on the way, too. CFC, an old 160-meter ham, is again active on 28 Mc. JAH is using full-wave 3.5-Mc. antenna to work his DX on other bands. JGY is rebuilding, using turret coils for band switching. 7EZT/1 received his new call, 1EZT. COI hooked TR1P along with some other nice juicy DX. One of JLT's choicest ones this month was OY3IGQ. BKG qualified for Class II OO in the past FM Tests. He is going after Class I in March Tests. OAZ has taken a position as chief operator at WBEC, Pittsfield's new b.c. station. Traffic: (Jan.) W1IHI 54, JAH 11. (Feb.) W1BVR 80, NY 37, AZW 23, MIV 20, JGY 3.

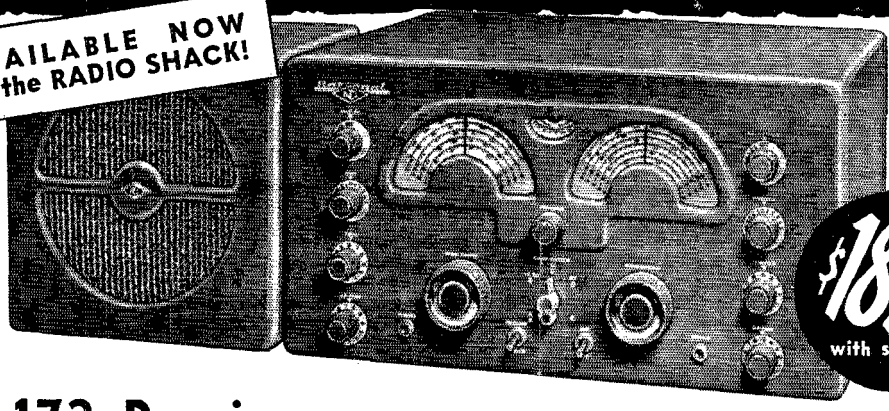
NEW HAMPSHIRE — SCM, John H. Stoughton, W1AXL — Well, that report in February *QST* sure brought results. The Nashua Mike & Key Club is going strong again. Officers for the next year are: NMB, pres.; DUB, vice-pres.; NQS, secy.; NAZ, treas. The club is sponsoring a code and theory course with classes twice a week. NAZ is the instructor with NMB as his assistant. The club also is participating in a joint emergency program with the City of Nashua. They have five 144-Mc. portable rigs and a master control station at the club room. NMB will sponsor the control station, which will use his call. NAZ is on 3.85-Mc. 'phone. DUB, HTO, and MLW are on 14 Mc. looking for DX. KYY and PKT are at U.N.H. PQK is Nashua's newest ham. MCS and PVF, of Littleton, have been using 144-Mc. gear to help in timing the interscholastic ski races this winter. KPD has a new Meissner Signal Shifter. TP has a pair of 813s on 3.85-Mc. 'phone. AP is building a new kw. rig while the XYL, PGX, works 28 Mc. LYA has a pair of 813s on 3.85-Mc. 'phone. Officers of the new Concord Brasspounders Club are: BFT, pres.; AVJ, vice-pres.; AVL, secy.-treas. Keep up the good work, gang.

RHODE ISLAND — SCM, Clayton C. Gordon, W1HRC — LWA has resigned as RM as he is moving to California.

(*Continued on page 100*)

Nationals' Newest Triumph

AVAILABLE NOW at the RADIO SHACK!



$189.50 with speaker

NC-173 Receiver

Unanimously approved by a trial panel of 50 leading New England amateurs, **this newest NATIONAL adds new features of convenience that will greatly widen your scope of activity.**

NEW* AVC Amplifier . . . is separate from IF channel . . . excellent AVC action ***on both phone and CW.***

NEW* Crystal Filter . . . adjustable selectivity serves broad-band broadcast and single-signal code ***on both phone and CW.***

NEW* Noise Limiter . . . "double action plus" . . . equally effective ***on both phone and CW.***

PLUS THESE FEATURES:

Calibrated bandspread • Parallel-connected capacitors for main tuning and bandspread • Range 540 kc to 31 mc and 48 to 56 mc • Voltage regulator • S-Meter usable on phone and CW • 13-tube superhet circuit • 3.5 watts audio output • For full details, write for data sheet.

Fully conforming to the famous NATIONAL standard of excellence, the NC-173 is a dependable performer under the most adverse receiving conditions. Order yours today for immediate delivery from the Radio Shack. Receiver, complete with tubes and matching speaker. $189.50

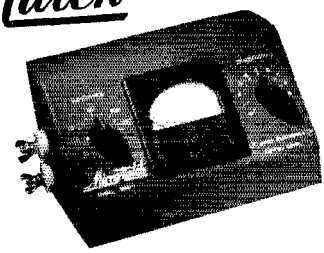
. . . And if you want time payments, we'll send receiver and speaker on down payment of $63.00; balance, including small carrying charge, in 12 equal payments.

Exclusively at the RADIO SHACK in Massachusetts

MicroMatch

the Indispensable Tool for Measuring Standing Waves and R.F. Power

$29.50



Here's What It Does!

★ Reads standing wave ratio at any point in any 70 to 300 ohm transmission line.

★ Reads R.F. power being fed down transmission line.

★ Works on any frequency from 3 to 30 mc at any power from 10 to 1000 watts.

★ Gives positive readings that let you match impedances accurately and adjust your rig quickly for top efficiency.

Read all about this new operating aid in April QST.

ORDER TODAY—IMMEDIATE DELIVERY from the RADIO SHACK

The RADIO SHACK Corp.

CABLE ADDRESS · RADIOSHACK

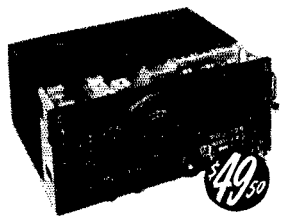
167 WASHINGTON ST., BOSTON, MASS., U.S.A.

The Smart Buyer Shops the Radio Shack

SCR-522 VHF XMTR-RCVR for all-purpose work at 100-156 MC

Used on all AAF and RAF planes—now yours at a fraction of cost. Ten-tube crystal-controlled superhet has 3-microvolt sensitivity at 10 mw output. 7-tube temperature-stabilized xmtr delivers 15 watts. Remote push-button tuning on 4 crystal-controlled send-receive channels. 28 volt d-c dynamotor powers entire rig. Complete with tubes, plugs, instructions for conversion to 110 volt a-c operation. Excellent condition. Weight, about 100 lbs.

*The one and only original RADIO SHACK is located in Boston and has no branches or affiliates elsewhere.

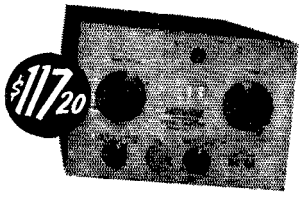


BC-348 RECEIVER . . .

Easy handling; constant sensitivity on 6 band-switched ranges from 200 kc to 18 mc (less BC band); Xtal filter, AVC, MVC, BFO, automatic noise compensator, temperature-compensated oscillator; output at 300 or 4000 ohms; vernier tuning all bands. Complete with built-in dynamotor, tubes, and instructions for conversion to 110v a-c.

COMPLETE A-C CONVERSION KIT FOR BC-348.....$6.50

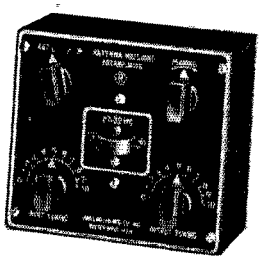
MEISSNER SIGNAL SHIFTER — NEW MODEL



Precision-built for hard, long use; built-in 6-band switching; covers 10, 15, 20, 40, and 80 meters; blank strip allows for additional band; six watts output all bands; choice of built-in or separate power supply.

SPECIAL SURPLUS VALUE! HALLICRAFTERS S36 RECEIVERS

Just 7 — Brand New — Complete, less speaker **$175.00** each

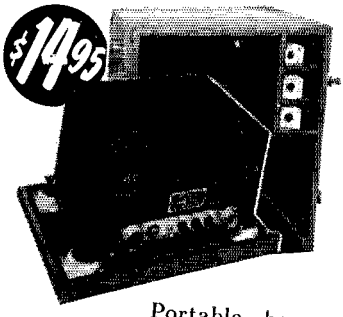


MILLEN R-9'er (less tube)

This electronic impedance matching device and broad-band preamp gives 6 and 10 meter signals a 30 db boost for an R-9 on every QSO. **$24.75**

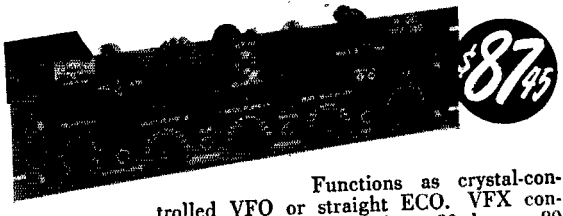
Millen 90700 ECO	**$42.50**
Millen 90800 EXCITER	**37.50**

POWER SUPPLY PE-110



Portable, heavy duty supply with 110-volt 60 cycle input; output 525 volts d-c at 250 MA, 250 volts d-c at 60 MA, 12 volt vibrator supply delivers 250 v. d-c at 60 MA; complete with four 5Z3's and one 80; wooden carrying case. Shipping weight 100 lbs.

SONAR VFX-680 ALL-BAND EXCITER $87.45



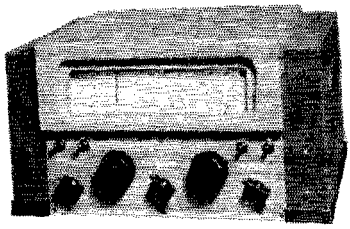
Functions as crystal-controlled VFO or straight ECO. VFX control permits xtal frequency deviation from 30 kc on 80 mtrs to 480 kc on 6 mtrs. Output: 4 to 6 watts overall. Brand new — furnished with tubes and coils.

SONAR FM EXCITER—MODEL XE-10 $39.45

Speed delivery and save C. O. D. charges — send full amount with order. 50% deposit required on all C. O. D. orders.

Stop! Look! Read! Real Radio Shack Values

NATIONAL RECEIVERS



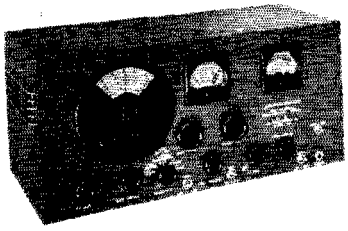
NC-240D	241.44
NC-46	107.40
HRO-5TA-1	306.71
Model 1-10A	67.50

HAMMARLUND RECEIVERS

HQ-129X	$173.25
SP-400X	342.00

R M E RECEIVERS

R M E-84	$98.70
R M E-45	198.70



HALLICRAFTERS RECEIVERS

SX42	$275.00
S40	89.50
S38	47.50

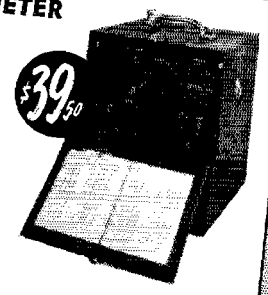
All sets complete with speakers except SX42 and 1-10A.

IMMEDIATE DELIVERY

Time payments available on all standard receivers. $5.00 deposit will hold receiver of your choice.

BC-221 FREQUENCY METER

Fundamental ranges are 125-250 and 2000-4000 kc. Complete with tubes, original crystal and calibration charts. Excellent condition. Order today!



BC-221 MODEL AK WITH MODULATION $79.50

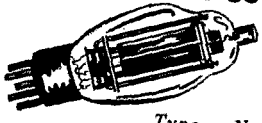
Fully equipped as described above. As good as new. Limited quantity.

XMTG CAPACITORS

Nationally known, high-voltage, oil xmtg capacitors, all in rectangular cases, with stand-off insulators.

Mfd.	Volts d-c	Net Ea.	Mfd.	Volts d-c	Net Ea.
4	600	$0.71	2	1500	$1.20
6	600	.79	4	1500	1.59
8	600	1.19	6	1500	1.79
10	600	1.29	2	2000	2.95
2	1000	.71	8	2000	3.75
4	1000	1.19	2	2500	3.25
8	1000	1.49	2	3000	3.45
10	1000	1.79	4	3000	4.25
			2	4000	4.95

GOVERNMENT SURPLUS TUBES



Type	Net
2AP1A	$5.25
2C34	1.12
2C40	2.62
2D21	.60
35T	1.95
VR75	.90
VR90	.75
VR105	.75
VR150	.75
3B24	3.00
3C24	1.20
5CP1	6.00
5CP7	9.00
5U4G	.45
5V4G	.85
5Y3GT	.28
5X4G	.55
5W4	.55
6AK5	.90
6C21	13.50
75TL	2.25
250TH	9.00
304TH	$9.95
801	1.72
802	1.57
803	9.00
809	1.79
811	1.95
813	6.75
814	4.50
836	1.50
840	2.70
866A	.75
872A	2.25
874	1.95
914	5.62
860	3.00
923	.45
931A	1.87
991	.30
1614	1.50
1619	.75
1624	.90
1625	.75
1626	.60
1651	.75
8005	$3.15
5R4GY	.94
8000	6.00
956	.75
957	.75
958	.75
959	.75
954	.75
955	.75
9001	1.05
9002	.90
9003	1.05
9004	.90
9005	1.05
9006	.60
3B24	3.00
832	2.25
(VT118)	
810	2.62
3C24	1.20
807	1.05
3BP1	3.00
826	2.25
884	.75
(VT222)	
2X2A	.90
815	2.25
(VT287)	
3E29	3.00

EXTRA! Brand New 110 volt a-c SELSYNS

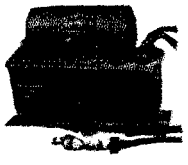
For Beam Antenna Enthusiasts; GE and Westinghouse; Model 2J5FBI; 110 volts, 60 cycles. Per pair, **$7.95**

HS33 HEADPHONES

With head band, rubber cushions, cord and plug. Used, but in A-1 condition. Only **$1.95**

PE-103 DYNAMOTOR — $9.00

Brand new, in original Signal Corps packing; delivers 160 mils at 500 volts; operates from 6 or 12 volts d-c; complete shock-mounted assembly includes breakers, switches, relays, filters, and cables.



The RADIO SHACK Corp.

CABLE ADDRESS · RADIOSHACK

167 WASHINGTON ST., BOSTON, MASS., U.S.A.

(*Continued from page 96*)

In the Frequency Measuring Test DWO made three measurements in the 7-, 14-, 3.5-Mc. bands with an average error of .0014 per cent and AJQ made three measurements in the 3.5-Mc. band for an average error of .0034 per cent. That's less than 14 cycles and 34 cycles per Mc., respectively. This qualifies both for Class I. BTV has built new shack in the basement. QR worked KH6IJ on 3.5 Mc. at 5:45 A.M. on Feb. 14th. LWA says the R.I. Net on 3540 kc. is running swell. AQ's 1947 officers are AWE, pres.; MNC, vice-pres.; MQY, treas.; BGA, secy.; AKA and CPV, tech. committee. The club has set up the "AQ" Net on 3520 kc., meeting nightly. CH, who now is the DX editor for *QST*, has been made an honorary member. EJ is on with 807. AOP has new 144-Mc. beam. AWE is DXing on 7 and 14 Mc. BGA is on all bands. CPV works Europe and Asia on 7 Mc. HCW has new NC-240 and prefers 27 Mc. MNC is operating 144-Mc. mobile. IMY is on 28, 7, and 3.5 Mc. MQY is on 28 Mc. IQZ is on 14-Mc. 'phone. JMT has p.p. 100TH at kw. and worked first Asian on 28-Mc. 'phone. Traffic: W1LWA 250, KYK 149, *INU* 106, BTV 46, DWO 37, JDX 33, NJY 16, QR 13, BGA 3, CPV 3, HRC 3, AJQ 1, HCW 1.

VERMONT — SCM, Gerald Benedict, W1NDL — MCQ heard NXH on February 28th and AW on March 1st on 28 Mc. MCQ now is OPS. CGV is on 28-Mc. 'phone with single 6L6. FRT is on with cathode-modulated rig on 14 Mc. AVP is now retired and will have more time for hamming. On January 5th, MLJ's granite finishing business was completely destroyed by fire. GQJ works PC Net with haywire antenna. Traffic: W1AVP 10.

NORTHWESTERN DIVISION

ALASKA — SCM, August G. Hiebert, K7CBF — Old-timer K7HV, active in Juneau during early 1930s, extends 73 to past acquaintances in Alaska. He now is WØHV, a development engineer for Collins at Cedar Rapids, Iowa. DM is back on Adak after a month in the States. 4ZZZ returned with him and is assigned to the Anchorage area. CBF just returned from a visit to Anchorage, where he had FB personal QSO, with CX, EU, and CA. AO is in that city taking a special CAA teletype course. Minus 50 degree weather must have frozen up most outlying stations this month. Reports are few and far between.

IDAHO — SCM, Alan K. Ross, W7IWU — Kuna: EMT has new p.p. 810s on the 3.5-Mc. band running about 700 watts. Nampa: IYG works new DX as follows: England, Luxemburg, France. Boise: The Gem State Radio Club conducts a code class three nights a week at the YMCA. Yours truly is the proud papa of a new jr. operator. I had the pleasure of a visit from BAA of Firth. He, JMH, and I held a hamfest in my shack. A cordial invitation is extended to any of you fellows who may be in Boise to look me up. Please drop me a post card with your report every month. The ARRL has qualified me as a Class I OO using a BC-221 frequency meter, so let me know if you want a frequency check. The June Field Day will be here before we know it so let's get our gear in shape. Don't forget to drop me a brief of your results for the June report. Traffic: W7EMT 78, IWU 9.

MONTANA — SCM, Albert Beck, W7EQM — Section EC: BWH. JDZ designed a new portable rig and is experimenting with v.h.f. transceiver. DPK, JIZ, and CVQ are sporting BC-348 receivers. The North Montana Radio Club organized an emergency net. ISA is building a 250-watt rig with VT127A in final. IWI will be on with a pair of VT127As. CVQ boosted power to 350 watts and has new 28-Mc. rotary beam. JIZ is building 813 crystal oscillator rig. HJM is getting out FB with 5 watts on 3.5 and 7 Mc. BHB is building second transmitter. CPY is experimenting with dipole antennas. JMX works c.w. with 3.9-Mc. Toothpick Club. BUJ has three 46s in a row. HEM is rebuilding using 813 in final. BXL is heard with portable rig on 3.85 Mc. JHR is active on 3.85 Mc. KPR and KUF are new Livingston hams. KUX is ex-9BNK's new call. Write to VE6CU, Waterton Lake, for reservations for Glacier Waterton International Peace Park Hamfest to be held at Glacier Park July 14–15. CJN is remodeling and IA is getting a kw. together in Butte. The Butte Amateur Radio Club is making Field Day plans. 6VAH is in Butte with KBOW.

OREGON — SCM, Raleigh A. Munkres, W7HAZ — New appointees: KL as OO, GVX as OPS, AOL as ORS.

(*Continued on page 102*)

(Continued from page 100)

GLF, Klamath Falls, writes a nice long letter on the activity down there. The club now has a code class twice a week with a good turnout. Club meetings are held on the 2nd and 4th Fridays. KL, our OO, has new BC-221. New officers of the Valley Radio Club, Eugene, are: FQO, pres.; FHB, secy.; KL, treas. KJE, Milwaukie, never fails to report! JSA reports twenty-one active members in the Rogue Valley Radio Club of Medford. Meetings are held on the 2nd and 4th Thursdays. Visitors are invited. HHH keeps weekly schedule with KA1AI. Phyllis Coe has returned to Bend after three years in Europe with the Red Cross and has recieved the call KSQ. GNJ is busy building transmitters, etc. Ex-7AEM now is 6YJT of San Francisco. The SCM attended a meeting of the Portland Amateur Radio Club and found a very enthusiastic group under the able leadership of IAC. He also attended a meeting of the Pendleton Club. Present were representatives from Pendleton, Walla Walla, Pascoe, Elgin, Starkey, LaGrande, and Baker. DXF, Northwestern Division Director, was speaker of the evening. Congratulations to OO CQE for his fine work in the Frequency Measuring Tests! KVG is a brand-new call. Oregon needs traffic nets!

PACIFIC DIVISION

HAWAII — SCM, John F. Souza, jr., KH6EL — The Hilo Amateur Radio Club had a chicken fry on Feb. 26th, its first anniversary. FE WACed twice in one week on 28-Mc. 'phone. EJ is back on 14 Mc. with BC-610. EB, 1N, BA, CJ, AW are on 28-Mc. mobile. JL, IL, DK, and DD are new ORS appointees. DD now is OES. GP is busy raising 65-ft. hollow pole for 28 Mc. BW is proud papa of twin jr. operators and is reported busy visual signaling with white flags on horizontal signal halyards. DF, Navy Electronic Station, now has six operators. GW has new HQ-129X. W9FDK/KH6 has been busy adding an XYL to the family. HR is busy on 7 Mc. with single 6L6. IJ is Assistant SCM. ET is on an extended trip to California. DJ has new Super-Pro 400-X. EK is building kw. to p.p. 250THs. JE is on 28-Mc. 'phone using a pair of HK24s and three-element beam atop 40-ft. tower. Traffic: KH6DF 9.

NEVADA — SCM, N. Arthur Sowle, W7CX — Asst. SCM, Carroll Short, jr., 7BVZ. SEC: JU. ECs: TJY, OPP, KEV. RM: PST. PAM: KHU. OBS: LUO. OES: TJI. JU purchased a lot of surplus from Las Vegas Air Field. KRI is on with JU's tank transmitter. SXD is on 7 and 3.5 Mc. JLN is on 3.85-Mc. 'phone. BVZ handles traffic on Mission Trail each night. OPP reports routine contacts on 7 and 3.5 Mc. PGD operates nightly schedule on 3.5 Mc. JXH is on 7 Mc. CDM gets good reports on 7 and 3.5-Mc. low power. JUO has a Nevada kw. on 14-Mc. 'phone, and has just completed postwar WAS. TFF has good quality grid-modulated 3.85-Mc. 'phone. ONG is DXing on 14 and 28 Mc. Southern Nevada AEC is working with the Red Cross. KHU is busy on Mission Trail and Transcon 'phone nets. CX has added p.p. 4–250As transmitter on 7- and 14-Mc. c.w. The Nevada Amateur Radio Assn. lists about 40 members in the Reno area. GC has new 654A portable station. Traffic: W7TJY 76, KHU 17, CX 8.

SANTA CLARA VALLEY — SCM, Roy E. Pinkham, W6BPT — Asst. SCM, Geoffrey Almy, 6TBK. PAM: QLP. RM: CIS. PBV expects to have high power on 50 Mc. from Pigeon Point. DX to the Pacific is good from his station. Antennas will be six "V" beams of which three already are in use. CFK, LCF, MUR, and BPT would like to trade locations with him. YAH worked XU6GRL on 3.9-Mc. 'phone with 100 watts input. ZZ sends in a nice list of DX worked during the last month. Miles has run his countries list to sixty-one with twenty-seven zones. He worked XU6GRL on four bands c.w. and 28-Mc. 'phone. SYW is holding nightly schedules at 10:17 with THV and gang. HJP is doing FB work from top of Mt. Tamalpais. He sure puts a nice signal into San José on 144 Mc. KG is making some good contacts using n.b.f.m. Terry has worked KA and ZL with as good reports as he gets using a.m. MUR ran up a nice total in the first half of the DX contest working on c.w. only. He made over 12,000 points. WUI made almost that number of points working on 'phone only. HC is ready to put the 'phone rig on the air but the modulator refuses to behave. Harry passed the Frequency Measuring Test, qualifying as Class I OO. The San Mateo Radio Club meets the 2nd and 4th Wednesdays of each month. Contact the club secretary, P.O. Box 751, for information on time and

(Continued on page 108)

TERMINAL Proudly Presents NATIONAL RECEIVERS - Immediate Deliver

For dependable, trouble-free operation that extra margin of receiver efficienc vest in a NATIONAL Receiver! For f delivery — from our large stocks of q amateur equipment—send your order

NC-173

You will find this newest National receiver chock-full of features which will greatly widen your scope of activity.

Frequency coverage includes conventional 540 KC. to 31 MC. range, plus the 48 to 56 MC. amateur six meter band. Calibrated bandspread tuning is provided for the 6, 10-11, 20, 40 and 80 meter bands, with additional logging scale for other bands. A total of 13 tubes provide such features as an R.F. amplifier stage, separate AVC amplifier, voltage regulated power supply and double-diode noise limiter. New crystal filter is highly flexible for wide-band broadcast requirements to sharp single-signal code reception. Operates on 115/230 volts, 50/60 cycles.

NC-173, complete with tubes and crystal, less speaker..... **179.50**

PM Speaker in matching cabinet..... 10.00

NC 1-10A

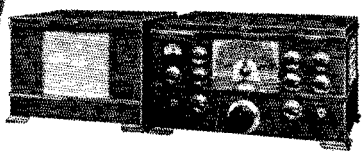
An improved super-regenerative receiver covering all wavelengths from 1 to 11 meters (28 MC. to 280 MC.).

Well-liked by both amateurs and commercial services for its smoothness and reliability. Plug-in coils, easily interchangeable, cover tuning range in six bands. Famous National PW geared micrometer dial has linear scale length of approximately 12 feet! Here is the ideal receiver for your UHF communications!

1-10A Table Model, complete with tubes and 6 sets of plug-in coils, less speaker and power supply..... **67.50**

MC5 PM Speaker in matching cabinet..... 12.00

5886 Power Unit, 115 volts, 60 cycles..... 22.43



NC-240D

12 TUBE —490 KC to 30 MC RF STAGE— CRYSTAL FILTER — ANL — BFO — AVC —STABILIZED OSCILLATOR — SLIDING COIL BANDSWITCH —"S" METER

The new National NC-240D is a brilliantly engineered communications receiver widely acclaimed by radio amateurs and general communications services. Competitively priced, yet nothing has been sacrificed to make the NC-240D one of the best communications receivers obtainable.

A 115-230 volt A.C. change-over switch enables the operator to cope with a wide variety of receiving conditions and requirements.

NC-240D, complete with tubes and crystal, less speaker..... **225.00**

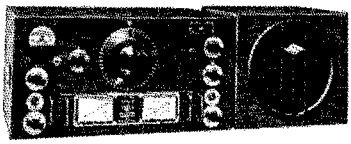
10" PM Speaker in separate cabinet harmonizing with receiver's trim lines..... 16.44

NC-46

A well-balanced 10 tube superheterodyne for operation on 105-130 volts, AC or DC. Continuous coverage from 540 KC. to 30 MC. in four bands with separate electrical bandspread for vernier tuning. Features include efficient noise limiter, CW oscillator, separate R.F. and Gain Controls, amplified and delayed AVC. The National NC-46 is adapted from U. S. Navy proven, National-made AC-DC communications receiver.

NC-46, complete with tubes..... **97.50**

NC-46TS PM Speaker in Cabinet..... 9.90



HRO-5A1

Newest and finest HRO receiver features a number of additional refinements among which are a new highly efficient noise limiter and a redesigned flexible crystal filter. Dependable PW geared dial provides smooth, positive tuning action over normal range of 1.7 MC to 30 MC, including electrical bandspread on 10, 20, 40 and 80 meter bands. HRO coil sets are available (at extra charge) to cover 50-100 KC., 100-200 KC., 180-430 KC., 480-960 KC. and 900-2050 KC.

HRO-5A1 (Table Model) complete with tubes, crystal and 4 coil sets covering 1.7 to 30 MC..... **274.35**

Power Supply No. 697, 115/230 volts, 50/60 cycles.... 20.36

MCS Table Model Cabinet PM Speaker..... 12.00

Terminal offers you MORE than just Good Values!

You can count on TERMINAL to be up - to - the - minute with the best and newest radio equipment! You'll find what you want at TERMINAL!

All latest receivers and transmitters for every amateur application are on display and demonstration in our modern Ham Shack.

ASK US FOR NATIONAL'S NEW 1947 CATALOG! DROP US A LINE!

If unable to visit our store, send us your mail orders with 25% deposit. Prices are F. O. B., New York.

TERMINAL RADIO CORP.

85 CORTLANDT STREET, NEW YORK 7, N. Y.

PHONE: WORTH 2-4415

PR Precision CRYSTALS

ORDER YOUR PR CRYSTALS FROM YOUR NEAREST JOBBER:

ALABAMA
BIRMINGHAM
Ack Radio Supply Co.
Reid Distributing Co.

ALASKA
ANCHORAGE
Alaska Radio Supply

ARIZONA
PHOENIX
Radio Parts of Arizona
Radio Supply Company
TUCSON
Elliott Electronics

ARKANSAS
FORT SMITH
Wise Radio Supply
LITTLE ROCK
Tanner Radio & Elec. Co.
TEXARKANA
Lavender Radio Sup. Co.

CALIFORNIA
BAKERSFIELD
Valley Radio Supply
FRESNO
Davis Radio Company
B. J. DeJarnatt
HOLLYWOOD
Hollywood Radio Sup. Inc.
Yale Radio Electric Co.
LONG BEACH
Scott Radio Supply
LOS ANGELES
Figart's Radio Supply Co.
Hoyt Radio Supply
Kierulff & Company
Papel Brothers
United Radio Supply Co.
Universal Radio Sup. Co.
West Coast Electronics Co.
OAKLAND
E. C. Wenger Company
SACRAMENTO
E. M. Kemp Company
SANTA ANA
Radio & Television Equip. Co.
SANTA BARBARA
Channel Radio Supply Co.
SAN BERNARDINO
George H. Bagley Co.
Inland Electronic Supply
SAN DIEGO
Electronic Equip. Distrib.
Shanks & Wright
SAN FRANCISCO
San Francisco Radio & Supply Co.
SAN RAFAEL
E. B. Abbett Company

COLORADO
COLORADO SPRINGS
Murray Radio Company
DENVER
Western Electronic Laboratories
GRAND JUNCTION
Radio & Elect. Supply Co.
PUEBLO
Radio & Telev. Sup. Co.
L. B. Walker Radio Co.

CONNECTICUT
BRIDGEPORT
Hatry & Young
HARTFORD
Hatry & Young
R. G. Sceli & Company
NEW BRITAIN
Universal Radio Co., Inc.
NEW HAVEN
Hatry & Young
NEW LONDON
Hatry & Young of New London
STAMFORD
Hatry & Young
WATERBURY
Hatry & Young

DELAWARE
WILMINGTON
Radio Electric Service Co.

DIST. OF COLUMBIA
WASHINGTON, D. C.
Capitol Radio Wholesalers
General Electric Sup. Corp.
Intercommunications Co.
Kenyon Radio Supply Co.
Rucker Radio Wholesalers

FLORIDA
MIAMI
Electronic Supply Co.
Herman Radio Supply Co.
PENSACOLA
Grice Radio & Electronic Supplies
ST. PETERSBURG
Welch Radio Supply
TAMPA
Thurow Distributors, Inc.
WEST PALM BEACH
Goddard Distributors

GEORGIA
ATLANTA
Concord Radio Corp.
Garvin Electric Company
MACON
Guy White Radio

HAWAII
HONOLULU
Radio Whlsale & Sup. Co.

ILLINOIS
CHICAGO
American Sales Company
Belmont Radio
Concord Radio Corp.
Green Mill Radio Supply
Radio Parts Distributors
The Radio Shack
DECATUR
York Radio Distrib. Co.
QUINCY
Cooper Supply Company

INDIANA
EVANSVILLE
Castrups Radio Supplies
FORT WAYNE
Pembleton Laboratories
MUNCIE
Standard Radio Parts

IOWA
BURLINGTON
Union Supply Company
CEDAR RAPIDS
Gifford-Brown, Inc.
COUNCIL BLUFFS
World Radio Laboratories
DES MOINES
Radio Trade Supply Corp.
DUBUQUE
Boe Distributing Co.
FORT DODGE
Ken-els Radio Supply Co.
SIOUX CITY
Duke's Radio Company
WATERLOO
Farnsworth Radio & Television
Ray-Mac Radio Supply

KANSAS
PITTSBURG
Pittsburg Radio Supply
TOPEKA
Acme Radio Supply
Overton Electric Co., Inc.
WICHITA
Amateur Radio Equipment Co., Inc.
Interstate Distributors, Inc.

KENTUCKY
SOMERSET
Hobes Radio Shop

LOUISIANA
SHREVEPORT
Interstate Electric Co.

MAINE
AUBURN
Radio Supply Co., Inc.
BANGOR
Radio Service Laboratory
PORTLAND
Electronic Supply Corp.
Radio Service Laboratory

MARYLAND
BALTIMORE
Henry O. Berman Co.
Radio Electric Service Co.
Wholesale Radio Parts Co. Inc.

MASSACHUSETTS
BOSTON
Hatry & Young
Radio Shack Corporation
Radio Wire Telev., Inc.
FALL RIVER
Flint Radio Company
LAWRENCE
Hatry & Young of Massachusetts
MELROSE
Melrose Sales Company
ROXBURY
Gerber Radio Supply Co.
SPRINGFIELD
T. F. Cushing, Distributor

MICHIGAN
GRAND RAPIDS
Radio Electronic Sup. Co.
LARIUM
Northwest Radio of Mich.

MINNESOTA
DULUTH
Lew Bonn Company
Northwest Radio
MINNEAPOLIS
Lew Bonn Company
Stark Radio Supply Co.
ST. PAUL
Hall Electric Company

MISSISSIPPI
JACKSON
Cabell Electric Company
Ellington Radio, Inc.

MISSOURI
KANSAS CITY
McGee Radio & Elec. Co.
JEFFERSON CITY
Central Missouri Dist. Co.
JOPLIN
Four-State Radio and Supply Co.
Mardick Distributing Co.
SPRINGFIELD
Harry Reed Radio & Supply Co.
ST. JOSEPH
Acme Radio Supply
St. Joseph Radio & Supply Company
ST. LOUIS
Gordon Radio Company
Interstate Supply Co.
Radonics (2 stores)
Van Sickle Radio Co.
Walter Ashe Radio Co.

MONTANA
BILLINGS
Electronic Supply Co.

NEBRASKA
LINCOLN
Hicks Radio Co.
Leuck Radio Supply
OMAHA
Omaha Appliance Co.
J. B. Distributing Co.
Radio Equipment Co.

NEW HAMPSHIRE
CONCORD
Evans Radio
DOVER
American Radio Corp.
MANCHESTER
Radio Service Laboratory

NEW JERSEY
ATLANTIC CITY
M. & H. Sporting Goods Co.
CAMDEN
Radio Electric Service Co.
CLIFTON
Eastern Radio Corporation
ELIZABETH
Jersey Radio Television Supply Co.
NEWARK
Continental Sales Co.
Radio Wire Telev., Inc.
NEW BRUNSWICK
William Radio Supply
TRENTON
Allen & Hurley

TURN PAGE FOR ADDITIONAL PR JOBBERS

PR Precision CRYSTALS

PR Precision CRYSTALS

ORDER YOUR PR CRYSTALS FROM YOUR NEAREST JOBBER:

NEW MEXICO
ALBUQUERQUE
Radio Equipment Co.
ROSWELL
Supreme Radio Supply

NEW YORK
BUFFALO
Dymac, Inc.
Radio Equipment Corp.
HEMPSTEAD
Standard Parts Corp.
JAMAICA
Harrison Radio Corp.
Norman Radio Distributors, Inc.
Peerless Radio Distributors, Inc.
NEW YORK
Electronic Marketers
Fordham Radio Supply Co.
Harrison Radio Corp.
Milo Radio & Electronics Corporation
Newark Electric Co., Inc.
Newark Electric Company
Radio Wire Telev., Inc.
Sun Radio & Electronics Co., Inc.
Technical Equipment Co.
Terminal Radio Corp.
NIAGARA FALLS
Niagara Radio & Parts Co.
ONEIDA
H. B. Reynolds Radio & Equipment Lab.
POUGHKEEPSIE
Chief Electronics
ROCHESTER
Beaucaire, Inc.
Hunter Electronics
Masline Radio & Electronic Equipment Co.
Rochester Radio Sup. Co.
SYRACUSE
W. E. Berndt
UTICA
Vaeth Electric Company

NORTH CAROLINA
CHARLOTTE
Radiotronic Distrib., Inc.
GREENSBORO
Johannesen Elec. Co., Inc.
RALEIGH
Carolina Radio Equip. Co.

OHIO
AKRON
Olson Radio Warehouse
CLEVELAND
Northern Ohio Labs.

OKLAHOMA
ENID
Radio-Electronics, Inc.
OKLAHOMA CITY
Radio Supply, Inc.
TULSA
Radio, Incorporated

OREGON
PORTLAND
Bargelt Supply
Harper-Meggee, Inc.

PENNSYLVANIA
ALLENTOWN
Radio Electric Service Co.
EASTON
Radio Electric Service Co.
ERIE
J. V. Duncombe
PHILADELPHIA
Almo Radio Company
Consolidated Radio Co.
Herbach & Rademan Co.
M. & H. Sporting Goods Co.
Radio Electric Service Co. (3 stores)
Eugene G. Wile
PITTSBURGH
Cameradio Company
M. V. Mansfield Company

SOUTH CAROLINA
CHARLESTON
Radio Laboratories
GREENVILLE
Carolina Radio Supply Co.

SOUTH DAKOTA
SIOUX FALLS
Power City Radio Co.
WATERTOWN
Burghardt Radio Supply

TENNESSEE
MEMPHIS
Shobe, Inc.
Tanner Radio and Electronic Supply

TEXAS
AUSTIN
The Hargis Company
BEAUMONT
R. C. and L. F. Hall, Inc.
CORPUS CHRISTI
Wicks-DeVilbiss Company
DALLAS
Crabtree's Whlsale Radio
R. C. and L. F. Hall
Wilkinson Brothers
EL PASO
Reeves-Elliott Co.
FORT WORTH
Electronic Equipment Co.
HOUSTON
R. C. and L. F. Hall, Inc.
LAREDO
Radio & Electronics Supply Co.
LUBBOCK
R. & R. Supply Co., Inc.
SAN ANTONIO
The W5HJY Radio Supply
TYLER
Lavender Radio Sup. Co.
WACO
The Hargis Co., Inc.

UTAH
OGDEN
Ballard & Carter Co.
SALT LAKE CITY
O'Loughlin Radio Supply
Standard Supply Company

VERMONT
RUTLAND
Mac's Radio Shop

VIRGINIA
ROANOKE
Leonard Electronic Supply Company

WASHINGTON
BELLINGHAM
Waitkus Supply Company
EVERETT
Pringle Radio Wholesale
SEATTLE
Harper-Meggee, Inc.
Radio Products Sales Co.
Seattle Radio Supply, Inc.
Western Electric Sup. Co.
SPOKANE
Columbia Electric & Manufacturing Co.
TACOMA
C. & G. Radio Supply Co.
A. T. Stewart Company
YAKIMA
Yakima Wholesale Radio Co.

WEST VIRGINIA
WHEELING
General Distributors

WISCONSIN
APPLETON
Valley Radio Distributors
MADISON
Radio Distributors of Madison
MILWAUKEE
Electronic Supply Corp.
RACINE
Standard Radio Parts Co.

CANADA
EDMONTON, ALBERTA
Radio Supply Co., Ltd.
Taylor and Pearson, Ltd.
HALIFAX, NOVA SCOTIA
Maritime Radio Distributors, Ltd.
REGINA, SASK.
Radio Supply & Serv. Co.
THE PAS, MANITOBA
L. J. Hamers & Co.
VANCOUVER, B. C.
Taylor & Pearson, Ltd.
VICTORIA, B. C.
Ellison Queale Radio Supply

SALES REPRESENTATIVES

FLOYD FAUSETT & SON
1316 Allegheny St., S.W.
Atlanta, Georgia
(Territory: Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, Virginia)

ADOLPH SCHWARTZ
220 Broadway
New York 7, New York
(Territory: Delaware, Washington, D. C., Maryland, New Jersey, New York, Pennsylvania, West Virginia)

MORRILL P. MIMS COMPANY
43 Leon Street
Boston 15, Massachusetts
(Territory: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)

HEFCO AGENCIES
1382 Queen Street East
Toronto 8, Ontario, Canada
(Territory: Eastern Canada)

M. F. KLICPERA
Box 3113
Houston, Texas
(Territory: Arkansas, Louisiana, Oklahoma, Texas)

MARSH AGENCIES
110 Battery Street
Seattle 1, Washington
(Territory: Idaho, Oregon, Utah —Western Part, Washington)

ROBERT C. RINDFLEISH
205 W. Wacker Drive
Chicago 6, Illinois
(Territory: Illinois, Indiana, Wisconsin)

HALLIDAY & McLOUD
711 Colorado Building
Denver 2, Colorado
(Territory: Colorado, Montana, New Mexico, Utah — Eastern Part, Wyoming, Nebraska — Western Part)

F. C. SOMERS & COMPANY
City Bank Building
Kansas City 8, Missouri
(Territory: Iowa, Kansas, Missouri, Nebraska—Eastern Part)

SPARLING SALES, Ltd.
270 Fort Street
Winnipeg, Manitoba, Canada
(Territory: Western Canada)

J. DAVIDSON & ASSOCIATES
P.O. Box 108
South Gate, California
(Territory: Arizona, California)

EXPORT REPRESENTATIVE: ROYAL NATIONAL CO., Inc., 75 West Street, New York 6, New York

PR Precision CRYSTALS

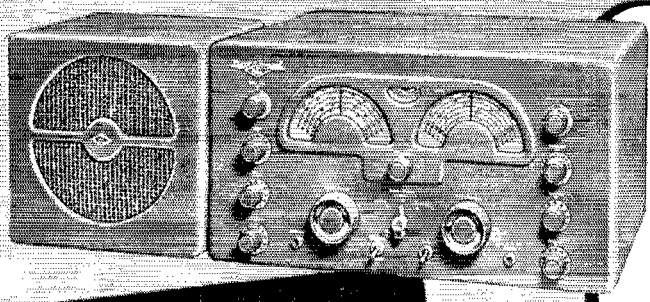
(*Continued from page 108*)

place. The Santa Clara County Club meets the 2nd and 4th Mondays of each month. Contact ZZ for information on time and place of each meeting. Traffic: W6TBK 7, ZZ 6, SYW 1.

EAST BAY — SCM, Horace R. Greer, W6TI — Asst. SCM, C. P. Henry, 6EJA. SEC: OBJ. RM: ZM. OO: ITH. EC: QDE. Asst. EC u.h.f.: OJU. FDR is ORS and is a member of Pioneer Net operating with 7 watts on 7- and 3.5-Mc. c.w. QXN is a good outlet for traffic on Pioneer Net. TYF has p.p. 813s in final. EJA has surplus 28-Mc. rig in car working FB. QDE has a 144- and 28-Mc. f.m. rig in auto. CDA likes his n.f.m. rig. PZ worked FP8A and ZK1AH on 7 Mc. MMZ is enjoying himself on 14- and 7-Mc. c.w. with an 807 in the final. The Oakland Radio Club, Inc., now meets at the Oakland Chapter, American Red Cross, the 1st and 3rd Thurs. of each month. TT has two new 28- and 14-Mc. beams each mounted on separate steel towers. BUY has new 28-Mc. beam on steel tower. IKQ made nice showing on 14-Mc. 'phone in first week of DX Contest and worked 8 new postwar countries. TI has 83 postwar countries. BUY has 84 and PB 80. FMY can be heard on 14-Mc. c.w. after those rare ones. QLH is building new beam that won't fall down. AED is on 28- and 14-Mc. 'phone. MVQ has new Oakland QTH. LMZ is trying to find time for DX. EY is trying to get the bugs out of his large rig. The SARO boys are active on 28-Mc. f.m. although the c.w. gang has its moments on 3.5- and 14-Mc. c.w. Each member of the Northern California DX Club, Inc., is a member of the ARRL. Those who are interested and can qualify should contact EJA, the club secretary, for details. The Mt. Diablo Radio Club is progressing satisfactorily. There are two new clubs in the Vallejo area. The East Bay section needs a good PAM. If interested, please contact me. NO is getting to be a fair 'phone man. SSN is a good man to take care of your receiver problems. The Hammond Memorial bug again will be given to the ARRL member in the East Bay section handling the most traffic in a six-months period. Prewar winners, whose calls are engraved on this trophy are: CDA, HHM, RJ, GHD, EJA, HH, IMI, ZM, EJA, and ZX. The new awarding period will be from Jan. 1947 to June 1947, inclusive. At present QXN is leading the parade. One month of non-reporting disqualifies a person. Get those traffic reports in each month, gang. ITH has returned from a Mexican trip, working many stations on 28 and 14-Mc. 'phone en route. CRF reports, "Gee what a mess on the air during the contest." Traffic: W6QXN 224, FRD 84, PZ 19, EJA 10, TI 7, CRF 6, TYF 4.

SAN FRANCISCO — SCM, Samuel C. Van Liew, W6NL — Phone JU 7-6457. Asst. SCM, Joseph Horvath, 6GPB. RM: RBQ. SEC: PTS. ECs: SRT, KNZ, DOT, KZP, LLJ, UHN, VCG, QFX. OOs: NJW, WB. OBS: FVK, KNH, DJI, OZC, BYS. ORS: RFF, BIP, ATY, RBQ, NL. OPS: OZC, NYQ, STY. The past month found the gang busy on DX or getting set for the DX Contest. DJI reports working ZE1JO, Zs, Gs, and many others. EYY holds daily schedules with Guam, all 100 per cent. He says DX is fine; he worked 11 Europeans and FA3BG during one week end. He now has a total of 52 countries worked. JWF reports the Mission Trail Net is very active and is establishing a Pacific division of the Mission Trail Net to contact the various Pacific islands. USA and KZF are working out the details. 28 Mc. will be used mainly. STY now has p.p. 35TGs working in final. He is applying for membership in the Rag Chewers Club. JQC says DX on 28 Mc. is good even at night. He works VS1BJ and CR9AG at 7:30 P.M. and ZS5 and 6 at 10 P.M. DOT is building portable gear for 7, 14, and 28 Mc. VQB and WCD are cranking up some fine gear for 420 Mc. They have a 25-tube double conversion receiver with 30- and 5.3-Mc. i.f. The receiver is either f.m. or a.m. They also are building pulse transmitter for 420 Mc. From Marin County we have the following: YLE is a new call at San Anselmo. PVC is working at RCA receiving station, Point Reyes. JB is running 600-watt 'phone on 3.85 Mc. FZG has new 3.5-Mc. c.w. station at Inverness. VKT, also of Inverness, is doing nicely on 7-Mc. c.w. DX. NLQ regularly schedules J3AAD, Kyoto, Japan, on 7-Mc. c.w. at 1 A.M. and 4 A.M. PST. He works VK, ZL, XU, and Js with good signal strength. YME is doing well with 28-Mc. mobile job. With the appointment of PTS as Section EC, SRT as San Francisco community EC, and KNZ as Marin Co. community EC, the Emergency Corps is off to a good start with drills already under way. Plans are under way

(*Continued on page 110*)



PLACE YOUR ORDER WITH ALLIED NOW!

THE NEW

NATIONAL

NC-173

Communications Receiver

is featured in your

NEW *ALLIED* CATALOG!

Yes, you'll find this great new receiver as well as a complete listing of famous NATIONAL products in your newest ALLIED Catalog. Everything you need to put your station in tip-top operating shape—all the *latest* gear—appears in this handy new Buying Guide. If you haven't yet got your copy, drop W9IBC a line, and we'll have an ALLIED Catalog on the way to you in a hurry.

National's New Feature-Packed Super-Value Receiver!

Here's an entirely new, highly versatile, moderately priced communications receiver packed with all the advanced features most desired by every Amateur and SWL. The NC-173 offers complete coverage from 540 kc to 31 mc—with extended range of 48-56 mc for the Amateur 6-meter band. The skillfully engineered 13 tube circuit is designed for high stability, average sensitivity of 3 microvolts, 6 position selectivity and a new high in operating ease. Plus values: New "double-action" type double-diode noise limiter; panel trimmer for maximum performance with any antenna; 3.5 watt output with exceptional fidelity; signal level meter; accurately calibrated, easy-to-read main tuning and bandspread dials; provision for battery operation in emergencies. Housed in an attractive smooth gray metal cabinet of modern design, complete with tubes and 6" speaker in matching cabinet. NET ONLY..... **$189.50**

For Earliest Delivery, Order Your NATIONAL Receiver From ALLIED

National NC-46 and Speaker	$107.40
National NC-2-40D	225.00
National HRO	274.35

Time Payments Available
Trade-Ins Accepted

Keep This Buying Guide Handy... FREE

ALLIED RADIO

Everything for the HAM

ALLIED RADIO CORP., D. L. Warner, W9IBC
833 W. Jackson Blvd., Dept. 27-E-7
Chicago 7, Illinois

- ☐ Send FREE 1947 ALLIED Catalog.
- ☐ Enter order for.....
- ☐ Enclosed $.....Full Payment ☐ Part Payment (Balance C.O.D.)
- ☐ Send Literature on Receivers and Time Payment Plan

Name.....

Address.....

City.....*Zone*.....*State*.....

(*Continued from page 108*)

that will be of interest to all who have emergency equipment. I sincerely ask that you support these men in a task that is interesting and well worth while. Traffic: W6JWF 47, EYY 28, VZE 27, BIP 6, ERS 2, STY 2.

SACRAMENTO VALLEY — SCM, John R. Kinney, W6MGC — Asst. SCM, R.G. Martin, 6ZF. RM: REB. OOs: ZF, OJW. OBS: OJW, AF. OES: PIV. ORS: REB, PIV, OJW, HIR. ZF reports that the Shasta Amateur Radio Club of Redding elected UIE, pres.; ATQ, vice-pres.; TDB, secy.; VYW, comm. mgr. The Mt. Shasta Radio Club elected TUT, pres.; OMR, secy.-treas. The Golden Empire Radio Club of Chico, VZK, pres.; meets every third Sunday. The SARC, Inc., had an attendance of over ninety at the February meeting. IQH won a pair of 872 filament transformers for his VT127As. VLR had 6V6, 6V6, 6V6, 807 into a pair of 812s. He worked ZL3AW and J2FOX with vertical folded doublet 1½ feet off the ground and got R9 reports. DBP worked VP5, CM, KP4, and J3AAD for DX. WTL has schedule with 4IRT on 27 Mc. AF's DX included 6VMS/KW6 and VS1AF. 7KBN/6 is living in federal housing project where amateur operating is forbidden. RJK, OTL, and RXY are tied up with local b.c. station KSYC. RYF, formerly with the AARS, is employed with the Pac. Tel. & Tel. Co. JDN is active. KTB has a pair of T20s on 7 Mc. and had Yreka gang help put up masts for sky wires. SXF has new QTH in Holliday Motel in Redding and has pair of 807s in final on 3.5 and 7 Mc. TUT has pair of 250THs in neat parmetal job with Signal Shifter and beams all over the place. YQC is new Chico amateur. TID and GHG have new 14-Mc. rotary beams. REB is looking for traffic hounds to take alternate control on the Pioneer Net. Traffic: W6REB 285, PIV 44, VLR 8, AF 1.

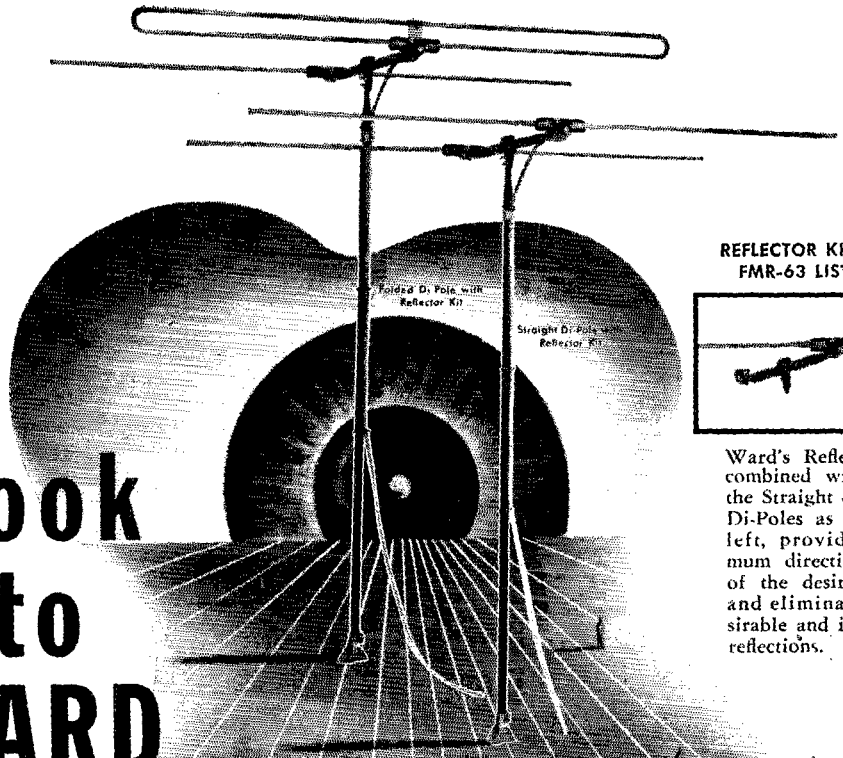
SAN JOAQUIN VALLEY — SCM, James F. Wakefield, W6PSQ — JCB is new editor of *Skip*, publication of the SJVRC in Fresno. If any of you want to get on the mailing list, drop him a card. KUT is assistant director of San Joaquin Valley section. GCF has handie-talkie on 144 Mc. MGN is on 28 Mc. with an HT-9. VYD, WJL, WJJ, SUV, and SGH have the 28700 Club on the air every night for rag-chew only. JCB has new shack on a half-acre. PSQ and JPU have VHF-152s and PSQ is using transmitter section of a 522, all into sixteen-element beams on 144 Mc. LOS has a Sonar unit for the 28-Mc. rig now. MYP has an 807 on 28 Mc. UID has a new shack and is back on 144 Mc. putting his usual signal into Fresno. EJD, HXA, JPU, and PSQ are on 50 Mc. MBFs, or modifications thereof, are being used with good results for low power. WJL has 500 watts into p.p. 257Bs into three-element beam. JPS has an NC-200. OXE has BC-348 and HK-24 rig on 3.5-Mc. c.w. 73, and get the reports in, gang. Traffic: W6SUV 8, PSQ 2.

ROANOKE DIVISION

NORTH CAROLINA — SCM, W. J. Wortman, W4CYB — Welcome to DYX, Elizabeth City, formerly KP-4BK, of Puerto Rico. AYA's call has been changed to HW. He is working 7 Mc. HVT and HEH are keeping the 50-Mc. band going and report that EIW and BYA will be going on this band. A net known as the "Tar Heel Six Meter Net" has been formed. Additional members are needed. If interested contact V. Howard, 1660 Stadium Drive, Winston-Salem. BGS is active on 14- and 28-Mc. 'phone and reports lots of DX coming in. IZR works KL7 in good style. KDI keeps busy on 14-Mc. c.w. DGV received a heard card from KA1SS but didn't work him as DCW did. KJS is running n.f.m. on 28-Mc. JRZ works the West Coast with crystal oscillator on 7 Mc. NI is on 3.85-Mc. 'phone with a half kw. keeping schedules weekly with 2LB. HUL and DCW are busy on new rigs. Is anyone in the State interested in 50 Mc.? Been experimenting some with it here. Wish that the Raleigh gang would pull another mass reporting deal as they did a couple of months back. Heard from Greensboro and Asheville once or twice. DSO finally got 28 Mc. rig perking. 5AZA now is 4LKI and has moved to the Queen City. CAY was under the weather but handled some traffic. CFL is rebuilding, adding a fancy new broad-tuned e.c.o., etc. HUJ is operating new f.m. at WBT. AAU actually is working c.w. for a change. Let's not forget the hamfest coming up in Raleigh. Traffic: W4CAY 6.

SOUTH CAROLINA — SCM, Ted Ferguson, W4-BQE/ANG — Thanks to GTW for his letter and the dope on the Sumter gang. JCO is planning to work portable while

(*Continued on page 118*)



Look to WARD for Greater FM Values!

REFLECTOR KIT MODEL FMR-63 LIST $5.25

Ward's Reflector Kit, combined with either the Straight or Folded Di-Poles as shown at left, provides maximum directional gain of the desired signal and eliminates undesirable and interfering reflections.

Ward, world's largest producer of aerials, now offers you leading values in FM with antennas completely adaptable to the varying requirements of each installation. They provide maximum electrical efficiency needed for finest FM reception. The ease with which they may be securely installed, plus strong weather-proof construction assures trouble-free operation – and extra profits for YOU!

The Straight and Folded Di-Poles shown at the right operate in a range of 88 to 106 mc. The Folded Di-Pole model provides broader antenna tuning and matched impedance to the 300 ohm transmission line for maximum response and energy transfer.

The Ward Reflector Kit can be combined with either of the two Di-Poles as illustrated above.

NOTE ALL THESE OUTSTANDING FEATURES:

- Universal base mounts on any roof or wall angle.
- Sturdy vertical element revolves or tilts for maximum gain.
- Di-Pole of corrosion-preventive aluminum. All other parts weather-proofed.
- Ring for guy wires assures secure installation.
- Sixty feet of dielectric 300 ohm parallel transmission line is insulated with polyethylene.
- Stand-off insulators minimize capacity to ground.

WRITE FOR FREE CATALOG

THE WARD PRODUCTS CORPORATION
1522 EAST 45th STREET • CLEVELAND 3, OHIO
IN CANADA: Atlas Radio Corp., 560 King St., W., Toronto, Ont., Can.
EXPORT DEPT.: C. O. Brandes, Mgr., 4900 Euclid Ave., Cleveland 3, O.

WARD *Aerials*

(Continued from page 110)

at the Citadel. GTD works 3.5-Mc. c.w. and has a new Meissner 150B. HSM has a new five-element wide-spaced beam for 28 Mc. GFP is dividing his time between 3.85 and 14 Mc. GTW says he is doing a fair job on 28 Mc. considering the power. CZA has taken over the 3.5-Mc. c.w. South Carolina Net and is interested in more stations in this net. Give him a hand, fellows. BSS is EC for the Hodges area, also reports that the ice took down his "V" beam. BFQ reports activity in the South Carolina Net. AZT reports that the 3.85-Mc. 'phone net meets each Sunday at 2:00 P.M. and invites all South Carolina 3.85-Mc. 'phone men to meet the net. ILP now has a new rig, a T55 with 175 watts, and says DX is good with this new rig. FNS has returned to Clemson College where he is a junior in E.E. LJJ is the latest addition to the Columbia family. Your SCM would appreciate a report on your activity, as that is the only way we can fill this space. Traffic: W4AZT 92, FNS 18 BSS 15.

VIRGINIA — SCM, Walter R. Bullington, W4JHK — LLI is a new call in Hampton and is active on 3.5-Mc. c.w. with a 6L6. KYD schedules KPV at V.P.I. twice a week. CLD is active daily on 3.85-Mc. 'phone and is experimenting with his VHF converter. The Danville Radio Club meets Monday nights in the Pythian Building. Officers are: JRI, pres.; JRR, vice-pres.; KRK, act. mgr. The club has an HT-9 on 7-Mc. c.w. with the club call, KZY. 3BZ, now 4CB, is active on 27 Mc. JRR is using an ex-police transmitter on 28 Mc. KCY and KRK, new calls, are active on 28 Mc. JAB is on 14 Mc. ISE is a student at Duke and is active on 7 Mc. week ends. KXE schedules the TO Net, NNJ Net, and the Rebel Net. JFV is gathering up the DX on 28 Mc. KAK is on 3.85 and 14-Mc. 'phone. JXE is active on 7-Mc. c.w. OT has an 807 on 7-Mc. c.w. JHI has a new SX-42. KFC had 100 QSOs in the first part of the DX Contest. IYC schedules 6OGM at 0200 daily with traffic to Japan. IWF and ISA are active on 7 Mc. JGO has an f.m. job on 28 Mc. 1UW has an 807 on 3.85- and 14-Mc. 'phone. FPS has a kw. on 14-Mc. 'phone and a new RME-45 receiver. JHK has moved to new QTH and plans rebuilding when things are back to normal. EOP is building new combination 14-28-Mc. beam with aluminum tower. Traffic: W4KFC 316, KXE 56, IYC 20, KYD 10, CLD 3.

WEST VIRGINIA — SCM, Donald B. Morris, W8JM — PQQ is at home in Charleston working for power company after graduation from W. V. U. He has kw. rig on 7 and 14 Mc. to attract DX. MOP handles traffic in the Hoot Owl 'Phone Net. QWM now is 9RBF in Chicago. GBF leads traffic men and has fixed frequency receiver on 3770 kc. VMK, with KFV and LGB assisting, built new 1-kw. rig. SHU, CSF, QHG, and JM have the Don Mix (Sept. *QST*) VFO and report excellent results. QHG, with new HRO, worked 15 countries on 'phone during first half of the DX Contest. LII and DFC snagged JM/8 from Webster County for a rare W. Va. County. ZOJ and VPO are brothers, both running high-powered rigs on the 'phone bands. WSL made the "How's DX" column for his excellent DX work on low power. YGL, FMU, and KWL handle world-wide traffic on 28-Mc. 'phone. GAD and CCN are active again after a long absence. VKC, Hampshire County, is active on 7-Mc. c.w. VAN and KWI have kw. 'phone and c.w. rigs on 3.85 and 14 Mc. RCN has returned to Clarksburg and is active on 3770 kc. CXU has been appointed as OBS. Traffic: W8GBF 60, CSF 28, OXO 25, DFC 10, MOL 10, MOP 10, EWM 8, JM 7, FMU 4.

ROCKY MOUNTAIN DIVISION

COLORADO — SCM, Glen Bond, WØQYT — BZV has moved from Akron, Colo., to Omaha, Neb., and has set up on 14296 kc. WAP now has 47 states verified on 7-Mc. c.w. postwar with 110 watts, pair 6L6s. DRB, in Canon City, sent in notice the first of the year that DRB was lashed down and secured and now traffic reports come in via EKQ. Give us the low-down, Clay. KVD, Colorado Springs, has done a very fine job organizing the emergency net. Plans are for a 28-Mc. net locally using all stations possible. There will be two mobile stations. NWQ is net control Nr. 1 and ZKM Nr. 2 for the 28-Mc. net. HDU will be control for the 7-Mc. net. KVD will be control Nr. 1 and QDX Nr. 2 of the 3.85-Mc. 'phone net with which it is planned to make a statewide set-up. Details will be forthcoming. The various nets consist of IHO, LZY, KMS, QDX, IOH, SWM, IQL, MGA, NWQ, ZKM, ANK, HDU, HEM, JVR, and KVD. Traffic: WØWAP 71, DRB 26, BZV 3.

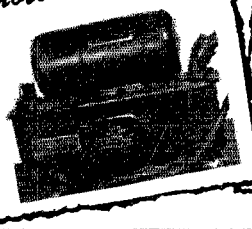
(Continued on page 114)

NEWARK HAS MORE RADIO BARGAINS THAN EVER BEFORE

CRYSTAL DIODES

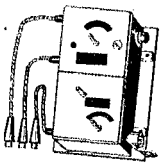
Now you can afford to experiment with wonderful new crystal Diodes. Used in noise limiter circuits, as second detector, and general rectifier applications. Maximum reverse voltage 3 volts, Max. 5 mils. Plug-in type. 1N21, General Purpose. 1N27 Video Crystal. **20¢**
Your Cost, ANY TYPE

Great Dynamotor Bargain!



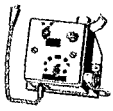
A fortunate buy enables us to offer this Power Supply at a sensational price. Brand New, delivers 500 VDC at 160 mils from 6-12 volt source. Switches, noise filters. 76 lbs. **$9.95** Only.....

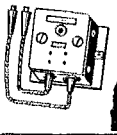
DUAL CONTROL BOXES



2-Channel box for intercom. PA, Ham work. Parts alone worth many times the price! 3-12 pt. rotary switches, 1-double deck, 2-triple deck, 12 pt. recessed male connector, pilot light, socket and bulb with translucent red cover, ¼ watt resistor, 3 pointer knobs, 3-ft. cables, 5 pt. female terminals. All in dual metal box 10 x 4 x 2". A hot buy for only..... **49¢**

SINGLE CONTROL BOXES





5 x 4 x 2". Two 3-deck, 12 pt. rotary switches, pilot light, 2-12 pt. recessed male connectors, 3 ft. 5-wire cable. With 2 bakelite knobs. Great Value! Only..... **39¢**

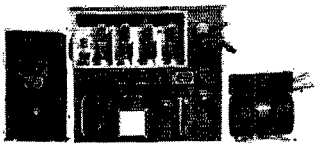
SINGLE BOX, as above, but with one rotary switch, 2-3 ft. 5-wire cables. Only..... **39¢**

SINGLE BOX — Push Button, high frequency buzzer, 2-3 ft. 5-wire connectors and several terminal strips. Parts alone worth twice as much. Only **39¢**

WAR SURPLUS TRANSMITTING and SPECIAL PURPOSE TUBES

1C21	$ .75	6J4	$1.50	250TH	$9.00	808	$3.00	83GB	$5.25	872A/872	2.25	958A	$ .75
1N21A	.20	10Y	1.50	304TH	12.00	809	1.50	832A	4.05	884	.75	959	.75
1N23	.20	35TG	1.95	304TL	3.75	810	2.63	836	1.50	921	.75	1616	3.00
2AP1	2.25	75TL	2.25	715C	33.00	811	1.95	837	3.38	922	.73	1619	.75
2C40	2.63	VR90	.75	800	2.25	813	6.75	838	3.75	923	.45	1624	.90
2C44	1.50	100TH	4.13	801A	1.73	814	4.50	843	.75	927	1.05	1625	.75
2D21	.60	VR105	.75	802	1.58	815	2.25	845W	3.75	931A	1.88	1626	.60
2X2/879	.90	VR150	.75	803	9.00	816	.60	860	3.00	954	.75	1629	.27
3AP1	3.00	204A	60.00	804	6.75	826	2.25	861	90.00	955	.75	2051	.90
5AP1	9.00	211	1.13	805	3.75	828	9.00	864	.60	956	.75	8005	3.15
6AK5	.90	217C	7.50	807	1.05	829B	3.00	865	1.50	957	.75	8016	.53

75 WATT PHONE RIG

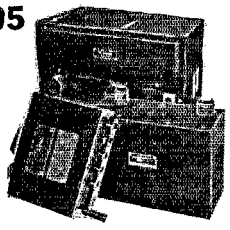


BC-375 E AAF XMITTER

A complete transmitting outfit for CW or phone operation. Cost over $2,000 to make. You pay less than 50¢ a watt . . . while stocks last!
You Get . . . 7 Tuning Units, 200-12000 kc; 24 volt Dynamotor (can be converted to 110 volt operation) with Relay, Filter, and Fuses; Antenna Tuning Unit BC-306A; Complete Set of Tubes. Electrically Perfect and Guaranteed — removed from unused aircraft. Wgt. about 400 lbs. A wonderful buy for any Ham! **$32.50**

All-Purpose 2-METER RIG

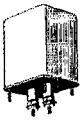
SCR-522 RECEIVER TRANSMITTER **$34.95**



By all means get this swell VHF Transceiver . . . one of the finest and most economical 2-Meter rigs you can buy today. Now available for a small fraction of the original cost.
Consists of 10-Tube Superhet Receiver with squelch circuit, 7-Tube XMitter, Remote Control Box, 28 volt Dynamotor (can be converted to 110 volt operation). Complete outfit with 17 Tubes, 4 Crystals. Perfect and Guaranteed—removed from unused aircraft. About 100 lbs. All for one Bargain Price.

WONDERFUL FILTER CHOKE BUY!

1.5 Henrys, 275 MA. Rect. can 4" H x 2½" x 2". DC. 50 ohms resistance. Porcelain standoff insulators. Breakdown voltage to ground 2000 volts. While they last.... **59c**



475 OHM CHOKE

Rectangular can 2¼ H x 1¾ Sq. 5 henrys at 60 mils. 475 ohms DC resistance. 2400 volt insulation. Limited Quantity, Only **39¢**

20% DEPOSIT REQUIRED WITH ALL C.O.D. ORDERS

SEND FULL AMOUNT SAVE C.O.D. CHARGES

Prices Subject To Change

NEW YORK
Offices & Warehouse
242 W. 55th St., N.Y. 19

NEWARK ELECTRIC COMPANY, INC.

CHICAGO
323 W. Madison St.
Chicago 6, Ill.

SEND ORDERS TO
242-5 W. 55th STREET
NEW YORK 19, N. Y.
OR
323-5 W. MADISON ST.
CHICAGO 6, ILL.

New York City Stores: 115-17 W. 45th St. & 212 Fulton St

(Continued from page 113)

UTAH-WYOMING — SCM, Victor Drabble, W7LLH — GBB is keeping schedules with the FARM Net and the Pioneer Net. MQL has a VFO for all bands to 28 Mc. and a 144-Mc. net for emergency use. UTM maintains a schedule on 7 Mc. every night with ØWAP. BED worked ZL1NF on 3.5 Mc. with a small 40-watt transmitter. DLR has a new slug-tuned exciter. DTB is working DX on 28 Mc. TVL is on 14 Mc. with a 50-watt rig and a two-section 8JK beam. JPN keeps schedules on 144 Mc. with SP at Salt Air. FTE is on 28 Mc. using a 4D22. GZG has a 40-42 on 14- and 3.5-Mc. c.w. JET runs 200 watts to an 813, modulated with a pair of 809s and uses a dipole on 14 Mc. and a folded dipole on 28 Mc. KHI is on 3.5-Mc. c.w. with 40 watts to a pair of 6L6s. JME is on 7- and 3.5-Mc. c.w. with 40 watts to an 807. KFV has 600 watts to a pair of 813s modulated with a pair of 805s on 14 and 3.85-Mc. 'phone. LE is on 3.85-Mc. 'phone with a 150-B Meissner transmitter and an HQ-120X. OWZ has 144-Mc. rig using an 852A and linear tank. ØEBI, in Laramie, is on 7- and 3.5-Mc. c.w. ØWLA, in Cheyenne, has 40 watts to an 807 on 7, 14, and 28 Mc. with a center-fed Zepp antenna and an S-20R receiver. 6VFK has 7 watts on 28-Mc. 'phone. Traffic: W7UTM 45, GBB 20, EVH 10, HDS 8, BED 1.

SOUTHEASTERN DIVISION

EASTERN FLORIDA — SCM, Robert B. Murphy, W4IP — The hamfest to be held in West Palm Beach June 15th is the major event of the section. It will be held in the Casino at Lake Worth. Prizes of all values and sizes will be given. Make your reservations at two dollars a head to BRB, president of the recently-affiliated West Palm Beach Club. 6WOQ/4 has left Banana River after serving very nicely in traffic-handling there. AYV reports a new ham, LCZ, in his town. FWZ is organizing the Gator Net. DU has a new Meissner. CFO is on 29 Mc. with a nice rig. AKH is the N.E. Florida DX champ. IPL is president of the JARS. GYZ has a new Supreme transmitter. FS and AWE gave some very good talks at JARS. DQW says the Rebel Net handles his traffic. GIC is working plenty of DX with 25 watts. He visited CCR and saw IE in Sarasota. BXL has been appointed ORS, is a member of the Gator Net, and is meeting most of the gang on the net frequency of 7290 kc. He is planning a 29-Mc. f.m. job. LAP has worked 46 countries since the first of the year. The Tampa Fair really handled the traffic, as shown by DUG's report. BNR made the official report and really did a good job. IML is now located in Manassas, Va., and is on 7 and 14 Mc. IWM, at Key West, says that the ham club down there will affiliate with ARRL soon. It looks as though EJD would like to have the EC job in Key West. KVZ's lady is the secretary of the club and is studying for her ticket. AAR is doing good work with the Rebel Net. IP is about to step out after pleasant contacts for about three years as your SCM. I wish to thank all the gang for making my job so easy. I would like to express my appreciation for the nice letters you fellows sent in the passing of my wife. BYF has been appointed Acting SCM. I know you fellows will help Mac all you can. Traffic: W4DUG 2318, DQW 1019, FWZ 571, EEW 180, AFV 100, GEE 50, LAP 27, BNR 25, 9ZVO/4 11, AYV 10, BXL 10, IP7.

WESTERN FLORIDA — SCM, Lt. Comdr. Edward J. Collins, W4MS — DAO has completed his r.f. section and returned to 28 Mc. KFP has a new RME-84. QG has renewed his license. ASV is giving 7 Mc. a whirl. BFD is putting up masts. CNK has been on 50 Mc. JV ran a kw. in the DX Contest. EQR is working 50 and 144 Mc. BKQ has a new VHF-152. HJA has been on 3.5 Mc. enjoying short haul QSOs. KIK sold his transmitter to KVG. ØMEI now is 4LNK. EGN has put his three-element beam on a tower. HIZ and BCC work all bands. ACB is converting SCR-522. EQZ has a swell new four-element beam on 28 Mc. MS is working on the kw. rig after taking a bruising on 14 Mc. DZX has p.p. 810s. DXQ is back on 7 Mc. JNP is looking at 807 rig. AXP keeps things moving on the Rebel Net. IVY is building beam for 28 Mc. but gets out well with dipole. GPC is increasing power. KXV assisted JV with the big rig. KMB is heard regularly.

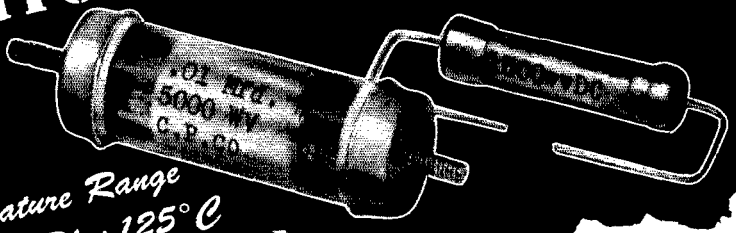
GEORGIA — SCM, Thomas M. Moss, W4HYW — Ralph Bean, FID, of Hapeville, has been appointed an Assistant SCM. KFL is a student at Georgia Tech., and is on from Atlanta. He suggests a "W1CA" (Worked One

(Continued on page 116)

PLASTICON* ASG Silicone-Filled GLASSMIKES

1-3/8 x 3-1/2

FOR HIGHER VOLTAGES



Extreme Temperature Range from Minus 60° C to Plus 125° C

From 600 to over 30,000 Volts

Modern functionally designed capacitors. Metal ferrules are soldered to silver bands fused to each end of heavy-walled glass tubes. This vacuum tight assembly is fungus-proof and passes Signal Corps, Air Corps and Navy thermal cycle and immersion tests.

Announcing an illustrated technical booklet on uses of

Plasticon* Glassmikes.

Contains the following subjects: —

- CHART OF RF RATINGS
- Glassmike characteristics and design data
- Comparison of Glassmikes and Mica Capacitors
- Uses of Glassmikes for improved RF and Audio bypassing
- Use in Audio and RF coupling
- Glassmikes in television power supplies
- Video coupling
- Vibrator buffer applications
- Geiger Counter Capacitors
- Instrument capacitors
- and many other applications

Due to the unprecedented demand we regret it is essential that a nominal charge of ten cents for handling and mailing be included when writing for the above free booklet.

***PLASTICONS: Plastic-Film Dielectric Capacitors**

Order from your jobber: If he cannot supply you, order direct

Condenser Products Company

1375 NORTH BRANCH STREET • CHICAGO 22, ILLINOIS

(*Continued from page 114*)

Call Area) certificate for those of us who have to grease our antennas to get out of the backyard. FKE is now OO Class II, and our latest RCC member. KKC is with telephone company at Thomasville. ØMMP is engineer at WGOV in Valdosta. FGH is NCS for South Georgia Swampwater Net on 28 Mc. IKJ and IPX qualified in the January FMT. FCZ and TL are additions to Cracker Emergency Net. Larry, of KTG, is now LDB. The Atlanta Radio Club is now publishing *The Atlanta Ham* for members. CFJ is engineer at WBGE, new b.c. station in Atlanta. HAH now is with WGST. F.m. activity is being reported from Atlanta. GMP will start code practice on 28, 27, or 50 Mc. soon. GZF now is with an Atlanta wholesale house. The *Cracker Waves Net* is planning more schedules. Get hamfest plans in early to your SCM. Publicity will be given in this column, and separate report sent to ARRL. Traffic: W4KV 115, HYW 20, FKE 7.

WEST INDIES — Acting SCM, E.W. Mayer, KP4KD — AM completed rebuilding with improvement in operation. He kept schedule with W2PWD for visitors in Puerto Rico. BE worked G2CDI. Both stations handled traffic. NY4CM reports by radio that he now has DXCC total of 105, has new VFO, and handles traffic. *AK is* on 14 Mc. with *100* watts. AO, DH, DJ, DO, BC, and BL were active in c.w. DX Contest as was KV4AD. KV4AA is on 7 Mc. with 80 watts. CK and CL are putting up four-element beam. With over 104 KP4 licenses issued more than three or four reports should be received directly. What say you fellows? Let's hear from you on the first of the month with a report of your activities for the preceding month. Traffic: NY4CM 20, KP4KD 8, 4AM 4, 4AK 3, 4BE 3.

SOUTHWESTERN DIVISION

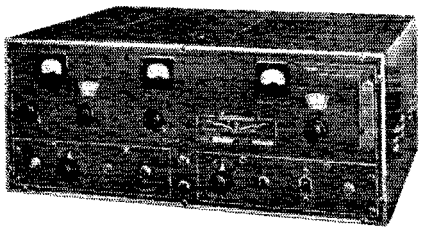
ARIZONA — SCM, Gladden Elliott, W7MLL — KQU uses 3 watts on 3.5 Mc. at Phoenix. KFF is on 3.5 and 7 Mc. at Globe. KDI is on 28 Mc. at Prescott. RU and NRI provided radio control for the Flagstaff Ski Meet. KNW is on 3.5 and 7 Mc. at Morenci. KUN is on 7 Mc. at Davis-Monthan Field. JPY and QAP have "V" beams. QAP did fair in the DX Contest on 90 watts. JZD uses cathode modulation on 28 Mc. OMH is getting a class ready for the R.I. in April. PDA is again with 813s for 700 watts. JOK and KEY are narrow-band f.m. exponents in Phoenix. ACN uses cathode modulation on 3.85 Mc. KMQ is on 3.5-Mc. c.w. at Mesa. KRW, at Mesa, is ex-ØITO. KRY and KSM are on 3.5 and 7 Mc. at Cochise. MAE, LSK, SOG, JOT, MWQ, and JMS provided radio communication for "Don's Trek to the Superstitions." KAC is on 3.5, 3.85, and 28 Mc. at Casa Grande and KQR is on 7 Mc. there. SAV is on 28 Mc. at Benson, and QMG is on 7 Mc. there. KFD has a surplus rig at Bisbee. The 25 Club is considering a club-house. 9UEE/7 is on 7 Mc. at Douglas. KWP, Plyant; KWD, Ying; and KWF, Painter; are new calls. KAE has a pair of 250THs. JXL is puting on KRC at Douglas H.S. UPM has 250 watts. Traffic: W7MLL 39, KOY 36, MAE 30, OIF 27, MNH 24, OAS 12, NRI 7.

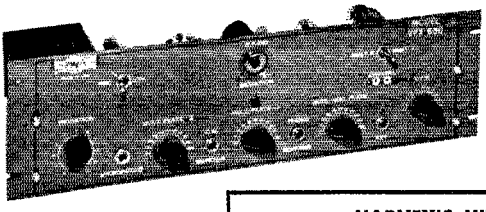
SAN DIEGO — SCM, Irvin L. Emig, W6GC — The San Diego section wishes to thank CHV for his excellent job as SCM the past two years. APG is Asst. SCM and temporary SEC. New appointments: LRU as OBS and FMJ as OO. Let's hear from those interested in ORS, OBS, OPS, OO, and EC appointment. JUM, BOS, LKC, and WNN are active on 50 Mc. and invite cross-band work with 28-Mc. BAM reports YJL is new amateur in Tustin. MKW is experimenting with antennas for 144 Mc. and says the SCIC net, operating on 145 Mc. Monday nights, covers San Bernardino, Riverside, Van Nuys, La Verne, Alhambra, Santa Ana, and Downey. JUL handled traffic from Byrd Expedition via Japan. CHV is building an e.c.o. for 28 Mc. FMJ joined Mission Trail Net. KW and GC qualified as Class I OOs. LUJ schedules KA1ZU daily for traffic. SKZ is rebuilding a kw. MI, BLZ, LDJ, and LRU participated in DX c.w. contest. OZH is experimenting with two four-element beams spaced one-half wave apart vertically. GCX is on 28 Mc. with f.m. TIK and UPP are active on 28 Mc with Mac keeping schedules with Guam daily and D4ADT, who is 6TIN, weekly. QG checks 50-Mc. m.u.f. daily so as not to miss any band openings. DEY is giving 144 Mc. a whirl. MQF is gathering DX cards on 14 Mc. AD, BAG, DZC, HWJ, and UNU are GG Breakfast Clubbers on 3950 kc. RPI is rebuilding television gear but gets on 3.85-Mc. 'phone now and then. 1DCE/6 made FB results in

(*Continued on page 118*)

HARVEY for transmitting equipment

The complete ham transmitter. **Supreme Model AF-100.** For CW, ICW, AM and FM phone on 10, 11, 15, 20, 40 and 80. Stabilized VFO or 2 xtal positions. Exciter band switching. 100 watts output on phone and CW. Compact, only 29⅜" long, 11¾" wide, 18⅜" deep. In stock for immediate delivery, with tubes, coils for all bands and built-in antenna relay. **$450.00**





Sonar VFX 680. Wrapped up in one package: a xtal exciter; a VFO; a VFX that permits deviation of xtal frequency as much as 30 kc. on 80, up to 240 kc. on 10; FM phone on all bands; and a CW or phone monitor for earphones and with a dual tuning eye. For rack or table mounting.....**$87.45**
We also have the **Sonar XE-10**.....**$39.45**

HARVEY'S HITS OF THE MONTH

Harvey has 20 meter crystals for a buck! Mounted in holder with ½" pin spacing. Also 40 and 80 meter and 6 and 13 mc. bands at the same low price.....**$1.00**
Special 8 mc. xtals for 2 meter xtal control, only.....**$1.50**
Also in stock complete line of Bliley AX-2 xtals
Include 10¢ postage with your crystal order

HARVEY'S HAMFESTIVAL OF VALUES

The new **Hammarlund FS135C Frequency Standard.** Fits any receiver and makes it an accurate freq. meter. Calibrate your receiver, check the xmittr. Can be adjusted to WWV. Complete with tube and 100 kc. xtal.....**$14.95**

Model 905 Trans-Meter. Nine meters in one. Field strength meter; wave meter; per cent modulation of xmittr; "S" meter; per cent modulation received signal; AC VTVM; DC VTVM; phone monitor; neutralizing indicator. Complete with batteries.....**$49.50**

BC375, xmittr covering 200 kc. to 12 mc. (less bc. band). Complete with 7 tuning units, antenna tuning unit, dynamotor, etc. A real outfit used by AAF.....**$35.00**

SCR522, VHF xmittr-rcvr for work at 100-156 mc. Designed for airborne use, ideal for portable. 10-tube superhet receiver; 7 tube xmittr delivers 15 watts. 28 volt dynamotor powers whole rig. Easily converted for 110-volt ac. operation.....**$39.50**

Receivers: Most models listed here are in stock for immediate delivery.

Collins 75A $375
Hallicrafters S38 complete $47.50
Hallicrafters S40A $89.50
Hallicrafters SX 42.....$275
Hammarlund HQ129X and speaker $173.25
Hammarlund SP-400-X and speaker $347.25
National NC173 complete $187.50
National NC-2-40D (complete with speaker).....$240
National HRO-5TA1 complete.....$306.71
National NC-46 less speaker $97.50
National 1-10A with tubes and coils.....$67.50
RME-45 complete $198.70
Hallicrafter panadapter complete.....$99.50
Mock 60T transmitters $150
Millen 90700 ECO.....$42.50
Millen 90800 exciter $42.50
Millen 90281 power supply $84.50
Millen 90902 scope $42.50

Gordon, Abbott and other rotary beams and rotators

Note: All prices quoted are Net, F.O.B. New York City and are subject to change without notice.

Telephone LOngacre 3-1600

HARVEY RADIO COMPANY INC.
103 West 43rd St., New York 18, N. Y.

(Continued from page 116)

FMT. WXW works ZL on 27 Mc. Club news: The San Diego club meets the 1st Mon. of each month at temporary quarters in Linda Vista Recreation Room. The Palomar Club meets the 2nd Mon. of each month, rotating between La Jolla, Oceanside, and Escondido. The Orange County Club meets the 3rd Tues. at Episcopal Church. The Helix Club meets 1st and 3rd Thurs. at La Mesa Shuffle Board Club House. Traffic: W6LUJ 31, BAM 23, OBD 22, YTH 12, FMJ 6, GC 5, CHV 2, FFV 2.

WEST GULF DIVISION

NORTHERN TEXAS — SCM, N. C. Settle, W5DAS/MNL — Asst. SCM, Joe Bonnett, 5III. SEC: QA. PAM: ECE. RM: CDU, JIH, at Mineral Wells, is back on. Our newly-organized EC net was in operation during an ice and rain storm in and around Junction and Mason. Our hats are off to the following who took part: LMM, HSX, HJP, FNY, IPE, IZ, CU, EYV, DSU, IVU, FMH, DSH, EWG, FNH, JBZ, AYB, DVQ, HBT, HML, GDX, GML, IU, HOF, CIX, DSF, KYB, GNH, QA, and 3LCK/5. Are you a member of the EC Net? How about it? 5KIA and LWT are active at El Paso again. MMT, ex-9QDE, in Fort Worth, has 807, HQ-129. JJF, at El Paso, is active on 28 Mc. with 200 watts. He hopes to be back in these parts in the near future. ARV, Ft. Worth, has OO and ORS appointments. BYX worked OX3GE like a local. SH, with BC-610 "V" beam, still is trying for Egypt. AJ writes a nice letter from Groesbeck and says he is back in the States and is about ready to fire up again. IVC is on 7 Mc. in Thornton. JQY has rebuilt the junk and it looks like a broadcast set now. He has sold his business and thinks he will do some hamming for a while. Your SCM has the call MNL for Dallas, and DAS for the shack at Lake Dallas. IME, the 4-watt station of the Dallas Amateur Radio Club, has worked all districts and Alaska, Cuba, and Honduras on 29,000 kc. How about some news from your town? Traffic: W5LSN 51, CDU 34, BYX 16, FMZ 11, ISD 10, ASA 7, LVR 6, DAS 4, 1LZ 4.

OKLAHOMA — SCM, Bert Weidner, W5HXI — Asst. SCM, George Bird, 5HGC. OBS: AFX, DRE. OO: EIH. RM: IGO. The state c.w. net is operating every night at 1930 on 3520 kc. HGC, IOW, JKS, and 6WIM/5, with 1GO as NCS, are handling a lot of traffic. More stations are needed to give an outlet for heavy Navy traffic. The 'Phone Emergency Net is in operation with HGC as control station. AI, ATJ, BDG, BLW, BKN, EYH, ESB, FDQ, FMB, HXI, HXU, and MMH are reporting into the net. HXU has 15 watts emergency power. FDQ reported on possible flood control traffic. DXJ is on 3.85-Mc. 'phone. JNG has a new harmonic. EAK now has a pair of HK54s on all bands. ATJ is using VT127A. AI now has a pair of 250THs on all 'phone bands. 144 Mc. is very hot in Oklahoma City with a few stations now on 50 Mc. ATJ had an emergency when the toll lines were out from Elk City to Oklahoma City because of ice. Contact was established with DRE and traffic was handled. The Oklahoma C.W. Net and the North Texas Net were also guarding the frequency. Traffic: W5IGO 238, HGC 25, JKS 18, 6WIM/5 7, IOW 1.

CANADA

MARITIME DIVISION

MARITIME — SCM, A. M. Crowell, VE1DQ — RM: EY. SEC; FQ. Excellent QRR work was done by FQ Mar. 3rd and 4th when all lines were down between Nova Scotia and the rest of Canada because of a heavy gale and sleet storm. MZ and DQ, the first to get on with restored power, started the ball rolling with the latter announcing that the lines were down and asking VE2s and VE3s to QRX for possible traffic. During the power cut at FQ's QTH, Brit operated at DQ when the latter was called away to work. FQ's good work won nice comment in the Halifax newspapers. Others taking part were BC, DQ, MZ, ET, IE, and FC. HJ was high traffic man and LZ runner-up. SP sends in nice lot of DX snared on 3.5 and 14 Mc. DB handles a few on 7 and 14 Mc. EY keeps the usual schedules on 3580 and 3775 kc. on Sun. and Tues. at 1600 and 2045. BC has been doing some 144-Mc. work and has worked from Mount Uniacke into Halifax. TL, BC, and QU made some very accurate frequency checks in the FMT. DS is active on 28-Mc. 'phone and has been giving the local boys a few checks with the 'scope. HD has a nice 28-Mc. 'phone

(Continued on page 120)

Here's the most versatile and practical antenna insulator-connector ever offered the radio amateur or the professional operator. The IMPEDACOUPLER makes a secure and weatherproof junction between Amphenol coaxial line and any current fed antenna or array. It also can be used in many other ways: for connection to flat lines, to an open wire line and to serve as a center insulator of a ½ wave doublet.

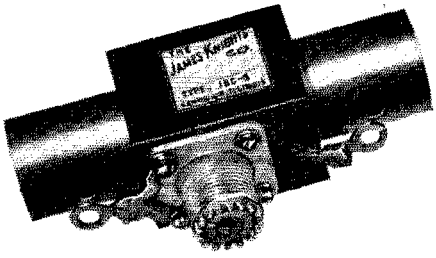
Equipped with an Amphenol type 1R receptacle, the IMPEDACOUPLER provides quick, positive connection without fanning and without disrupting terminal impedance of the line.

INSULATION PLUS STRENGTH

A genuine MYKROY center insulator block provides optimum dielectric properties, has ample strength to withstand the pull of the antenna and to support the weight of the coaxial line.

The insulator is drilled at both ends for bolt or rivet for holding tubing and connections, or for looping wire if latter is to be used.

The insulator ends are machined to fit the inside diameter of standard aluminum or dural tubing having 1" outside diameter, commonly used for rotary beams. However, the user can easily turn down the insulator ends to fit his particular needs. With the IMPEDACOUPLER, losses from moisture, deterioration at antenna end of the line and resultant insulation breakdown are eliminated.



Write for IMPEDACOUPLER folder illustrating fifteen practical applications, or see the IMPEDACOUPLER at your dealer's.

Weight Only 6 oz.
Net Price Less Amphenol 1SP Connector **$3.50**

Other J-K Products Include Quartz Crystals, Crystal Ovens, Frequency Standards.

The JAMES KNIGHTS Company

SANDWICH, ILLINOIS

(*Continued from page 118*)

signal using Millen rig. PB and ET were quite active in the 'phone DX Contest. Traffic: VE1HJ 62, 1LZ 58, 1QT 36, 1EY 8, 1BC 4, 1SP 4, 1DB 2.

ONTARIO DIVISION

ONTARIO — SCM, David S. Hutchinson, VE3DU — The following VE3 stations qualified for certificates in January Code Proficiency Run: QD 15, ACR 20, APS 25, VZ and WY 30 w.p.m. The rejuvenated Beaver Net on 3535 kc. is doing a good job with TM, AWJ, OI, BLE, WY, WX, ATR, BCS, SF, HP, XO, QU, and MB as operators. There is room for stations north and east of Toronto. The Ontario 'phone net is going great guns with more stations coming in all the time. New officers of Frontier Radio Assn. are: CP, past-pres.; ADN, pres.; AEP, vice-pres.; AWJ, secy.; and MY, treas. AWJ is prospective ORS for Windsor. XA will be on soon from Kingsville. CP had 8 QSOs last LO Nite. JH is back on in the Squit and is looking for new QTH. UA, BNQ, and WX visited CP. LV is on from Lambeth. Chatham now has the Kent Radio Club with AQB, pres., and CI, vice-pres. The 144 Mc. net in Toronto consists of ANY, ATB, PY, BAX, AWX, ARP, EQ, AWC, and ARP. The net has portable 60-cycle gas-driven power unit, and has already worked ten W2 stations. WY is OBS and is doing a good job on QBN. The WSRC has been presented with new club trophy, "Ye Centre Tappe," by its founder, VE2XR, ex-3LR. It is awarded to the club member doing outstanding work in ham radio. AWX is the winner this year for his work in the SS Contest. AYE did well in the DX Contest. MI schedules VE2XR, Montreal, Mon. through Fri. on 7 Mc. AXQ tied up with AFARS and radio club. BAJ, with 13 watts, worked his 20th state. VD cannot locate any traffic men on 7 Mc. BOI is new Peterboro ham. QK is QRL with *XTAL*. CAR keeps OBS schedules. DU visited WY. The London Radio Club had 67 out at February meeting. KM is NCS on Ontario 'phone net "B." BGT is new 50-Mc. station in Hamilton. A hamfest was held at BNQ's with 34 VE3s present. ANY had QSO with W4 on 50 Mc. March 4th. Traffic: VE3HP 224, 3QK 158, 3WX 132, 3ATR 111, 3BCS 81, 3TM 67, 3CP 61, 3SF 42, 3WY 34, 3KM 15, 3VD 14, 3CAR 13, 3XO 7, 3BFX 6, 3AWJ 5, 3AXQ 4, 3BAJ 3, 3WB 1.

QUEBEC DIVISION

QUEBEC — SCM, Gordon F. J. Phelan, VE2SU — SU worked five DX stations in the contest at the astounding speed of one station every three-quarters of a minute. DX worked 42 in 22 countries in the first week end. TN was burned out and lost all but his SX-25. CD is chasing parasitics. NK has 3.5 Mc. rig on in addition to 28-Mc. rig. TM QSPed a message to HB from W1AW concerning his signals on 3700 kc. At the time, HB was dismantled. QA recently demonstrated the operation of a ham station to the local Chamber of Commerce at Cap de la Madeliene. TA is on the air again. DX, our PAM, is control station for the Quebec-Ontario 'phone net, now operating at 7:00 P.M. each Monday. DR retired from the QSL Bureau. At last 50 Mc. is beginning to talk. The time, every Monday night from 9:30 to 12:00. All 50-Mc. stations are asked to register with the SCM. YF advises that VE4IF is on 14-Mc. 'phone at 10 P.M. most nights looking for traffic for the West. BD, LY, KH, LP, AX, RZ, AI, KZ, GG, HZ are among those interested in 50 Mc. BB is Assistant EC for the Lachine district. He is net control for 3.5-Mc. c.w. The AFARS boys spent an enjoyable evening at the 401 Squadron Officer's Mess inspecting the shack. For information on AFARS, contact K.R. Patrick, RCA, Montreal. EA is building plate modulator. OB is in Lennoxville with 14-Mc. crystal working. If willing to help out when emergency comes, register your call and address with the SCM. Traffic: VE2II 105, BB 90, DR 75, TM 29, SU 18, WZ 2, YJ 2.

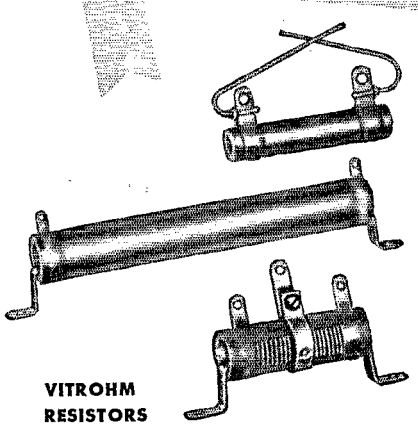
VANALTA DIVISION

ALBERTA — SCM, W. W. Butchard, VE6LQ — WG does FB job substituting for AO on Alberta Net. He will have VFO going soon. AO went to town in DX Contest. JF enjoys QRM on 3.8-Mc. 'phone. WZ, of Barons, is heard on 3.8-Mc. 'phone now. ZI, also of Barons, runs a pair of T55s on the same band. GK has a rig on 3.8 Mc. with QTH

(*Continued on page 128*)

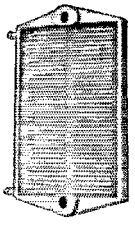
Get Greater Efficiency through CORRECT CURRENT CONTROL

with WARD LEONARD RESISTORS & RHEOSTATS



VITROHM RESISTORS

Exclusive features insure that extra performance needed in critical circuits. Fixed Resistors available in 8 stock sizes from 5 to 200 watts. Adjustable resistors in 7 stock sizes from 10 to 200 watts. Wide range of resistances.



VITROHM PLAQUE RESISTORS

Inductance at frequencies up to 1 MC and distributed capacitance up to 5 MC are negligible. Effective as terminating resistors for Rhombic antennas. In 20, 40, and 125 watt sizes, wide range of resistances.

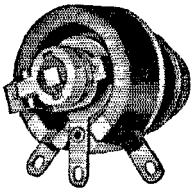
Current control is stable, efficient, trouble-free . . . when you use Vitrohm wire-wound resistors and rheostats. The special vitreous enamel coating developed in our own laboratories is tough, crazeless, acid and moisture resistant. Protects the wire . . . stands up under the most severe service.

Radio and Electronic Distributor Division

WARD LEONARD ELECTRIC COMPANY

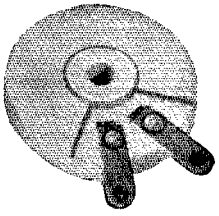
53-B West Jackson Blvd., Chicago 4, U. S. A.

Authorized Distributors Everywhere



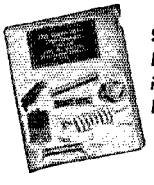
RHEOSTATS

For fixed or variable close control. Winding secured and protected by exclusive WL vitreous enamel. Stock sizes: 25, 50, 100, and 150 watts, in wide range of resistances.



DISCOHM RESISTORS

Compactly built . . . especially useful where space is limited. Low value of inductance and distributed capacitance. Easily mounted. Rated at 18 watts, in wide range of resistances.



SEND FOR CATALOG

For helpful data and information, write for Resistor-Rheostat Catalog No. D-2

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control devices since 1892

(Continued from page 120)

at Olds. AC is now manufacturer's agent for several well-known lines of radio equipment, among which is the famous Gon-Set converter. IR put a pair of 807s in final and had a tough time getting them tamed down. WS is Edmonton's standout DX station on 28 Mc. Seems like it's no effort for Art to hook the hard ones! EL, of Camrose, runs input of 650 watts to 813s on 3.8-Mc. 'phone. MJ is doing an FB job of his OBS duties. Listen for him at 1900 on 3.8-Mc. 'phone or 1915 on 3.7-Mc. c.w. LG, SZ, and MJ put code practice out on 3.5-Mc. c.w. and have goodly number of students making use of them. NARC held its annual dinner on February 28th with a very good attendance. AH received very favorable comment as CFRN's chief engineer in newspaper write-ups on occasion of that station's increase of power. How about some news from Southern Alberta for this column? Traffic: VE6WG 28, 6LQ 22, 6MJ 20, 6AO 7.

BRITISH COLUMBIA — SCM, W. W. Storey, VE7WS — YS is open for contacts on 28-Mc. c.w. AKK is operating on 3.5-Mc. c.w. MH is putting up 135-foot antenna wire. AK is heard testing on 28-Mc. 'phone. ADV is heard on 28-Mc. 'phone with 125 watts, an FB new rig, single 812 final, enclosed in metal cabinet. AJR is working all the DX on ADV's old rig on 28-Mc. 'phone. UU is heard on 14-Mc. c.w. with 150 watts. LF is open for contacts on 7- and 3.5-Mc. c.w. XT wants contacts on 7- and 14-Mc. c.w. AZ has discarded the PM speaker as a mike for an FB new one with a plastic case. UU is building a new cathode modulator for the HK54 final. A very attractive YL from South Africa, ZS6GH, turned up at the Vancouver Amateur Radio Club meeting on Jan. 17th. Tom Clark gave a demonstration with a Millen VFO exciter and a Gon-Set converter. A special meeting was held Jan. 24th to suggest proposals for the ham bands to be incorporated in the license for 1947–8. On Jan. 31st ID gave a talk on wide-band audio and vido amplifiers. KI has been doing wonders with a single 6L6 and has worked all W and VE districts. Art Spence is building a high-fidelity amplifier and modulator with a cathode follower output stage. MQ and BQ are very active on 28 Mc. EV is hunting bugs in an f.m./a.m. receiver. TQ's 60-foot tower came down during a local storm when the wind hit a velocity of 70 miles an hour. OT is putting up a new 28-Mc. rotary beam antenna.

PRAIRIE DIVISION

MANITOBA — SCM, A. W. Morley, VE4AM — The WARC now meets the 4th Friday of each month in the Free Press Bldg. Visitors are always welcome. The club has a technical committee which also is acting as a vigilante committee working in close liaison with the R.I. An improvement is noted in notes and over-modulation. It is up to every individual ham to keep his equipment working properly and avoid getting on the black list. Please coöperate. AE has gone back to his vertical and is working DX before his busy season starts. GW and WK are new on 3.5 Mc. DT, of Myrtle, is on 3.5 Mc. WF is QRL building rigs. AC worked VP6AB, W4GCB/KL7, and K6CGK on 3.85-Mc. 'phone and C1CH and XU6GRL on 14 Mc. and has nice p.p. 807s on 14-Mc. 'phone. AM/JM are heard on 'phone. AD lost his antenna but it was quickly replaced. BC schedules DQ nightly. BQ is having antenna trouble, only gets 88/9 reports from DX. XO moved into the city and set up temporarily to work in DX Contest. EA and QI are two 50-Mc. fellows now heard on 3.5 Mc. Let's hear from YOU. Traffic: VE4AC 8.

Strays

What chance has the kid got? W3TGP's newborn was delivered by W3KOX; its grandfather is W3MHE!

—•••—

Noble E. Brewer, WØDKK, ex-W9DKK, is very much alive and not a Silent Key as reported in January *QST*. We are happy to make this correction. Formerly of Boulder, Colorado, Mr. Brewer is now on the air from R.F.D. No. 4, Topeka, Kansas.

Where Do YOU Go From Here?

CREI Streamlined, spare time training is the DIRECT COURSE to that Secure, GOOD-PAYING JOB You Want

NEVER was there such widespread opportunity as exists today in every field of radio-electronics. Not only are there countless new jobs . . . but *more* jobs with good salaries. The demand, however, is far beyond the number of radiomen *qualified* to fill these positions.

You may have "gotten by" up to this point. But if you want to progress with the industry . . . if you want an important, good-paying position and the security that goes with it—you must acquire up-to-date technical training.

No matter if your interest lies in broadcasting, aviation, manufacturing, television or radio service, or in any of the many other radio-electronics applications that are open today . . . you can enroll with CREI confident that this high-calibre, professional, practical radio-electronics engineering training will give you proper and sound qualifications for the field of your choice.

Decide today "where YOU will go from here". You can assure your future security . . . end the threat of competition challenging you for your job. CREI is prepared to train you for a better place in this new world of electronics. Mail the coupon today for details of the CREI self-improvement program. Yes, a 3c stamp can result in more security . . . a better job . . . happiness. Write *now*.

If you have had professional or amateur radio experience and want to make more money, let us prove to you we have the training you need to qualify for a radio job. To help us intelligently answer your inquiry—PLEASE STATE BRIEFLY YOUR BACKGROUND OF EXPERIENCE, EDUCATION AND PRESENT POSITION.

VETERANS! CREI TRAINING AVAILABLE UNDER THE "G. I." BILL!

Capitol Radio Engineering Institute

An Accredited Technical Institute

DEPT Q-5, 16TH AND PARK ROAD, N. W., WASHINGTON 10, D. C.

Branch Offices: New York (7): 170 Broadway • San Francisco (2): 760 Market St.

Mail Coupon for FREE BOOKLET

CAPITOL RADIO ENGINEERING INSTITUTE
16th & Park Rd., N. W., Dept. Q-5, Washington 10, D.C.

Gentlemen: Please send me your free booklet, "CREI Training for Your Better Job in RADIO-ELECTRONICS", together with full details of your home study training. I am attaching a brief resume of my experience, education and present position.

CHECK COURSE ☐ PRACTICAL RADIO ENGINEERING ☐ PRACTICAL TELEVISION ENGINEERING

NAME.....

STREET.....

CITY.....ZONE.....STATE.....

☐ I am entitled to training under the G.I. Bill.

House Cleaning 'Phones

(*Continued from page 88*)

if it's a *sharp* filter. The tendency to make crystal filters broader and broader in recent years is a concession to those who want their selectivity in tepid doses; we're not talking about the kind of selectivity that cuts the desired sidebands along with everything else, nor about "medium" or "half-sharp" selectivity. The typical sharp-filter characteristic shown in Fig. 6 shows how the crystal meets the requirements already outlined. It has a highly-peaked resonance curve, and if the phasing condenser is set off neutralization there

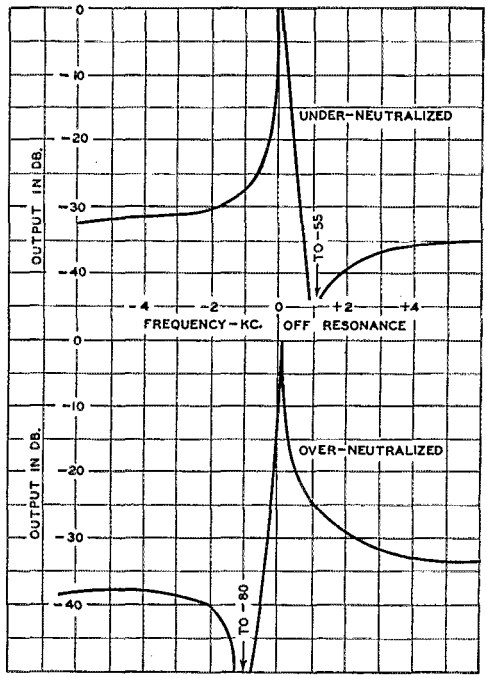


Fig. 6 — Crystal-filter selectivity curves (without other i.f. selectivity). This figure, reproduced from page 31, March, 1947, *QST*, shows how the single-sideband characteristics of the filter can be varied by shifting the phasing notch. The single-sideband effect can be enhanced by use of an i.f. amplifier having the proper shape of selectivity curve, and with its center frequency placed in the middle of the flat portion of the crystal curve, thus putting the crystal peak at one edge of the system as a whole.

will be a flat-response portion on one side (which is where the desired sidebands can be placed in single-sideband reception) and a deep notch on the other. The notch eliminates most of the other sideband and the normal selectivity curve of the receiver's i.f. section takes care of the remainder.

The notch can be shifted to the other side of the resonance peak, reversing the performance so that either sideband can be selected at will.

(*Continued on page 146*)

Atlantic City

(Continued from page 33)

files, translation, etc., all incident to its daily workings for a period of months. There will be a meeting room, possibly associated with the chairman's quarters, and in the normal course of events it is the practice of the American group to meet each day under the leadership of the chairman to hear reports of progress from the various "fronts," discuss developments affecting the U. S. position or requirements, map out tactics, etc. In most of these, the industry representatives are included, sitting with our people in intimate daily contact to plan the U. S. moves. We'll be there. Once the initial proposals have been formulated, this participation in our own delegation's daily planning represents our best line of defense, our most valuable opportunity to protect our interests. Incident to this will be our actual attendance at committees, subcommittees, subsubcommittees, etc., where we will be able to advise our Government spokesmen and may even be called on by them to express the U. S. point of view in matters affecting amateurs.

Then there is the "after-hours" mixing with our own people and the representatives of other governments, conversations and discussions with them at lunches and dinners, over coffee tables, and so on. It is all logical and familiar, and works out nicely.

Now as to voting, about which, you will recall, we promised we'd have something to say before we finished. It isn't possible to talk very concretely about the voting question because it is such a perpetual bone of contention that it really never has been settled in all its details. Of course, as we've said, governments are the only ones entitled to vote. But how many votes per country . . . and what is a country . . . and how about colonies? Ah! — now the fight is on! And a real squabble it usually is, too; voting questions sometimes cause wrangles lasting weeks: not voting on the conference items themselves, but arguments as to how it shall be done — purely academic stuff. Well, it's about time we put an end to all this by saying that as a matter of actual practice, hardly any question is ever submitted to vote. The way things work out, nobody would think of putting a matter to vote until the sentiment has been thoroughly determined and hashed out and everybody lined up — and when that has been done no voting is necessary. Consequently, it is rarely resorted to; decisions are usually made in terms of the obvious consensus and that ends the matter.

Prospects

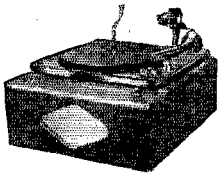
We've purposely avoided saying very much about our prospects at Atlantic City. We know what our own Government's position is; we know it is going to do its very utmost to put over its own allocation table and persuade other governments to adopt its point of view on that table, including its provisions for amateurs. We also know

(Continued on page 128)

SUN RADIO The Home Of Nationally Known Radio Parts

WAR SURPLUS EQUIPMENT

At A Fraction of Their Original Government Cost

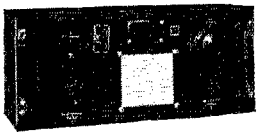


AUTOMATIC RECORD PLAYER

Including Webster No. 50 changer; three tube amplifier, 5" Alinco V speaker in a deluxe leatherette case. List.....$57.50

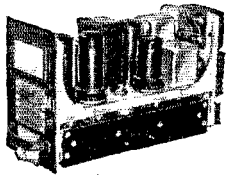
YOUR COST..... **$36.75**

Lots of six, each $34.50



R. F. TUNING UNITS

Beautiful black crackled aluminum cabinet with two variable transmitting condensers and two vernier dials, one heavy duty ceramic four position wafer switch, mica condensers, 2,500 working volts and coils wound on porcelain ribbed forms. Available TU5B (1500-3000 kc) TU7S (4500-6200), TU8B (6200-7700 kc), TU9B (7700-10,000 kc) and TU10B (10,000-12,500 kc.) Please specify model... **$3.89**



SPERRY AMPLIFIER

Brand new servo amplifier containing two beam power output tubes (1632) similar to 25L6, two twin triodes (1633 and 1634) similar to 6SC7, two mica condensers, dozens of color coded half watt resistors, two dual and four section bathtub condensers, three transformers, two wafer switches, one volume control, four octal sockets. Easily convertible **$3.95**

SUN'S GREATEST OFFER!

While They Last

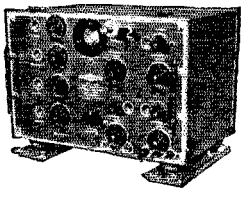
CHECK THESE VALUES!

SUPERHETERODYNE RECEIVER

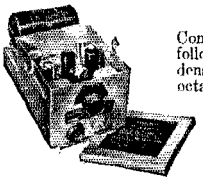
This crystal fixed frequency receiver comes with full conversion instructions for variable tuning of all ham bands and broadcast. A highly selective superheterodyne receiver, 110 V. A.C. power supply built in. Using the following tubes: 6K7-RF Amplifier; 6K8-Mixer and Oscillator 6K7-I.F. Amplifier; 6F7-Detector and A.V.C. 6C8-Output and Noise Suppressor; 80-Rectifier. Dimensions 3½ x 19 x 11½ inches. Comes complete, Brand New, with one set of coils and two sets of tubes..... **$16.95**

Extra set of coils.....$2.95

BENDIX TRANSMITTER 100-WATTS



Three 807 tubes: Four 12SK7: One 2-inch 5 amp. RF meter: Four Separate Master Oscillators. (These can be easily changed to cover 20-40-80 meters and by using crystal for the 10 meter band you will have a complete coverage transmitter.) Four Separate output tanks. One 4 Position selector channel switch having seven sections which changes the ECO, IPA and output tanks simultaneously. All the controls are mounted on the front panel. The housing is cast aluminum; shields and case are sheet aluminum. Dimensions 11 x 12 x 15 inches, weighing 35¼ lbs. Complete, simple instructions for conversion furnished. Brand-new, complete with tubes..... **$49.95**

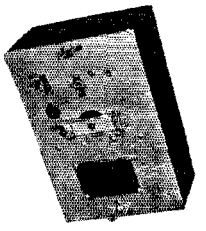


INTER-COM AMPLIFIER

Comes completely wired in aluminum cabinet with following: 2-12A6, 2-12J5 tubes, 1 bathtub condenser, 3 can filters, 12 precision resistors, 4 low loss octal sockets, shielded input and output transformers, 2 shielded R.F. chokes, 1 S.P.S.T. toggle, 28v D.C. dynamotor. Sun Radio furnishes the instructions for easy conversion to Hi-Fidelity phono or speech amplifier..... **$8.95**

NAVY SPEAKER

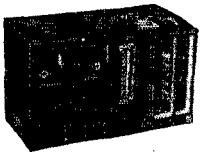
Stromberg Carlson and RCA waterproof speakers. Brand New in original cartons. 25 Watt PM driver unit with line matching transformer and projector mounted in heavy duty round metal baffle. Ideal for communication receivers and sound systems at lowest price ever offered..... **$14.95**



NAVY V.H.F. RADIO TRANSMITTER

Brand New!

Battery operated (67½ V. "B." and 1½ V. "A.") Frequency 80 to 105 M.C. Complete with 2-1G4 tubes and full instruction manual..... **$6.95**



BC-684 F.M. 35 WATT TRANSMITTER

Brand new, complete with eight tubes, crystal control, 10 channel pushbutton, non-lenier modulation coil... less coverplate, crystal and power supply..... **$17.95**

SUN RADIO

OF WASHINGTON, D. C.

938 F STREET, N. W. WASH. 4, D. C.

● *All items F.O.B. Washington, D.C. Orders $30.00 or less cash with order. Above $30.00, 25 percent with order, balance C.O.D.*

(Continued from page 186)

that with the exception of Canada no other country in the world believes as strongly in amateur radio as does the United States, and that the record of the past makes it almost certain most of them will be coming to the conference proposing cuts in this band or that which, in the aggregate, will make our future look pretty grim. The question of our future, then, boils down to how successful our Government's efforts will be. This is not a matter where senators and congressmen or the public at large can have any effect, pro or con. The negotiation of the treaty and regulations is exclusively a responsibility of the Department of State, a responsibility it entrusts to the U. S. delegation during the conference itself. Our future, then, depends upon the work of the U. S. delegation at the conference, with the best advice and backing we can give them.

As to where we expect pressure, and of what nature, we frankly are going to duck the question, at this time. The author, with Secretary Warner and other officers of the League, attended the special meeting of the League's board of directors on March 14th, and reported in detail on this point, but intentionally "off the record." It is difficult to see where our best interests would be served by spreading our thoughts on this subject in detail on these pages, as of this time just prior to the conference, when about the only effect might be to give the wrong people ideas that wouldn't otherwise occur to them. There is no gainsaying that the situation created by another of the periodic reopenings of the allocations table, combined with the known traditional views of most other nations with respect to amateurs and the generally increasing pressure on the spectrum, is a cause for concern — but to every other established service as well as amateurs. Such a situation is not new, however, and we've made out pretty well in the past, as indicated in the first half of this article in the previous issue. We can only say that the pattern is a familiar one, the rules of the game well known, and the important preliminaries already taken care of. With our favorable U. S. proposals, an aggressive and expert U. S. delegation, and the best efforts of our own representatives, we're in the best position possible for the scrap.

That, we think, just about winds up the story. It has been impossible, obviously, to touch on the hundreds of details and "angles" with respect to legislative history and interpretation, conferences, principles involved in putting together allocation tables, etc. However, we hope that the average amateur has a more complete picture of the situation and an improved understanding of what is behind our existing frequencies, our U. S. proposals, and the workings of a conference.

Now we move to Atlantic City where, you can be assured, we'll do our very best. Wish us luck!

Transmitter Monitoring

(Continued from page 56)

be flimsy, the chassis is so small that it is adequately supported, and the side walls of the cabinet bearing on the chassis also contribute to the rigidity.

The shield can for the antenna post is one of the small aluminum cans 35-mm. film is packed in, and it was "chiseled" from an amateur friend who is also a photographer. The cover of the can is fastened to the panel with two screws, and a National XS-7 steatite bushing serves as a feed-through and antenna terminal.

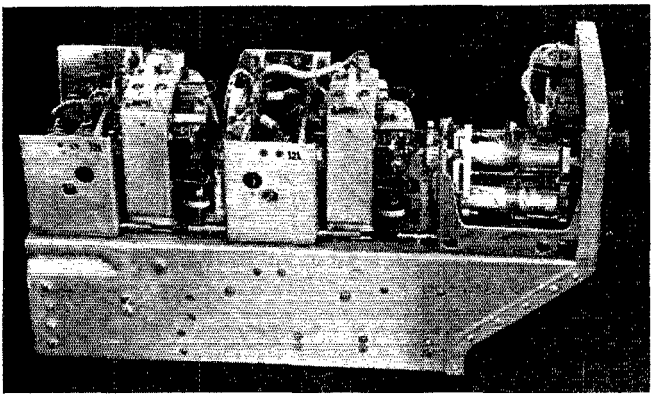
The coils are wound on Silver Type 125 coil forms, which are low-loss tube bases, and the winding data will be found in Fig. 1. For any one range, both coils are wound in the same direction, and the grid and plate leads are taken off at the outside ends of the coils. It isn't necessary to build coils for each amateur band, since it is recommended that one's listening be done on the band in use or on a higher-frequency one. If one's transmitter has no harmonics, it will of course be necessary to listen on the band being used, but transmitters with no harmonics at all are rather rare.

The monitor can be put into use as a portable receiver by changing the value of the grid leak, R_1, to 1.0 or 2.0 megohms, since the lower value shown does not make for maximum sensitivity.

General

Some may be disappointed to learn that a monitor wasn't described that could be used alongside a 1-kw. transmitter. While it is doubtless possible to build such a device, it would require signal-generator shielding technique, which requires double shielding and elaborate r.f. filtering of the headphone leads. Since it isn't likely that amateurs will go to such elaboration, it is felt that a clear picture of the limitations of simple equipment is more useful than a description of an elaborate unit that wouldn't be duplicated. The leakage — reverse of pick-up and a good indication of the effectiveness of shielding — from the monitor shown was checked by touching the monitor at various points with the antenna lead of a communications receiver. A strong signal — about S9 on the meter of an NC-200 — was obtained at any point on the monitor cabinet and on the headphone leads, so the shielding is far from complete. It might be possible to improve the shielding by better bonding of all joints between covers and case and by better filtering of the headphone leads, but probably the only real answer is double-shielding. However, running one's hands over the 'phone cords or touching the cabinet at any point results in no shift in detector frequency, so the shielding and filtering are reasonably effective. Using the monitor at a distance from the transmitter where the field strength is reasonable *will* result in excellent monitoring of one's signal, and that is the purpose of the gadget.

Look to H & R for Outstanding Values!



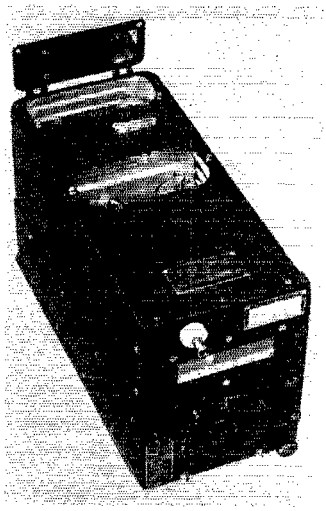
AVAILABLE FOR THE FIRST TIME!

THE

V.H.F. ARC-5

★ Covers the 100 to 156 MC band
★ Four frequencies available
★ Crystal controlled
★ Power Requirements—500 V.D.C.—150 to 200 Ma. and 28 V.D.C.
★ Tube Complement—2-Type 1625 Multipliers (12V.—807's), 2-Type 832A's
★ Can be frequency or amplitude modulated
★ Crystals in the 8.0 to 8.2 MC. range can be used with this unit to cover the 2-meter band or can be driven with a Sonar Exciter
★ Overall Size—15½" L. x 5" W. x 8¼" H. Weight 11 lbs.
★ Furnished with an Aluminum cover
★ Brand new—Original Factory packing
★ Supplied with tubes, but less X'tals, power supply and modulator. No. T-23 Range 100–156 M.C. No. T-126 Range 100–146 M.C.

Your cost each, either type..... **$12.95**



LOW FREQUENCY ARC-5 AIRCRAFT RADIO

Top Flight Equipment • • • Ground Level Price

★ An extremely stable low powered V.F.O. at a price below the cost of the tubes alone
★ Light weight (10 lbs.) requires little modification to use on 40 or 80 meters as an X'mitter or exciter for up to ½ K.W. final amplifier
★ Power requirements—12 VAC., and 500 V.D.C.
★ Built-in antenna network
★ Oscillator and amplifier are gang tuned and signal is extremely stable
★ Oscillator is temperature compensated
★ Includes a resonance indicator and a calibrating crystal
★ Tube complement—1—1626; 2—1625; 1—1629
★ Brand new—Limited quantities

No. T-18 Range 2.1 MC to 3.0 MC
No. T-20 Range 4.0 MC to 5.3 MC
No. T-21 Range 5.3 MC to 7.0 MC
} Your Cost Each..... **$6.95**

No. T-22 Range 7.0 MC to 9.1 MC } Each..... **$9.45**

"THE HAM CENTER"

HERBACH & RADEMAN, INC.

522 MARKET ST. • PHILA. 6, PA.

FREE MONTHLY BULLETIN

A free bulletin published every month, crammed full of select government surplus items and the latest and newest devices of the outstanding radio manufacturers. A postcard with your name and address sent to Dept. Q6 will place your name on our mailing list. Write today.

Eliminating Car Noise

(Continued from page 40)

position when the receiver is not being used.

There may be other sources of interference in cars which are in poor mechanical condition. Such things as slipping clutches and dragging or worn-out brake linings have been known to cause noise. All of the remedies described above resulted in interference in the author's car being reduced on the 10-meter band to a point where it is almost impossible to detect with no signal being received and is completely overridden by even a very weak signal. Operation while in motion is now possible at all times, and the signal-to-noise ratio is such that another car can be heard approaching at a distance of a quarter of a mile. The best limiter for ignition noise from other cars has been found to be a small neon bulb, without resistor, connected across the primary of the receiver output transformer. A switch may be installed to take it out of the circuit when it isn't needed. It doesn't remove ignition noise and leave only the signal. Nothing will do that when the noise recurs rapidly as in a car operating at normal speed. It does take some of the rough quality away from interference-ridden reception, however, and makes it much less objectionable to listen to.

If such successful results can be obtained with a car which is almost nine years old, it is safe to assume that near-perfect results can be obtained with a new car. The author hopes to be able to find out soon.

How's DX?

(Continued from page 55)

ZM6AA, Frank Perkins, C/o Treasury, Apia, Western Samoa; and ZM6AB, Des Fahey, Superintendent, Apia Radio, Apia, Western Samoa . _ . _ . _ W6BVM contributes: VR51P, Mr. Monahan, Civil Airways, Fua Amotu Airport, Tonga Island . _ . _ . _ W7RT gives us: KL7AA, Anchorage, Alaska; KL7AG, ACS, Box 79, Fairbanks, Alaska; KL7DM, Brigadier General Edmund Lynch, USA, Hq. Aleutian Sector; KL7DU, C/o CAA, Cape Yakataga, Alaska; KL7CP, Clark Morse, P.O. Box 1487, Anchorage, Alaska . _ . _ . _ Does anyone know the QTH of W6TMY/Saipan? W4BRB reports that cards sent to the address he gave are being returned, stamped "unknown" . _ . _ .

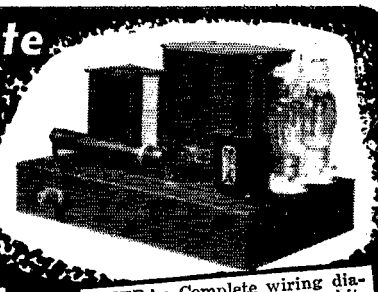
Tidbits:

The "Foreign Notes" section of this issue carries the revised list of QSL Bureaus of the world . _ . _ . _ A big stack of cards from VP2AT has just passed through the QSL Managers. Lots of fellows are going to be mighty disappointed when they submit these cards for DXCC and get them rejected. They carry only the call of the station worked and nothing else. A card for any award must show all the dope. Apparently there were so

(Continued on page 154)

Buck's Complete POWER SUPPLY KITS

Contain Everything



EXTRA: Complete wiring diagram supplied with every kit.

ORDER NOW AT THESE SPECIAL PRICES!

From transformers down to chassis, each kit contains everything you need to build your own power supply. Kenyon transformers, Cornell-Dubilier condensers, RCA tubes, Ohmite bleeders, Johnson and Millen sockets, Millen plate caps and high voltage connectors, and special heavy-duty chassis with bottom plates.

Famous parts. Dependable parts. Guaranteed brand new, and in manufacturers' original cartons. If bought separately, these parts would cost you more money. And think of the convenience of getting all necessary parts in one package!

Order your kit now and start buildin'.

POWER SUPPLY FILTER SYSTEMS CONSIST OF 4 MFD. FILTERED CHOKE INPUT

Kit No. 1
Delivers 500 or 750 Volts DC @ 300 ma.
Your cost **$29.50***

Kit No. 2
Delivers 1000 or 1250 Volts DC @ 300 ma.
Your cost **$39.50***

Kit No. 3
Delivers 1500, 1750, or 2000 Volts DC @ 300 ma.
Your cost **$49.50***

* Including unpunched, heavy-duty chassis and bottom plate

SIMPSON MODEL 260 MULTITESTER

RANGES

Volts D.C. (At 20,000 ohms per volt)	Volts A.C. (At 1,000 ohms per volt)	Milli-amperes D.C.	Ohms
2.5	2.5	10	0-2000
10	10	100	0-200,000
50	50	500	0-20 meg.
250	250	—	—
1000	1000	—	—
5000	5000	—	—

Your cost, with test leads **$38.95**

ONLY SUN RADIO HAS THE "MULTI-PLUG" OUTLET BOX

One wall outlet becomes EIGHT with Allied Labs' "Multi-Plug". Eliminates makeshift, dangerous extensions. Two fuses protect your main line against shorts and overloads. All metal-enclosed. Has eight standard receptacles. Complete with 12 ft. of heavy duty cable and two 15 Amp fuses for 110-125 Volts AC or DC.

A safe shack for only..... **$9.17**

BUCK'S LINE OF THE MONTH
(E. F. Johnson Co.)

DUAL CONDENSERS
(4500 V)

Type	Max. Cap.	Min. Cap.	Length	Cost
50ED45	51	9	6 5/32"	4.77
70ED45	73	11	7 7/16"	5.37
100ED45	100	15	9 9/32"	6.18
	(7000 V)			
50DD70	50	13	5 13/16"	6.60
70DD70	72	16	7 22/32"	7.50
100DD70	99	21	9 15/32"	8.70

ANTENNAS

10QS	5.85
20QS	9.90
40QS	16.80

SOCKETS

#210 — Bayonet aluminum shell, porcelain base, for 866's, 811's, etc.	66¢ Each
#267—7 pin miniature, all ceramic	30¢ "
#277B—7 pin miniature, ceramic with shield base	45¢ "
#278A—1 3/8" shield for 277B	12¢ "
#278B—1 3/4" shield for 277B	12¢ "

HERE ARE SOME MORE BUCK STRETCHIN' VALUES IN KENYON TRANSFORMERS!

DRIVER TRANSFORMERS

Type No.	Primary to match	Class AB or Class B Tubes	Ratio (pri. to ½ Sec.)	Cost
T-251	Single 53, 6A6, 6N7, 56, 6C5	53, 6A6, 6N7	2.3:1	$3.39
T-252	Single 30, 49, 89	19, 30's, 49's	1.7:1	2.97
T-253	Single 46, 59	46's, 59's, 6F6's	2.3:1	3.57
T-255	P.P. 56, 6C5, 53, 6N7	6L6's	3.2:1	3.39
T-267	4-2A3's	354E's, 354F's	2.1:1	6.96
T-271	P.P. 45's, 2A3's, 6F6's	6L6's, 809's, T4Z0's	3.7:1	4.77

KEN-O-TAP MODULATION TRANSFORMERS
Will match any Class B tube or tubes to any Class C load

Type No.	Audio Output Primary	Class "C" Secondary	Primary Range	Secondary Range	Cost
T-489	15 watts	30 watts	2000-20000	200-20000	$4.38
T-493	40 watts	80 watts	2000-20000	200-20000	6.36
T-494	75 watts	150 watts	2000-20000	200-20000	9.57
T-495	125 watts	250 watts	500-18000	200-19000	21.15
T-496	300 watts	600 watts	500-18000	200-19000	32.10

SUN RADIO
& ELECTRONICS CO., Inc.

ESTABLISHED 1922

122-124 DUANE ST. · NEW YORK 7, N. Y. · BArclay 7-1840

(*Continued from page 133*)

many cards that the necessary lines weren't filled in. Sorry, fellows . . . . . Word received from VP2MY states that the letter following the prefix VP2 indicates the island, viz., VP2A, for Antigua, VP2K for St. Kitts, and VP2M for Montserrat, in the Leeward Island group. For the Windward Islands, it's VP2D for Dominica, VP2G for Grenada, and VP2L for St. Lucia . . . . . W2UCW wants the gang to know that if they worked D4ADT after September, 1946, they will not receive a card, as the call is being used without authority. However, any contacts prior to September will be QSLed by Jim . . . . . A few hours after the 11-meter band was authorized in Australia, on Feb. 27th, W6WXW and VK2EO had a 28-minute QSO, for what seems to be the first VK-W 11-meter contact . . . . . Here is another suspected bootlegger turning up, happily, as legit. If any of you contacted VS1ON, VS2QEU, W6QEU/VS1 or HS1SS during January, February and March of 1946, drop a card to Peter K. Onnigian, Rt. 4, Box 451, Fresno, California, for full confirmation . . . . . D3CSC, an old DXCC member, who gave many of us some pleasant prewar contacts, is working for Mackay Radio, Berlin, and hopes to be on the bands again soon when permission is granted by OMGUS. Thanks to W2STX for the above information . . . . . W8PCS saved a long time and finally had enough money put away for a beam for 20, but, we sadly recount, the XYL found it and now she has a new fur coat! . . . . . Vy 73 till next month . . . . . .

25 Years Ago

(*Continued from page 60*)

work is one using a 60-cycle sync and a transformer with a 23,800-volt secondary. The receiver field is covered by articles on "An Efficient Tuner for Short Waves," an inexpensive tickler-type single-layer coil circuit, described by H. J. Goddard, 9ZX, 9EE, and by the details of a "Two-Control Tuner." March *QST*, which featured the improved Reinartz tuner, is completely sold out!

"Who's Who" portrays and introduces two of our ARRL division managers, East Gulf's genial B. W. Benning, 4BZ, and Quebec's hard-working Albert J. Lorimer, Canadian 2BF. Station decriptions show us the shacks of 5HK, the spark at Oklahoma City, and 9AAS, prominent c.w. installation at Owensboro, Ky.

The Old Man returns, this time venting his wrath on "Rotten Broadcasts," a tirade bemoaning the degradation of our 360 meters to the "yowling" programs of the new radiophones. The commercial voice stations are growing in number, as witness their full-page listing and the photograph of the swamped desk of amateur radio's friend, Chief Radio Inspector Terrell, which are published in this issue's radiophone section. And *QST* is growing too — over 50,000 copies a month are now being sold!

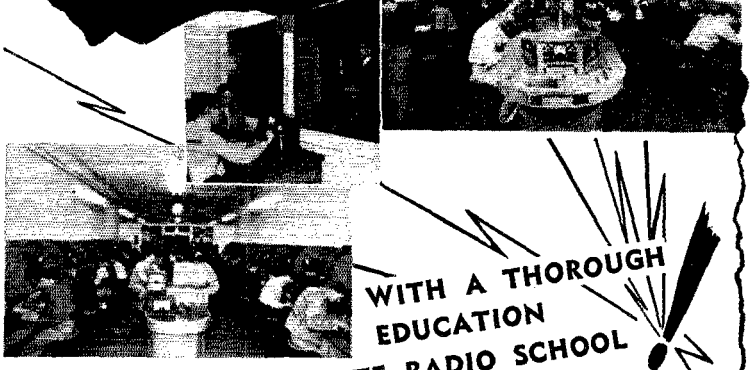
Announcing

THE NEW ADDITION TO OUR

RADIO **SCHOOL**

BE A RADIO TECHNICIAN

A PROFESSION WITH A FUTURE



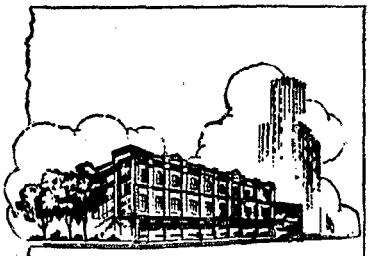
WITH A THOROUGH EDUCATION FROM OUR COMPLETE RADIO SCHOOL

Here's an opportunity to break into Radio.

Here's a chance for you to be your own boss, to own your own Radio Shop, to be a Radio Engineer, to enter this constant and ever expanding field of Radio (and its allied branches, electronics, television, radar).

Here's the Tyler Commercial College partial list of their highly specialized radio program. A program that represents the most extensive and complete training they have been able to devise in more than 30 years of experience in the radio-broadcasting field.

Here's an opportunity to examine the contents of the Tyler Commercial College Catalogue and to determine for yourself how radio training at Tyler Commercial College will enable you to find your own place in one of the many interesting and profitable jobs in the vast radio industry.



GENERAL RADIO COURSE

The course in General Radio is designed to provide a broad foundation for careers in the technical radio field. Among the various job objectives are Radiotelephone Operator (broadcast, police, or airline), Radiotelegraph Operator (marine, zone police, or airline), and Radio-Electronics Technician (industry). Success in qualifying for F.C.C. Radiotelephone or Radiotelegraph License is a requirement for graduation; therefore, an extensive study of radio theory, essential radio mathematics, and laws and regulations governing radio communications is included in preparation for operator license examinations.

Average Time to Complete Course . . . 12 Months

RADIO MAINTENANCE AND REPAIR COURSE

The Radio Maintenance and Repair Course offers preparation for a career as radio receiver repairman, sound-system technician, and radio service shop operator. Accurate, up-to-the-minute knowledge of radio principles and practice is essential for future success in this important field of radio. After a thorough introduction to radio and electrical principles, emphasis is directed to modern trouble-shooting methods, notable "signal-tracing." A section on facsimile receivers, frequency-modulation (FM) receivers and television sets is provided to bring the repairman up-to-date on recent developments. A wide range of topics is covered in this course, all of which are important to the modern repairman.

Average Time to Complete Course . . 10 Months

Send for Free Catalogue

For full details and catalogue regarding this unique school, write to The Tyler Commercial College, Radio Department, Q, 115 South College, Tyler, Texas.

Attach this to your letter head or card.

MAIL TODAY

TYLER COMMERCIAL COLLEGE

115 South College Tyler, Texas

APPROVED BY VETERANS ADMINISTRATION

A STATE APPROVED INSTITUTION

World Above 50 Mc.

(Continued from page 65)

and drove to Mt. Tamalpias, a distance of 220 miles from W9OAW/6, but, though W6OVK remained on to act as relay station, the signals could not be heard at this distance. The strength of signals between W9OAW/6 and W6OVK improved during the afternoon, reaching a peak of about S8 by 5:30, despite the fact that Mt. Hamilton, 4209-foot elevation, lies directly in line between the sea-level location of W6OVK and Grant Grove. Mt. Tamalpais is a relatively clear shot by comparison, though both locations are beyond line of sight.

The equipment used by the two mobile stations was identical, the transmitters each running about 15 watts to an 832 in the final, feeding 6-element arrays. The rig at W6OVK runs 40 watts to an 829, tripling in the final, with an output of about 10 watts. The antenna is an "H" array with reflectors spaced 0.15 wavelength in back of the driven elements.

W6WVY, San Luis Obispo, is experimenting with 235 Mc., and is interested to know whether any others are active in that area.

Last Microwave Band Occupied

Within a short time after the various amateur allocations in the microwave range were announced, most of them had been put to actual use for amateur communication. The one remaining unused was, paradoxically, the lowest of all in frequency; but that one, the 1215-Mc. band, is now receiving some attention in several quarters. At North Harwich, on Cape Cod, W1BBM has done two-way work with W1ARC at a distance of four-tenths of a mile. Using two 2C40 transceivers and parabolic reflectors, the signals at this distance are extremely strong, so the boys are confident that they can extend their coverage to substantial distances.

Another amateur interested in microwave development is W2RAB, who is moving to Montgomery, Ala. He would like to hear from amateurs in that area who might like to work with him. His address: James E. MacDowell, 1206 South Perry St., Montgomery, Ala.

Spurious Radiations

(Continued from page 67)

"Push-push" amplifiers are frequently used for doubling and quadrupling. They give the tuned circuit an impulse twice in the same direction for each input cycle; therefore, they tend to suppress the odd-harmonic output. Similarly, push-pull multipliers may be used as triplers, in which case, if the output from each tube is carefully balanced, the impulse from the second tube tends to cancel power from the first tube on the even harmonics, such as the second and fourth.

Crystal-controlled and a few other types of

(Continued on page 138)

(*Continued from page 136*)

receivers use multiplication from a low-frequency oscillator in order to obtain mixer injection voltage. Because of the presence of undesired harmonics of the original oscillator frequency, aggravated by a tendency to overdrive the mixer, such receivers are likely to respond effectively to frequencies other than the one to which the receiver is tuned, unless the r.f. stages and shielding are very effective in preventing such frequencies from reaching the mixer stage. This condition is in addition to the better-known difficulties with images and r.f. drive-through.

Conclusions

In order to reduce the probability of operation on undesired frequencies, several features should be brought into consideration by the designers of transmitters and receivers, such as:

a) Minimum multiplication, using a high-frequency oscillator. Especially interesting in this respect are the new Western Electric CR-9 harmonic crystals in which the first tuned circuit operates up to 50 Mc. The circuit might be described as a "neutralized Tri-tet with a crystal gate."

b) The selection of an oscillator frequency which permits multiplication of not more than 2 or 3 in a single stage.

c) The use of many tuned circuits, each lightly loaded, so as to retain a high degree of selectivity. Broad-band and bandpass circuits are less desirable in this respect.

d) Reduction of leakage output from multiplier stages, not only into power lines and other radiating media, but also into the output amplifier itself. The use of interstage shielding to reduce stray coupling is indicated.

e) Use of push-push or push-pull multiplier stages where applicable in an attempt to reduce the output on the even or odd harmonics adjacent to the desired multiplication by careful balance.

Most of the features listed above are strictly a matter of design. However, the amateur can aid materially in suppressing spurious radiation by careful alignment and balance where they apply, provided that these factors are made variable.

About the Author

• Commander Elmer H. "Bill" Conklin, USN, follows such an ambitious schedule that we can't figure out how he finds time to turn out such fine efforts for *QST*. When serving Uncle Sam, Bill is in the Fleet Technical Section, Office of Chief of Naval Operations, Washington. His work relates largely to gear operating above 30 Mc. and to shipboard radiotele-type. As ex-W3JUX, our author is holder of WAC and RCC certificates, with DX-ing, v.h.f. and experimenting taking up his allotment of hobby time. Commander Conklin was formerly associate editor of *Radio* and *Radio Handbook*.

The Radio Amateur's LIBRARY

These are the publications which every amateur needs. They form a complete reference library for the amateur radio field; are authoritative, accurate and up to date

Title	*Price*
QST	$2.50 per year*
Operating an Amateur Radio Station — Free to members; to others	10c
The Radio Amateur's Handbook	$1.25**
The Log	35c each; 3 for $1.00
How to Become a Radio Amateur	25c
The Radio Amateur's License Manual	25c
Hints & Kinks for the Radio Amateur	50c
Lightning Calculators:	
a. Radio (Type A)	$1.00
b. Ohm's Law (Type B)	$1.00
A.R.R.L. Antenna Book	50c
The Minilog	25c
Learning the Radiotelegraph Code	25c
A Course in Radio Fundamentals	50c

*Subscription rate in United States and Possessions, $2.50 per year, postpaid; $3.00 in the Dominion of Canada, $4.00 in all other countries. Single copies, 35 cents.

**Postpaid in U.S.A. proper—$2.00 postpaid, elsewhere. (*No stamps, please.*)

THE AMERICAN RADIO RELAY LEAGUE

Incorporated

WEST HARTFORD 7, CONNECTICUT

Relax, Men!

(*Continued from page 68*)

into a frenzy and the transmitter will turn out as it should, looking as if it were built in a foxhole during a bombing raid. We have found, after twenty years experience, that the floor or drainboard in the kitchen makes the best workbench. If the drainboard is used it may be necessary to scrape the dirty dishes off into the sink.

Now for a few remarks on transmitter construction that may make your work easier and the finished product more pleasing to the eye. First, put all the wiring on top of the breadboard. If it is placed underneath you won't be able to see it without turning the transmitter over, and who wants to turn a transmitter over? Then there is the matter of the proper wire to use. Very simple; use any wire. Wire is wire, isn't it? Handbooks are in the habit of specifying wire size and type of insulation but we all know that the handbook writers are in league with the wire manufacturers somehow or other. Best practice in haywire construction dictates the use of any available wire that happens to be long enough to reach between the two dingbats you wish to connect. Some of the best examples we have seen have as many as thirteen different types of wire in a single unit, all the way from lamp cord to piano wire. The quickest way to connect two points is to grab up the handiest piece of scrap wire and solder it in place, shoving any excess (if the wire is too long) down against the baseboard or cramming it under a tuning condenser or tube socket.

We are appalled at the increasing tendency to mount meters on meter panels. For one thing, this entails gouging out holes to fit the meters. A little thought will show you that the simplest and best way to mount a meter is to hang it at a convenient point by the use of strings or to lay it down on the breadboard without any support at all. After all, the meter won't get up and walk away!

What about following parts specifications in construction of your equipment? Well, some haywiremen automatically class as sissies all those who religiously follow the parts list accompanying the diagram of the gadget they are building. We don't go so far ourselves, but merely consider such people Milquetoasts who are afraid to express their individualism. After all, if the list calls for a 50,000-ohm grid leak and you haven't got one, you just haven't got one, have you? Of course not. But maybe you do have a 25,000-ohm resistor (any wattage will do; don't let them fool you). All right, put it in then and forget it. The guys who make up that stuff you are blindly following don't know everything.

Power supplies are a cinch because the parts don't even have to be nailed down; they are usually heavy enough to stay put by their own weight. The handbooks are full of nonsense about ripple percentage and voltage regulation but don't let it worry you. Remember that those

(*Continued on page 148*)

KAAR FIRST with INSTANT HEATING FM

in ALL THREE Mobile Bands!

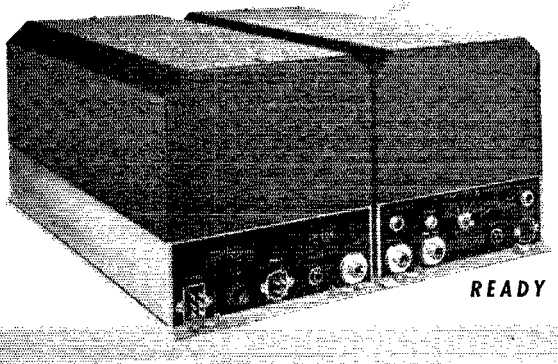
- **30-44 MC BAND**
- **72-76 MC BAND**
- **152-162 MC BAND**

Kaar instant-heating mobile FM radiotelephones are now available in ALL THREE mobile bands! With Kaar instant-heating, the average power taken from the battery is cut approximately 90%, eliminating the need for special batteries or generators. Kaar 20, 50, and 100 Watt mobile radiotelephones powered by standard 6 volt vehicle batteries give you superior performance and more dependable service, at less cost.

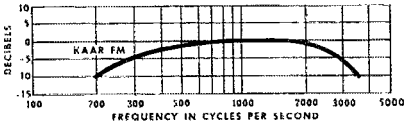
Kaar precision engineering and expert craftsmanship have made possible amazing improvements in tone performance. All Kaar radiotelephones give you voice quality that actually permits recognition of a speaker's voice!

The rugged, compact Kaar radiotelephones are easily serviced or checked. A quarter turn of two airlock fasteners allows dust cover to be lifted off; the entire chassis may be removed by releasing two slide catches.

Write to Kaar Engineering Co., 605 Emerson Street, Palo Alto, California, for catalog describing the Kaar instant-hegting radiotelephones and specify the equipment in which you are most interested. Write us today!



IMPROVED OVER-ALL FREQUENCY RESPONSE THROUGH KAAR FM TRANSMITTER AND RECEIVER



READY TO GO . . . INSTANTLY! KAAR

(*Continued from page 140*)

people have to make a living writing that stuff. A filter consists of a choke and condenser, right? Then just put in a choke and a condenser and you've got it whipped; it's that simple.

Someone has asked us about antennas so we will pass on a few items on the subject that we've learned. We learned this in 1929 and it has stuck with us ever since. First a simple rule: An antenna is a piece of wire which is put up in the air and connected somehow to the transmitter. Note how this rule instantly simplifies the whole matter, banishing confusion and doubt. To be on the safe side, always make your antenna sixty-six feet long. You know what sixty-six feet looks like, don't you? Just stretch out some wire until it looks like you have sixty-six feet and put it up in the air. One important point that we should mention concerning antennas is the problem of making up joints. We have found that soldered joints are no good besides taking a lot of time and being a general nuisance. The rosin doesn't hold very well. We just twist the joints together and let it go at that and find it much the best method.

Now, how about results? Following our system, as outlined above, we put a transmitter on ten meters a week ago. We have worked one station, which proves something. It proves that *conditions are terrible* on ten meters.

About the Author

• It's a pleasure to present this return engagement by Keith S. Williams, W6DTY, author of "It's Fascinating Work," that sparkling bit of humor enjoyed by so many of our August '46 readers. Enlisting in the Navy as an RM2c, W6DTY served two years with the Pacific Fleet Air Force, being stationed at Roi Island in the Marshalls. He was honorably discharged as an ACRT in 1945. Williams was associated with the Southern California Edison Co. as a substation operator for a number of years. At present he is a civilian radio technician at the U. S. Naval Base, Port Hueneme, Calif. His ham radio interests have included 80-meter traffic handling, rag-chewing, chasing DX, the acquirement of an ARRL Code Proficiency Certificate at 35 w.p.m., and receipt of a Navy Day letter. He is one of those poor frustrated souls with 47 states in the bag, and one to go, for WAS! Will some generous South Carolinian please take pity on our author?

CQ means Commercial Quality in the Supreme Model AF-100 Transmitter

Compare these features...

Simplest "rig" to install and operate. Efficient with either balanced or unbalanced transmission line at 50 to 600 ohm characteristic surge impedance.

Highly stable Variable Frequency Oscillator followed by slug-tuned buffer and doubler stages ganged to oscillator dial. Simplifies working through severe QRM. Readily establishes and holds QSOs.

A six-band job—10, 11, 15, 20, 40 and 80 meters, for CW, ICW, AM and FM Phone.

Narrow, medium or wide-band FM transmission obtained by adjusting same volume control that controls level for amplitude modulation!

Because of ICW feature, it maintains QSOs under severest conditions of QRM and QRN! Peak power for ICW approximately four times average carrier level. ICW output fully 200 watts!

Each AF-100 subjected to four-hour locked key square-wave 100% modulated heat run, before leaving plant. Same life test as for U. S. Signal Corps equipment!

And ALL for only $450.00 complete with tubes and coils!

Yes, despite the within-reach cost, the Supreme AF-100 is designed and built in accordance with the best commercial practice. And that means for continuous operation when desired—hour after hour, day-in-and-day-out—today, tomorrow, and for years to come.

This six-band 100-watt desk-type transmitter is one of the most versatile "ham rigs" yet offered. It embodies those features most desired by the majority of amateurs. Above all, it's the first transmitter offered to "hams" which has the very latest feature of Frequency Modulation in the band of frequencies now assigned for this purpose—27.185 to 27.455, and 29 to 29.7 megacycles. And it is continuously tunable throughout the range of each amateur band!

Come what may by way of frequency changes, (F.C.C. allocations) and whether AM or FM, the Supreme AF-100 will always be ready to function at a mere twist of the knob. It's built for the present and the future!

ASK TO SEE IT! All leading distributors handling "ham" equipment are now stocking the Supreme Transmitter line. Ask your favorite distributor to show you the AF-100. Ask for latest literature—or write us.

Supreme TRANSMITTER CORPORATION

Manufacturers of Communications Equipment

280 Ninth Avenue • New York City 1, N. Y. • Wisconsin 7-5413

Export Division: The Radelma Company, 53 Park Place, N.Y.C.

Foreign Notes

(Continued from page 69)

AUSTRIA

After eight years the *Osterreichischer Versuchssenderverband* resumed activity with offices at Kierlingerstrasse 10, Klosterneuburg. Application was made for reinstatement of affiliation with I.A.R.U., which was granted conditionally.

There is no immediate hope that transmitting licenses will be issued, but local amateurs are busying themselves with a study of developments in radio technique during the war years, to which they previously had no access. There are 280 members, and news is spread through the wireless magazine, *Radio-technik*.

MAY HAMFEST CALENDAR

ALABAMA — The Ben Lane Amateur Radio Club, Dothan, is holding a Hamfest on Sunday, May 25th, at the Wagonwheel in that city. OMs, XYLs and YLs are invited to the affair, which starts at 10 A.M. and features a steak dinner, prizes and an all-around good time. Registration is $2.00, closing May 11th, and should be made through T. D Wilson, W4KTP, P.O. Box 135, Dothan, Alabama.

MICHIGAN — The annual Hamfest of the Detroit Amateur Radio Assn. is scheduled for Sunday, May 18th, at the National Guard Armory, Ypsilanti, 30 miles west of Detroit on the route to Chicago. Prizes, short talks, traffic meetings and YF and YL doings are billed. Registration: $1.00 for hams, 35 cents for womenfolk. Further information may be obtained from G. H. Goldstone, W8MGQ, 1745 W. Boston Blvd., Detroit 6, Mich.

WASHINGTON — The Cascade Radio Club of Snohomish County is staging its Northwest Hamfest on Sunday, May 25th, in the new Sons of Norway Lodge Bldg., Everett. Contests, demonstrations, speakers, motion pictures — in fact all the makings of a bang-up good time — are promised. Registrations can be made by writing Leo Loken, Secy., Cascade Radio Club, 2806 Rockefeller Ave., Everett, Washington.

—•••—

NEW ENGLAND radio amateurs are invited to attend an all-day engineering meeting on Saturday, May 17th, sponsored by the newly-created North Atlantic Region of IRE. Papers on communications, microwaves, f.m., and measurements will be presented at the session, which is to be held at the Hotel Continental, Cambridge, Mass. Registration in advance is requested, and may be made through H. H. Dawes, 275 Massachusetts Ave., Cambridge 39, Mass. Registration fee for the meeting only is $2.00 for nonmembers of IRE. Students may attend free by applying through the IRE representative at their school.

Strays

Franklin D. Green of Champaign, Ill., sightless since birth, amazed FCC examiners in the Chicago office by making a grade of 100% on his Class B examination. Franklin is now signing W9LIR.

—•••—

"New Electronic Terms" Department:

Journal of Commerce: "A new booklet on insulating varnishes . . . has been published by the General Electric Co. resin and *insulting* materials division." — *A. J. Stobbart*

Baltimore *Sun:* ". . . Jackson tube *duster*, table model, good condition. . . ." — *W3KRE*

(Italics ours.)

A Tonic for Tired Purses!

Before . . . . After

a Walter Ashe Trade-In-Deal!

It's the smart way to deal! Trade in the old now with Walter Ashe, and get top allowance! Tell us what you have to trade . . . we'll make you a real offer!

NEWEST RECEIVERS!

National HRO	$274.35
National NC-240D	225.00
National NC-46	97.50
RME-45	198.70
RME-84	98.70
Hammarlund HQ-129X	173.25
Hammarlund SPC-400X	342.00
Hallicrafters SX-42	275.00
Hallicrafters S-40	89.50
Hallicrafters S-38	47.50

Prices Subject to Possible Change

SONAR EXCITER VFX-680

A complete all-band, narrow band, frequency modulated phone or CW exciter, incorporating the Sonar NBFM modulator and VFX oscillator. Either VFO or VFX operation with any type cut crystal, resulting in a rubber crystal. It's new! It's here! It's a real sensation! Complete with tubes and power supply, less crystal **$87.45**

D&L NARROW BAND F.M. ADAPTER

$15.45

Eliminate QRM! Minimize man-made noise! Reject A.M. signals in F.M. switch position! Especially designed and engineered for the reception of narrow band F.M. signals. Easily attached to your present receiver, giving you A.M. or narrow band F.M. reception by position of SPDT switch. Unit tunes to any I.F. frequency between 425 and 475 KC. Not a discriminator or ratio detector. Uses a 6AG5 limiter and a 6H6 in special phase shifting circuit.

THROAT MIKES, 200 ohm carbon, a real sensation at... **35¢**

SHURE HAND MIKES, brand new surplus type T-17B, 300 Ohm, push to talk carbon mikes with cord and plug..... **$1.49**

ASTATIC R-3 MICROPHONES economy type for PA and home recording. Our special bargain price..... **$4.95**

JUST ARRIVED! MEISSNER 90800 SIGNAL SHIFTER

Complete—coils included for 10, 11, 15, 20, 40, and 80 Meter operation... **$120**

TRANSMITTING CONDENSERS

Brand new 2 mfd. x 5000 V. Dykanol. Regular $29.63. Special..... **$7.51**

Brand new 2 mfd. x 4000 V. Dykanol. Regular, $25.44. Special..... **$6.36**

THE ASTOUNDING "MICROMATCH"

NOW AVAILABLE FROM STOCK

$29.50

AS PER APRIL QST

DYNAMOTOR POWER SUPPLY, brand new, U. S. Army PE-103 operates from 6- or 12-volt battery. Delivers 500 volts DC at 160 Ma.... **$9.95**

REVERSIBLE MOTOR, ½ to 2 r.p.m. with conversion instructions for rotary beam drive, has 50 inch-pounds torque **$4.95**

TYPE HS16A HEAD PHONES, Army surplus 2000 ohm with 6 ft. cord.... **$2.05**

Transformers & Chokes

These Items F.O.B. St. Louis

RCA 1 KW. MODULATION TRANSFORMER, pri. will match class B tubes up to 10,000 ohms plate to plate. Sec. No. 1 450 Ma. for beam tube plate. Sec. No. 2 80 Ma. for screen grids..... **$14.95**

THORDARSON SMOOTHING CHOKE, 200 mills, 12 Hy..... **$3.50**

SURPLUS FILAMENT TRANSFORMER, 5.25 V. @ 25A..... **$6.15**

SURPLUS FILAMENT TRANSFORMER, 110 VAC pri. sec. 6.3 V. @ 3A..... **$1.08**

SURPLUS FILAMENT TRANSFORMER, 110 VAC pri. sec. 6.3 V. @ 3.6A, 6.3 V. @ 6A..... **$1.18**

THORDARSON HEAVY DUTY BROADCAST TYPE PLATE TRANSFORMER. 115 or 230 V. pri., 1510–0–1510 V. @ .5A sec. tapped at 1330 and 1230 V., easily worth 3 times our low price of... **$39.50**

Limited Quantity

WØGTF WØPGI WØQDF WØJWD WØULH WØIYD

Get Your Name On Our Mailing Lists

Walter Ashe RADIO CO.

1125 PINE ST. ST. LOUIS, MO.

(Continued from page 144)

Furthermore, the notch is movable so that a particular undesired carrier on the rejected-sideband side can be eliminated with practical completeness.

Tuning with a sharp crystal filter puts a heavy premium on frequency stability. We have yet to see a receiver (although admitting that we haven't had a chance to play with a few of the latest models) that will not "chirp" or "flutter" when the tuning is done with a really sharp crystal and the a.v.c. is on. The higher the signal frequency the more the instability shows up. Without a.v.c. things are considerably better, because there is no continually-varying gain to react on the frequency of the receiver's h.f. oscillator. Another disadvantage of a.v.c. is that between-signal noise is terrific, inasmuch as the audio level, when set for the modulation on a carrier, is much too high when there is no carrier present because then the receiver returns to something approximating normal operation.

Even though the elements of high-selectivity reception are available in the better present-day receivers, there is still ample room for improvement. The one most needed is a really high order of frequency stability. There is also need for steeper-sided i.f. selectivity curves and narrower i.f. bandwidths independent of the crystal filter, further to cut down adjacent-channel interference. Effective use of the filter demands plenty of audio gain. And an operating convenience, if not a real essential, would be a means for holding the audio output at a more or less constant level — a volume compressor, in other words. Oddly enough, there appears to be no need — if it's communication we have in mind — for bigger and better r.f. gain, bigger and better audio quality, bigger and better S-meters. Yet those seem to be the features on which most of us judge receivers.

As we said at the start, it's time we took a realistic viewpoint on amateur 'phone — if we want better communication.

Strays

One of the most annoying temper-raising finger-burning operations in rig building is the holding of small parts in cramped places while soldering. These headaches can be completely done away with by the use of a surgeon's Hemostat, which can be purchased for about a dollar at any second-hand medical supply store. This handy gadget looks like a pair of scissors but actually has jaws similar to long-nosed pliers. The big feature of the tool is a ratchet-like catch incorporated between the handles, so that once that elusive 100-$\mu\mu$fd. mica has been caught in the jaws, the handles may be snapped together to hold the condenser fast. When so held, it can be maneuvered into soldering position with the Hemostat and kept rigid during the process. The fingers also are at a safe distance and a better connection results in every way. — *W6QJW, ex-/KL7*

SPRAGUE TRADING POST

FOR SALE — T-20, brand new; latest edition Ghirardi's Radio Troubleshooter's Handbook; 22½ V. large filament transformer. Bill Gordon, Oxbow, Sask., Canada.

WANTED — For cash: Used correspondence courses, Rider's manuals; radio, television, electronics, radar, electricity. State title, author, age, condition, school or publisher, lowest price. J. Conino, 2733 Onzage, New Orleans, La.

SWAP — Remington portable, like new. Need small ham receiver like NC-44. NC-45, FB7A, FBXA, Howard, Hallicrafters. Bud Woida, W9KQB, 2315 Monroe St., Two Rivers, Wisc.

WANTED — R.M.E. DB20 preselector. Will buy same or swap loctal tubes, hi-fi phono pickup, etc. S. Weisz, 3417 E. 147th St., Cleveland, Ohio.

WANTED — Power Pack for RCA Radiola 17, new or used in good condition. Will buy table model radios, any condition, for cash. Describe fully. Edward C. Punt, 397 Melrose St., Brooklyn 6, N. Y.

SELL OR SWAP — Triumph 351 Multimeters; 12 V. and 110 V. 100-watt American Beauty soldering irons; 100–455 KC i.f. transformers. Most all types tubes, parts and tools. G. F. Roby, 1119 Milwaukee Ave., Chicago 22, Ill.

FOR SALE — Meissner signal spotter, late '41 with two sets of coils for 80-40 meters. Absolute match for deluxe signal shifter. R. B. Parker, Box 395, Harwichport, Mass.

FOR SALE — National N.C. 2-40 10-band receiver with N.C. 10" speaker to match. Have ATR 120 mil inverter, for D-C, if desired. Only a few weeks old. Martin Electronics, 142 Ralph Ave., Brooklyn 33, N. Y.

WILL SWAP — Six 807 tubes, new; two 6L6GA tubes, new; 1350 V. c.t. 320 ma plate transformer. Need 0-250 d-c milliammeter; input choke, 500 ma, 1700 V. insulation. Harry W. Lawson, W2TTZ, 307 College Ave., Ithica, N. Y.

FOR SALE — Hallicrafters S-19 Sky Buddy, excellent, $37.50; Meissner 3-tube regenerative receiver, $10. Will trade both for S-38 receiver. Marvin J. Hayostek, Lakefield, Minn.

FOR SALE — Howard 437-A with 5-meter and crystal phase, and noise limiter, less crystal. George N. Baltaeff, 48 N. Millick St., Philadelphia 39, Pa.

FOR SALE — Meissner 14-tube traffic master, partially wired, less cabinet, $65; Webster deluxe record changer and recorder, play 17, 10 and 12" records, mixed, 1¼ oz. pick-up, perm. needle, new, $75. J. W. Bourke, Box 35, East Rockaway, N. Y.

WANTED — Kenyon plate transformer T-656; Kenyon input choke T-510 or equal. State price. Walter V. Tyminski, Jersey City 6, N. J.

WANTED — Automatic keyer with paper blanks and punch. Eric Palmer Jr., 815 Quincy St., Brooklyn, N. Y.

FOR SALE — 30 Misc. *QST*'s, Sept. 1922 to Dec. 1931, $3. Wm. C. Lafferty, Fix Road, Grand Island, N. Y.

SELL OR SWAP — 6L6-807 40-watt transmitter complete less meter, crystal. Swap for HQ 120 or similar. Sell for $110. Phone or c.w., 80-20 meters. Black metal cabinet and panel. W4ILP, 417 S. Fairview, Spartanburg, S. C.

FOR SALE — Partly finished, 30 watt, phone-c.w., transmitter kit with tubes, coils and power supply for 80 meters. $30. J. D. Rector, 3555 W. 109th St., Inglewood, Calif.

WANTED — Communications receiver. Howard Keck, Summerfield, Kan.

FOR SALE — Complete station. All band, 1 KW transmitter, HQ-129-X receiver. Spare gear, meters, etc. Value far in excess of price asked. Ray Tomlinson, 623 E. Brown St., Trenton 10, N. J.

SELL OR SWAP — Model B Cine, 16mm 50' or 100' 3.5 lens: Phone rig, 807, pair 809 or 812's 801 class AB mod, power supply 350 V., 750 V. at 200 ma. VFO with separate power. All or part. Need LM, Meissner Deluxe. T. F. Pollock, 8 Whitwell Place, Newport, R. I.

SELL OR SWAP — Sonar narrow band FM exciter, brand new, factory guarantee still good; Hallicrafters S-38, A-1 condition. Ray Gendron, 32 Bradford St., Pittsfield, Mass.

FOR SALE — Meissner 3-tube battery regenerative receiver, 17 to 545 meters. Complete with tubes, excellent condition, $15 f.o.b. Otto Pollei Jr., 2122 Edgeland Ave., Louisville, Ky.

FOR SALE — Mobile 40-80 meter transmitter-receiver set, famous Mark II. Two sets in one including 235 mc transceiver. Only $30.25. J. Janis, 162 W. Follett, Fond du Lac, Wisc.

FOR SALE — National NC-100-ASD 10-tube receiver, 1300 KC–30 MC, 200–400 KC, "S" meter, noise limiter. Matching speaker case with Jensen 8" P.M. 20 spare tubes. Hardly used, $80. R. C. Hansen, 316 E. 12th St., Rolla, Mo.

FOR SALE — Meck transmitter T-60, $140, includes Turner mike 33-D. F.O.B. C. Metroplis, W7JLK, 1329 E. Stewart, Las Vegas, Nev.

FOR SALE — New 250-watt UTC S-22 modulation transformer, $20; radio-phono combination, value $71.95, for $50; emission type tube checker, used, $20. Chas. Albright Jr., Box 494, McCamey, Texas.

WANTED — Any information on wire recorder magazine MX-303A/ANQ-1 S1072–DAY–DE, especially the motor attachment and bearing, amplifier connections. H. Sherman, 2099 Cornell Rd., Cleveland 6, Ohio.

YOUR OWN AD RUN FREE

The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less. Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these columns.

***Dept. Q–57,* SPRAGUE PRODUCTS COMPANY**

North Adams, Mass.

(Jobbing distributing organization for products of the Sprague Electric Company)

Hints and Kinks

(*Continued from page 78*)

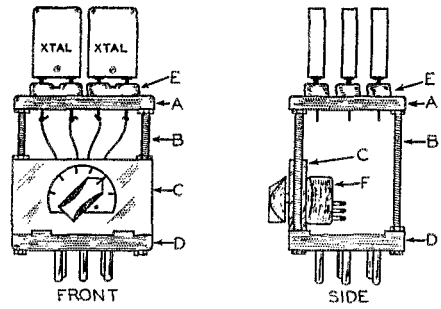


Fig. 2 — Constructional details of a simple multiple crystal holder. The unit makes use of a 5-prong plug-in-coil base, and will hold up to six of the small-size crystal holders. *A*, *C* — sheet of ¼-inch transparent insulating material; *B* — 9/32 threaded brass welding rod; *D* — 5-prong coil base (National PB-10); *E* — ceramic crystal socket; *F* — six-position selector switch.

Advantages? Well, the unit has several of them. In some multiple crystal holders that are on the market, all of the crystals have to be mounted in the holder, and require special crystals. In this unit, the entire batch of crystals can be changed with ease, and the less expensive types can be used. The unit doesn't occupy much space, and is neat and clean looking. Front-panel control of the switch is made possible by the use of a flexible shaft and coupling. Most hams have the necessary material in the junk box, and even if all parts have to be purchased, the cost is slight.

— *Bill Roper, W7DPK, ex-W9YOJ*

Correspondence

(*Continued from page 73*)

time they come back. What's this? A construction permit?

"Mr. Jimmy Blank: You are hereby authorized to construct and operate an amateur radio transmitting and receiving station on State St. on the following terms:

"1. You will construct a radio receiver, either a regenerative or superhet of not less than three tubes, capable of operating on Construction Permit Band X.

"2. You will construct a radio transmitter capable of being operated on 'phone or c.w. with a power output of not more than 100 watts, and capable of being operated on CP Band X.

"3. You will operate on CP Band X for a period of from 2 to 6 months, during which time you will apply for a regular license furnishing this Commission with schematic diagrams of the receiver and transmitter with a general description of each, and a list of certified radio contacts made on CP Band X. You will sign an affidavit that your equipment was homemade and not purchased as an operating unit."

Well, it's a new one on me, but I get busy and build a receiver like the one on page 242 of the 1947 *Radio Amateur's Handbook*, and a transmitter like the one on page 256. I crank up and meet a lot of other guys like myself, all trying to get a start. We get along fine. There aren't too many bugs in the rig, so I soon fill out the papers for a regular license, send them in and, first thing you know, I can operate anything but Class A bands. The little rig works pretty well, too. I go down and maybe buy a half kilowatt, but somehow it never seems to work quite as well as the little rig. . . .

Perhaps these remarks won't suit anybody, but I'll bet if the guys learn amateur radio by hand and heart they won't gripe so much, and our bands will be a better place to live in.

— *Edwin Nuttall, W5KU*

Table-Top Transmitter

(*Continued from page 19*)

the tank circuit is tuned to the crystal frequency (3.5 Mc. with a 3.5-Mc. crystal or 7 Mc. with a 7-Mc. crystal) the crystal will usually stop oscillating entirely, as indicated by a sudden increase in plate current to a high value when the tank circuit is tuned to the high-capacitance side of the dip in plate current. The best tuning adjustment under these circumstances is a bit to the low-capacitance side of the dip. When the oscillator tank circuit is tuned to a harmonic of the crystal frequency, the circuit normally will continue to oscillate regardless of the setting of the tank condenser. Tuning is then merely a matter of adjusting the tank circuit to resonance as indicated by the plate-current dip or by maximum final-amplifier grid current. Tuning the tank circuit to resonance should result in a reading of grid current to the final amplifier. The oscillator tank circuit can then be adjusted to a point which will give maximum amplifier grid current consistent with reliable keying. During the adjustment the key should not be held closed longer than is absolutely necessary, since the amplifier screen current will run to a considerably higher-than-normal value without plate voltage and load.

Neutralizing

The amplifier should be neutralized at this point. At the start the aluminum strips (shown in the photograph) should be exactly alike — about ½ inch by 3 inches, with the centers of the feed-through insulators on which they are mounted 1⅛ inches from the tube bases. The adjustment consists of clipping off the ends of the strips about 1/16 inch at a time until the amplifier is neutralized. Any of the usual indicators of neutralization may be employed, the most convenient method being to alter the neutralizing capacitance as described until the grid current remains steady as the plate tank condenser is swung through resonance.

After neutralizing, reduced high voltage may be applied to the amplifier and its plate tank circuit tuned to resonance as indicated by a dip in plate current. The antenna should not be coupled to the output stage until it has been tuned as described, the link being swung as far out as possible during preliminary adjustment. When the point of resonance has been found, full voltage may be applied and the antenna circuit coupled and tuned in the manner proper for the type of antenna system and antenna tuning arrangement used. Regardless of the system employed, it should be remembered that the last adjustment in coupling and adjusting the antenna to the transmitter is that of tuning the amplifier tank circuit for minimum plate current. This should always be done after every adjustment of antenna coupling or tuning. Otherwise, the amplifier may be operating very inefficiently off resonance and exceeding the dissipation rating of

(*Continued on page 154*)

(Continued from page 150)

the tubes. The minimum plate current at the dip when the amplifier is fully loaded will, of course, be the maximum rated plate current — 440 ma. for the two tubes in this case.

Tuning the first 807 as an oscillator is similar to the method outlined above for the second tube, except, of course, that the oscillator will operate regardless of whether or not the key is closed. It should be tuned with the key closed.

The adjustment of the second tube as a frequency multiplier is simply the selection of the proper coil and tuning to resonance as indicated by the plate-current dip, making certain that it is not tuned to an undesired harmonic. The desired harmonic can usually be identified with little difficulty, since the multiplier is always used as a doubler and the output, as indicated by amplifier grid current, is much less at the harmonics of higher order, especially since these responses are at multiples of the crystal frequency and not always multiples of the frequency to which the oscillator output is tuned.

TABLE III

Combination	1st 807 at Resonance — Key Open	1st 807 at Resonance — Key Closed	2nd 807 at Resonance	Final Grid — No Plate Voltage	* Final Grid — Full Load
A	—	—	40–60	40–50	40–50
B	—	—	75	40	42
C	—	—	65–70	43	46
D	46	48	80	38	39
E	15	20	64	30	30
F	16	100	78	30	32
G	40	50	86	18	25
H	73	55	81	18	28

* WITH excitation control at maximum.

Table III shows a typical set of current values in milliamperes which may be expected in the various stages. They are readings taken at 400 volts and may vary somewhat because of differences in crystal response and to a certain degree with the length of certain leads in the oscillator circuits which may affect the amount of feed-back.

It might be mentioned in closing that the Tri-tet oscillator may be expected to self-oscillate with the crystal removed, or in case the crystal refuses to oscillate. With the crystal operating normally, however, no trouble of this sort should be experienced so long as the cathode-coil dimensions are followed closely.

At the maximum rated input of just under 1 kw., the rig should deliver 600 watts or better on all bands.

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 30¢ 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 30¢ rate. Provisions of paragraphs (1), (2), (4) and (5), apply to all advertising in this column regardless of which rate may apply.
(7) Because error is more easily avoided, it is requested signature and address be printed plainly.
(8) No advertiser may use more than 75 words in any one issue.

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 or services advertised.

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

CRYSTALS: Precision low drift units. Type 100A in 80, 40, and 20 meter bands. Two units plug in one octal socket. One dollar each. Rex Bassett, Inc., Ft. Lauderdale, Fla.

QSLs in colors. Stamp for samples. Glenn Griffeth, W3FSW, 1042 Pine Heights Ave., Baltimore 29, Md.

DEKA-XTAL. New compact 10-crystal unit for standard 5-prong socket. Looks and operates like a dial-knob. Just plug it in and turn to any of 10 frequencies, your selection. Ask your dealer or write us. Also other low TC ham crystals in FT cases to fit octal sockets. 80 and 40 ± 1 kc. $2.65; 20 ± 4 Kc., $3.50. Scientific Radio Products Co., 738½ W. Broadway, Council Bluffs, Iowa.

IN Stock: new and used Hallicrafters, Hammarlund, National, Pierson, RME, Collins, Temco, other rcvrs and xmtrs. All other amateur parts. Trade-in accepted. Terms financed by me. Write: Henry Radio, Butler, Mo. and Los Angeles 25, Calif.

WANTED: "Wireless" apparatus prior 1925; early books, catalogs magazines, etc., Franklin Wingard, Rock Island, Ill.

AMATEURS, experimenters, industrials and export accounts Write for catalog and monthly bulletins. Buy the "TB" guaranteed way and save. TAB. Dept. Z, 6 Church St., New York 6, N. Y.

AMATEUR radio licenses. Complete code or theory preparations for passing amateur radio examinations. Home study and resident courses. American Radio Institute, 101 West 63rd Street, New York City.

FOR Sale: One 16B Western Electric A.M. radio transmitter used, in good condition complete with tubes. 50-watts output 30 to 60 megacycles. Sale price, $500. F.o.b. Cleveland, Ohio. Inq: Graybar Electric, Inc. 1010 Rockwell Ave., Cleveland 14, Ohio.

SURPLUS bargain catalog. Send for the bargain ham catalog everyone is talking about. Surplus Radio, Inc., 30 Munson St., Port Washington, N. Y.

RME-45 for sale. Model just prior to calomatic tuning. In perfect condition. Hardly used. A good buy at $148. W1KC; 240 Moreland St., Worcester, Mass.

FOR Sale: New Aercraft batteries, 11-67 A. H. $5 — $10 ea. 2000-volt Westinghouse generator, 250 mills, $15. 32-volt, 750-watt engine driven generator, $35. Walter Naef, 2937 Hermina St., Madison 4, Wis.

SCR-211-A and BC-342-N, sell or swap. H. Hoechstetter, 4921 White Settlement Rd., Ft. Worth, Texas.

W3MCB wants: Meissner signal shifter. Urgently needs Cooke radio slide rule. Jack Kear, 6711 Kelly St., Pittsburgh 8, Pa.

DON'S QSLS. "Leaders in the field." Samples. 2138 So. 16th Ave., Maywood, Ill.

SELL RME LF90 converter; navy CN240 long-wave tuner; QSTs 1922 to 1940 inclusive. Make offer. R. S. Munsell, W8HS, 797 Center St., Astabula, Ohio.

WANTED: January and February 1940 issues of "Radio." Will buy or trade for back issues of QST. A. B. Tyle, 1834 N. E. 52nd Ave., Portland 13, Oregon.

CARTOONED QSLs from your photograph. Write for details. Harney, W2EDD, 914 N. Broad St., Elizabeth 3, N. J.

WANTED: Stancor P-10 complete in good operating condition. Also used SX-28. KPHCH, San Patricio, Puerto Rico.

SELLING Collins 30-J-18. Photos and details on request. WØQFZ, 2705 South 7th St., Council Bluffs, Iowa.

WANTED: HT-9, HT-4-E or any xmtr with over 100 W. output, fone & cw in A-1 condition. W6VRO, 250 No. Orange Grove, Pasadena 3, Calif.

SELL: BC-224E rcvr, converted to 110 V AC. $85. W9NCC, 1937 So. Courtland,

FOR Sale: SX-28A, 1 yr. old, with spkr. Best offer gets it. Cash only. Write Joseph Janovsky, W2OVF, 362 Powers Ave., New York 54, N. Y.

SELL: six 808s, $2.40 ea; four 803s, $8.75 ea. All new but unboxed W3KUP, 208 Federal St., Butler, Pa.

XTALS, mounted BT, fit 5 pin socket, 40-meters, 8 Mc for 2 meters. 9 Mc for 11 or 10 meters, your appro. frequency 75¢. McCarty, 7301 Ibsen, Chicago, Ill.

300 Watt modulation transformer from BC-610 for sale, new, $15. James Buck, WØZDS, 1224 Orchard Drive, Ames, Iowa.

W6VJT is former W7AEM.

BARGAIN Bulletins: xmtrs-rcvrs-xfrmrs, photoflash technical experimental surplus. Our prices are making history! Lectronic Research, 5832 Hegerman St., Phila., Pa.

PATTERSON PR16 receiver, 16 tubes, 5.5 to 37 Mc, crystal filter, separate speaker, good condition $40. or will trade for Kw. plate transformer. WØQXT, Pleasant Hill, Mo.

WANTED: University RCP-12 chandelier type speaker baffle. Will buy or trade. Ralph Senechal, 586 Hampton Rd., Hayward, Calif.

QSLS, SWLs, fast service. New amateur gear. Terms on the big items. Write Dossett, W9BHV, Frankfort, Ind.

QSLS, samples, Albertson, W4HUD, 705 So. Hamilton, High Point, N. C.

SELL BC-221, $35; LM frequency meter with blank calib. book, $30; Weston 687 output meter, $10; Simpson 240 Hammeter, $15; Jones-Motorola tachometer, $40; G-E DP9 50 millivolt ammeter with shunts for 15, 50, 150, 500 amps, $50; Weston 564 voltohmeter, $20; Shure 55A microphone with 40-ft. line and xfrmr, $30; Astatic DN-HZ, $20; BC-659 mobile 10-meter FM xmtr-rcvr, $35; Send for list of two and three inch meters; Cross, W2OXR, 71 Crosshill, Staten Island, N. Y.

COAX 34U heavy-duty, 15¢ ft. Sample, 10¢. Willard Wilson, W3DQ, Wilmington, Del.

SELL BC-312-N rcvr rewired for use with external a.c. power supply. Original motor-generator included. First reasonable offer over $40 takes it. Make sep. offer for oversize power supply, 150 Ma. Wanted: technical manual TM 11-866 for Hammarlund Super-Pro, BC-779-B. State price. J. Weber, 514 Ludlow Ave., Cincinnati 20, O.

SELL BC-406A, $25; BC-611A, handy-talky chassis, with coils, $7; BC-645, $18, and AN/ARR5 (S36A) without power supply, $125. V. Beckman, 4437 Lee Heights, Cleveland 20, O.

SURPLUS tubes: 6L6s, 75¢; 6SJ7s, 50¢; 6SK7s, 40¢, etc. 600 v. condnsrs, 5¢ to 20¢ and other ham gear. G. Ruzicka, W2NUZ, 759 Highland Ave., Newark 4, N. J.

BEAUTIFUL inexpensive QSLs, samples, stamp. Robert Timmers, 6 Meiner Rd., Appleton, Wis.

TRANSFORMER: Raytheon, 509, 360, 0, 360, 509V, 290MA (both simultaneously 140/150 MA), 375-0-375, 60 Ma, 5V, 3A, 5V, 3A, 5V, 3A, 6.3V, 3A. $2.75, Choke. Raytheon 5HV, 150 Ma, $1. Ham Rad, Bedford, Mass.

COMPLETE station, sell for $150: 70-watts, 80 M. thru 6 M. with modulator, xtal mike, NC-44 rcvr. Also antenna wire, insulators, xtals, etc. Am leaving country soon. W1NSS, 126 High, Bristol, Conn.

FOR Sale: Thordarson plate xfrmr T-6412 980-0-980, 300 mils, $10. B&W turret (new) BTCL, $7, Johnson variable condnsr, 100DD90, $7.50, Collins, Class B xfrmr input-output, 150-watts Class C, $10, National TML-100D variable, $7.50. Forester, 461 Motheral. Monessen, Pa.

QSLS. Quality prints on Kromekote cards. W1KMP, P.O. Box 219, Cambridge, Mass.

2C44 lighthouse tubes. Guaranteed. $2.40 postpaid. Knights. P. O. Box 583, Trenton 4, N. J.

QSLS? SWLS? No cheap trash! Modernistic? Cartoon? Deluxe? Photographic? Samples 20¢. Bliley Crystals? "Printer" Sakkers, W8DED, Holland, Mich. (Veteran)

INSTRUCTOGRAPH and oscillator with ten tapes. Brand new. $30. Antonio Romano, 162 Highland Ave., Fitchburg, Mass.

TRADE: most anything in commercial refrigeration line for xmtr or gear. What have you and what do you need? W. A. Boon, P. O. Box 339, Biloxi, Miss.

THROAT mikes, $1.00. Headphones, $2.50. Hand-mikes, T-17, $3.50. Airforce types. All prepaid. Aero Parts Supply, Municipal Airport, Houston, Texas.

SELL or trade 132 miscellaneous copies Radio News, 1922-38 volumes 11, 12, 14, 15 complete. Also Volume 1, No. 1 Radio Mechanics, Oct. '26. All excellent condition. Make offer. W5LRJ, 721 SW 3rd St., Perryton, Texas.

SELL new Meissner signal calibrator, $60; new Meissner signal spotter, $20. WØICR, 140 So. Canosa Ct., Denver, Colo.

WANTED: HRO Super-Pro or Collins 75A rcvr. Also want kilowatt xmtr, consider home-built but prefer factory. Must be bargain but will pay up to $1000 for something really good. Craig, 180 No. Commercial, Salem, Ore.

NEW surplus xmtg tubes. Bargain prices. Write Trans Sales, 17530 Daleview, Lakewood, O.

SYLVANIA IN21 crystal, hi frequ. plug-in type, 2 for 98¢. Sprague 1600 VDC, metal encased, oil impregnated condnsr, 25 for $2.49. Write for circular. Erie Supply Co., 88 Exchange, Rochester, N. Y.

SALE: SX28 used. Reasonably good condition, $125. W2SHA, 158 No. Walnut, E. Orange, N. J.

WANTED: In perfect condition, various months of QST 1925 to 1943, Radio News, 1923-43; Radio Craft 1929-44; complete QST prior 1925; Radio News prior 1923. Have few extra QSTs. What have you? Russell Worthy, 18 Spring, Williamstown, Mass.

SELL complete laboratory improved BC 342 Signal Corps rcvr. W4HQM, Humboldt, Tenn.

WANTED: Receiver such as S-39 or SX-25 preferably or S-20R or S-19R. Describe fully, price and condition. David Gifford, Laurel Heights, Shelton, Conn,

POWER Supplies, field strength meters, parallel lines, complete units or kits. Send for bulletins. Spectra Products, 17 E. 42nd St., N. Y. 17, N. Y.

FOR Sale: 25-watt battery-operated Cw rig with VP-557 Mallory Vibrapack. Top quality thruout. Almost new. WØMEK, Pisek, North Dakota.

SELL Millen VFO, $37; 2000 V. Ct. 250 Ma. G-E xfrmr, $5. W2-HFM, Merrick, N. Y.

PANADAPTOR. 6 mos. old, like new. What am I offered cash or trade in xmtg gear or National 110. Chapman, 6 Gile Hall, Dartmouth College, Hanover, N. H.

HALLICRAFTERS S-36A rcvr, brand new, A-1 condition, price $230. 250-watt CW rig, complete, PP-1812s, 807, 616; power supply inc. on 2 chassis. Only $50. George Hadorn, 520 7th Ave. SW, Cedar Rapids, Iowa.

SW3, 10–160 coils, inc. bandspread, power supply, 2-stage ampf. Sell $25 or trade for surplus xmtr or rcvr. F. D. St. Clair, Port Jefferson, N. Y.

WANTED: 10-meter coils for Natl. FBXA Rcvr. W4KOP, 6121 Sylvan Ave., Norfolk, Va.

FOR Sale: Complete station, 250-watt fone or c.w. rig, 6 ft. Bud rack, 40–20–10–6 meter 200-w. fone, 2 meters. Rcvr. No. 1, 6–10–20 m. Rcvr. No. 2, TRF 2 m. Ants. 2 m. ground plane & 50′ coax. 20 m. doublet. $300. complete. W3GQK, 6949 Rodney St., Phila. 38, Pa.

NEW Transceiver xfrmrs, midget mike & plate to grid, $2.25 pentode to 5 watts r.f., $1.65; hermetic P. P. 6V6 to 30 watts r.f. $2.75; postpaid. Radio Transceiver Labs, 116–23 Jamaica Ave., Richmond Hill 18, N. Y.

SET of nine hex keys for hollow head set screws with holder, 75¢ postpaid. Drill and tap sets. Write for folder. Riverside Tool Co., P. O. Box 87, Riverside, Ill.

TELEVISION-FM components — complete line IF and RF coils. Write for circular. Vision Research Labs, P. O. Box 52, Kew Gardens 15, N. Y.

SELL Meissner Deluxe Signal Shifter with 10, 20, 40, 80 meter coils. W1VG, 99 Bentwood Road, West Hartford, Conn.

SELL QST 1922 November, 1923 except June, all 1924, 1925, 1926, 1927, 1928, 1929 January, 1930 September, 1933 August, 1935 February, August, September, October, December, 1936 all, 1937 January to August, 1941 August and October, 1942 June to December, 1943 all, 1944 January to June, 1945 March, May and October. ARRL Handbooks 2nd, 12th 1936; 1942 Editions. Popular Mechanics 1915 November, 1932 all. Book, Practical Wireless Telegraphy by Bucher. Make offer. H. L. Wheitsel, Landsdale, Pa.

CUSTOM built audio chokes and filters. Also xfrmrs, etc. Communication Specialties Co., 2924 Alabama, St. Louis Park, Minn.

FOR Sale: BC-610 xmtr, AT-3 antenna tuning unit and speech ampf. Never been in use, new, selling out. Only $500 takes all. Luther Bevans, 706 Market St., Pocomoke City, Md.

VOLTAGE regulated power supplies, adjustable 150 to 300 v. DC, 100 Ma., 6.3 volts, 3 amps. Outlet connections for HRO rcvrs. Ideal for BC221 freq. meter or BFO. Beautiful grey crackle chassis, dust cover and controls. Priced at less than cost of parts. Only $20 ea. f.o.b. NYC. W2EIJ, 201 Prince Ave, Freeport, L. I., N. Y.

KW Ampf. complete with pair 204As, 40–80 tank coil, fil. xfrmr, neutralizers, grid condx. comp. except meters and grid coil, working order, $25. Want to buy older model comm. rcvr for cash. W7GNJ, Bend, Ore.

WANTED: Meissner Signal Shifter, 150B type or old model. State condition and type. W1ARO, 2 Bonad Road, Winchester, Mass.

CRYSTALS: Where quality and not price is main consideration, demand Eidson crystals. Fine commercial units for Aircraft, Police, Marine, Geophysical and other services; crystal regrinding. Also broadcast station monitor service. Over decade of satisfaction and fast service! Eidson Electronic Co., Temple, Texas.

QSLS, personal stationery, colors, quality printing. 24 hr. service. Stamp for samples. Reber Print, R. D. No. 1, Sewell, N. J.

HAMS: an 8 x 10 exact reprod. of your ham ticket beautifully mounted on long-lasting Duron Board and sealed in transparent plastic to last forever. Framing unnecessary, ready to hang. Satisfaction guaranteed. Act now. $3 postpaid. Send name, address, call, issuance date to W2GPG, P. O. Box 22, West Orange, N. J.

BEST offer: Model 772 Weston analyzer with televerter for hi-voltage measurements. Good condition. W9VEI, 5036 Agatite Ave., Chicago 30, Ill.

FOR Sale: RME-45 "Calomatic" 5 months old, $150. 40-w. fone, c.w. xmtr like (Radio News Oct '46, P. 32) $42; RME-45 cabinet $10; Richard Rice, 406 W. Oregon, Urbana, Ill.

SELL NC-46 and spkr, used 10 mos. Old model DB 20, all good condition. $110. takes works. W3INV, 5526 Malcolm St., Phila. 43, Pa.

SWAP SX-28A, HRO-M all coils (9), S-36 Hallicrafters rcvr AM-FM 27, 5-143 Mc. All in excellent working condt, sev. months old, mounted in 7 ft. new relay rack. For '41 car or what am I offered. Am also looking for good Presto portable recorder. J. Barreca, 223 East Fifth Street, N. Y. 3, N. Y. Tel. Orch. 4–7512.

SELL: Comet Pro, good cond. comp: coils 8 to 550 meters. 10" Jensen spkr in matching metal cabinet. Best offer f.o.b. Cedar Rapids, Iowa. WØWCV, Vernon Perry, 207–27th St., N. E.

FOR Sale: BC-610 comp. with coils for 20–40–80. Factory overhauled. Best offer. F.o.b. Miami. Address W4GUY, Box 55, Cocoanut Grove, Fla.

QSTS wanted: Dec. 1916 thru Aug. 1917; June 1919 thru Oct. 1919; Sept. 1925. For sale: Jan. 1916, Sept. 1927, Nov. 1927, Oct. 1928, Dec. 1931. Make offer. Johnnie Mulligan, W2RTW, 819 Clairmont Ave., Elmira, N. Y.

QSLS: new designs, samples 10¢. QSL Printers, Box 974, Ft. Wayne, Ind.

WANT pair EE-8 or German field telefones, and 20-meter 3 element rotary beam with indicator. W4KTZ, Eupedon Farm, Clarksville, Tenn.

SELL HQ129X rcvr. Practically new, perfect condt, less spkr. Best offer over $130. Albert Odmark, 24–14 Steinway St., L. I. C, N. Y.

MOBILE rig batteries surplus Army, Navy. Dry charged for long storage life: 12v 34AH, $10.50; 12 v 17AH $8.50; 24v 11AH, $15; W4IJC, 229 N. E. 70th St., Miami, Fla.

SALE Utah No. 1 CW unit, $50. Strite, W3IHF, 31 No. Grant, Waynesboro, Pa.

CRYSTAL processing kit: inc. 4 finished highly active "BT" xtals; state preference in 5.4 to 8.4 megacyle range; 2 hldrs, abrasive, instructions, treatise, $1.00 plus postage. Breon Labs, Williamsport, Pa.

SWL, QSL, W1JFS, 9 Fellows St., Danvers, Mass.

SALE: Army Super-Pro, excellent condition, 550 Kc to 20 Mc. in cabinet, with spkr. $180. WØSQN, T. G. Pedrick, 401 E. Park Ave., Ottumwa, Iowa.

QSLS, highest quality, samples free. VVS Print, 1704 Hale Ave., Ft. Wayne, 6, Ind.

RADIOFILE indexes all material in 8 leading radio mags. New index issued monthly covering everything pub. January to date. Comp. index for 1946 available. Radiofile gives permanent life to back issues, instantly locates info on any pub. radio subject. Sample issue, 10¢. Year's sub, $1. Richard Dorf, 255 W. 84th St., NYC 24.

QSLS, SWLS, 10-day delivery. Samples 10¢. McQuade, W8WRL, 1071 East Fulton, Columbus 5, Ohio.

QSLS, SWLs. Meade, WØKXL, 1507 Central Ave., Kansas City, Kans.

SELLING BC-1004 Hammarlund Super-pro, 300-watt fone/xmtr. Send for list of parts and prices. H. J. Miller, Lock Haven, Pa.

SELL Meissner 150-B xmtr comp. with ECO and tubes. Converted to op. 20 fone and c.w. Good op. condition. Total time used on air, 1 month. Reason for selling, want low power. Price $290. Vibrop, orig. bug, black crackle finish, good condx. Little used, $10. Wm. Plimpton, W2IXH, RFD Martinsville, N. J.

SWAP or sell: modulation xfrmr VM-4, UTC varimatch 300 watts audio; PR 203Zs, sockets, $30. Thordarson 2500 or 2000 V.D.C. 300 Ma; T-200; socket. $30. Want: xfrmrs VM-3 or similar. Plate 1000 V.D.C. 500 Ma. M. Malley, WØSRU, Edgewater, Colo.

QSLS, SWLs, guaranteed prtg, fully equipped to give reliable, speedy service on std. samples. Write for prices on your own designs, and samples, Richard Franzen, W2DEE, Maple Shade, N. J.

SEND 3¢ stamp for sample QSLs to Harrison, 8001 Piney Branch Rd., Silver Spring, Md.

SELL all or part: reason: marriage. All top line parts: 1 Kw. Cw fone. in 7 ft. relay rack. Time delay overload protection. Four extra heavy supplies, inc. 3 Kv. Write for descrip. of all or any unit. W2QGR, 104 Russell Ave., Buffalo, N. Y.

I Have a new commercial power supply 1250 V. DC 600 Ma. Will sell for $90 comp. Also several 2–12 henry swinging chokes 1.0 amp. $7.50 ea. J. E. Stacy, 84 Faun Bar Ave., Winthrop, Mass.

SWAP Or sell: 6L6-807 40-watt rig for 20-40-80 meters fone or c.w. Comp. in black metal cabnt with panel, tubes, etc. Less xtal and meter, swap for HQ-120 or similar rcvr. State condition. Sell for $110. Specify coils. W4ILP, 417 So. Fairview, Spartansburg S. C.

SELL: S-20R one year old, perfect condx, $50, 2-meter TR-4, 955 rcvr, tube, with 110 V. A.C. and 6V. D.C. pwr supp., $45. W1MSZ, 2 Shadow Lane, Wellesley, Mass.

SELL immediately: $200 or best offer: 250-watt xmtr, 813 final, 1250V 700 Ma. pwr supp uses 4-872s in bridge, 2-811s, 2-813s. Other items. H. W. Lawson, 307 College Ave., Ithaca, N. Y.

DYNAMOTORS: 6.3 v. 6 amp. input gives 240 volts at 100 mls continuous 125 mils intermittent. Less than 40° C. rise. Alnico Fields, high efficiency, ideal mobile supply. Manuf. ratings 12–24 volts in, 500 volts out. Brand new, gov't. insp. Factory sealed in waterproof cont. Comp. data incl. Shppg. weight, 12lbs. $4.50 ea. f.o.b. W2SYG, 375 Oak P.; Mineola, L. I. N. Y.

HT-9 xmtr, 2 mos. old, 40201OM coils, new extra 814, make offer, Marks, 97 South 8th, Brooklyn, N. Y.

PLATE xfrmers for sale. Pair of our tested xfrmrs made by Kenyon will supp. 3000-0-3000 at 300 Ma. continuous; 400 Ma. intermittent. Only $17.50 per pr. Brand new 304 TL tubes, $11.50. Shipped c.o.d. collect. Send ord. to Plastic Welding Corp., 407 Broome St., N. Y. C.

FOR Sale: HT-9 with 20 and 40 meter coils, $265. Also HQ-129-X with spkr, $160. Both less than four months old. WØABG, 1323 Leavitt, Waterloo, Iowa.

NEW Aluminum Durel tubing ¾" O.D. .049" wall, 12′ lengths for all beams expressable, W6WGG, Rte. 1, Beaumont, Calif.

NEW Receiver covers broadcast 20–40–80 m. bands. With tubes, accessories $16. Bruce, 1171 Union, Manchester, N. H.

SELLING out: send for list of accumulated ham gear and other hobby items. C. R. Funk, 220 Tennyson, Detroit 3, Mich.

SELL ART-13, unused, with xtal, less tubes, $75. W8QDD, 51 Clio St., Dayton, Ohio.

FOR Sale: Hallicrafters S-27 in good shape. 27–144 Mc. FM-AM-CW. Cost $305 new. Acorn tubes in RF sec. Similar to S-36A. Best offer over $200. Ted Rogers, 530 Division, Huntington, Ind.

SELL: TU-5-B and TU-9-B tuning units, $2 ea. J. A. Robertson W4OA, 455 So. Broad, Mobile, Ala.

MEISSNER xmtr 150-B brand new, comp. with signal shifter, spares & tubes. 150 watts fone c.w. $225 or best offer. W1PAR, Ed Riccio, 5 Shute St., Everett, Mass.

FOR Sale: Mobile P. A. loudspkrs, sev. mikes. Will sell cheap. Write for descrip. L. S. Hackman, 1208 Lee St., Jefferson City, Mo.

SELL: National HRO Sr. 2.5 v. model. New tubes, coils, factory recondx. by Natl. 1.7-30 Mc. Bandspread 5 meter, BFO. Best offer over $200. R. Potter, 33–30 85th St., Jackson Heights, L. I., N. Y.

HRO-5TAI Natl. Rcvr, spkr, pwr supp, coils, 1.7-30 Mc. for sale. Brand new Oct. '46, never used. Price: $250 comp, shipmt. prepd. T. Streeter, jr., W1NMU, Norwich, Vt.

TUBING aluminum in stock. Ideal for any beam. Send for my reasonable prices. W9TFY, Alpha, Ill.

BC-610-E like new, may sell, make offer. Latest pre-war Deluxe Signal Shifter never used, with coils. $50. Commercial adjustable 10-meter vertical coaxial antenna engraved with frequencies for adjustment, $15. Local buyer preferred. W2FMF, 8237 Witkop Ave., Niagara Falls, N. Y.

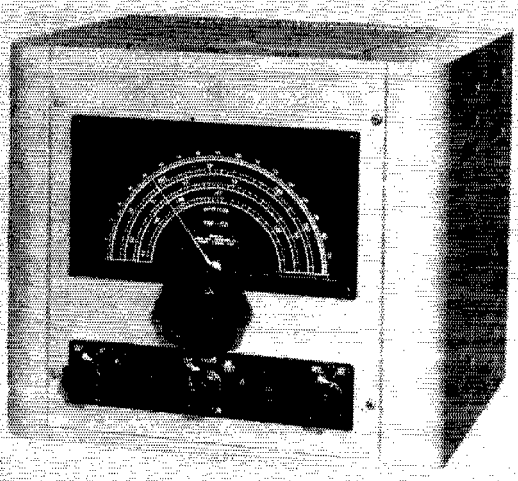
$100 or best offer; large assortment prewar ham equipment including 250-watt Thordarson multimatch modulation xfrmer, 811s, 852s, 866s, chokes, hi-voltage xfrmers, filament xfrmrs, etc. Phone Fitzroy 6229, Los Angeles, Calif. Ex-W6FQK is now W9KWL

Index to Advertisers

Now Available - the new . . .

VHF 152 converter

FOR 2, 6 and 10 METERS



ACTIVITY ON VHF BANDS MOUNTING RAPIDLY

EXTEND the present range of your receiver to include the two, six and ten meter bands with the new VHF 152. Even if your present receiver goes to ten meters, enjoy better reception on that band by the complete absence of images.

Activity on the two and six meter bands is mounting steadily with a new high predicted for summer operation. With the VHF 152, you, too, can take part in this rapidly expanding field of amateur activity. What's more, you'll do the job on these frequencies more efficiently and more economically than is possible with a higher priced, specifically designed VHF receiver.

Features

TUNING MECHANISM
An all-gear, planetary drive. The three bands are calibrated to cover the full sweep of a seven-inch diameter scale, calibrated in mc.

MINIATURE TUBES
New miniature tubes are used for sensitivity, stability and extremely low ***VHF*** *circuit noises. A Built in power supply includes voltage regulator tube.*

SENSITIVITY AND IMAGE REJECTION
Order of two microvolts on all bands. Image rejection ratio of approximately 54 db eliminates images.

ANTENNA CONNECTIONS
Provision made for use of four separate antenna connections.

OTHER FEATURES INCLUDE
Shielded output cable, sturdy construction, antenna change-over switch, band selector, tuning control, line switch.

Illustrated Folder On Request

TIME WILL TELL

RME

FINE COMMUNICATIONS EQUIPMENT

RADIO MFG. ENGINEERS, INC.

Peoria 6, Illinois U. S. A.

WØHBG selects Collins again

BY DIRECT WIRE FROM

WESTERN UNION

SIGNS

CLASS OF SERVICE

This is a full-rate Telegram or Cable-gram unless its de-ferred character is in-dicated by a suitable sign above or preced-ing the address.

R. B. WHITE PRESIDENT

NEWCOMB CARLTON CHAIRMAN OF THE BOARD

The filing time as shown in the date line on full-rate telegrams and day letters, and the time of receipt

WUC 22 NL PD= WUX CLINTON IOWA JAN 17 1947

ARTHUR COLLINS= COLLINS RADIO CO=

AFTER TEN DAYS ON THE AIR AND BEING SUBJECTED TO JUST ABOUT EVERY POSSIBLE OPERATING ABUSE, THE NEW COLLINS 30- K HAS PROVEN ITSELF TO BE THE TRANSMITTER THAT AMATEURS HAVE DREAMED ABOUT. THE THIRD CONTACT WAS OUT OF THE COUNTRY. EVERY QSO HAS RESULTED IN COMPLIMENTS ON THE QUALITY OF THE 30-K SIGNALS. ITS EASE AND SPEED OF HANDLING IS ALMOST UNBELIEVABLE. FOR EXAMPLE THE TRANSMITTER WAS SET FOR 40 METER C.W. WHEN I HAPPENED TO HEAR A CUBAN CALLING CQ ON 20 METER PHONE. BEFORE HE HAD FINISHED HIS CALL, I WAS ABLE TO BAND SWITCH THE TRANSMITTER TO 20 METERS AND TUNE IT UP IN PLENTY OF TIME TO CALL THE CUBAN WHEN HE STOOD BY, AND GOT HIM. I WANT TO TAKE THIS WAY OF CONGRATULATING THE STAFF, TECHNICIANS, AND PRODUCTION WORKERS WHO MADE THE 30-K WHAT IT IS-- THE FINEST TRANSMITTER THAT HAS EVER BEEN OFFERED TO US AMATEURS=

CLYDE H HENDRIX WCHBG BREEZY POINT

CLINTON IOWA

Clyde Hendrix, President of Pillsbury Mills' Feed and Soy Division, owned one of the earliest Collins amateur transmitters. Here he is shown taking delivery of his new Collins equipment.

The 30K-1 is *engineered for satisfaction.* Get the details from your nearest dealer (See February, 1947, issue) or write to us.

"Hundreds of dollars in hundreds of prizes at the Midwest Division Convention, May 24-25 at Cedar Rapids. Sponsored by Iowa City and Cedar Rapids amateurs. Don't miss it."

FOR BEST RESULTS IN AMATEUR RADIO, IT'S . . . COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 West 42nd Street, New York 18, N. Y. 458 South Spring Street, Los Angeles 13, California

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

WINNING PERFORMANCE NATURALLY with National Equipment

A high scorer for his section in the recent phone sweepstakes of the American Radio Relay League was Frank Glennon of Canton, Mass., W1KQN. He was one of the many ranking amateurs who owe their creditable scores in the CW and Phone SS Contests in large part to the splendid performance of their National equipment.

Basic units in W1KQN's enviable layout are the National NC-2-40D receiver and the National NTX-30 Exciter. In addition, many National components were used in his transmitter.

Year after year, in thousands of ham shacks around the world, National equipment keeps delivering the kind of performance that wins.

National

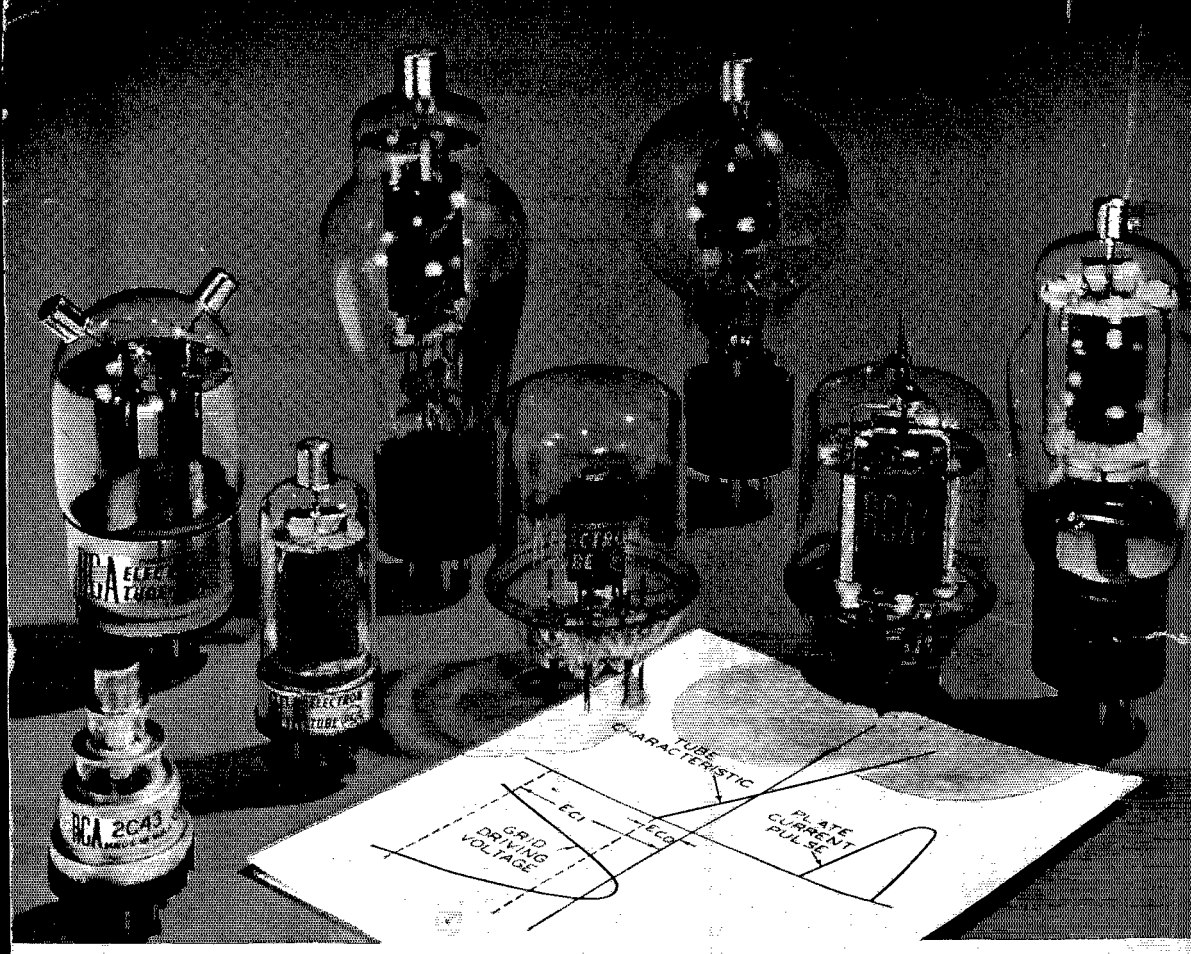
EST. 1914

MALDEN, MASS.

NATIONAL

COMPANY, INCORPORATED

MAKERS OF LIFETIME RADIO PRODUCTS



In doubler service *emission* counts . . .
. . . and RCA power tubes have plenty of it

YOUR CHOICE OF RCA TUBES FOR DOUBLER SERVICE			
Tube	Type	Heater (or Fil.) watts	Max. plate dissipation watts
2E26	beam	5.0	13.5*
2C43	triode	5.7	12
807	beam	5.7	30*
808	triode	30.0	75*
811	triode	25.2	55*
815	beam	5.0	25*
826	triode	30.0	75*
829-B	beam	14.2	45*
*Class C telegraphy (ICAS) rating			

It takes a lot of cathode emission to back up those he peak plate current pulses when you're driving a frequen multiplier tube for optimum gain.

That is why the RCA 2C43, 808, 811, and 826 high- triodes . . . and the RCA 2E26, 807, 815, and 829-B hi transconductance beam power tubes are preferred ty for medium-power doubler and tripler service. They p duce maximum plate-current swing for a given grid sig voltage. And they have the high-power filaments heater-cathodes required to handle high peak p current . . . *with emission to spare.*

For complete information on doubler and tripler op tion, see the Jan.-April issue of RCA Ham Tips. Ask y local RCA Tube Distributor for your copy, or write R Commercial Engineering, Section M-54E, Harrison, N

THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA

TUBE DEPARTMENT

RADIO CORPORATION of AMERICA

HARRISON, N. J.