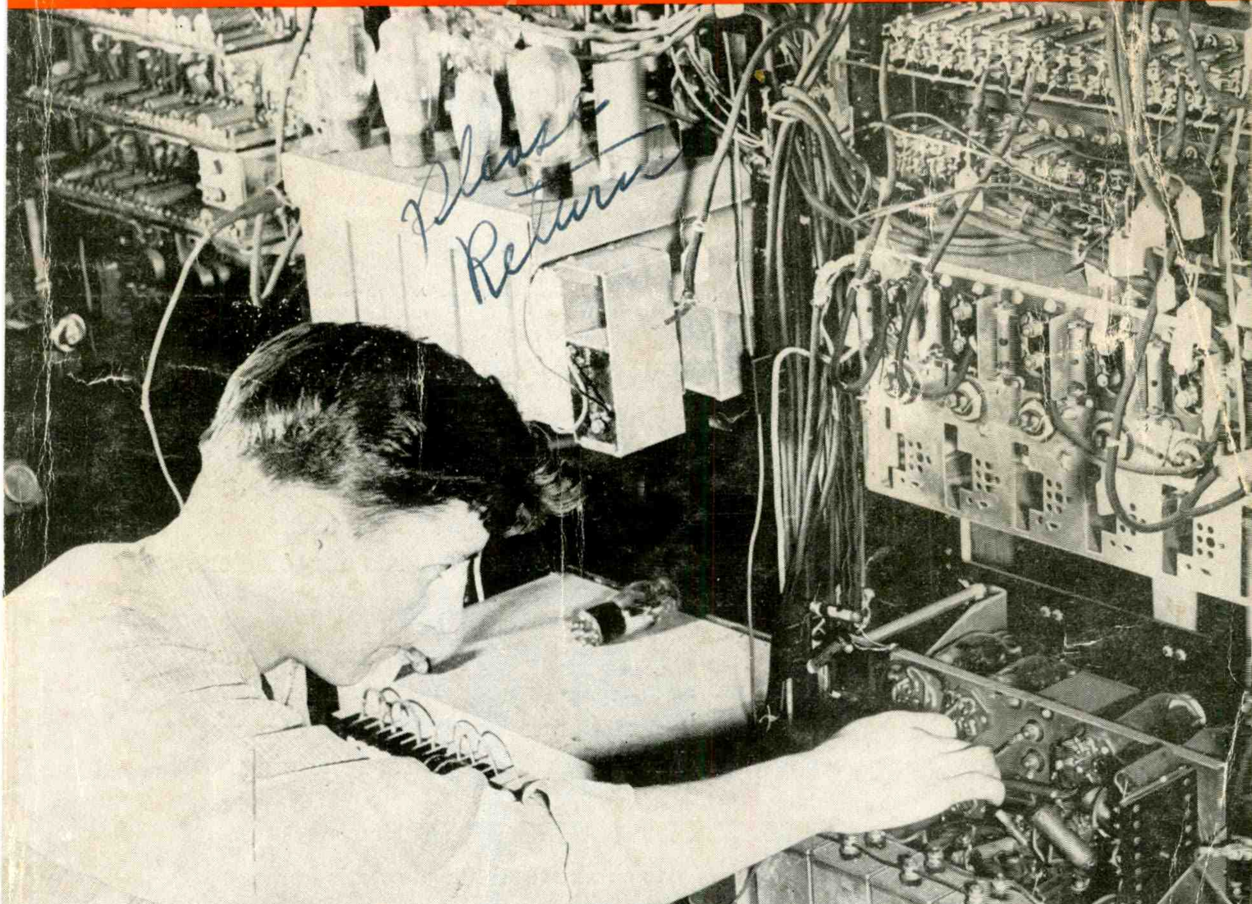
AMATEUR RADIO DEFENSE



PUELICATION OFFICES:
Monadnock Building
San Francisco - California

APRIL-MAY
1941

25 CENTS
Yearly Subscription $2.50

TOP QUALITY

Communications Performance

ENGINEERED to a high degree of perfection. The SX-28 offers every worthwhile feature necessary to top quality communications performance. 15 tubes, two stages pre-election, calibrated bandspread inertia controlled, micrometer scale tuning inertia controlled, tone and AC on-off, beat frequency oscillator, AF gain, RF gain, crystal phasing, adjustable noise limiter, send-receive switch, AVC-BFO switch, bass boost switch, phono jack, 80/40/20/10 meter amateur bands calibrated, wide angle "S" meter, band pass audio filter, improved signal to image and noise ratio, push-pull high fidelity audio output, 6 step wide range variable selectivity, improved headphone output. Model XS-28 with crystal and tubes $159.50.

the hallicrafters co.

CHICAGO, U. S. A

USED BY 33 GOVERNMENTS **SOLD IN 89 COUNTRIES**


Take it With You Wherever You Go!
THE Sky-Traveler (Model S-29) is a portable designed to communications receiver tolerances. You can take it with you wherever you go, or use it at home. Operates on 110 volts AC or DC or from its self-contained batteries. Frequency coverage from 542 kc. to 30.5 mc. on 4 bands. Telescope antenna with high gain coupling circuit provides truly remarkable reception throughout the tuning range. Electrical band-spread. Automatic noise limiter. Battery life prolonged through a self-contained charging circuit. RF stage used on all bands. Sensitivity below two microvolts on all bands. Permeability tuned RF and IF circuits. Weight including batteries 18 lbs. The Sky-Traveler (Model S-29) $59.50.
the hallicrafters co.
CHICAGO, U. S. A.
USED BY 33 GOVERNMENTS
SOLD IN 89 COUNTRIES

VOL. 1 • No. 6-7
APRIL-MAY, 1941
★ ★ ★

STAFF

A. H. HALLORAN
Editorial Director

H. W. DICKOW
W6JYN
Managing Editor

L. R. HUBER
W7CRJ
Associate Editor

FRANK C. JONES
W6AJF
Technical Editor

C. C. ANDERSON
W6FFP
Engineering Draftsman

N. R. FARBMAN
W6SEM
Staff Photographer

L. L. FUNSTON
W6QQU
Illustrator

BUSINESS OFFICES

Monadnock Building
San Francisco, Calif.

•

Subscription Price: $2.50 per year in the U.S.A. and its possessions. Elsewhere $3.00 per year.

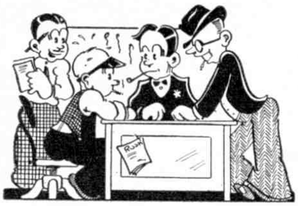
AMATEUR RADIO DEFENSE

Published Monthly
By
Pacific Radio Publishing Co.
In the Interests of
Amateur Radio Defense Association

★

CONTENTS FOR APRIL-MAY

★



Chats with the Editors

. . . A reader in Indiana complains that too much editorial stress is placed upon the "old men" of amateur radio whose accomplishments have been extolled in these columns. He writes: "If you want to know how good an 'old man' really is, ask his wife." To which we reply: "C'm'n up and see us some time."

* * *

. . . To make matters worse, the mother of an enterprising young amateur informs us that she will not permit our magazine to find its way into her household because our "Miss Match and Mister Q" cartoons contribute nothing to an amateur's education. To this we made no reply, because A.R.D. is not published for the benefit of small boys. Furthermore, scores of readers have fallen in love with "Miss Match," and some have told us that a clearer understanding of technical radio can be gained from a close study of our monthly cartoons!!!

* * *

. . . We guessed wrong. We told you that a bigger A.R.D. would be printed when (and if) more advertising support comes to us. The summer season is close at hand and it is not reasonable to anticipate an influx of new advertisers during the months when amateur sales are at a low ebb. Because this magazine is not published for profit, and because no salaries are paid to anyone connected with A.R.D., the lack of advertising support will necessitate combining the June-July issues into one. All subscriptions will, of course, be extended an equal number of issues for all "doubling" of the publication circuit. Other magaines have been known to suspend publication during slack seasons, so we will compromise by combining the next two numbers into one—thereby giving us an opportunity to catch-up on a bit of much-needed sleep. It's been a tremendous job to handle the affairs of this little magaine and our big Association, but we are enjoying every minute of it. We will cram our future issues so full of new technical scoops that we feel certain you will be compensated for the temporary lay-off we will take during the hot summer days. We have chosen to publish this announcement early in order to set at rest the usual crop of wild rumors always associated with a temporary delay in getting a magaine into the hands of its readers.

* * *

. . . Almost daily we are asked why more of the very prominent manufacturers of radio equipment have not seen fit to use our advertising pages, and why we carry so few advertisements in a magazine so widely accepted in amateur circles. True, we haven't many advertisers, but those who are with us can be depended upon to stand back of the radio amateur through thick and thin. Some of our advertisers haven't built a dime's worth of amateur gear in months—they are making equipment for governmental service. They feel that they owe much of their present success to the amateur—and so they have thrown their shoulders to the wheel to help us in our nation-wide campaign to strengthen the radio defense of the Nation. So, then, when you browse around a radio store, glance through your current copy of A.R.D. and check the list of advertisers who made possible the publication of this magazine. When you buy their products you can rest assured that you have purchased something made by the "R9" champions of our good, old amateur radio.

* * *

. . . The War Department is seeking complete data on amateur radio facilities and manpower through a comprehensive questionnaire already in the hands of many. If you have received these forms, return them promptly to the prescribed address. And remember our editor's predictions: *"If the amateur makes himself needed during the present emergency which is upon the country, there will be no total 'buackout' of amateur radio."*

* * *

. . . Sealed orders are being made ready for A.R.D.A. members in certain areas where military tests will soon be undertaken. You will be given short notice to get on the air and help make these tests as sensational and as successful as the Seattle black-out operations of our Association. We'll act first—and talk later.

Application for Enrollment

In

Amateur Radio Defense Association

★ ★ ★

PATRIOTICALLY pledging my service to the radio defense of the United States of America, I hereby apply for enrollment in the *AMATEUR RADIO DEFENSE ASSOCIATION*. I agree to keep my radio equipment in good working order, ready to meet emergencies which may arise as a result of foreign aggression or other catastrophies. I agree to participate in such tests and training in preparedness to meet disaster to normal communication facilities as may be asked of me, provided that I am not then engaged in other work which I deem more essential to my personal welfare.

IN RETURN for my pledge of service, I am to receive a Certificate of Enrollment in the *AMATEUR RADIO DEFENSE ASSOCIATION* and am to be advised, by radio or otherwise, of the activities of said association, all without financial obligation on my part. It is mutually understood that the costs of printing and mailing the Certificate of Enrollment will be borne by the Publishers of the magazine "*Amateur Radio Defense*," who pledge themselves to publicize the Association activities, to print technical information which will improve the practical effectiveness of my equipment, and to seek greater recognition for the amateur radio operator as a means for aiding the national defense.

Pledged at..............................., ..., **on this**..............
Town State

day of..............................., **194**....

Witness

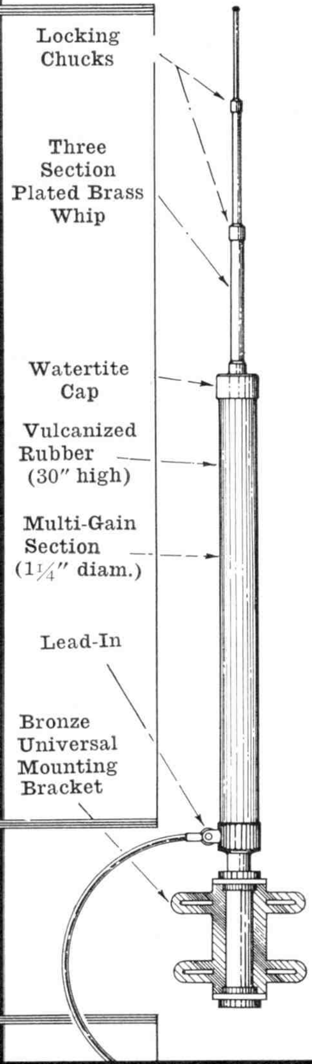
.... Enrollee...............................

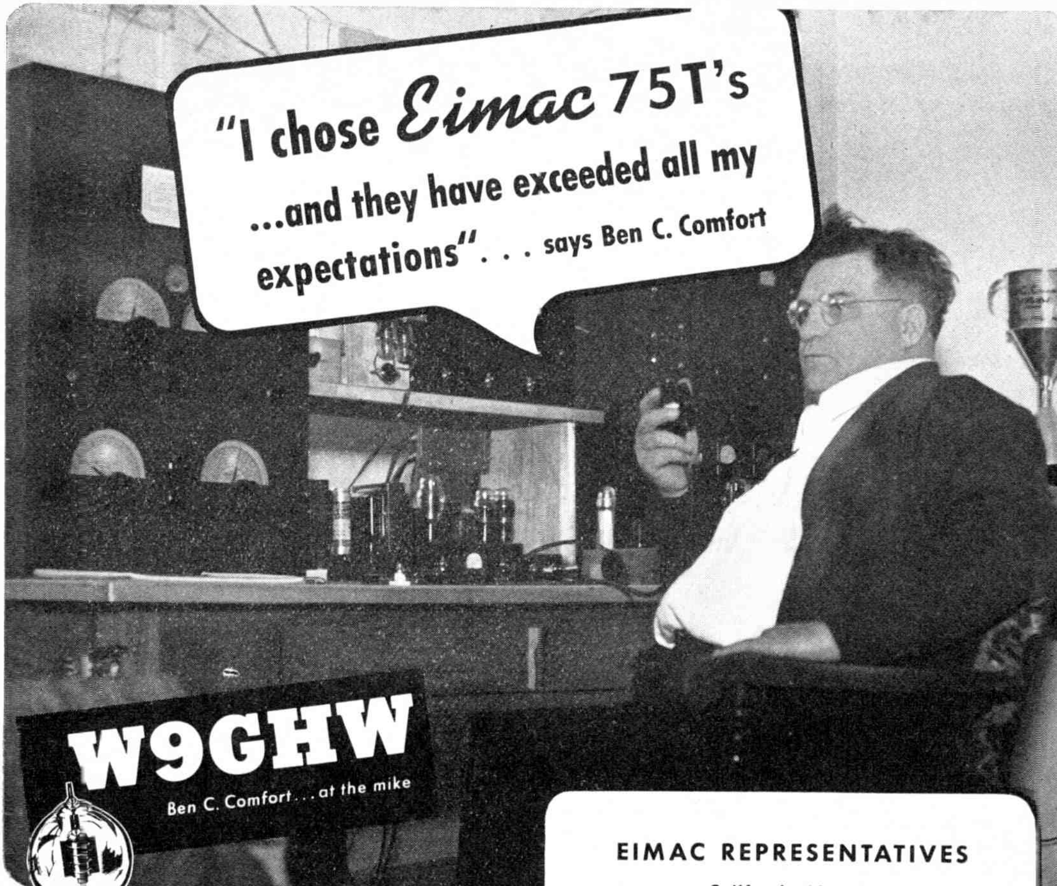
Full Name...............................
Complete Address...............................
Call Letters...............................When Received...............................
Age...............................Race or Color...............................
Code Copying Speed (1.. in Handwriting............... (2) On Typewriter...............
Present or Past Employment in Commercial Radio...............................
Army or Navy Service...............................
Present Station Equipment: Power...............Operating Bands...............
C. W.?...............Phone?...............ECO?...............
Antenna Type............... Receiver Type...............
Measuring or Direction-Finding Equipment...............................
Academic Education:...............................
Mobile Equipment (auto, boat, plane)...............................
Public Speaking or Writing Ability...............................
Nautical Instruments Owned ....
Membership in Other Communication Networks...............................
Organization Experience and Willingness to Enroll Others...............................
Other Special Qualifications...............................
....
....

The above information is needed for guidance in classification for specialized services. Please write it in detail and mail it to

AMATEUR RADIO DEFENSE,
Monadnock Bldg., San Francisco.

A handsome Certificate of Enrollment will be mailed free to each licensed amateur radio operator who requests it.


Locking Chucks
Three Section Plated Brass Whip
Watertite Cap
Vulcanized Rubber (30″ high)
Multi-Gain Section (1¼″ diam.)
Lead-In
Bronze Universal Mounting Bracket



Ben says..."the performance of any transmitter is no better than the Class C amplifier...I was very careful in my choice of every unit that went into its construction ... after considering them all, I chose Eimac 75T's and they have exceeded my expectations ... I have loaded them from 150 watts to 1050 watts input and they have come through with flying colors."

At the present time Ben is running the pair of 75T's at 310 watts input. The results obtained with this class C amplifier speak well for the design and performance of the tubes. Right now Ben is converting other sections of his transmitter to Eimac Tubes. There's no stronger recommendation than that. A pair of 75T's going in as doublers.

EIMAC REPRESENTATIVES

California, Nevada
HERB BECKER, 1530 W. 104th St., Los Angeles, Cal.

Wash., Ore., Idaho, Mont.
GENERAL SALES CO., Verner O. Jensen, 2605-07 Second Ave., Seattle, Wash.

Colo., Wyo., New Mexico, Arizona, Utah
RICHARD A. HYDE, 4253 Quitman St., Denver, Colo.

Ohio, Mich., Ky., Ind., Minn., Mo., Kan., Neb., Iowa
PEEL SALES ENGINEERING CO., E. R. Peel, 154 E. Erie St., Chicago, Ill.

N. Y., N. J., Penn., Md., Del., Dist. of Col., Maine, N. H., R. I., Conn., Mass.
ADOLPH SCHWARTZ, 14726 Elm Ave., Flushing, New York.

N. Caro., S. Caro., Georgia, Tenn., Fla., Ala., Miss.
JAMES MILLAR, 316 Ninth St. N. E., Atlanta, Georgia

Texas, La., Okla., Ark.
J. EARL SMITH, 2821 Live Oak St., Dallas, Texas.

Chicago, Illinois, Wisconsin
G. G. RYAN, 549 W. Washington Blvd., Chicago, Ill.

Eimac TUBES

Eitel-McCullough, Inc. • San Bruno, California

The Editor's CQ

Strength For Weak Links In Defense

DURING the old-fashioned Days of Chivalry, "when knighthood was in flower" and warfare was ideally characterized by honor, protective kindness for the weak, generosity to foes, and a high-minded devotion to the common welfare, the most important item in the equipment for defense against arms, or weapons of offense, was an armor of chain-mail. It was a flexible mesh, forged from thousands of links and worn as a protection against spear and sword. As it was no stronger than its weakest link, the strengthening of weak links was an all-important process in preparation for defense.

During these modern Days of Villainy, when gangsters are in power and warfare is characterized by the very opposites of the old-fashioned chivalry, the radio communication network figuratively corresponds to the old-time coat-of-mail. It, likewise, is no stronger than its weakest link, the strengthening of which is now a vital factor.

The links in this defensive chain are more varied and extensive than is generally realized. It supplements the wire telegraph and telephone facilities and comprises not only the commercial point-to-point and broadcast stations, the established military and police communication services, and the radio aids to aviation, but also a vast network of amateur stations. As the latter constitute the admittedly weaker links in the chain, our consideration may be confined to them.

The amateur stations may be roughly classified under five categories: the Army Amateur Radio Sysstem, the Naval Communication Reserve, the American Legion network, stations owned by playboys, and stations owned by mature operators who are not associated with the foregoing. What are the weaknesses of each of these general classes and how can they be strengthened?

The first two classes are inherently strong. But as their primary purpose is to prepare men for active duty in the armed service, their very strength is, paradoxically, their weakness as regards home defense. For each man assigned to active duty means one man less for home duty. They can be effectively strengthened by providing men capable of taking the vacated places.

The American Legion network is also inherently strong. But its traffic is largely limited to the 160-meter 'phone band, whose dependable daylight range seldom exceeds a hundred miles. Whilst it is superb for local contacts. it cannot "carry the message to Garcia" when he is a thousand miles away. It needs DX telegraphic communication facilities.

The thousands of enthusiastic and patriotic playboys are not competent, as a rule, to handle traffic rapidly and accurately during an emergency. They can be trained to do so, but this will take time which may not be available. Furthermore, most of them are of draft age and their stations will be closed when they are called to the colors, thus automatically eliminating many links in the defense chain of armor.

The thousands of older operators have good and sufficient reasons for not associating themselves with any of the other groups. They are not wearing Army or Navy regalia because they prefer to serve in mufti. Many of them are veterans of the first World War and recognize that young men are more effective for active service. Their weakness has been their lack of organization.

From the preceding realistic analysis of the weak links in the armor-chain it is evident that each of the five classes has its vulnerable "heel of Achillees," who, parenthetically, was himself no "heel," if we are to believe the classic myths. They can all be strengthened by organizing a reserve personnel competent to fill the vacancies in the inactive ranks and equipped to transmit on all the amateur bands.

This organizing task was voluntarily undertaken by the Amateur Radio Defense Association six months ago. It has already enrolled a great many old-timers, has sponsored several successful communication tests under emergency conditions, such as the Seattle "blackout" in cooperation with the American Legion network, and is daily increasing in strength. It is mobilizing the potential energy of mature men into a dynamic power for defense. It is welding the weak links in the chain and does not compete with or take the place of any other group. Does this exposition of its purposes and functions answer your question about it?

How the Seattle Amateurs Organized Their Facilities for the Black-Out Test

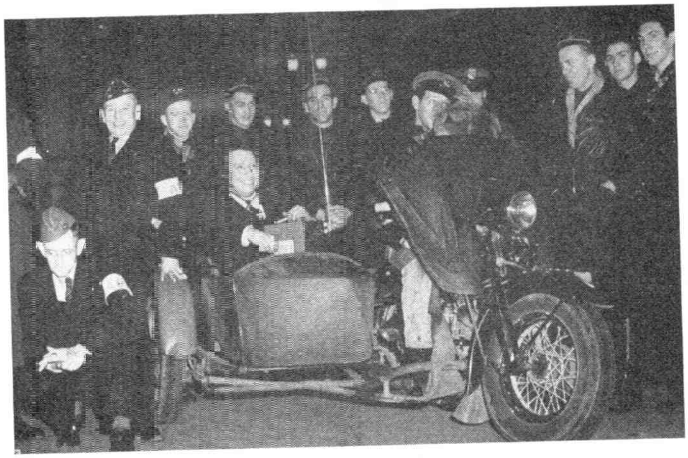
★

For the benefit of the scores of Amateur Radio Defense units now busily engaged in laying plans for active participation in emergency tests, a complete set of instructions is here disclosed for the proper organization of a network. Patterned after the astoundingly successful Seattle black-out test, these same plans will be of timely help to every defense-minded amateur.

★

JOHN P. GRUBLE, W7RT, Area Communication Officer of the 7th Area for Amateur Radio Defense Association, enthusiastically acclaims amateur radio's part in the Seattle blackout test as one of the outstanding achievements of recent years. The success of the test was due to organization and leadership, and—above all—to the selection of licensed radio amateurs best able to meet the emergency. From a long list of active amateurs, and with a personal knowledge of their respective capabilities, the Area Communication Officer was enabled to choose those best fitted for the task. How well these amateurs conducted themselves in this, the first major test of amateur radio's worth in a war-like emergency, was related completely in the last issue of this magazine. Since its release there has been an abundance of mail from individual amateurs, from radio clubs in many parts of the nation, and from others who had no previous realization of the importance of auxiliary amateur communication at a time when it is needed most. The majority of requests concerns the plan of action and the steps taken to make certain that there would be no failure in any link of the chain of stations which had agreed to take part in the operations. Here credit in great measure is due the skilled men of amateur radio who followed their instructions to the letter; not one of them fell short of his objective and his aim. A few days previous to the announced date of the black-out test a letter of instructions was transmitted to each participant. With this letter went a chart, in mimeographed form, and upon which was detailed the precise course of action to be followed by all member stations. Different charts were sent to different participants, the net result being total radio coverage of the blacked-out area on all of the amateur bands. Reference to the charts gave each member a clear picture of the job he was asked to perform. No wordy elaboration was required, and the old axiom, "*A picture is better than a thousand words,*" held true in this case. Almost instantly each member station operator knew what to do and how to do it. The speed with which this information was compiled and placed into the hands of all operators is worthy of especial mention. Mr. John P. Gruble and several of his associates met in the rooms of a Seattle hotel one evening, and before the conference was adjourned the entire plan of action had been perfected, flawlessly and simply. A mimeograph machine was pressed into service and the next day each participating station was in receipt of complete, brief instructions and a communication chart. Some of these charts are reproduced for the benefit of the many who have asked for the facts needed to duplicate the Seattle success. It can be seen that utmost simplicity is the keynote. In an emergency there is no time to waste on dillydallying with inconsequential matters. The idea is to do a job, do it right, and do it in a hurry. Modern armies move with lightning-like speed; radio communication must move with even greater speed.

With these charts now reproduced, it is sincerely hoped that the scores of Amateur Radio Defense units in many parts of the United States will be enabled to perfect similar plans for handling local or national emergencies. Take advantage of every opportunity to tie-in with all defense under-



Area Communication Officer Gruble, W7RT, very portable and very mobile, ready to go for a ride in motorcycle furnished by a corps of volunteer motorcycle club members. The motorcycle members belong to the Queen City Motorcycle Club, and to "The Cossacks," a motorcycle group. These two groups furnished nearly one hundred motorcycles and drivers for cooperation with Seattle's police during the test blackout.

takings in your respective communities. Call your best men into assembly and devise a plan along the lines of the Seattle test. It proved its worth. First determine what you want to do, and the area you wish to cover. Inform all local, state and governmental radio agencies of your plans and send copies of all charts and instructions to each of the foregoing. Mail a written request to your nearest military headquarters and ask that an official observer of the U. S. Army be assigned to supervise your activities. Explain your purpose thoroughly. Make all of your facilities known. And, above all, make sure that powerful c.w. stations of A.R.D.A. members will be in readiness to keep a channel open with the nearest military headquarters and also with *W.A.R.* in Washington. Send copies of your plans to W.A.R.

As was to be expected, the best coverage in Seattle was by means of UHF equipment which could be quickly transported to any scene of action and placed into quick service. Immediately upon receipt of reports from the UHF field operators, the information was then re-transmitted by fixed stations in the homes of participating members, and a running account sent directly to Washington.

Without advance notice to the amateur fraternity, it is highly gratifying to observe the number of letters from amateurs who report that they "overheard" the tests. From Alaska to the southern end of California these communications came, and still they come, as you will learn from the notations by our A.C.O., later in this text.

It is not necessary that a large number of amateurs be available for the successful

The American Legion amateur station located at the County-City Bldg. Shown in photo are, left: Bruce Daly, W7CKJ, operating 'phone rig; center: Keith Olson, W7FS, looks over rig being operated; right, John Gruble, W7RT, looks over his $2\frac{1}{2}$ meter transceiver . . . (Note arm band, which reads "Seattle ARP", meaning Air Raid Patrol).

conduct of any emergency radio undertaking. A few dozen *good* men can do a better job than a great host of "run-of-the-mill" amateurs. Seattle proved this point in unmistakable fashion. The wild confusion commonly associated with a very large group of individuals is positively a detriment to the conduct of a serious emergency undertaking. Choose your associates with the greatest of care.

Reports are now being received of several large-scale defense communication undertakings on the part of our ever-growing membership. Some astounding news will reach you through these pages very soon. First we will take action—and without benefit of advance publicity or fanfare; then we will report our successes in this magazine.

●

W7RT Reports Receipt of Test Blackout General Messages

●

Written confirmations on the receipt of our "general message" sent out by Seattle ARD stations during the night of the Seattle blackout have been coming in from all over.

Following is a list of amateurs who voluntarily sent written verifications that they had received our general message that same night. (Other verifications are still coming in.)

We know there are numerous others who relayed the message and copied it, but we are only keeping record of the written verifications . . . remember all of these messages were sent almost simultaneously on various bands, and all of the relaying took place within a few minutes after the blackout ended at 11 p.m. . . . think this is wonderful, especially since the "general message" had a check of 84—which is a good-sized message!—therefore, thirteen messages times 84 words text means that at least 1,092 words were copied via amateur radio. However, if you figure that first the short messages from local stations went to control W7BL, thence W7BL's message to all stations, thence the relayed messages . . . this totals up to a lot of words handled in a hurry! And all this within about 45 minutes!

Many amateurs receiving the general message expressed great interest in our work . . . some wanted to join ARD . . . some wanted to congratulate us . . . some sent in written verifications by airmail . . . etc! Now this is what I call REAL amateur radio service, and I don't mean maybe.

OUT-OF-TOWN STATIONS WHICH SENT WRITTEN VERIFICATIONS:

1—W7AEA, Tacoma, Wash.	(Copied the message from W7RY, Seattle)
2—W7DXQ, Clarkston, Wash.	(Copied the message from W7RY, Seattle)
3—W7DZX, Toledo, Wash.	(Copied the message from W7EKA, Seattle)
4—W6SPI, Alameda, Calif.	(Copied the message from W7EK, Everett)
5—W7DYD, Bothell, Wash.	(Copied the message from W7KO, Seattle)
6—W7HZG, Pomeroy, Wash.	(Copied the message from W7FSH, Seattle)
7—K7IFZ, Juneau, Alaska	(Copied the message from W7BL, Seattle, also aided by W7GYD, Seattle)
8—W6QKI, San Diego, Calif.	(Copied the message from W7GTD, Seattle)
9—W6MYT, Hollydale, Calif.	(Copied the message from W7GVH, Seattle)
10—W6RUT, Ontario, Calif.	(Copied the message from W7FRU, Seattle)
11—W7IFV, Longview, Wash.	(Copied the message from W7EUI, Kirkland, Wn.)
12—W7AKP, Everett, Wash.	(Copied the message from W7GVH, Seattle)
13—W7KP/K7, Yakutat, Alaska	(Copied the message from W7GYD, Seattle)

Bear in mind that all stations in parenthesis first copied the same message from W7BL

★

See Page 14 for Complete Diagram for Seattle Black-Out Communications Plan

★

• *Here is a copy of the general message sent out from master control station W7BL on 3955kc fone, 1-KW, after all of the 15 messages from local network were received . . . this message was copied by the locals and others, and relayed to distant points immediately, such as to Yakutat and Juneau, Alaska; to Los Angeles; to Washington, D. C.; to Everett, Wash., etc.*

MSG NO 1 FROM W7BL CK 84 SEATTLE WASH TIME 11:10 PM MARCH 7

TO
ANY AMATEUR RADIO STATION

SEATTLE HAS JUST COMPLETED A TEST BLACKOUT THE FIRST CITY OF MAJOR SIZE IN THE UNITED STATES TO DO SO STOP AMATEUR RADIO PROVIDED EMERGENCY COMMUNICATION STOP REPORTS FROM TWENTY STATIONS JUST RECEIVED VIA RADIO INDICATE COMPREHENSIVE SURVEY OF LIGHT CONDITIONS AND AIRPLANE MOVEMENTS CAN BE SUCCESSFULLY CARRIED OUT IN A CITY OF THIS SIZE WITHIN TWENTY MINUTES STOP AMATEUR RADIO HAS AGAIN SCORED A SUCCESS STOP FULL DETAILS WILL BE MADE AVAILABLE LATER STOP PLEASE ACKNOWLEDGE RECEIPT OF THIS MESSAGE BY RETURN MAIL

(SIGNED)
W7BL

From: W7RT

Seattle, March 4, 1941.

INSTRUCTIONS FOR AMATEUR RADIO DEFENSE WORK

The success of our work during the test blackout in Seattle (10:30 to 11 P.M., Friday, March 7), depends on each one of us DOING OUR PART, and doing it ACCURATELY.

The BAND you will use is the one listed at the top of each sheet whereon your call appears.

See where your call is listed. You will contact the control station for your band at the exact time given nearest your call. Control station is encircled on the chart.

After the band control station has collected your message, he will contact W7BL (3955kc fone) as per schedule outlined. W7BL will gather these messages from all the bands, analyze them, include dope in a GENERAL MESSAGE, which will be transmitted "QST" style to all of you at 11 P.M.

All of you, after sending in your message to your own band control station, should stand by and COPY THE GENERAL MESSAGE from W7BL (3955kc fone) at 11 P.M. Copy this, and relay this GENERAL MESSAGE to an out-of-town station as soon as possible. Explain that this message is a test QSP in connection with the "blackout," and ask the out-of-town station to mail you a copy by return mail as a verification of receipt. (Address the message merely to whatever station you relay it to.)

Here is what you send to your band control station on your schedule as per chart: SEND HIM THE FOLLOWING FORM MESSAGE, filling in the blank spaces with correct data as existing near the vicinity of your own station at schedule time, to the best of your knowledge. Opposite "A", fill in your own station call, followed by time of schedule. Opposite "B" in first space send number of airplanes sighted (none, one, two, three, six, etc., whatever the case may be) . . . in second space fill in direction the planes were heading at time seen (north, south, etc., whatever the case may be). Opposite "C" fill in direction from your station where most lights are still visible at time of sked . . . (north, east, etc., give general direction of most lights visible within say 3 to 5 miles radius from your station location.)

SEE ENCLOSED MESSAGE FORMS, USE THEM

BE ACCURATE—PROVIDE YOURSELF WITH FLASHLIGHT

HERE IS THE MESSAGE YOU SEND ON SCHEDULE

(Use this message form, send it as outlined here, filling in only blank spaces as per instructions on separate sheet.)

(A) Number 1 from W7............Time:............
To W7BL, Seattle, Wash.
(B) Report..........Airplanes Traveling..........Stop
(C) Lights Visible to........................of me Stop
(Signed)
W7 ....
(Operator's Own Call)

(Clip the above form, or copy, and have it on hand for your schedule Friday.)

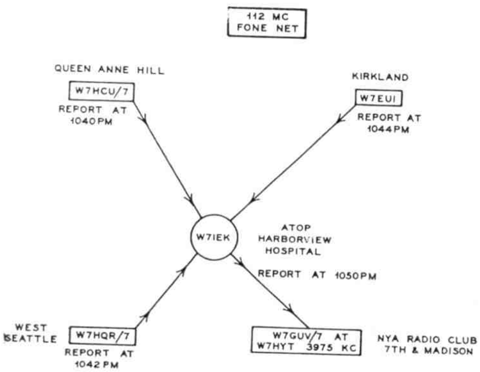
In case no airplanes are sighted, state "no airplanes traveling stop" . . . In reporting "lights visible" report only the BRIGHTEST, or GREATEST NUMBER, and only if fairly close to your station, say within a mile or so, and NOT over 5 miles distant. Have a helper handy to report what is seen; be careful to report ACCURATELY at time of SKED. Report planes only if their lights are seen, or their motors heard; if many planes, report course of those NEAREST your station.

This will be a fine test for us, so let's do a GOOD JOB.

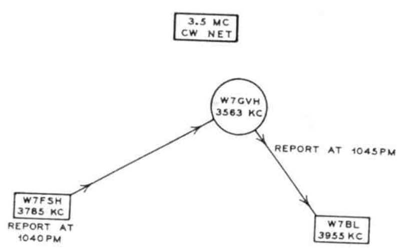
Thanks,
JOHN W7RT.

Amatuer Radio Defense Network

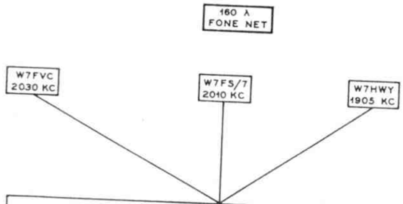
As Used During Seattle Black-Out Test



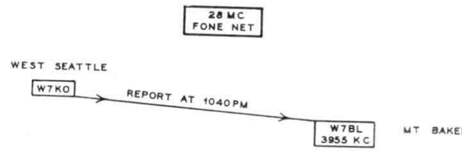
Before and after net skeds, above stations will listen for W7HMA or Bremerton station on 2½ meters. No rag-chewing will be tolerated. Have a flashlight ready, also accurate timepiece. Report presence of planes or boats.



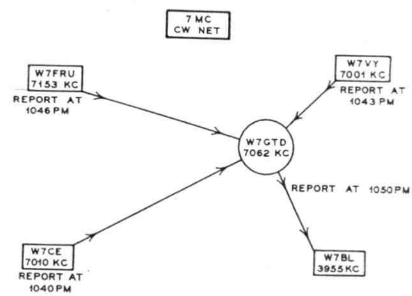
Above stations will transmit on frequencies indicated. Stand-by for W7BL on 3955-KC. 'phone at 11 p.m. Copy this message—relay it to all out-of-town stations. Listen for W7EK, W7EGE, W7AKP on 80-meter c.w., also W7HGZ on 80 c.w.



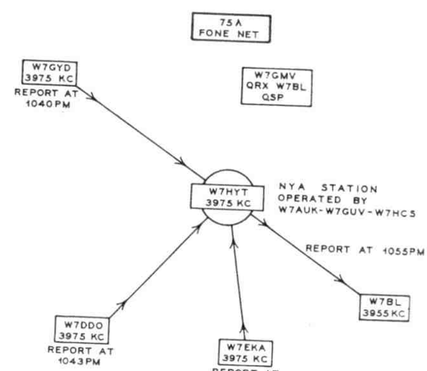
Above stations will stand-by for W7BL's general message at 11 p.m., 3955-KC. Also listen for all 2½-meter signals. Make contact with Everett, Wash., and relay general message to all stations.



After clearing with W7BL, above stations will listen for general message at 11 p.m. from W7BL on 3955-KC. Relay this message to any other station standing by.



Above stations will transmit message shown on form attached to instructions. Then stand-by for W7BL general message on 'phone, 3955-K.C. at 11 p.m. Relay this general message to out-of-town stations immediately upon receipt.



Above stations will send message shown on form, attached. Be prompt! Keep accurate time! When clear, QRX for W7BL on 3955-KC. 'phone, and relay his general message to all out-of-town stations. Ask for written confirmation of messages sent to all out-of-town stations.

NEWS from WASHINGTON

Special National Defense Listening Posts Will Study Foreign Short-Wave Broadcasts

ESTABLISHMENT of special national defense "listening posts" to record, translate, transcribe and analyze foreign short-wave broadcasts is being undertaken by the Federal Communications Commission in co-operation with the Defense Communication Board.

A 24-hour watch for subversive and other pertinent radio propaganda from abroad is being set up at primary monitoring stations strategically located throughout the United States and its possessions.

A picked force of 350 technicians, translators, clerks, propaganda analysts and other experts will work in eight-hour shifts to keep abreast of all overseas emissions which may involve propaganda intended for persons in this country or neighboring countries. Such continuous listening is necessitated by the difference in time and propagation characteristics of international broadcasts. The listeners and analysts will pay particular attention to voice broadcasts, including newscasts, speeches, announcements and playlets, as well as some musical programs.

After being recorded in the field, all this material will be coordinated and studied at Washington. The extent of the work involved is indicated by the fact that it requires an average of seven hours of translation and transcription to fully process one hour of recorded material. It will be necessary to record and analyze matter of which 75 per cent will be in languages other than English.

This necessary step to deal with vital national defense problems developed by radio is taken on recommendation of the Defense Communications Board, as approved by the President and the Bureau of the Budget. It has a high degree of cooperation from other Government agencies, who want to be correctly informed on the extent and character of foreign broadcasts reaching this country. Broadcasters and private propaganda analysis organizations are cooperating in this patriotic endeavor to keep the Government fully informed on the situation in the air.

* * *

Growth of Newspaper Requests for "FM" Facilities Prompts Inquiry Into Effect of Such Press Control.

IN view of the increasing number of applications by newspapers to operate radio stations in the new high frequency (FM) broadcast service, the Federal Communications Commission ordered public hearings and an investigation to determine what policy or rules, if any, should be promulgated.

Through such hearings and investigation, the Commission will seek to obtain full and complete information for its guidance in passing upon applications for high frequency broadcast stations (FM) and for future acquisition of standard broadcast stations by newspapers. Hearings will be conducted with the objective of determining whether or not joint control of newspapers and radio broadcasting stations tends to result in an impairment of radio service under the standard of "public interest, convenience and necessity." The hearings to be held on this issue will be of a broad, public character open to all applicants, prospective applicants, grantees, existing licensees, representatives of trade groups affected, and such other witnesses as the Commission may wish to call.

The question of newspaper ownership of radio stations has long been debated before the Commission and elsewhere and has been an issue in a number of specific cases presented to the Commission. The Commission has in the past denied licenses to newspapers where there was a well qualified applicant asking for the same facilities. In one case, for example—at Port Huron, Michigan—the Commission favored a non-newspaper applicant for a radio station because it would afford the community "a medium for the dissemination of news and information to the public which will be independent of and afford a degree of competition to other such media in the area."

In undertaking public hearings, the Commission does not imply that it is opposed to newspaper ownership of radio stations in general or in any particular situation. The purpose of the hearings and the investigation is to obtain for the Commission sufficient information so that it will have a rational basis for the determination of future cases.

Cathode-Modulated 'Phone With Eimac 75T Triodes

Cathode Modulation is becoming increasingly popular, particularly among those who desire to convert a high-power c.w. transmitter for voice operation. This manuscript by our Technical Editor, who is responsible for cathode modulation as we know it today, tells how to build a combination high-power c.w. and medium-power voice transmitter with 75T r-f amplifier and 6L6 modulator.

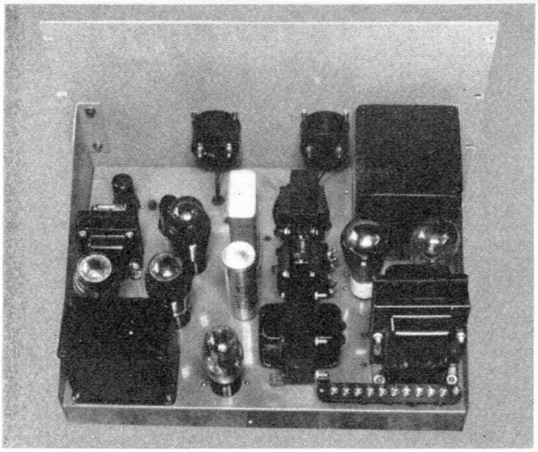
By Frank C. Jones, Technical Editor

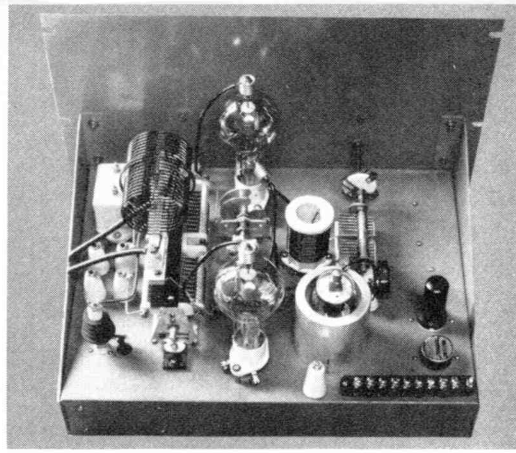
CATHODE modulation can be applied economically to a c.w. transmitter of any given power input. It is not necessary to increase the air-gap in the plate tuning condenser, and a pair of 6L6G tubes in the modulator will supply ample audio power to cathode modulate an r-f amplifier with power inputs as high as 250 watts. The 6L6Gs can be connected in class-AB_2, or in class-B as triodes with the screen and input grids tied together. The modulator of transmitter illustrated in the photographs was originally planned to operate with triode-connected tubes from another 6L6G driver stage, but the problem of voltage regulation necessitated a modified form of class-AB_2 amplification. The heavy-duty 600-volt supply for connection to the crystal oscillator, 807 buffer and audio system would not permit the addition of a pure class-B modulator without encounterinig difficulty from voltage regulation in the exciter circuit. With a separate power supply for the crystal oscillator and buffer stage, on the other hand, the triode-connected 6L6 tubes will easily supply 50 watts of audio power when connected to a 600-volt source. This condition is for zero-bias operation of the modulator, a no-signal plate current of approximately 20-ma. and a full-signal plate current of approximately 150-ma. Variation of d.c. plate current caused trouble in the r-f exciter when the latter was connected to the same 600-volt source. It was very difficult to obtain upward modulation of antenna current under these conditions, since the r-f grid driving power in the final amplifier is slightly reduced during modulation because of the drop in d.c. plate supply to the 807 tube. It was then found that the 6L6G tubes could be operated with cathode bias in tetrode connection from a common 600-volt power supply with relatively small change in d.c. plate current during modulation, and a common 600-volt supply for the r-f exciter and complete audio channel was then made possible.

The r-f portion of the transmitter is built on a standard 13-× 17-× 2-in. chassis with a 6F6 pentode crystal oscillator driving an 807 buffer or doubler. The latter is shunt-fed in order to utilize a split-grid circuit in the final r-f amplifier. The combination of plate r-f choke in this stage, together with the 807 shunt-fed r-f choke, caused a low-frequency parasitic oscillation during peaks of modulation. The difficulty was cured by connecting an additional 30-mh. r-f plate choke to the 807 plate choke. This added inductance prevented the 75T stage from acting as a low-frequency tuned-grid-tuned-plate oscillator. No difficulty was encountered from UHF parasitics in this particular final amplifier design, and a slight tendency for a parasitic in the 807 stage was eliminated by connecting a 50-ohm, 1-watt resistor in series with the input grid lead at the tube socket.

The plate circuit of the crystal oscillator consists of a 200$\mu\mu$f. midget tuning condenser which covers the 80- and 160-meter bands with a single small plug-in coil mounted on the under-side of the chassis.

The 807 bias circuits were chosen so as to give efficient operation as a doubler, but with a sacrifice in r-f output when used as a straight amplifier, with the result that the output is nearly uniform for both types of operation. The negative side of the C-bias supply for the final amplifier must be connected to the grid return lead of the 75Ts, and the positive side to a tap on the output



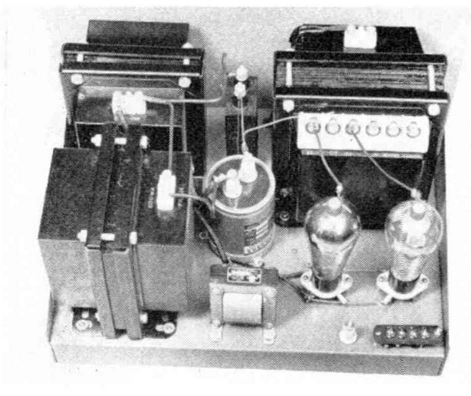


Only two chasses are required for the exciter, final r-f amplifier, speech channel and its power supply. The illustrations show the principal components for a compact medium-power cathode-modulated transmitter, described in the text.

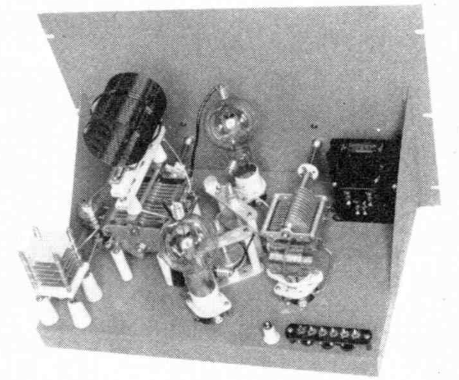
winding of the modulation transformer. This connection is necessary in order to prevent excessive grid modulation in the 75Ts. The amount of audio power should be approrimately 20 per cent of the d.c. power input to the final r-f amplifier, and this requires that the grid return circuit be tapped near the center of the output transformer for low-μ tubes, and fairly close to the filament center-tap side for high-μ tubes. The same C-bias supply is used to bias the 807 stage through an R/C filter in order to reduce the d.c. bias voltage and to remove the audio-frequency component present in the C-bias supply circuit. The C-bias on the final r-f amplifier is reduced to some value less than twice cut-off for c.w. operation by opening a switch which automatically connects a 3,000-ohm resistor in series with the positive lead of the rectifier circuit. For cathode modulation it is desirable to have from two to three times cut-off bias for the modulated stage. Fixed C-bias supply on the buffer and final amplifier permits the crystal oscillator to be keyed for c.w. operation.

A universal type of antenna coupling circuit with split-stator tuning condenser and tapped coil is built into the transmitter. The condenser and coil can be connected in a number of combinations with flexible leads and clips; the tuning condenser sections can be operated in parallel or series, either across the coil or in series with it. The antenna coil is link-coupled to the final tank inductor. This form of universal antenna unit is ideal for connection to an end-fed or single-wire antenna, also to 600-ohm non-resonant feeders, or to a Zepp-fed antenna. The additional tuned circuit is a distinct aid for suppressing harmonics.

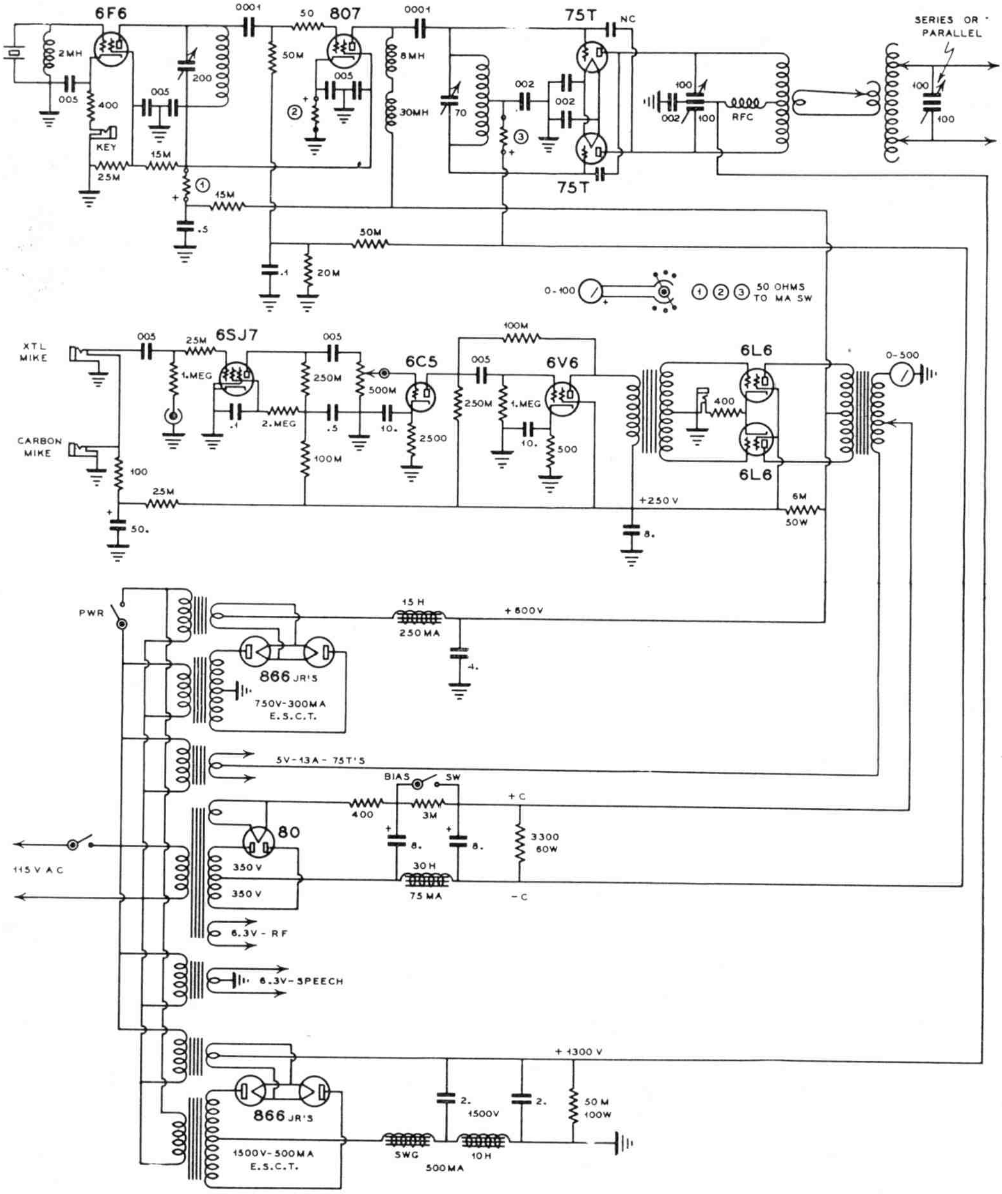
The audio system is arranged for connection to either a crystal microphone or low-level carbon microphone by means of two input jacks in the grid circuit of the 6SJ7



Power supply and filter for final r-f amplifier stage.



Another 75T r-f amplifier for a cathode-modulated transmitter previously built.



Schematic wiring diagram of 250-watt cathode-modulated 'phone and 500-watt c.w. transmitter.

speech amplifier circuit. When a crystal microphone is plugged into the proper jack, the jack for the carbon microphone is then automatically removed from the circuit. The carbon microphone is connected across a portion of the low-voltage power supply in order to secure a few milliamperes of current to energize the carbon granules. The 6SJ7 is resistance-coupled to a 6C5 triode which, in turn, is resistance-coupled to a 6L6G tetrode driver stage. The latter operates with inverse feed-back in order to lower the plate circuit impedance for operation as a class-B driver. The amount of audio gain with the circuit constants shown is considerably greater than required for close talking, and it will be desirable to reduce the maximum gain by changing the ¼-megohm resistor (from plate of the 6L6G to 6C5 tube) to one of a lower value, such as 100,000 ohms. The 6L6G modulator should operate into a plate-to-plate load of from 8,000 to 10,000 ohms. The cathode impedance of the 75T r-f amplifier is in the vicinity of 5,000 ohms when the plate input is adjusted to some value between 200 and 250 watts. It is desirable to use a heavy duty modulation transformer specifically designed for cathode modulation, since these transformers are usually built with a secondary winding capable of carrying at least 350-ma. of d.c. plate current. With this type of transformer it is not necessary to short-circuit the winding when the input power is increased for high power c.w. operation. It is quite possible to operate the 75T stage with plate current of more than 400-ma. for c.w. without damage to the tubes.

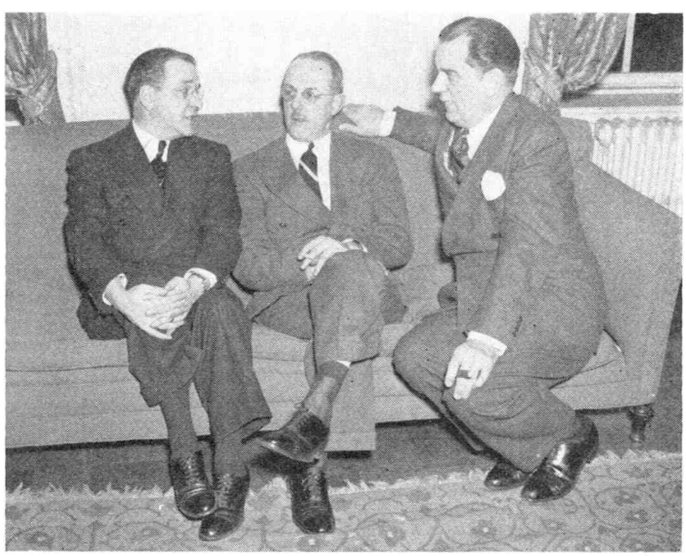
The 807 plate circuit, or 75T grid circuit, should be slightly detuned to the high-capacity side of resonance for 'phone operation in order to reduce the grid current to approximately 10- or 12-ma. The C-bias voltage can be reduced, and the 807 circuit tuned for maximum grid current of 30-to 40-ma. into the 75Ts for c.w.

Typical current readings are 25-ma. to the 6F6 oscillator and 807 screen combination, 50- to 60-ma. for the 807 cathode circuit, 10-ma. of grid current and 200-ma. of plate current in the 75T stage for 'phone operation, and 35-ma. of grid current and 400-ma. of plate current for c.w. service.

The plate current for 'phone operation is usually limited by the permissible plate dissipation, and this is always greater than for c.w. since the tubes operate at a lower value of efficiency. The plate circuit efficiency ranges from 50 to 60 per cent for 'phone operation, due to the lower value of grid drive, as compared to efficiencies of from 70 to 80 per cent for c.w. The same degree of antenna coupling is satisfactory for both c.w. and 'phone, and is approximately that value which delivers maximum r-f output into the anteenna system.

The taps on the cathode modulation transformer can be arranged so as to transform the 4,000- to 5,000-ohm secondary load up to approximately 10,000 ohms for the modulator tubes. The grid-bias return tap into the secondary winding is best located with the aid of an oscilloscope and carrier-shift indicator.

Over thirty members of the Chicago Chapter of the Veteran Wireless Operators Association attended a dinner at the Lake Shore Athletic Club in that city to discuss their part in national defense and to further the progress of the Chapter. The retiring chairman, George I. Martin of R.C.A. Institute, presented a life membership certificate to the new chairman, W. J. Halligan, President of the Hallicrafters Company. Plans were formulated for future meetings to be held at regular intervals.



W. J. Halligan George I. Martin Wm. Dornfield

How To Be Happy Tho Married To A "Ham"

★

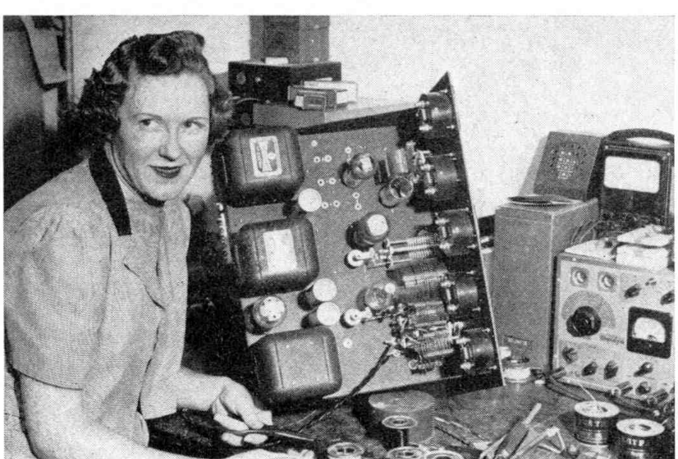
Milton R. Winsby, W6SSN, and his good YF, Betty J., are a pair of dyed-in-the-wool radio amateurs. "Milt" has a de-luxe transmitter — so Betty decided to build one, too. Milt is a licensed amateur, so Betty will soon have a license of her own. There's nothing in amateur radio the OM can do that his wife can't duplicate. Read the story and be convinced.

As Related to the Editors by W6SSN

ABOUT a year ago W6SSN completed a high-power 'phone and c.w. transmitter. A beautiful job it is. You saw it pictured in an earlier issue of this magazine. Milt's wife, Betty, does not envy her OM for his accomplishment; she decided to build a station of her own.

Betty is Secretary to the Director of Vocational Education for the Alameda, California, Public Schools. In order to see a project through to its satisfactory conclusion, she realizes that one must first gain a thorough knowledge of the how and why of the undertaking. And when she decided to go in for amateur radio she first made a thorough study of electrical and radio fundamentals in order to make certain that she would know what made the wheels go 'round. Her ambition was the construction of a modern amateur transmitter, the likes of which would be the pride and joy of any radio amateur. Milt agreed to tutor her in the subject of radio. He explained the intricacies of the vacuum tube, for example, by showing Betty what's inside a tube. Diodes, triodes, pentodes, and all other types of tubes were taken apart, element by element, and the functions of each explained. Thus Betty could literally see what took place when a tube was put into operation. Transformers, chokes, resistors, microphones, and all kinds of small parts were likewise dismantled and their functions explained in understandable terms. Not until Betty knew how these parts performed in a radio circuit did she attempt to construct her amateur transmitter.

The crystal oscillator was built first. It was wired from a rough sketch, then given a thorough test. Milt stood by and explained the process of oscillation, regeneration, crystal r-f current and all other functions of the oscillator circuit in order to make sure that when Betty takes her amateur examination she will know what she is talking about. Few amateurs have had a better un-

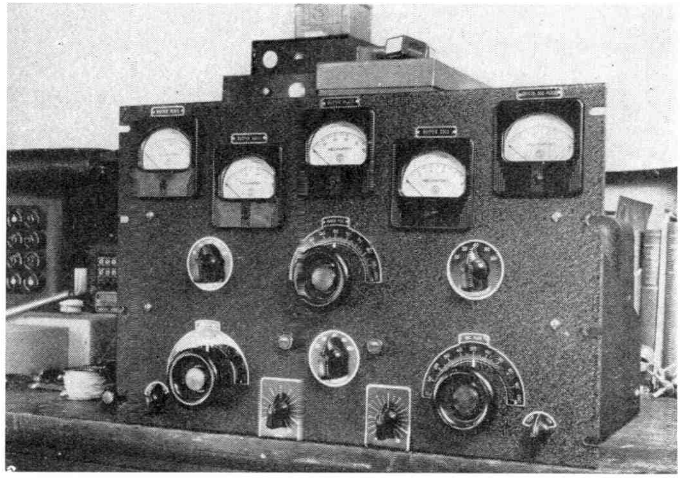


★

Betty Winsby at work on the exciter stage of her transmitter. Her biggest thrill came when the oscillator was put through its initial tests. "She would tune and re-tune the stage by the hour," the OM relates, "and the sharp, sudden dip of oscillator current held great fascination for her."

★

Here's a front view of the YL-made exciter unit, every bit of the work—with the exception of cutting the large meter holes through the metal panels — is by Betty herself: She can twirl a mean hand-drill and solder connections like a veteran hamateur, but her strength gave out when it came to the meter holes. No need to apologize, Betty, we can't do better ourselves.



derstanding of technical radio than Betty; both she and Milt are proud—and rightfully so—of their accomplishments.

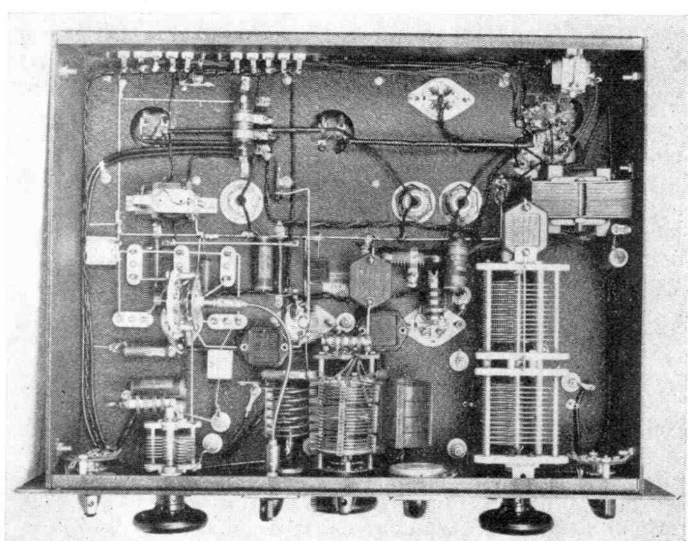
After a circuit had been mastered technically, the next step was the mechanical construction. There are no rats' nests in Betty's transmitter. True, her first attempt was not altogther a masterpiece of assembly and wiring, but she stayed with it—re-wiring some of the circuits as many as three times, until every wire was neatly put into position. The photographs speak for themselves.

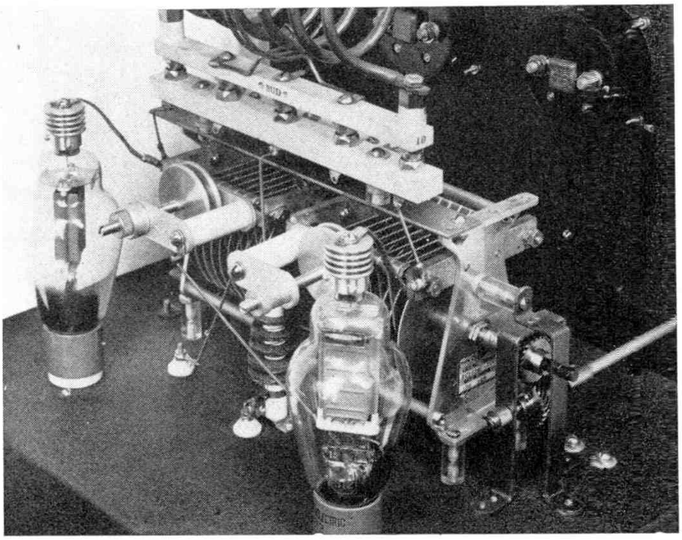
She spent about a year of her spare time on the construction of her transmitter. All of the small holes in the chassis were drilled or punched without help from Milt. The OM cut the large meter holes in the panels—and nothing else. Betty's knowledge of amateur transmitter construction was gained in part from pictures in radio magazines and books. She would lay-out the complete chassis and then consult with Milt for further opinions. But Milt could suggest no improvement, and the transmitter in its final form, as depicted in the photographs, is her own interpretation of what a business-like amateur set should look like.

Betty is a very modest young lady; we couldn't get her to elaborate on her achievements But from Milt we learned that she had broken all of her finger nails while building the transmitter (even as you and I), that she had several times grabbed hold of the hot end of the soldering-iron (even as

★

Crawling into the large metal cabinet which houses Betty's transmitter we took a shot of the under-side of the exciter deck. Few amateur transmitters can boast of neater workmanship. All bus wires and other connecting leads had to be made "just so," and some of the wiring was replaced three and more times before it suited Betty's fancy.





★

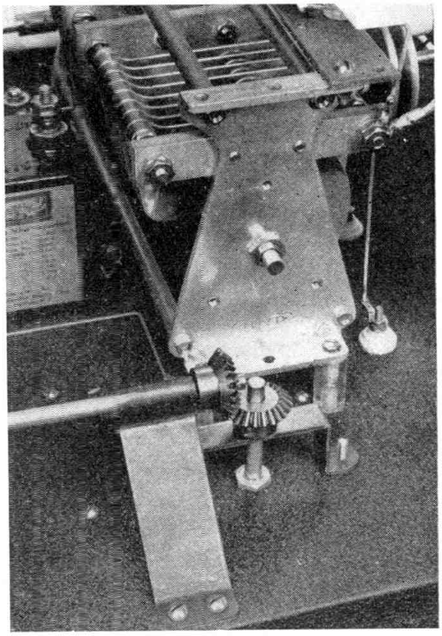
Betty's final r-f amplifier is beautifully constructed. Note particularly the right-angle gear drive for rotating the plate tuning condenser, and observe the neat arrangement of mounting the neutralizing capacitors.

you and I), that she had been a steady customer of the corner drug store—buying "new-skin," bandages, and cleaning fluids (even as you and I), and that she got her fingers mixed-up with the r-f and B plus just as often as any other amateur.

In Betty's transmitter are some refinements not found in the OM's transmitter. For instance, she learned from the good books that meters should be by-passed for r-f—and so she installed the condensers. Later she advised Milt to do likewise, but he blushingly admits he hasn't gotten to it yet. To cap the climax, Betty's transmitter is working magnificently, while in Milt's transmitter one of the transformers decided to have a smoke. Soon it smoked itself out, and everything else with it. So Milt persuaded Betty to loan him one of the transformers from her transmiter while his "pig" was being repaired.

It pleased us very much to learn that she had mastered the boresome subject of parasitics from information published recently in this magazine. She can neutralize her final amplifier "right on the schnozzle," and she knows just where to look for trouble when anything goes wrong. A great thrill was experienced when the final stage was connected to a dummy lamp load. The glow in the lamp was none the less for the glow in Betty's eyes.

The transmitter is housed in a large streamlined metal cabinet. Safety features are used throughout. Relays are placed where needed, and there isn't a piece of haywire or a haphazard bit of construction in any part of the transmitter. Betty has become proficient in the handling of tools, and she experienced no difficulty punching-out the socket holes in the chasses. You'll hear this transmitter on the air very soon—just as soon as she is able to copy the code a bit faster than is normally required for a li-



Close-up of the right-angle drive for rotating the plate tuning condenser. This arrangement makes for perfect symmetry of tuning controls on the front of the panel.

cense. She can put down 13-wpm right now, but she wants to do even better—not satisfied with merely "getting by."

The line-up in the transmitter is a 6V6 oscillator, into a 6L6, into an 809, then into a pair of 812s in the final r-f stage. A conventional speech channel drives a pair of 811s in the modulator. The input to the r-f amplifier is just under 500 watts for c.w. and approximately 400 watts for 'phone operation.

Like all other amateurs, Betty is not satisfied with her original design. She is already laying plans for re-building the transmitter so that a pair of 35Ts can be substituted in the final stage.

Her great ambition is her first contact on the air as a licensed amateur—and she insists that this inaugural QSO be with Ella Christensen, K6ROJ, on the Island of Hawaii. Betty is a booster for our Amateur Radio Defense Association. She realizes that the day may come when all of the men of amateur radio may be asked to serve Uncle Sam. If she can then do her part to help keep open the channels of communication, she feels she will have been amply rewarded for the interest she has taken in amateur radio.

Now a few words about Milt, the OM. He's mighty proud of Betty's achievements, and he has thoroughly enjoyed coaching her in the technique of radio. Milt and Betty are now drawing plans for a new home with lots of space for radio rooms. There will be antenna towers and rotary beams, and the antenna elements will be adjustable from the ground by means of ropes and pulleys fitted to the movable members. The Winsby folks have invested a lot of money in amateur radio; their expenditure to date is $3,200.00. Milt has built numerous transmitters for other amateurs in his immediate vicinity, and his reserve stock of radio parts looks like a branch department of a radio store. He has just completed a beautiful emergency transmitter for defense service, and it will be described in these pages next month. He is laying plans for the kind of a station most useful for total participation in our A.R.D.A. program, and he will have in his possession all of the equipment needed for a thorough job. He already has a complete recording outfit, amplifiers of varied and sundry kind, and almost everything else an amateur could want or need, including an amateur-minded wife. Those of us not quite so fortunate should lay this copy of A.R.D. under the wife's breakfast plate—and await the results (if any).

Amateur Radio Committee of the Defense Communications Board

THE above-named committee has been appointed at Washington, D. C., to study the facilities of amateur radio, to recommend precautions in their operation, and to suggest their allocation to meet Army and Navy requirements under various emergency conditions arising with respect to the national defense. Its functions, like those of the Board's ten other sub-committees, are purely of an advisory nature, and it has "no power to make final disposition of any matter presented to them by the Board for study." The Board's findings and recommendations are to be based upon the advice given by its committees and by "such representatives of other government agencies and of the civilian communication industry" as may be consulted, "to the end that the needs of all may be considered and provided for insofar as the situation permits." The findings and recommendations "shall be submitted to the President for final action through one of his administrative assistants."

The preceding excerpts from President Roosevelt's Executive Order creating the Board under the Communications Act of 1934 plainly state that the Board is not a Star Chamber which meets behind closed doors. Its recommendations must be predicated on the needs of all, and it has no power to enforce them. As these are essentially the principles proposed by the Amateur Radio Defense Association prior to the President's order, the Association is in enthusiastic accord with the Board, not only in words but by deeds.

The successful A.R.D.A. performance at Seattle, as reported elsewhere in these columns, may be cited as an example of what can be accomplished by pre-trained men who are working for the national defense rather than for personal glory. This is the finest form of cooperation with the Board, for actual deeds mean more than can any mere words.

F. D. Wells of the Technical Staff of "Amateur Radio Defense," puts his new Harmonic Oscillator through a series of tests. His latest engineering contribution is a scoop of the first order.

At Last! -- a harmonic oscillator that requires no regeneration -- will not self-oscillate -- and operates with almost any type of crystal. A boon to the amateur.

★

How often have you wanted a crystal oscillator-doubler which will not "take off", with consequent out-of-band operation, and which can be tuned to the fundamental frequency of the crystal without fear of damaging the quartz plate? Here is the answer to your problem.

★

*By F. D. Wells, W6QUC**

THE harmonic oscillator has an inherent tendency to produce excessive crystal current because regeneration is introduced to keep the crystal in oscillation. Regeneration must obviously be controlled—usually with a padder condenser—and if it is not held to a safe level there is danger of injury to the quartz crystal. On the other hand, if a 60-ma. pilot lamp is inserted in series with the crystal as recommended by the designers of harmonic oscillators, a precau-

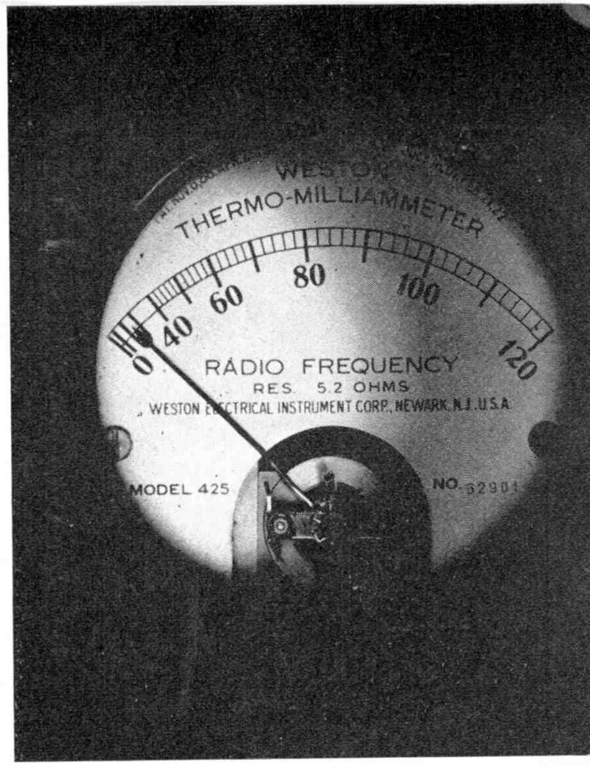
**Engineer, Technical Radio, Inc.*

tion too often ignored by the experimenter, the only serious mishap would be a burnt-out inexpensive lamp.

The harmonic output from an oscillator is determined largely by the amount of regeneration that can be tolerated before the crystal loses control of the output frequency. If the oscillator circuit is quite heavily loaded, the regeneration can be increased still further without danger of self-oscillation. Once adjusted to this point, maximum drive is delivered to the succeeding stage of a transmitter circuit and it can be seen that a somewhat delicate balance will then exist between regeneration and loading. If this balance is upset the circuit will become a self-excited oscillator. Precarious adjustments of this order are not necessary, and if the regeneration remains within reasonable bounds the harmonic oscillator becomes a very stable performer. The urge to increase the regeneration is directly proportional to the inactivity of the crystal. From the foregoing it is evident that if regeneration can be obviated there would be no further danger of self-oscillation. In the hope of achieving this objective, experiments were conducted with conventional tubes of the 6V6 and 6L6 types. The aim was to operate the first three elements (cathode, control-grid and screen) as a *Pierce Oscillator*, with the harmonic output extracted from the plate circuit by means of a tuned tank. The results of the tests proved that no combination of circuit constants would produce crystal oscillation, and it is not known if other designers have had greater success.

With the advent of the comparatively-new 6AG7 pentode, which has been generally ignored for r-f service, a new and better type of harmonic oscillator has been developed.

The 6AG7 is a metal tube designed for video circuits as a power amplifier. With 250 volts on the plate, 140 volts on the screen and 2 volts of negative bias, it is possible to produce a peak swing of 70 volts across



Figures don't lie. The r-f thermo-milliammeter indicates the low value of crystal r-f current in the new Wells Oscillator. Many crystal cuts were tried in this new circuit; all gave satisfactory performance—even the low-cost variety.

a 1,700-ohm resistor in the plate circuit. Since the bias voltage is low, a very minor grid swing will produce relatively large output. For class-C r-f operation the same reasoning will apply, and very little bias is needed; the driving requirements are likewise modest. As a harmonic oscillator the 6AG7 surpasses any other tube for the *Jones* circuits, principally because so little regeneration is required. On the other hand, this tube has made possible the design of a new oscillator circuit which should meet with wide acceptance among experimenters. The tube pin connections are unlike those of the

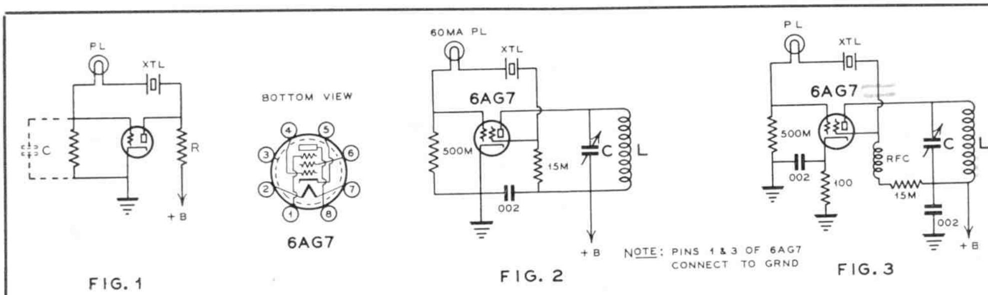
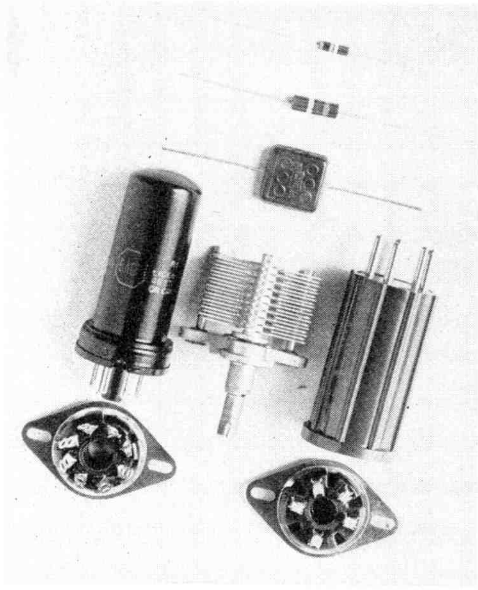


Fig. 1—Typical Pierce Oscillator. Fig. 2—Simplified Harmonic Oscillator.
Fig. 3—Harmonic Oscillator with cathode bias and r-f choke in screen circuit.



Here are the components (crystal excepted) for the new Wells Oscillator. No simpler ocsillator assembly has ever been devised.

more conventional oscillator tubes and care must therefore be taken to correctly rewire the socket if operation in a *Jones* oscillator is desired.

In the newer circuit under discussion, the reader will recognize Fig. 1 as a standard *Pierce Oscillator*. A quick glance at the harmonic oscillator, Fig. 2, reveals that the first three elements of the 6AG7 are connected precisely as in a standard *Pierce* circuit. The conventional small by-pass across the grid resistor (shown dotted in Fig. 1) is not required in the new circuit.

Since all oscillators are rich in harmonic content, it is merely necessary to select the desired harmonic by tuning the plate circuit. Regardless of plate tuning, *and whether the plate is connected into the circuit or not*, the crystal will oscillate freely in its independent circuit. It can readily be seen that the frequency control, or any oscillation whatsoever, is dependent upon the crystal itself. The circuit will *not* oscillate if the crystal is removed. Extensive tests have proved that there is no appreciable crystal r-f current, yet it is conceivable that the placement of parts could be such that crystal r-f current may result. In view of this vague possibility, and in the interests of good circuit practice, a 60-ma. pilot lamp should always be connected in series with the crystal.

In addition to the elimination of regeneration in this new circuit, the number of components has been reduced to a minimum. See Fig. 2. The grid resistor is rated at ½-watt; the screen resistor 1-watt.

Greater output can be obtained if an r-f choke is connected in series with the screen resistor. Another refinement is a cathode resistor and by-pass condenser to prevent excessive tube dissipation when the crystal is removed from its socket. There are many who prefer operation of circuits without *B* voltage on the quartz crystal plate, and for this reason an isolating by-pass is inserted between crystal and screen. The recommended circuit with these additions is diagrammed in Fig. 3, although Fig. 2 is entirely satisfactory if extreme economy is demanded.

The screen of the 6AG7 is not by-passed to ground because it serves as the plate in the *Pierce* circuit portion of the oscillator. The no. 1 and no. 2 pins of the tube are grounded, thereby grounding the shell of the tube, internal shield, and suppressor-grid.

Typical operation of the oscillator tube calls for 300 volts on the plate and approximately 200 volts on the screen. The screen voltage can not be measured readily because of the presence of r-f. The meter leads will either stop or hinder oscillation of the crystal, and as a consequence the screen reading will be erroneous. Normal cathode current under operation is approxnmately 30-ma. The outuut is comparable to that of other harmonic oscillator circuits.

This oscillator will double, triple and quadruple, although the output decreases as the harmonic order increasees. As a doubler, the circuit delivers ample output to drive a 6L6 or 807 in a succeeding doubler stage.

The oscillator is tuned by observing maximum grid current in the following stage, or a preliminary check of the circuit can be made by coupling a pilot lamp and loop of wire to the plate tank. A meter in the cathode circuit of the oscillator will not give an indication of resonance, yet a slight flicker can be noted when the plate condenser is tuned through the resonance point.

The screen can be keyed for c.w. operation, with a keying relay at the point where the screen resistor connects to the positive B supply.

One of the good features of this new oscillator is its ability to operate on the fundamental frequency of the crystal without noticeable crystal r-f current inherent in the circuit.

The author solicits correspondence from readers who build this oscillator.

Preparation For ★ ★ ★ Commercial Operator Licenses

The author of this manuscript is well known to the radio fraternity as the publisher of a book entitled "RADIO OPERATOR'S LICENSE GUIDE". He knows his commercial radio thoroughly, and you can profit from the advice he gives . . . particularly if you are a radio amateur seeking employment in the commercial field.

*By Wayne Miller**

WITH the present world upheaval it is mandatory that each and every one of us exert our every effort towards doing our bit to help keep America free from the results of world conquest. Towards this goal I am willing and anxious to contribute my efforts in behalf of the thousands of radio amateurs who will contribute so greatly by fitting themselves for commercial grade operator licenses and thereby take their rightful places in the communication systems.

Having spent the greater portion of fourteen years of extensive experience within the communications industry as an instructor in accredited radio schools I believe I am in a position to clarify and explain the means and methods of attaining proficiency as a radio operator and obtaining the various grades of commercial radio operator licenses.

Based on actual observation of amateurs and former amateurs in various technical schools throughout the country I have arrived at the definite conclusion that an amateur invariably developes into a good commercial operator. Fundamentally this is a sound assumption since an amateur is by choice and not of necessity interested in radio, and through this interest applies himself to a course of study with far greater zeal and effort than a newcomer whose interest is solely directed towards the monetary considerations a professional career offers.

I have found radio amateurs of two separate and distinct types, the traffic handler and the 'phone enthusiast. Sub-divided among the types are the experimenters, the hobbyists and the pure and simple "piddlers." Without reservation each of the various types of amateurs has a certain degree of respect and admiration for the commercial radio operators, whose accomplishments they consider as surpassing their own.* This respect and admiration is not wholly justifiable, as we shall see, and leads to a feeling of inferiority of their commercial brethren in whose footsteps they fear to tread. True, a great number of commercial operators are former amateurs; it is my opinion, however, that the rank and file of amateurs consider the attainment of a "commercial ticket" beyond their capabilities. The feeling of inferiority is directly traceable to two distinct causes, first and foremost being the lack of readily available information as to who and what is a commercial operator. Amateurs in general seem to have the impression that a commercial operator is a wizard of the air waves, possessing a high degree of training and familiarity with commercial-type manufactured equipment. This impression is definitely in error since I have found innumerable commercial operators whose knowledge of radio is so far surpassed by the slightly better than average amateur that the comparison is absurd. Many of the countless thousands of commercial operators who obtained their licenses in the "back when" days haven't the slightest conception of what's going on in radio or of the recent advances in the art. The second and minor cause for a feeling of inferiority is directly traceable to the commercial operators themselves, especially the "sees-all, knows-all" type who frowns with scorn upon the deeds and accomplishments of the amateurs. In such operators the graduation from amateur to commercial status leaves a mark that cannot be erased. Instead of lending a help-

**The Engineering Building, Chicago, Illinois.*

ing hand toward his amateur brethren he is more concerned in making himself appear as standing on a pedestal upon whose pinnacle an amateur can never tread.

Few amateurs realize the ease with which a commercial operator's license may be obtained. Not that I am attempting to create the impression that the examinations are easy; they are not. However, it isn't necessary to expend countless time, energy and dollars in search of the elusive information that eventually "lands" the 'large size' wallpaper." The information is available to everyone and at a very low cost. There are no secret formulae nor evasive questions. The Federal Communications Commission is not concerned with where you obtained the information nor what it cost you, they are only concerned with whether or not you are an operator, and if so, how good an operator.

Time was when the examinations were strictly commercial in character, the theme of their entire context being stressed upon requiring an actual knowledge of commercial equipment and installations. To cite examples, applicants were required to draw, circuit for circuit, actual commercial installations and designate the type. In these diagrams the applicants were required to draw actual connections of existing installations, and, in numerous occasions, draw a particular type or model of set. All this has been changed, and for the better. The new examinations require a knowledge of radio, not a knowledge of trade names and symbols. This change in the system of issuing and grading a radio operator's license is a vast improvement over the older systems of the Department of Commerce and the Federal Radio Commission, the credit for which goes, and justly so, to the Federal Communications Commission under whose able administration the radio facilities of the Nation have been so vastly improved. The Commission has weeded out the undesirable characteristics of the older systems and has substituted a new order, which tests with a greater degree of accuracy the ability of an applicant to hold a license and operate equipment.

Commercial operator licenses are now divided into two fundamental types, the radiotelegraph and the radiotelephone classes. Each of the two has been further sub-divided into three distinct grades, ranging from the Restricted Permit grade requiring a minimum of knowledge and ability to the uppermost grade requiring considerable skill and proficiency. The credits for the higher grades of licenses have been made accumulative, i.e., the holder of a lower grade need only take an examination of greater scope in order to obtain a higher grade of license. This sub-division of grades creates a degree of enthusiasm towards the attainment of a higher grade of license that is overwhelming in its effects. There is no more of the old and time worn procedure of repeating the entire examination when a raise of grade is contemplated; instead, the applicant submits his existing license for examination and recording and takes only such sections of the examinations as are required in order to raise the grade. The time and effort required in taking the examination has been further reduced by the application of the true-false and answer-elimination type of question which provides a greater degree of accuracy in grading the examinations and eliminates the possibility of failure because of the incorrect interpretation of the applicant's answers.

The commercial operator license examinations have now been divided into six parts or elements and the various grades of licenses are interlaced with the elements. The elements are progressive in scope and application, and cover only such legal and technical material as would be encountered in the operation of the various types of stations for which the licenses are applicable. Paraphrased questions comparable to the actual questions of the various elements are available from the *Superintendent of Documents, Government Printing Office, Washing, D. C.*, in a booklet prepared by the Federal Communications Commission entitled *"Study Guide and Reference Material for Commercial Radio Operator Examinations."* The price is fifteen cents; stamps are not acceptable.

A study of radio in preparation for the various commercial grades of operator licenses can be divided into four parts, an outline of the material together with a source of the information of which follows:

1—**Laws, Rules and Regulations**

2—**Theory, radio and electrical**

3—**Motors, generators and batteries**

4—**Commercial equipment and operation**

The Laws, Rules and Regulations are covered in detail by the Study Guide referred to above and by the following publications which are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices indicated. (No stamps.)

a **Communications Act of 1934, Revised to May 20, 1937, price 15 cents.**

b **Part 1 FCC Rules of Practice and Procedure, 10 cents.**

c **Part 2 FCC General Rules and Regulations, 10 cents.**

d **Part 3 FCC Standard and High Fre-**

quency Broadcast Rules & Regulations, 10 cents.

e Part 4 FCC Other than Standard Broadcast Rules & Regulations, 10 cents.

f Part 5 FCC Experimental Service Rules & Regulations, 5 cents.

g Part 6 FCC Fixed Public Radio Service Rules & Regulations, 5 cents.

h Part 7 FCC Coastal & Marine Relay Service Rules & Regulations, 5 cents.

i Part 8 FCC Ship Radio Service Rules & Regulations, 10 cents.

j Part 9 FCC Aviation Radio Service Rules & Regulations, 5 cents.

l Part 11 FCC Miscellaneous Radio Service Rules & Regulations, 5 cents.

m Part 12 FCC Amateur Rules & Regulations, 10 cents.

n Part 13 FCC Commercial Operator Rules & Regulations, 5 cents.

A thorough study of the above mentioned material should prove adequate for any of the various grades of licenses. It is not necessary that the rules be memorized nor written verbatim, it is only necessary that the sum and substance of the law be understood and explained in an understandable manner.

The radio and electrical theory, with the following exceptions, is covered in sufficient detail in amateurs handbooks. A thorough study of this material with particular attention being given measurements and tube operation should prove adequate for any of the various grades of licenses.

While a great deal of material is given in the handbooks with regard to motors, generators and batteries additional study will be necessary. This study can be undertaken either by the purchase of standard texts or by a few hours spent in a public library. The questions are by no means difficult, yet a thorough understanding of the principles involved in the operation of these units is desirable.

Commercial equipment and operation is covered in sufficient detail in the following publications, available at prices stated. The publication "*Radio Direction Finder And Its Application To Navigation*" covers in detail the operation of radio compasses which is required in the various grades of radiotelegraph license examinations, while the publication "*Radio Operators Traffic Manual*" covers the handling of traffic in commercial circuits. These subjects are the only two which are not covered in detail in the handbooks.

For those students desiring a complete study course in one volume I cannot recommend too highly "The Radio Manual" by George E. Sterling. This volume, written by one of the country's foremost engineers, covers the entire subject of radio communication in a thorough and understandable manner.

* * *

Radio Direction Finder And Its Application To Navigation — Bureau of Standards Scientific Paper No. 428—*Superintendent of Documents, Government Printing Office, Washington, D. C., price* 15 *cents.*

Radio Operators Traffic Manual—Radiomarine Corporation of America—75 *Varick Street, New York, New York, price* $1.00.

The Radio Manual—By George E. Sterling, D. Van Nostrand Company, Inc., 250 *Fourth Avenue, New York, New York, price* $6.00.

**This statement is not to be construed as meaning that a commerical operator cannot be an amateur, rather it means that the feeling is manifest among amateurs who are not commercial operators or engineers.*

W7RT Reports Nazi Propaganda Station Operating in Amateur Bands

. . . While QSO W2KYO in Brooklyn, New York, on 7mc. the other evening he told me that he was hearing a BBC broadcast station, and a German broadcast station, R9 right near the middle of the 40 meter amateur band. He had me listen on about 7140kc., and sure enough I could hear a carrier . . . this was the BBC bc station; and about 10 kc. below that was another weaker carrier which he said was the German (propaganda) station. It was an especially good DX nite, because W2KYO was R8-9 here . . . if you want more on this, suggest you write to W2KYO, Brooklyn, N Y., about it, and better verify any statements through him, as he claimed to be getting the broadcasts very FB! (the reception here was around 9 p.m., or so, PST, and could hear the carriers for several hours, with slow signal variations over that time . . . QRM and low signal strength did not permit me to get enough of either station to identify them positively here.)—**W7RT**.

"Desperation Beams"

By Clayton F. Bane, W6WB

The "Desperation Beam" derives its name from an attempt in desperation to shoot a 10-meter signal over the highest hill in San Francisco and into the Hawaiian Islands. A wire-element beam, only six feet above earth ground, and fed with a single-wire feeder, was hurriedly erected by the author — and to his amazement a contact with K6OQM was established after all other types of beam antennas had failed to either transmit a signal to or receive one from the Islands. Clayton F. Bane, in his inimitable manner, tells how you can duplicate his success. Furthermore, he expounds a wealth of information on the correct method of tuning any type of beam array. Here is an antenna article that will prove helpful to every beam twirler.

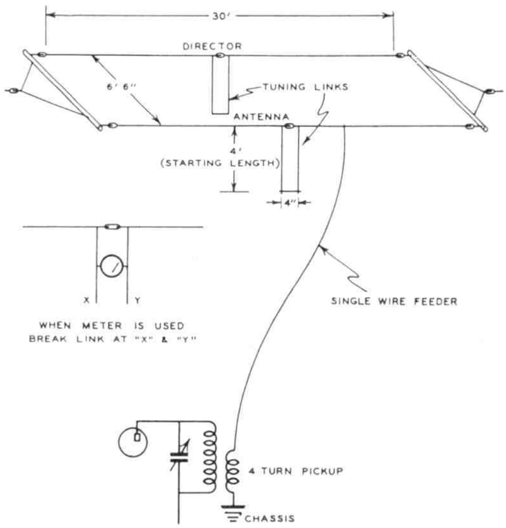
★

To all of us, at one time or another, has come the urge for additional gain from our antenna systems. If you are like the writer, this urge normally comes about the time it starts to get dark, or on Sunday when all stores are closed. It always seems that no materials are ever available to venture into the realm of new and untried antennas, particularly those that have the greatest gain.

On one certain Sunday the writer found himself badly in need of lots of antenna gain. This need arose from the fact that W6QUC was blissfully working K6OQM and try as I could, no sign of K6OQM could be detected, even in one of Mr. Hallicrafter's excellent receivers with all sails flapping. There was only one thing to do—a beam must be erected, and immediately! For the ten-meter band this in itself was encouraging since the length would be short enough to handle easily. Some rapid calculations followed. The wife's broomstick was sacrificed—feeder spacers were cut off the old feed line (a remnant of happier DX days) and we were ready for the experiment. An antenna was measured off, followed by a director. Here the problem of feeding the arrangement arose. Presto—single-wire-feed! The desperation effort was tied to a tree on one end, and to the window on the other. A quick check on the receiver showed K6OQM coming in about R5. Success! This was the first time that K6 signals had even been heard in my location on ten meters—a high hill behind me very effectively kept them away. To cap the climax, directly after hearing the K6 signals we were able to make contact. *The antenna was only 6 feet off the ground and the transmitter power input approximately 30 watts to a doubler.*

We can now detour from the haywire part of the thing and see what this little story means. First of all, there would appear to be excellent possibilities of substantial gain in a two-element beam with conventional wire elements. And likewise it would appear that such a beam could be fed with a single-wire feeder. An analysis of the assumption will reveal some interesting facts.

One of the first considerations in wire-element beams is that there will inevitably be losses due to the dielectric of the insulators and the spacing dowels. When two elements are spaced one-tenth wavelength apart, the center impedance of the antenna element instead of being the mythical 72 ohms drops to a considerably lower value.



Constructional details of the wire-element, two-band, single-wire fed beam antenna.

Conversely, the impedance at the ends of the antenna rises, and so does the voltage at these points. This means that the end voltage will be much higher, and that the losses in dielectrics in the field created by the ends will be greater. The answer is simple: use excellent insulation and keep the physical mass of the dielectric to a minimum. This same treatment applies to the W8JK types of antenna with close-spaced elements. The impedance at the center being greatly reduced (to perhaps 15 oms), the current at the center point will rise rapidly. Knowing this, the resistance at the center must be kept to a very low value, else the I^2R losses will become excessive. This precaution applies particularly when the center of the antenna is broken for a feeder or a small one-foot tuning section. All joints should be very solidly made and soldered.

There is one point in regard to a wire-element beam that must be definitely taken into account if any gain is to be expected. Here again the fact that the elements are close-spaced means that the resonant point will become quite sharp. Another way of stating this is that such an antenna has a high "Q." For reasonable performance it is almost mandatory that the antenna be resonated in some manner to the approximate operating frequency of the transmitter. These antennas with only two elements are not as critical in this regard as antennas having three or four elements, but are nevertheless bad enough to warrant exact tuning. The normal figures for determining the length of a half-wave antenna will hardly suffice. They would be sufficient for determining a preliminary length of wire to put up in the air, but are of little value unless one happens to be fortunate enough to hit the correct figure on the nose by sheer accident. Details of tuning will be given later in this article.

The choice of whether the other parasitically-excited element shall be a director or reflector rests with the individual. From my own standpoint I prefer a director. With a director tuned for maximum forward gain, as is normally desired, the front-to-back ratio is very low and the antenna will work as a half-wave on the opposite side from the director with little loss. The possible gain from a single director approaches 6-db., which is not to be taken lightly. The actual gain from wire-elements will of course be somewhat less than that of a good two-element pipe or rod array.

The director must be actually tuned for maximum gain. Experience has shown that the equations given for predetermining the proper length are of little value. Proximity of the element to building, poles and spacers, as well as other factors, affect the calculated length. Tuning this element is in itself a problem. We have devised a simple method of determining the correct director or reflector length by simply measuring the r-f current in the center of either element.

Writers of antenna material have always advocated a local station for measuring the field-strength by noting the readings on an "R" or "S" meter as the length of the elements is varied. In my own experience this has not always worked out satisfactorily. There is not only the difficulty of keeping in communication with the remote station while you are perhaps fifty feet in the air doing the tuning, but also the fact that the readings sometimes do not hold constant, or give proper increases or decreases. This latter feature may well be explained by the fact that some portion of the antenna feeder system may be radiating to such an extent as to cloud the meter readings at the other end. At best, this practice is difficult and none too satisfactory. It may have occurred to you that a meter in the center of the director (or reflector) could be used—and so it can. However, you *do not* tune for maximum current in these elements. Reasoning will show that if one tunes for maximum current in the parasitic elements, the maximum current will occur when the element is resonant with the antenna, i.e., the same length. Unfortunately this is not the condition for either director or reflector. The director must be shorter than the antenna, and the reflector longer. Obviously, then, maximum current will not be correct. But what ratio of maximum-to-correct-element-current is indicated? We have found by making a number of measurements, and averaging the results, that the director will be tuned for maximum forward gain when the director current is 70 per cent of maximum. In tuning, arrange the director to be long enough to be able to tune to resonance, and then tune for maximum current, observing the exact value as indicated on the meter. Now shorten the length of the director until the current drops off 30 per cent. This should coincide with a director length which will give maximum forward gain. In tuning a reflector, this 30 per cent drop from the maximum or resonant value should be obtained by *lengthening* the reflector. The 30 per cent point gives *minimum* signal to the rear of the reflector. Incidentally, the factors given should apply equally to other types of two- or three-element beams. It does require the use of a thermo-galvanometer or r-f ammeter, but this type of instrument can usually be borrowed if not available.

The wire-element beam can be fed with a single-wire feeder without difficulty. This may appear to be a somewhat radical statement to those who demand a non-radiating feeder, but its very simplicity warrants certain considerations by those whose principal aim is simplicity of installation with a fair amount of gain. It has one definite advantage; it permits operation on a harmonic. Thus the beam described with single-wire feed will work on both 20 and 10, and do a good job on both bands.

Actual placement of the single-wire feeder does not appear to be unduly critical. The normal value of 16 per cent of the total length tapped off-center works nicely.

The only factor that may give rise to difficulty with the single-wire feeder is that its length may approach some even multiple of a half-wave. If this is the case, the feeder is likely to take the load itself and do most, if not all, of the radiating. If the feeder is out in the clear it normally makes a good radiator and is apt to enhance the thought that the system is a beam instead of a simple vertical radiator. The correction is obvious—change the length of the feeder to avoid direct feeder resonance. One of the reasons influencing our choice of a director instead of a reflector was the fact that we realized full well at the start that the feeder would pick-up by itself, and thereby mask the front-to-back ratio.

Summarizing, it can be stated that these simple wire-element beams have considerable merit, and can in fact be erected for some of the lower frequency bands, such as 40 or 80. The use of single-wire feed permits two band operation. A final word on actual tuning should permit duplication of our results.

For 20- and 10-meter operation, follow the drawing of Fig. 1. Note here that both antenna and director are broken in the center with a strain insulator, and a small section is dropped down for insertion of the tuning meter. It is suggested that the siingle-wire feeder be first connected to the director at a point approximately one-third the length of the antenna from one end. Set your transmitter to the middle of the band in which you intend to work, and couple the feeder to the transmitter. This will give you a driver antenna to excite the main antenna for tuning. Open the center link on the main antenna and insert the r-f meter (see Fig. 1-"A"). Move the meter in and out of the center link until a maximum current indication is obtained. This indicates antenna resonance. Now join the link (at the point where the meter showed greatest reading) with a permanent bus. The single-wire feeder should now be connected at the proper point on the antenna just tuned. The feeder so connected should now be coupled to the transmitter at reduced input. Place the meter in the link in the director element and tune for maximum current. Change the position of the meter, remembering that you want to move so that the director is *shorter*, until the reading drops to 70 per cent of its maximum previously-noted value. Join the link at this point with a piece of bus bar and solder. Your antenna system should now be in as close a state of adjustment as it is possible to obtain.

If field-strength measurements are made simultaneously, it will be noted that maximum forward gain occurs when the director current drops off some 30 per cent from its maximum value. (Remember that the director is *shorter* than the antenna. If you go in the wrong direction and make this element *longer* than the antenna, you will have a *reflector*—and minimum back response).

It is to be hoped that this method of procedure will be tried by other antenna experimenters so that reports can be collected to give a drop-from-maximum value in parasitic element current which can be averaged over varying sets of conditions. Such a figure can well be a distinct contribution to the beam-tuning fraternity whose ranks are growing rapidly. The writer has found a 30 per cent drop to be the average over a number of tests made with model beams in the UHF region.

The War—and the Radio Amateur

★

SINCE April 1st amateurs have been paying 10 per cent more for the parts manufactured by one of our largest amateur equipment suppliers. Jobbers received notice of the price boost during the last week of March.

One very large Eastern communication corporation sent its scouts into the field in an attempt to purchase, at retail, every available small variable tuning condenser of a popular amateur type. A West Coast jobber refused to dispose of his stock, preferring to keep a supply of these condensers on hand to meet normal amateur requirements.

Two well-known types of amateur transmitter tubes are no longer being manufactured, due to the defense emergency. Amateurs are cautioned for the last time to lay in a stock of tubes now.

Some of the large Eastern manufacturers engaged in building radio equipment for the Government have been allowed to purchase a small quantity of "tabooed" raw material in order to keep the amateur market supplied with a reasonable amount of gear through the current year. This is another direct hint that no further restrictions are to be placed upon the amateur.

Not all radio manufacturers are busy with defense orders. One large West Coast radio plant is so devoid of contracts that a number of its key men have been laid off.

Business seems to be picking up in radio stores. More and more amateurs are returning to the air, and all of the bands are very much alive.

The FCC has permitted the amateurs to use mobile and potable-moblie equipment during the forthcoming field days, June 7th and 8th. You may operate your rigs from 4:00 p.m. EST June 7, to 6:00 p.m. EST June 8th, 1941. Confirm this by writing the FCC for a copy of ORDER No. 73-D, or can take our word for it and save the Commission a needless amount of work.

Our DX editor received word that several *G* amateurs are on the air, by special permission of the British Government. These amateurs, however, are in the Government service. Does this mean that steps are under way to open the amateur lanes between the Gs and Ws? We are practically allied with Britain now, and some means of reopening our amateur channels between the two countries would have great merit.

Numerous readers have requested us to help bring abount a means whereby amateurs in the U.S.A. can QSO the South Americans . . . if only to enhance our "Good Neighbor" policy. It can't be done. Our "Good Neighbors" include the South American amateurs, of course—but not the host of Nazi agents in those countries—men who would be first to take advantage of such a situation. On the other hand, if the British Government officially permits some of its amateurs to operate their rigs, and knowing these men to be of our own kind, it seems more logical to assume that we should ask for some modification of the W-G restrictions. In the meantime, a lot of us are wondering why we can't do something to get our Canadian friends back on the air—even if only those in the Government service.

The war situation, from the standpoint of the amateur, seems about the same as last month. No change should take place in 1941. It will take time to build the great fleet of merchant ships required to transport our aid to Britain. In the meantime, pay less attention to the war—and more to your amateur radio. The war will go on, and so will the amateur.

A W9, now a commercial operator on one of our merchant ships, tells us that contrary to belief only one U. S. flag vessel has been sunk in World War No. 2. She was the *"City of Rayville,"* sunk in the Straits of Tasmania by a mine sown by a German vessel. Fred Gritsner was the radio operator aboard. Part of the cargo of the ship flying up from the forward hold penetrated the overhead of the radio room. The transmitter was struck by a piece of the flying cargo and the ship went down by the head before it was possible to send a radio call for help.

Current joke of the war revolves around the Fascist restaurant proprietors who were forced to close their doors because the Italians ran out of "grease." If you don't get it, page Mussolini!

DON'T FORGET . . .

The next two issues of A.R.D. (May and June) will be combined into one . . . out on June 1st.

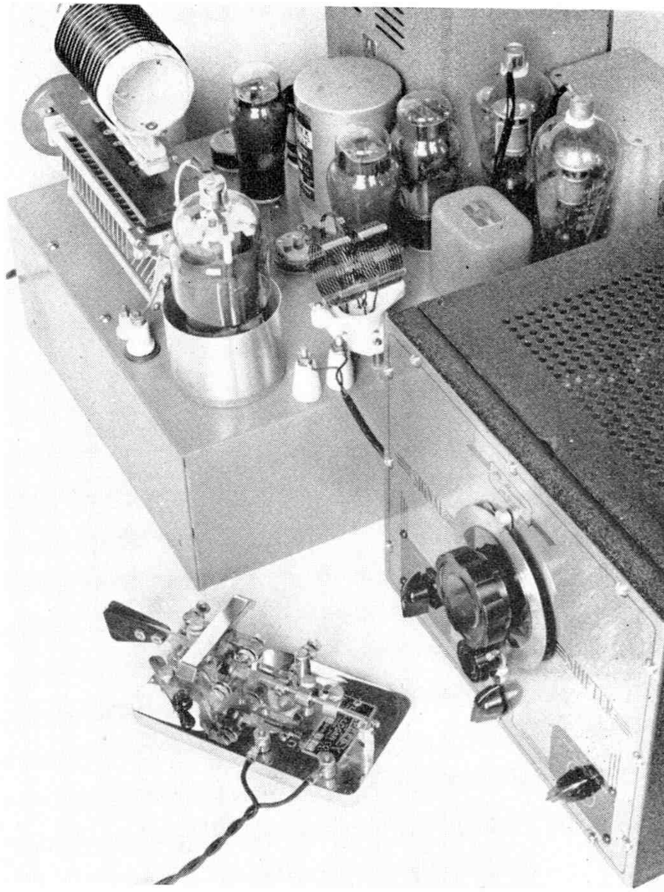
★

813 Beam-Tube Transmitter for Reliable Defense Communication

★

● This is "The Transmitter of the Month", designed by our Technical Staff for the many readers who solicited advice on the proper operation of large beam-power transmitter tubes. Next month a series of article on small beam-tube transmitters begins.

By The Technical Staff



Rear view of the 813 beam tube transmitter and Meissner Signal Shifter. This medium-power compact ensemble can be quickly transported from place to place, and connected to the 110-volt a.c. mains anywhere—or to an auxiliary power plant—in order to establish emergency communication. The output of the transmitter is great enough to insure a powerful signal at the receiving point, a distinct advantage for reliable communication when and where it is needed.

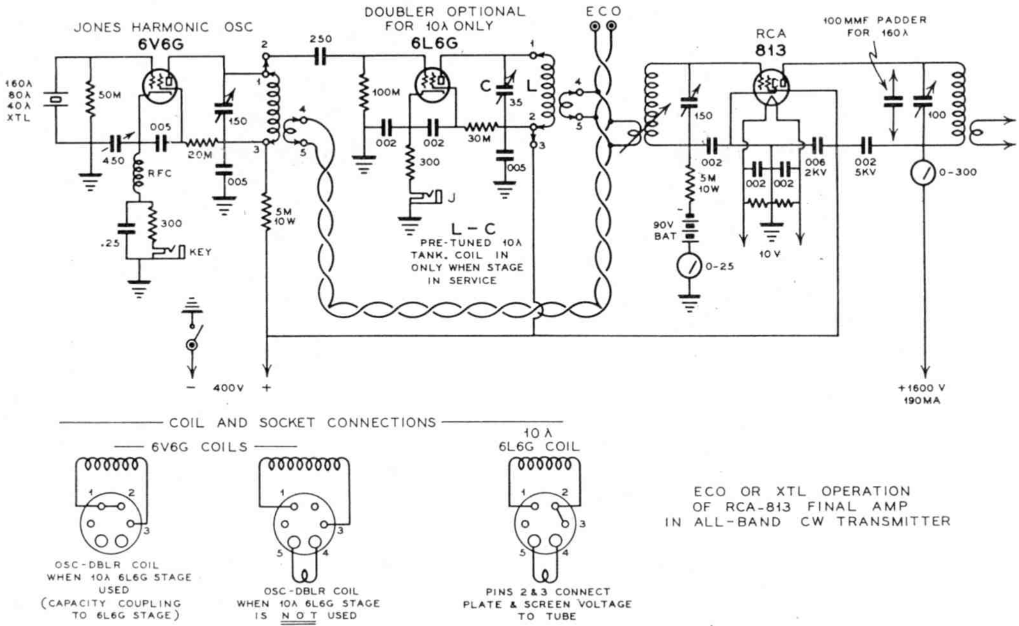
THE photographic illustrations show a versatile c.w. transmitter of medium power output. Although of considerable weight it is nevertheless possible to carry it from place to place with a none too great effort. Thus it can serve adequately for defense communication, and is infinitely more dependable and reliable from the standpoint of sure-fire cross-country communication than smaller c.w. transmitters of lower power. It may be necessary, at some early date, to have on hand just such a transmitter, which can be moved quickly from place to place when the need arises. Although this transmitter operates from the 110-volt a.c. power source only, provision has already been made by many municipalities to provide emergency power from gas-engine plants so that auxiliary transmitters can be put into operation quickly in the event of failure of the established sources of power. A medium power transmitter, therefore, will have a number of distinct advantages in the defense program, especially for operation in central control stations or at the headquarters staff of radio defense units. The transmitter shown in the photographs is very compact. Two power supplies are on a common chassis with the r-f portion and high-voltage supply above the chassis and the low-voltage supply

Looking down on the 813 transmitter, the top portion of the auxiliary fixed-tune tank for 10-meter operation can be plainly seen. This is truly a versatile transmitter. A modulator can be connected to the final r-f amplifier for 'phone operation, if and when desired. Stand-off connectors are seen at the extreme right of the chassis.

below. The high-voltage supply includes an 1,800-volt (each side of c.t.) transformer, 300-ma. choke, 2μf. oil-filled condenser, a pair of 866 rectifier tubes, filament transformer for the rectifiers, 100,000-ohm heavy-duty bleeder, and on-off switches of the conventional type. In order to accommodate the several bulky high-voltage components, a chassis 5-in. deep is required. The high-voltage transformer, rectifier tubes, filament transformer for the rectifiers, and the high-voltage filter condenser are mounted above chassis, as the photograph shows. The filter choke and bleeder resistors are mounted on the under side of the chassis. The metal case must be removed from the choke in order to make room for it—if its physical size is more than 5-in. overall. High-tension wire must be used under the chassis for the high-voltage leads. The low-voltage supply consists of a 450-volt (each side of c.t.) transformer, 5Z3 rectifier, 250-ma. filter choke, 4μf., 1000-volt oil-filled filter condenser, and a bleeder resistor. All except the 5Z3 rectifier tube and its filament transformer are mounted below chassis. The low-voltage supply also delivers screen voltage to the RCA-813 beam-power tube; this is a better method than the conventional series-dropping-resistor connection.

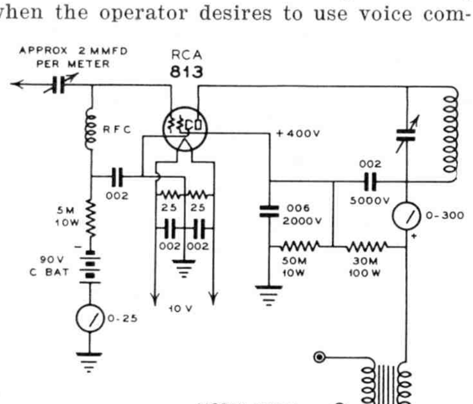
Bias for the RCA-813 is secured from a combination of B-batteries and resistor. Two midget 67.5-volt B-batteries, connected in series, are mounted below the chassis and held in position by a metal strap. A 3,000-ohm, 10-watt resistor is connected in series with the batteries and the grid r-f choke. The circuit diagram specifies 90-volts of battery zias and a 5,000-ohm resistor, although it was found in actual operation that 135-volts of battery bias and a 3,000-ohm resistor will likewise give excellent results. Furthermore, the 67.5- volt batteries are very small in physical size, and may be more readily procurable than small 45-volt units. Either of the aforementioned combinations will give equal results.

The transmitter was designed to operate from a *Meissner Signal Shifter* for home-station operation, or from a crystal oscillator-doubler of the *Jones* harmonic type for fixed frequencies. The output from the ECO is fed directly into the tuned grid circuit of the final r-f amplifier, and the crystal oscillator tube and coil are removed from their sockets when ECO operation is desired. The oscillator in the transmitter illustrated has an 80-meter crystal for fundamental operation. It will function with extreme satisfaction as a 40-meter doubler from an 80-meter crystal by substituting a 40-meter plate coil for the 80-meter coil. The oscillator tuning condenser is mounted below chassis and rotated from the front of the transmitter with the aid of an insulated shaft and knob. In order to make for still greater flexibility, a 6L6G doubler stage for 10-meter 'phone operation was added to the transmitter, so that the set could be modulated by a separate speech channel. Removal of the 10-meter fixed-tune



Complete schematic wiring diagram of the 813 beam-tube transmitter and supplementary sketches showing coil connections for ECO or crystal operation.

tank automatically disconnects the plate and screen voltage from this stage. Consequently, this transmitter is not only a c.w. unit of medium power output but it can be plate-and-screen modulated from a separate unit, when the operator desires to use voice communication. A 150-watt modulator will then be required.



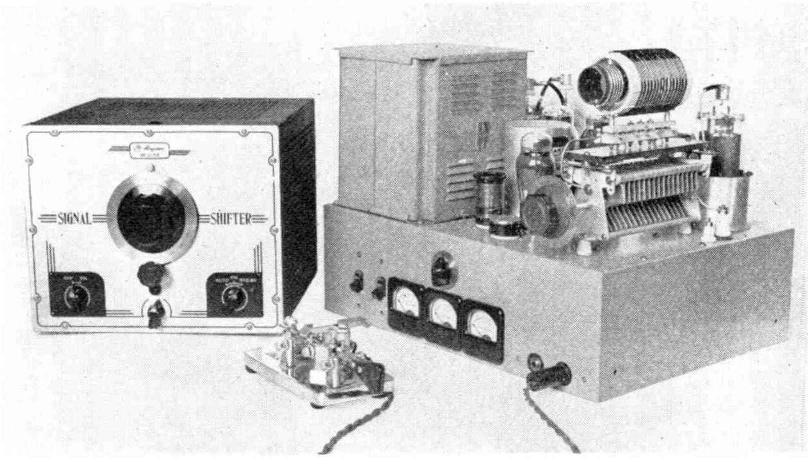
The final r-f amplifier can be biased for c.w. or 'phone operation in the manner shown above. This method is to be preferred over that shown in the tube bulletins.

Either a 6V6G or 6F6G tube will operate in the harmonic oscillator without circuit modification. The RCA-813 is so easy to drive that a small oscillator will give satisfactory results. The grid current to the large beam-power tube should be from 2- to 3-ma., and a d.c. milliammeter, permanently connected into the grid circuit, is as essential adjunct to a transmitter of this type.

Much has been said about the shortcomings of high-power beam tubes, the danger of failure by reason of too-high grid drive, and the difficulties encountered in securing the proper supply for the screen. Many amateurs have refrained from using these tubes because of their high initial cost and the fear that difficulty would be encountered from self-oscillation, parasitics, etc. If a few cardinal precautions are exercised before the transmitter is placed into operation, there is nothing about these large beam tubes more complicated than the simple triode. The first precautionary measure—and it applies equally to triode amplifiers—is to reduce the plate and screen voltages to a low value when the initial adjustments are made. A 2,000-ohm heavy-duty resistor should be connected into the center-tap of the filament circuit when first tuning-up. Screen voltage should preferably be secured from a separate

★

Front view of versatile beam-power tube transmitter and Meissner Signal Shifter for dependable defense communication.



power supply, such as from the crystal oscillator source, as in the case of the transmitter under discussion. Biased in the manner shown, with a combination of battery and resistor bias, and with the cathode circuit of the harmonic oscillator keyed for c.w. telegraphy, there will be no excessive screen supply on the final amplifier tube when the key is open. It is suggested that by-pass condensers larger than those recommended by the tube manufacturers be used for by-passing the filament and +B circuits; values of .005μf. were chosen for the transmitter illustrated and diagrammed. These by-pass condensers should be connected directly to the respective tube socket contacts, and with very short connecting leads to the common ground point. The final amplifier will "take off" if its tank coil is not shielded from the crystal oscillator plate coil be shielded for operation on all bands, over the oscillator plate coil if a condition of self-oscillation is prevalent in the final r-f stage. In the transmitter shown in the photograph this shield was required only when the higher frequency bands were used, although it is suggested that the oscillator coil be shielded for operation on all bands, merely as a precautionary measure. Self-oscillation of the final amplifier is indicated by a continued glow of the dummy antenna load lamp when the telegraph key is opened after having first been closed. Obviously, there should be no glow in the lamp when the key is open.

The grid tuning condenser is mounted below chassis and the shaft is fitted with an insulated rod, slotted at the end, so that the capacity can be varied by screwdriver adjustment through a 3/8-in. hole on the side of the chassis. It is not necessary to vary this condenser from the front of the chassis because once adjusted it need not be changed for any particular band of operation. Mechanical construction is also simplified by obviating this control.

A toggle switch can be connected into the negative-B lead of the low-voltage supply so that plate and screen voltage can be removed from the oscillator, and at the same time disconnecting the screen supply for the final amplifier.

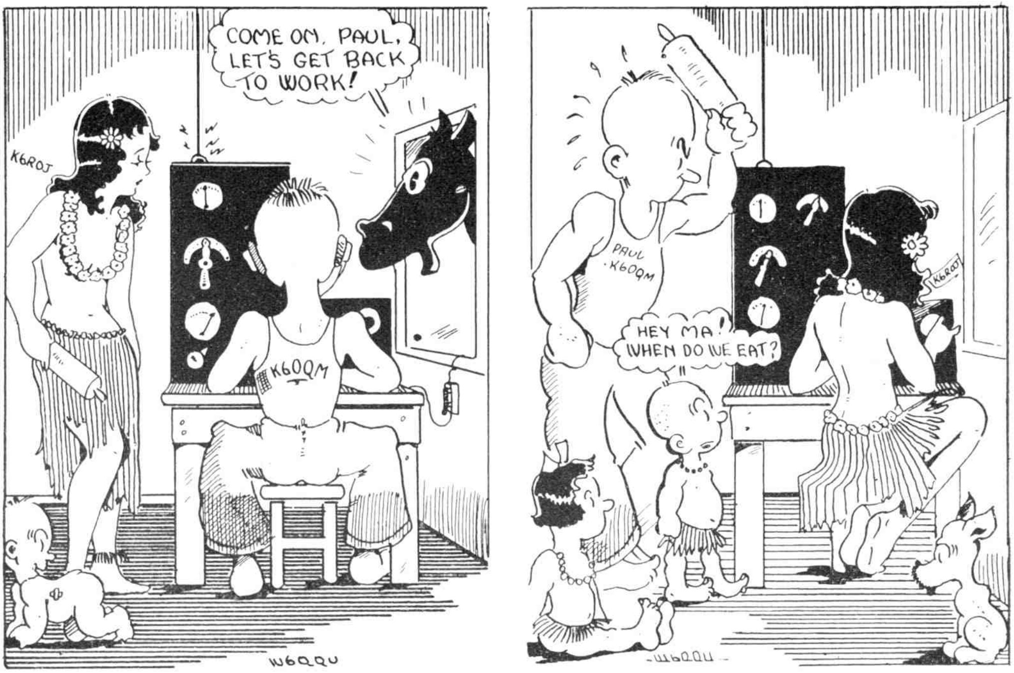
When free from parasitics, and with an R/C filter connected across the telegraph key plug, keying is sharp and clean; there will be no thumps or clicks. The R/C filter can consist of a 300-ohm resistor in series with a 1/4μf. paper condenser, shunted across the plug into which the key jack fits.

The antenna can be coupled to the final plate coil in any conventional manner. Several turns of heavily insulated wire can be wound around the "cold" end of the tank coil, or a variable coupling coil, as shown in the photograph, can be used. Approximately 12 turns of wire should be wound on the smaller, variable-type of coupling coil.

New Ideas In 2½-Meter Sets

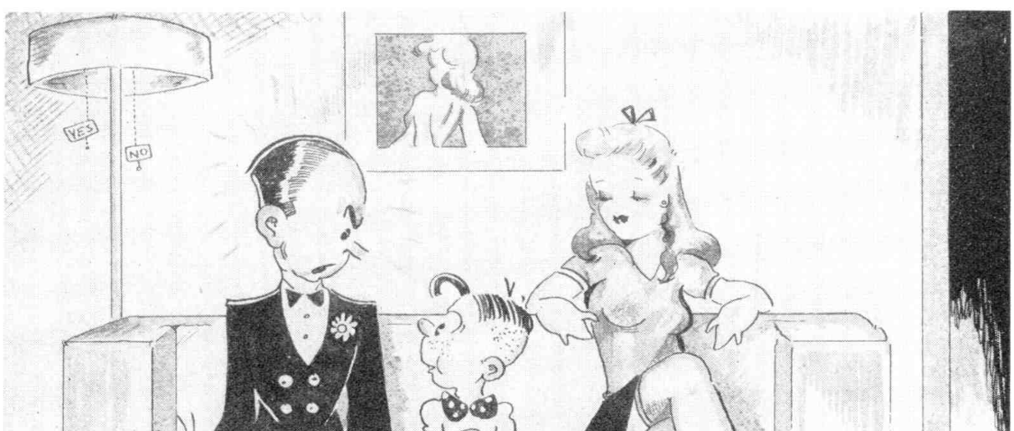
. . . Clayton F. Bane, W6WB, has something new for the UHF enthusiasts—and at the very time when 2½-meter communication will reach its seasonal high mark. If you want something newer and better for your automobile installation, or for operation at home, don't miss the next issue of A.R.D. And we remind you once more that during the slack summer months we will combine two issues of the magazine (June-July) into one. So much new material will appear in this combination issue that you will be able to keep busy for two months with the construction of the numerous new sets to be described.


QRM QRN
W6QQU
I'M A RADIO AMATEUR. HOW MUCH WILL A TELEPHONE COST ME PER MONTH?
IN THAT CASE, IT WILL BE TWO SIX BITS PER MONTH — AND $10:00 DEPOSIT ON OUR MICROPHONE!
W1OZZZ
CLICK
THE "SADDEST" WORDS OF TONGUE OR PEN; THAT "BLANKETY" ANTENNA IS DOWN AGAIN!
FANCY HASH
"Feedback"
High ankle radiation
HUH?
I DO
YEP
Close Coupling
HEY JOE LOOK AT THEIR GROUND CONNECTION!
"OK MARCONI — GIVE ME THAT 80 TUBE OUT OF MY BROADCAST SET!"
BUT DARLING I GOTTA SKED.



AS IT WAS AS IT IS

Life at **K6OQM-K6ROJ** on the Island of Hawaii is just one **QSO** after another. See Page 42 for complete details.



Mister **Q** to Miss Match: "Let's eliminate the **BUFFER** in this hook-up."

Techquiz Problem No. 2 Stumps Many Contestants

★

"Joker" In Catch-Question Found By Two Readers Only

★

By C. C. Anderson, W6FFP

KNOWING that the majority of our readers are fully versed in the technical side of radio, it was decided to "pull a sneaker" for Techquiz Problem No. 2 in order to determine how many would be on the lookout for a catch question. It did not take long to learn that a technical man is a technical man —and by the same token he pays little heed to matters other than those which directly affect the mathematics of radio. As a consequence the majority of contestants who solved the first problem correctly did not "see" the catch-question in Problem No. 2. Here is the problem, as reprinted from our last issue:

What is the impedance of the same cube (shown in Problem No. 1) WHEN "A" AND "B" ARE CONNECTED TO A 110-VOLT, 60-CYCLE POWER SUPPLY and each resistor is replaced by a coil consisting of 33 turns of No. 40 D.C.C. wire, wound on a 1-inch diameter coil form, along a length of 1-inch? The resistance of the wire in each coil is assumed to be 10 ohms.

The Answer — "The coil blows up when connected across the 110-volt line."

Two contestants found the "joker." Wayne Miller, first to solve Problem No. 1 correctly, was also first to send in the correct answer to Problem No. 2. We wonder if he first wound the coil, as specified in the problem, and then connected it across the a.c. line in order to measure the impedance? HI! That would have been a very quick and simple method for deriving at the correct solution.

The other successful contestant is Chas. E. Thompson, W6UQ, of San Francisco. He qualified his answer, as did Mr. Wayne Miller, by stating that the coil has a definite impedance for a minute fraction of a second before it blows up. Both contestants likewise submitted correct information for calculating the impedance, but the editor of this department had but *one* answer in mind—and it concerned a smoking, burning coil—rather than its impedance.

This is the first and last "catch question" we will include in the Techquiz columns. Scores of readers sent the customary reams of mathematical data giving proof of their findings—all related to the impedance of the circuit, and with three exceptions these solutions were correct.

We present a strictly mathematical question for Problem No. 3, shown in the boxed copy on the facing page. Every contestant should solve this problem with comparative ease. We look for an avalanche of mail, and we hope your name will appear in the winning column of the next issue.

After the March issue of A.R.D. had been put to bed, five additional readers submitted correct answers to Problem No. 1. Because none had seen the answer to this first problem, by reason of the fact that the magazine had not been put into the mails when the answers were received, we rightfully credit the following with 1.000 pct. for the first answer:

Clifford Atkinson, Jr., W5GOC
New Orleans, Louisiana
Geo. S. Dunlap, W9OGG
Denver, Colorado
Bob MacFarland, W5BKS
J. W. Roby, Jr., W5HTI
RM2C, U. S. Navy
John A. Springer, W8BCY

In all, seventeen contestants out of a total of almost 400 came through with a perfect score for the first problem. There are some who, for reasons beyond their control, were unable to submit a solution to the second problem. Our old friend Lieut. A. W. Greenlee, W4HGM, was forced to withdraw temporarily from the contest because of a serious injury sustained when his U. S. Navy

TECHQUIZ PROBLEM No. 3

Here is the third Techquiz problem. Even if you failed to solve Problems No. 1 and 2, make an effort to solve Problem 3, because some of the earlier contestants may fail to solve the newer problems, thus giving you ample opportunity to compete for the trophy.

The Problem: A parallel circuit is made up of five branches; three of the branches being pure resistances of 7, 11, and 14 ohms, respectively. The fourth branch has an inductive reactance of 500 ohms. The fifth branch has a capacitive reactance of 900 ohms. What is the total impedance of this parallel network? If a voltage is impressed across the network, which branch will dissipate the greatest amount of heat?

MAIL YOUR SOLUTION WITHOUT DELAY

plane crashed to the ground. He is now confined to the hospital and his good wife sends word that the OM is well along the road to recovery. The entire 20-meter fraternity was deeply shocked to hear the news of Bill's accident, and every last ham on the band whishes him a speedy and complete return to health. The 20-meter band just doesn't seem the same because of Bill's forced absence.

The Techquiz editor is grateful to all who submitted answers to the first two problems. It is sincerely hoped that all contestants will "stick with the ship," because one can never tell when the other fellow's score may take a sudden dip. Get your pencil and paper ready for Problem No. 3. It is a straightforward technical question, but not quite as easy to solve as would at first appear.

Some interesting sidelights on the Techquiz Contest are worthy of comment. Mr. C. E. Thompson, W6UQ, instantly found the "joker" in Problem No. 2 in the form of heavy, black-face type for that part of the problem which made reference to the 110-volt connection. He writes: "When something is printed in heavy type, there's a reason for it. I smelled a rat. I don't know whether or not there is a joker in the problem, so I'll take no chances — I'll make doubly sure of maintaining a high score by qualifying my answer with and without the joker."

Trick questions have long been used in many contests and in examination problems. Not so long ago Uncle Sam used a trick problem to advantage by asking applicants to check resistor values with an ohmmeter, and with the resistors lying on a *metal* table. If the applicant proceeded to test the resistors while they remained on this *metal* table, he was not permitted to continue with the examination. On the other hand, if he removed the resistors from the *metal* table and carried them to an adjoining *wooden* table, and then measured the values, he was allowed to proceed with the examination.

Techquiz Box Score

Alanzman, John W8OFW/W8VOG	0.500 Pct.
Atkinson, Clifford, Jr. W5GOC	0.500 Pct.
Bolvin, C. J. WPDO/W8LVV	0.500 Pct.
Dunlap, Geo. S. W9OGG	0.500 Pct.
Friesen, Vernon O.	0.500 Pct.
Greenlee, A. W. W4HGM	See Text
Lundy, C. E. W6CY	0.500 Pct.
MacFarland, Bob W5BKS	0.500 Pct.
Miller, Wayne	**1.000 Pct.**
Nadeau, Ralph U. W1ICS	0.500 Pct.
Roby, J. W., Jr. W5HTI	0.500 Pct.
Scairpon, Jim W2KAV	0.500 Pct.
Schor, F. W.	0.500 Pct.
Searles, Paul D.	0.500 Pct.
Springer, John A. W8BCY	0.500 Pct.
W6UQ	**1.000 Pct.**
Welch, J. R. W6WC	0.500 Pct.

Ella and Paul

There's hardly an amateur on the 10-meter band who hasn't heard K6OQM or K6ROJ, Paul and Ella Christensen, located on the Island of Hawaii. You'll know more about 'em after you read this story. And we promise still more "inside information" when additional "leaks" reach the editors.

★

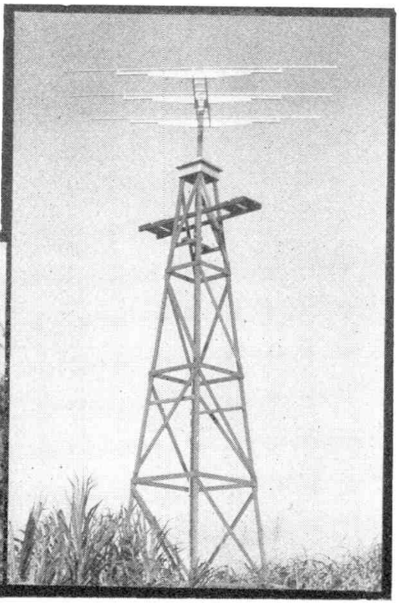
DOWN on the Island of Hawaii, some 90 miles from Honolulu, is a little village called Kukuihaele, pronounced coo-coo-eee-high-lee, precisely as it isn't spelled, in typical Hawaiian fashion. The Hawaiian alphabet has but 13 letters, which would lead one to surmise that the native words would be easy to pronounce. The four-letter word Oahu, the name of the island on which Honolulu is situated, is pronounced O-wahoo. The letter W is pronounced as V, and this could be one of the reasons why the Hawaiian amateur calls begin with K.

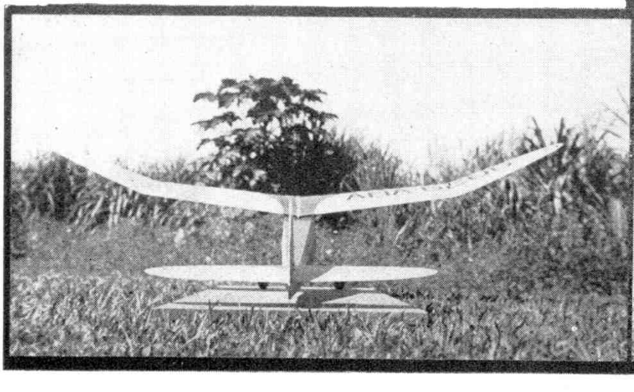
In the little village of Kukuihaele the biggest thing in "town" is a tower which supports a rotary beam. The feed lines connect to a pair of transmitters, one built and operated by Paul Christensen, K6OQM, the other by his good YF, Ella, K6ROJ. Husband and wife are both licensed radio hams, two of the grandest scouts on the air. They keep the 10-meter band open almost all year 'round. When Paul goes to work, Ella gets her rig in operation and carries on where he leaves off. Little do they realize how helpful they have been to those who test 10-meter receivers for a livelihood. Throughout the radio plants of the nation it has long been regarded false economy to buy a signal generator for 10-meter tests—they simply keep tuned to K6OQM-K6ROJ, because either of those signals is almost always on the air.

If you want to make a contact, you first mail your application to Kukuihaele, and you patiently await your turn for a QSO.

The whole Christensen family is radio-minded. It eats, sleeps and drinks amateur radio. Pliers and screwdrivers have replaced knives and forks at the dinner table, and the burnt breakfast toast is scraped with a file. The mosquito netting on the windows serves as a Faraday Screen. The spaghetti bins in the kitchen are plainly labeled "eating variety" and "insulating variety," to make certain the wrong kind does not find its way into the tummies of their children. And talkinig about the children, they knew the code from the day they first began to talk. Ella can *prove* it, "because," she says, "the very first thing the baby said was 'da-da-da,' and that's the letter 'O' in radio code, or I'm no operator!"

To the right is the K6OQM-K6ROJ antenna tower and rotary beam array. The landing platform near the top of the tower protrudes from both sides; one side is for Ella, the other for Paul, just like twin beds, eh? And down below is the model airplane built by Paul. Soon it will be fitted with the necessary gear to make it radio-controlled.





Ella secured her ham license about a year ago. Paul taught her the code. He learned about women from her, and she learned about hams from him. Next thing she wanted was a transmitter of her own. So she went to Honolulu and bought the parts. And the customary metal chasis. Then she drilled the holes, thousands of them, but when she started to mount the parts she found that none would fit the holes—so now they have a new sieve for the kitchen. The radio stores ran out of the kind of parts she wanted, and the usual substitutions were made. "Isn't it strange," she says, "that when you go into a radio store to buy a certain list of parts you always come home with a load of stuff you never heard about before, and instead of getting on the 10-meter band with the conglomeration they sell you, more likely than not you'll wind-up with a parasitic oscillation on 53 meters instead!"

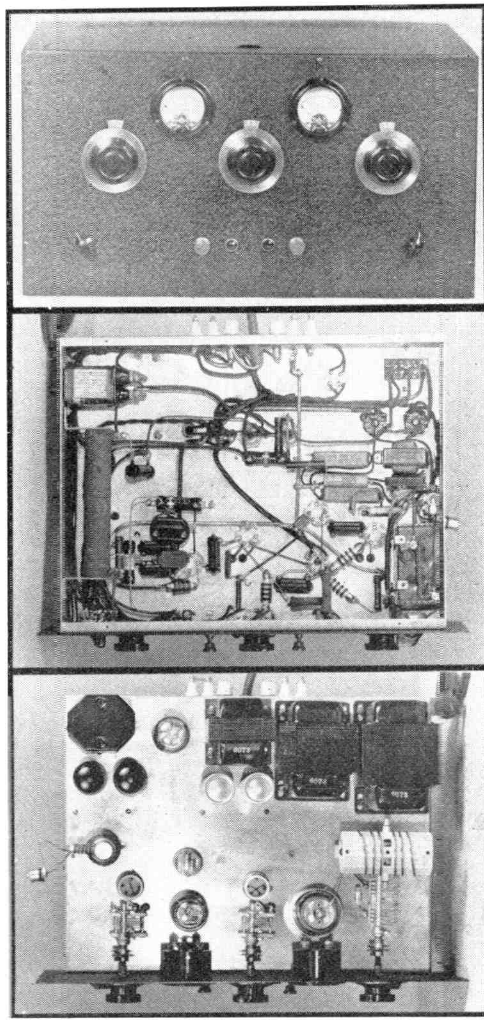
Ella is a realist. She predicts a brilliant future for the fair sex of amateur radio. She feels that the day is not far distant when husbands hang wash on the line while women hang traffic on hooks. One of the happiest of her days was when her amateur call was assigned. Husband Paul was long noted as a famed 10-meter hound, and Ella was referred to as Missus K6OQM. "Phooey on that stuff," said she, "that call belongs to the OM, so I'll have to get one of my own." And she did.

Ella did a swell job of constructing her transmitter, as the photographs reveal. It was made by hand—the hard way—because there are no sheet-metal shops in Kukuihaele. Socket holes were enlarged to the proper size with a file, and long hours were devoted to this gruelling task. Her transmitter has a powerful wallop in the 10-meter band, the K6ROJ signals being R9 plus as a general rule rather than an exception.

Amateur radio has been a blessing to our good friends K6OQM and K6ROJ. Without it life would be rather drab in their remotely-located village. Paul has an executive position with the plantation interests; his position is on a horse—which he rides through the pineapple and sugar cane fields to see if the natives are on the job.

If you contact K6ROJ you'll get a classy QSL card from her. It shows Ella in her grass skirt, doing a hula dance for the ham fraternity. Many amateurs have offered to swap two of Paul's QSL cards for one of the K6ROJ variety.

Kukuihaele is 100 per cent signed-up with Amateur Radio Defense Association, but Paul is of the opinion that the city is immune from attack, because the invaders wouldn't know how to pronounce the name of the place, nor even how to spell it. And they'd go coo-coo in Kukuihaele because they could never get their traffic through; people just won't talk to anybody 'cept Paul and Ella down there!



• Three views of the professionally-appearing 'phone transmitter for 10-meter operation, built entirely by Ella. The YLs are giving many an OM something to think about when it comes to transmitter construction.

Neutralization of U-H-F Doublers For Greater Output

This timely subject deals with a timely problem. It tells how to get more power output from a U.H.F. doubler circuit by means of neutralization. The degenerative feed-back of the doubler circuit is neutralized, and considerably greater efficincy is thereby realized. These findings are the results of tests made in the engineering laboratories of Heintz and Kaufman, Ltd., to whom we are indebted for the information.

★

RECENT progress in the development of crystal-controlled UHF transmitters has necessitated high-frequency doubler and tripler circuits capable of delivering reasonable amounts of power. The conventional class-C r-f amplifier can be utilized to generate power output which is a harmonic of the signal voltage applied to the control-grid. This holds true because the pulsations of plate current flow contain energy on harmonic frequencies as well as on the fundamental. For this reason it is only necessary to tune the tank circuit to the desired harmonic, such as the second or third, and power on that frequency will then be delivered from the amplifier while at the same time the power on the remaining frequencies is suppressed.

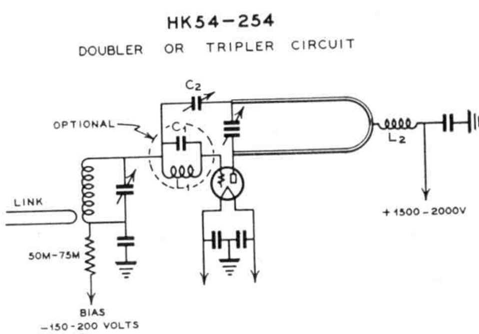
A practical doubler circuit will develop approximately 50 per cent of the output normally obtained from the same tube operating as a class-C amplifier, and the third harmonic output will be roughly 25 per cent of the class-C amplifier output. To obtain the relative power outputs it is essential that the class-C amplifier be properly adjusted in order to provide efficient operation as a doubler or tripler. The essential prerequisite is that a high value of bias be employed, so that the pulses of plate current will be short. As with the class-C amplifier the amount of bias is related to the driving power required, and actual operating conditions are chosen which result in a compromise between high efficiency and reasonable driving power.

The conventional doubler or tripler circuit employs an unneutralized triode, and energy from the plate circuit is fed back through the plate-grid capacity of the tube to the grid circuit. If this energy finds its way to ground through a capacity circuit, the feed-back energy is degenerative. Consequently there is a flattening-out of the grid-drive pulse, and the efficiency of the tube is lowered. This condition can be avoided by the use of a screen-grid tube, or by a neutralized triode-tube circuit. In either case the grid drive pulse becomes a sine wave, and maximum efficiency is obtained. The neutralizing adjustments are not critical.

The design of a fundamental circuit leaves several choices with the experimenter. Since the harmonic energy which the tube is able to deliver is tied-up in the shape of the plate current pulse, there is no particular choice as to transmitting tube characteristics. However, since extremely high bias is required and because large voltages must be generated across the grid tank coil, it is advisable to choose a tube with good grid-to-filament insulation and with low grid-to-filament capacity. Gammatron types 54 and 254 are ideally suited for this purpose. In general, screen-grid tubes employ grid insulators, and the input capacities are of a high order. The latter condition is not favorable.

A push-pull circuit will operate only on odd harmonics because the balance circuit tends to cancel the even harmonics. A single-ended circuit does not possess this fundamental property, and it will therefore operate on either odd or even harmonics of the grid-drive frequency. Thus the single-ended circuit is more adaptable.

When operating in the ultra-high region, particular attention must be directed to circuit losses and circuit radiation. Transmission lines and conductors should have heavy current carrying capacities, and the inter-electrode capacities of the tube should be low. Leads should be short and direct. The circuit must be balanced to ground to prevent radiation. To satisfy this condition, a push-pull circuit is generally used. On the



C_1—The function of this condenser is to remove all traces of parasitics on the plate circuit frequency; its capacity should approximate that of the grid lead reactance.

●

C_2—This condenser balances the circuit to ground and "roughly" removes feed-back due to tube plate-to-grid capacity.

●

L_1—Choke for passing d.c. For 125-Mc., use 10 turns of no. 20 wire, ½-in. dia.

●

L_2—To resonate at frequency of grid.

●

other hand, balance to ground can be obtained in a single-ended circuit of the type shown in the accompanying diagram. It is seen that condenser C2 acts both as a neutralizing capacitor to prevent degenerative feedback and also as a balancing condenser on the transmission line circuit to prevent undue circuit radiation. This circuit has all of the necessary requirements for good doubler or tripler efficiency, and at the same time it is universal in its application. The Table shows optimum operating conditions for the types 24, 54, and 254 Gammatron tubes:

The optional circuit C-1-L1 is designed to eliminate the lead inductance to the grid of the harmonic amplifier tube. This is necessary in some cases to eliminate parasitic oscillations. In general, this circuit will not be required at frequencies of 60-Mc. and less on the grid. The value of C1 is approximately 30$\mu\mu$f., while L1 consists of 10 turns of no. 20 wire, close-wound on a ½-inch form.

Gammatron Tube Type	24	54	254
Plate current	30	50	80 ma.
Plate voltage	1000-1500	1500-2000	1500-2000 volts
Grid leak	50-75	50-75	50-75 ohms in M
Grid current	3-4	6-8	6-8 ma.
Fixed bias	75-100	150-200	150-200 volts

The Army Got 'Em

By Bud Crawford, W9BDO

. . . **W9JIF** is now being heard from Ft. Joe Robinson, where he operates one of the army xmtrs since joining-up recently. He's another of our ARRS boys who has stepped up the tempo.

* * *

. . . **W9WZB** and **W9WZH** maintained a QSO throughout the years and became well acquainted by ham raydeowe. The other day **W9WZB**, now the deputy sheriff of Dawson County, was pleasantly surprised to find a visitor in a Captain's uniform to be his radio pal **W9WZH** stopping in for a personal QSO while enroute to the camp in Arkansas. "Doc" **W9WZH** is a molar man, so maybe some of you amateurs will have to "open your mouth" to him before your hitch is over.

. . . **W9GKZ** will be in the service by the time this reaches your optics. While in kollitch Frederick had military training, so he'll likely be promoted to a "general" in short order. He's a bang-up c.w. op, you know.

* * *

. . . **W7GGG**—("Goodness Gracious Gertie")—Dock Zuckerman, asked to take his turn immediately in the navy so the Western Nebraska Radio Club is holding its monthly meeting in Cheyenne in order to give Doc a farewell party.

* * *

. . . A recent epistle from **W9IDO** says Don is now at Camp McChord—getting a good daily washing from Jupe Pluvius.

Crystal Control For 2½-Meter Operation

Here is a home station 2½-meter transmitter of unusual merit. It incorporates every modern UHF feature desired by the average amateur, and its performance is of an exceptionally high order. But in this manuscript the author tells more than the constructional details for building a modern 2½-meter set; he discloses a better method of tuning the hair-pin rods—and if you follow his advice closely you will get more power out of your present transmitter.

By Clayton F. Bane, W6WB

MANY who think of equipment for 2½ meters consider only the self-excited versions, feeling that crystal control is too complicated. The transmitter herein described should attest to the fact that this is not necessarily true. Considering that the crystal frequency is approximately 6,400-Kc., and that only three stages are required, simplicity is really the keynote.

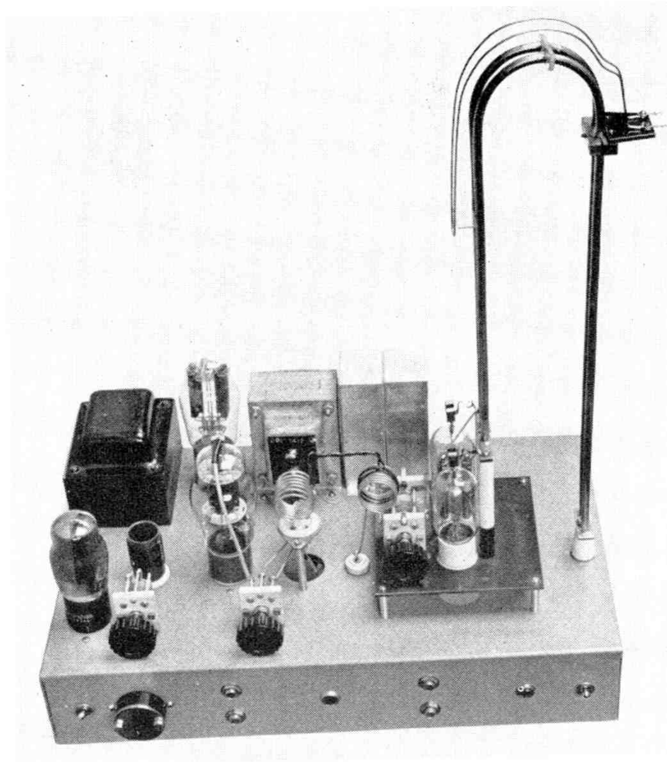
There are a number of ways of approaching the problem of basic design. One thought would be to use a 10-meter crystal and double twice. The main drawback to such a design is that our experience with 10-meter crystals has not been too encouraging. Normally they are quite fussy oscillators and, in addition, their factor-of-drift with temperature change is appreciable. If a lower frequency crystal is chosen, greater initial crystal output may be obtained and less drift experienced. There is the further point that conventional oscillator circuits (with which one is normally quite familiar), are easy to get into operation. The 6V6G is an excellent straight-through or harmonic oscillator and was thus selected for this application in the transmitter under discussion. One of Frank Jones' better-known oscillator circuits was pressed into service to permit stable oscillator doubling.

A multiplication factor of 18 times the fundamental crystal frequency should be selected. The oscillator doubles, the next stage triples, and the final stage also triples. Thus, 2 x 3 x 3 equals 18. First select a frequency in the 2½-meter band, then divide this frequency by 18, and the result will be the proper fundamental frequency for the crystal. In this particular transmitter it is 6,388-Kc. (114,984-Kc. output frequency).

The selection of the first tripler stage is rather limited by the fact that one must choose a tube which will require low grid excitation, thus lessening the power-output requirements of the oscillator. Here the choice is naturally a beam tube, logically an 807 or its equivalent. This tube performs satisfactorily, but from a purist standpoint it must be admitted that the output frequency of this stage, 38,328-Kc., does not particularly look with favor upon the high output, or plate-to-ground capacity of the 807. Lacking something better, however, the 807 does a good job.

The final output stage is much more dependent upon the choice of satisfactory tubes. The amount of power output is a definite determining factor, but for medium-low powers the *Heintz and Kaufman* type 24 Gammatron is in a class by itself. The small physical size of this tube, its adaptability to short connecting leads, its very low input and output capacities, and its ability to perform with reasonably low drive, makes it a unanimous choice. This choice is not predicated upon this transmitter alone, but also from a number of other units built commercially, all of which performed creditably.

By the very nature of the beast, a push-pull stage will not operate as a frequency multiplier for the even harmonics. It will, however, do a fine job as a multiplier for the odd harmonics and full advantage is taken of this fact to use a pair of 24's in push-pull as triplers. The push-pull connection has a very definite advantage for ultra-high-frequency service, in that it provides a fully balanced-to-ground system. At these frequencies, where condensers act as inductances and the latter as condensers, it



The complete $2\frac{1}{2}$-meter transmitter and hair-pin rod assembly.

behooves the builder to observe the fact that a balanced circuit will pay dividends. Grounds at these frequencies are difficult to attain. A ground loop through a six-inch section of chassis can act as a common impedance for two circuits and give rise to all kinds of erratic effects, none of which will improve the performance. Push-pull operation avoids these difficulties.

In UHF frequency multiplying stages, a peculiar effect is very apt to be experienced, in that there is a seeming inability to give reasonable plate efficiency or power output. This effect can normally be traced to the fact that the output harmonic is fed back through the tube grid-to-plate capacity in such a manner as to flatten-off the peaks of the exciting voltage. This flattening effect is exactly the converse of that desirable for good efficiency. It causes the multiplier plate current to flow a greater portion of the cycle, and thus tends to increase the plate dissipation while actually causing a decrease in output. The answer to this problem is relatively simple—cross-neutralize the two tubes. This prevents undesirable feedback and permits a peaked wave form on the exciting voltage; it likewise reduces the number of degrees over which the plate current flows, and thus the plate efficiency is increased.

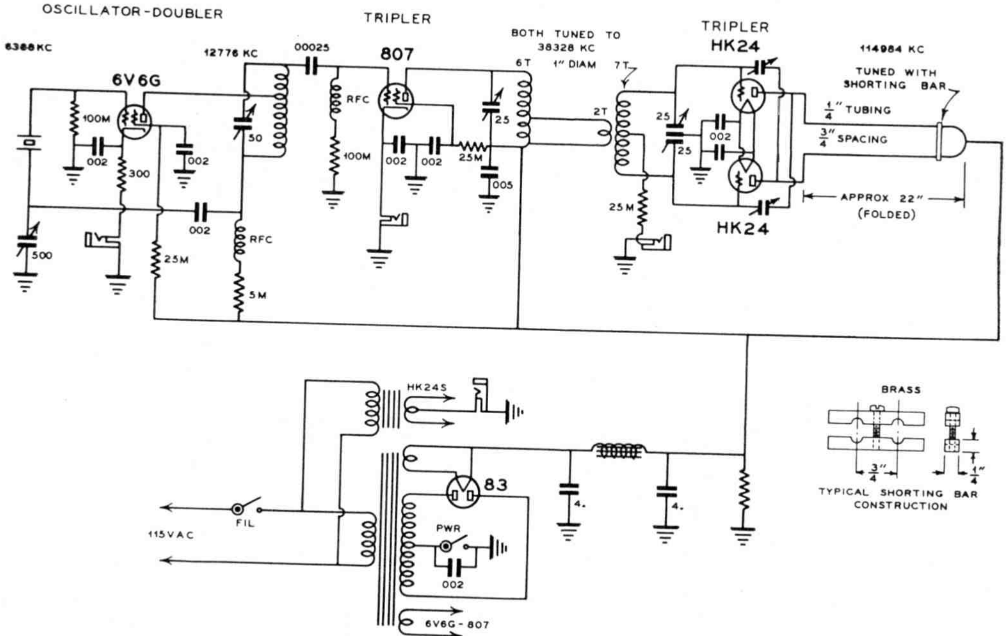
In actual practice there is no simple way in which this neutralizing can be done. Fortunately the process is not critical, and adjustment of the two neutralizing condensers, meanwhile checking for minimum plate current dip, will be an entirely satisfactory procedure.

The photographs and circuit diagram serve to illustrated the construction; they also give all pertinent coil data, values, etc.

Tuning the UHF Transmitter

IN the initial set-up, the harmonic oscillator must be the first approach. The reader is referred to January *ARD*, page 31, "*RATIONALIZING THE HARMONIC OSCILLATOR*," by C. F. Bane.

Note that the plate of the crystal oscillator is tapped down on the plate coil. This will permit a step-up ratio to the grid of the 807 tripler, which results in a substantial increase in grid drive. It is emphatically stated that some type of accurate absorption-frequency-meter must be available to

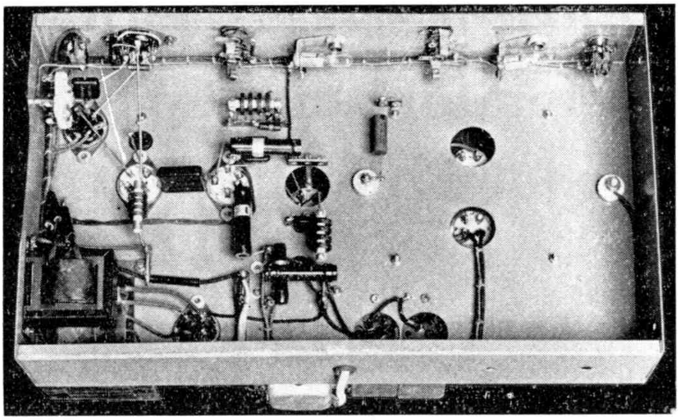


Circuit diagram of r-f portion of 2½-meter crystal-controlled transmitter.

tune a transmitter of this type. There are so many combinations that are incorrect that it is easily possible to operate on some frequency far removed from the 2½-meter band. Check the oscillator for the second harmonic, (this will lie in the 12,000-Kc. region), the 807 for the third harmonic (near 38,000), and it will be possible to tell the length of the plate rods if the output stage is functioning correctly.

The transmitter should be tuned step-by-step with plate voltage removed from the final amplifier. Dip the oscillator plate, follow with the 807 plate, and then connect the meter into the grid of the output stage. Adjust the coupling link for some arbitrary value of grid current. Rotate the split-stator grid tuning condenser for a further maximum, then check back to the 807 plate and restore this stage to minimum. The grid current on this particular transmitter with the voltages shown will be from 10- to 15-milliamperes.

The next adjustment will try the patience of a saint, but once the technique is solved subsequent adjustment will be simple. With voltage removed, set the shorting bar on the hairpin so as to take advantage of the full length of the rods. Apply plate voltages and note the plate current. Make these observations short until the stage is resonated, so as to avoid damage to the tubes. Take a heavily insulated screwdriver and, shorting the two rods in the hairpin, carefully move the screwdriver upward toward the plates, starting from the far, or shorting-bar end. The idea is to furnish a shorting-bar which can be quickly moved over the length of the rods. If all previous steps have been correctly taken, it will be found that there will be a certain point on the hairpin where the final amplifier plate current will take a dip. This dip may be very sharp and may also be slight at the start. Once this point has been spotted, the permanent shorting bar can be secured into position. This is a very delicate adjustment and will require moving the bar a very slight amount each time, then tightening the holding screws and checking the plate dip. Assuming that the minimum plate current dip has been found, the entire process must be repeated. The neutralizing condensers are first adjusted. Unfortunately, changing these condensers even by a very slight amount changes the tuning of both the grid and plate circuits. If the neutralizing condensers are of small capacity, 3-5$\mu\mu$f., it is best to begin with full capacity and work outward. This will be found to be a much easier procedure and requires fewer adjustments. The best possible minimum or dip is the goal. The grid tank and the shorting bar on the plate tank must both be compensated for each movement of the neutralizing condensers. Attempt to keep the two neutralizing condensers at the same capacity on each adjustment to avoid serious unbalance which generally shows up in the form of one tube doing all the heating. Much time can be saved by using the screwdriver



The under-side of the transmitter is as neat as the top.

to short the bars while testing, and if it is held firmly enough against the two rods, the same approximate idea of the dip can be obtained as if the regular shorting bar had been in position.

Necessarily, a word description of this tuning procedure is difficult and is apt to create the impression that tuning must be done by a purple yogi. Actually, once the general idea is understood, the stage can be retuned from scratch in a few minutes.

The plate hairpin is actually a quarter-wave line, which means that it will present a high impedance, high voltage at the tube plates and a low impedance, high current at the shorting bar end. The shorting bar must then carry relatively heavy currents, and just any shorting bar will not suffice. The strap connection must have a reasonably large surface and the connection must be solidly made. With the high current at this point, even a small amount of resistance can result in high loss. See Fig. 2 for a suggested design of a good shorting bar.

The theory of the quarter-wave line for a tank circuit is intensely interesting, but hardly within the scope of this article—which has to do mainly with general design and tuning. Reference to this subject may be had by reading the excellent articles by Mr. Winfield Wagener (of Heintz & Kaufman, Ltd.) elsewhere in this magaziine. Attention is further directed to an article by the same writer in the March issue.

This 2½-meter transmitter is an exact duplicate of one previously built, and has justified its existence by providing the technical staff with an exciter for making antenna measurements. It is a three-man production; *Wells, Farbman and Bane* all had a hand in its construction, adjustment and operation. Why not build one and find out what beam antennas can really do on 2½?

Proposed Denial of Bible School Application

PUBLIC interest, convenience, and necessity will not be served by granting the application of God's Bible School and College, Cincinnati, Ohio, for a construction permit looking to establishment by that institution of a new international broadcast station to serve Latin America, according to a proposed decision of the Federal Communications Commission.

In Proposed Findings of Fact and Conclusions (B-132) based upon a hearing August 13, 14, and 26, 1940, the Commission points out that while the chief frequency requested—21610 kilocycles—is available, its characteristics do not permit rendition of a satisfactory program service to South America except during the daytime at certain seasons of the year. Also, by reason of the differences in direction of the zones of Mexico and Central and South America, it would be necessary to utilize two antennas, instead of the one proposed, in order to render adequate service. Moreover, no comprehensive inquiry was undertaken by the applicant with a view to determining the types of programs which would be acceptable to the potential audiences.

Therefore, the Commission concludes:

1. The applicant does not propose to provide adequate technical facilities to carry forward the proposed service.
2. The applicant has failed to show that the technical operation of the proposed station would be conducted by qualified persons.
3. The proposed programs were not predicated upon a comprehensive survey designed to determine whether such programs would be acceptable to the areas to be served, nor has the applicant shown that it has the necessary program sources available to render an international service in the public interest.
4. Public interest, convenience, and necessity will not be served by the grant of this application.

The applicant proposed to operate three hours a day on 11710 kilocycles and unlimited time on 21610 kilocycles with A3 emission and power of 60 kilowatts.

Combination Fixed-Tuned C.W. Keying Monitor and Code-Practice Oscillator for 110-volt A-C. Operation

Not just another monitor for c.w. keying, but a combination code practice oscillator and keying monitor which requires no re-tuning when bands of operation are changed. Its advantages will be recognized and appreciated by the E.C.O. enthusiasts — also by those who want to brush-up on code speed.

By The Laboratory Staff

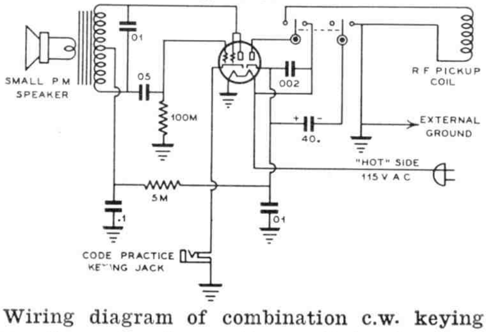
MANY forms of keying monitors and code oscillators have recently been treated in amateur texts, but the device herein described has several unique features which have not heretofore been combined into a common unit. It is a decided convenience to have on hand a checking instrument which requires no re-tuning when frequencies or bands of operation are changed, and the inclusion of a code practice oscillator in a common circuit serves a dual purpose of enabling the operator to "check his fist" and help others become more proficient in code speed.

The device under discussion requires relatively few parts and the completed instrument can be housed in a compact case. No special equipment is needed, but the push-pull output transformer should preferably have a high step-down ratio in order to maintain a light load on the audio oscillator.

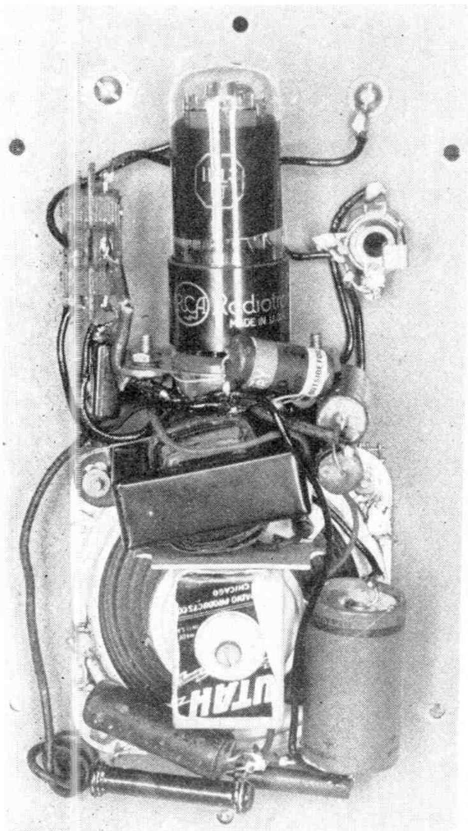
Technical Considerations

THE 117L7GT combination tube can be incorporated advantageously in a combination audio-oscillator-rectifier circuit. The oscillator includes a center-tapped push-pull output transformer with its primary connected in a standard Hartley Oscillator circuit. A small 2-inch permanent dynamic speaker is connected across the voice coil; it will deliver sufficient sound output for monitoring a c.w. signal, or for code practice. The audio-frequency can be adjusted to any desired pitch by varying the size of the grid-leak or grid condenser, or by changing the value of shunt condenser capacity across the primary winding. The loudspeaker proper does not load the oscillator to such an extent as to prevent oscillation at audio frequencies.

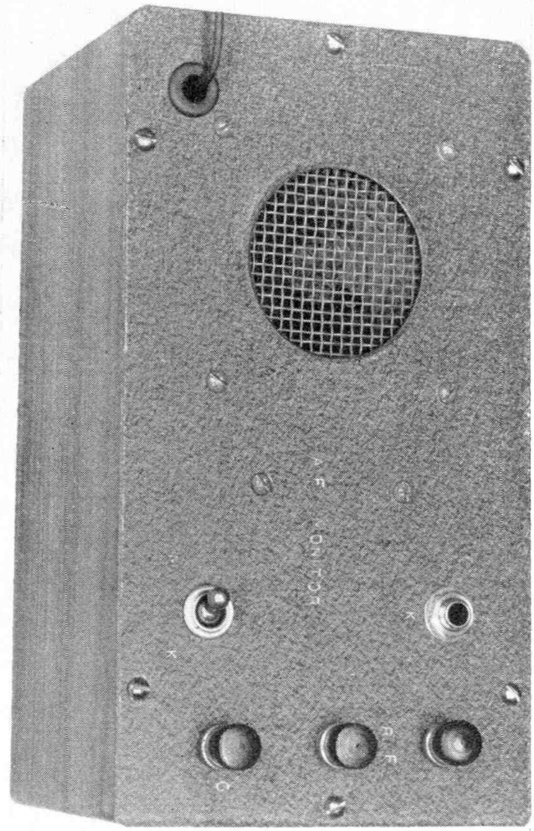
The half-wave rectifier portion of the 117L7GT tube serves to rectify the 110-volt a.c. line supply so as to provide a source of power when the unit is used as a code practice oscillator. When operated as a c.w. monitor this same half-wave rectifier section is connected to an external r-f pick-up coil which, in turn, is coupled to the tuned transmitter. The pick-up coil may require from 2 to 10 turns of wire loosely coupled to the antenna or tank coil, and with the degree of coupling dependent upon the amount of power output from the c.w. transmitter. It is necessary to absorb approximately ½-watt of power from the transmitter in order to provide a source of d.c. plate power to the audio oscillator of the monitor. Since this rectified r-f power will vary in accordance with the c.w. transmitter key-



Wiring diagram of combination c.w. keying monitor and code practice oscillator for operation from 110-volt a.c. line.



Interior view, showing midget permanent magnet loud-speaker and essential components.



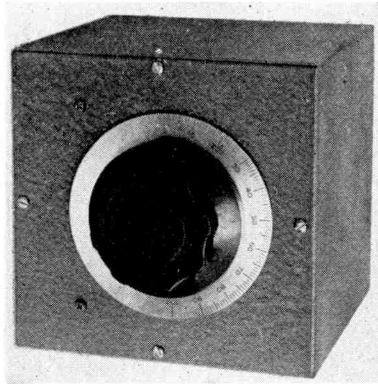
Front view of the keying monitor and code practice oscillator.

ing, the audio oscillator will exactly follow the keying, provided that the R/C constants in the filter circuit are correct. For this reason it is necessary to use a d.p.d.t. toggle switch to changeover from code practice to c.w. monitoring, since the 40μfd. 250-volt filter condenser must be disconnected from the circuit for c.w. monitoring. This condenser is essential for the reason that when the rectifier is connected to the 110-volt line it is necessary to filter-out the a.c. hum pulsations.

For code practice the toggle switch is thrown to the position which disconnects the r-f pickup coil and connects the rectifier plate to the "hot" side of the 110-volt filament circuit when the telegraph key is plugged into the closed-circuit cathode jack. For c.w. monitoring the toggle switch is thrown in the opposite position, and the telegraph key removed from the audio oscillator in order to permit it to follow the keying of the transmitter.

The audio volume of sound can be adjusted to any desired level by changing the position or number of turns in the r-f pickup coil. The latter can be connected to the monitor by a two-wire twisted rubber-covered lamp cord of any desired length.

One side of the 115-volt filament circuit is connected to an external water-pipe ground, and the other side to a single conductor a.c. cord and conventional two-way plug, which must be plugged into the 115-volt circuit in the proper position in order to pick-up the hot or ungrounded side of the a.c. line. If the plug is inserted in the incorrect position the tube will not function, but no harm will result. This type of connection provides an external ground to the monitor and lessens the danger of shock to the operator.



Front view of the 10-meter converter. A vernier tuning dial is a convenience for covering the congested band.

Compact 10-Meter Converter

Your BCL short-wave receiver can be made to operate with exceedingly good results on 10 meters by connecting a converter ahead of it. Many types of converters have been tested in the laboratory, but none has given the splendid performance of the one described in this text. It's as simple as A-B-C, both in design and construction.

By F. D. Wells, W6QUC

HOW often have you built a piece of "inexpensive" equipment, only to find that the cost of the completed project was several times the original estimate? Here is your opportunity to avenge yourself—by constructing a 10-meter converter from parts taken from a "run-of-the-mill" worn-out broadcast receiver.

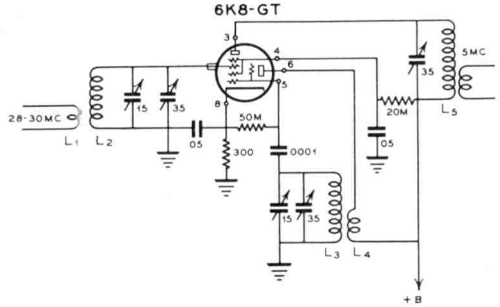
A good 10-meter converter for attachment to some of the earlier amateur receivers, or to a broadcast receiver of conventional design, can be built for less than five dollars, complete with tube and metal shield-can for housing the converter.

Construction

FROM a standard dual 15$\mu\mu$f. per section midget variable condenser, two of the rotor plates must be removed. The result is a condenser with 3 plates in each section, one rotor and two stator plates. Across each section is connected a 35$\mu\mu$f. trimmer condenser. Air-pads would be more satisfactory from the standpoint of stability, but their cost is greater than small mica-insulated trimmer pads.

The coils for the converter are wound on ¾-in. dia. *Amphenol* polystryrene forms; these forms are inexpensive and easy to drill. The antenna coil has seven turns of no. 18 wire, space wound, with a pitch of ten turns per inch; the actual winding length is 0.7-in. This coil is indicated as L_2 on the circuit diagram. On this same coil form there is another winding, indicated as L_1, and wound at the bottom of L_2. The L_1 winding consists of two turns of no. 30 silk-covered wire, one turn of which is *interwound* with L_2. The oscillator coil, L_3, L_4, is wound with the same pitch as the antenna coil, and the grid winding consists of five turns of no. 18 wire, wound to cover a length of ½-in. The oscillator coil plate winding has 2½ turns of no. 30 silk-covered wire, of which 1½ turns are interwound with the grid coil. The output coil L_5 consists of ½-in. of close-wound no. 28 enameled wire. Coil L_6 is at the bottom end of L_5; it has five turns of no. 30 silk-covered wire, wound on a form made from a strip of celluloid.

The 35$\mu\mu$f. trimmer condenser connected across L_5 tunes this coil to 5,000-kc, which is also the frequency to which the receiver dial must be set. This frequency was chosen



Circuit diagram of 10-meter converter. Coil-winding data is included in the general text.

because it is commonly found on receivers with short-wave bands, and also because it is readily identifiable by the signal from WWV in any part of the United States. It was considered advisable to select a medium-high-frequency so that there would be no difficulty whatsoever from image interference.

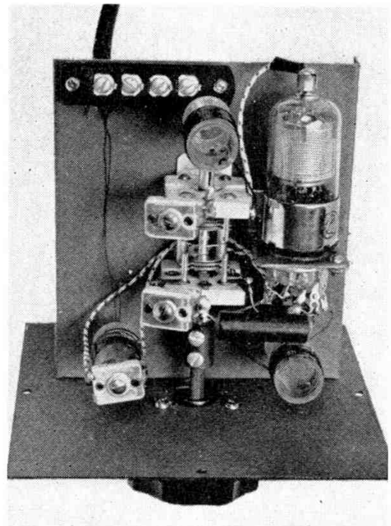
The converter incorporates a 6K8GT tube mounted in a horizontal position to permit very short leads and easy wiring. It is assumed that the power supply of the receiver to be converted for 10-meter reception will handle the filament and plate current for the 6K8GT tube. Practically all short-wave receivers will handle this additional current readily.

The rotor of the tuning condenser in the converter should be grounded securely at both ends. The screen and cathode by-pass should be made as close to the tube socket pins as possible, and should return direct to the ground point on the tuning condenser.

Correct polarity must be chosen for the oscillator plate coil so that the triode section of the 6K8GT will oscillate. The +B supply should be well filtered. If an audio signal is superimposed upon the supply voltage due to poor regulation in the receiver power supply, a 10,000-ohm series resistor, by-passed with an 8μf. tubular electrolytic condenser, should be included in the +B lead to the converter.

Alignment

THE alignment procedure is very simple. A signal generator is connected between the grid cap of the 6K8GT and ground. The receiver is tuned to 5,000-kc. With an input signal of 5,000-kc. from the generator, the trimmer condenser on L_5 is rotated for maximum response. The signal generator should now be connected to the input terminals of the converter, and the tuning dial of the converter set at center scale.



Looking into the 10-meter converter. Note mounting of tube and small components to facilitate short leads.

With an input signal at 29,000-kc. from the signal generator, the trimmer condenser on the oscillator section of the two-gang condenser in the converter should be rotated until the signal is intercepted; then the trimmer condenser on the antenna tuning section should be adjusted for maximum response.

In the interests of those who want a simple converter, regardless of its general form, it can be said that a single 6K8 tube will perform a highly commendable job. Checked with an SX-24 receiver, 10-meter signals received conventionally were increased in strength by two R-points when the receiver was tuned to 5,000-kc. and connected to this converter.

* * *

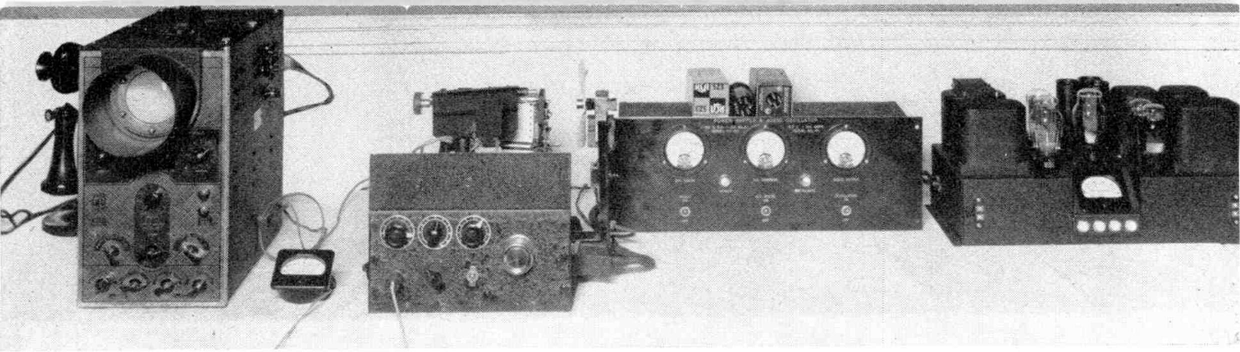
New RCA Transmitter Tube Manual

• RCA has just released a new 16-page booklet RCA Transmitting and Special Purpose Tubes (Form TT-100/3-41). This booklet catalogues all RCA non-receiving types—Transmitting Tubes, Transmitting Rectifiers, Television Tubes, Oscillograph Tubes, Phototubes, Acorn Tubes, Gas-Tubes, Voltage Regulators, and Special Amplifier Tubes. The charts of phototubes and transmitting tubes facilitate selection of a tube type for a particular service or application.

Tube types especially suited for u-h-f uses at frequencies of 100 megacycles and above have been indicated in red for convenient reference. Similarly, types of special interest to radio amateurs have been indicated in bold face.

This new booklet, 8½" by 11" in size, is printed in red and black and is illustrated with photographs of different tube types.

Readers can obtain a copy of this new booklet from their nearest RCA distributor or by sending 10 cents to cover handling costs to Commercial Engineering Section, RCA Manufacturing Co., Inc., Harrison, N. J.



The Engineering Forum

By The Technical Staff

The resonant frequency of an antenna — the correct adjustment of feeder stubs — the determination of proper L or C for tuned circuit, and many other applications are found for the simple grid-dip meter. It is a most inexpensive and useful test instrument. This manuscript will make many readers grid-dip-minded.

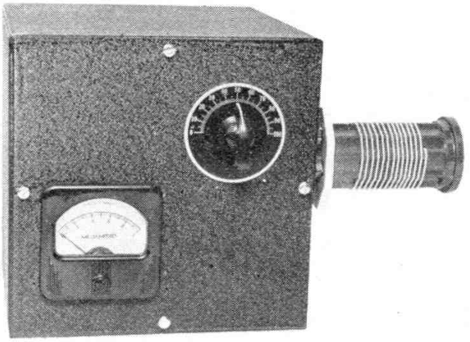
Item No. 14—Grid-Dip Meter

A GRID-DIP meter is a vacuum-tube oscillator; it consists essentially of a vacuum tube, a coil and condenser for tuning the oscillator to a desired frequency, and a 0-1-ma. d.c. milliammeter for reading the grid current of the oscillator. It has many application as will be detailed later. It is a valuable adjunct to any amateur station because it serves as a wavemeter as well as a device for determining the resonant frequency of any circuit, including antennas.

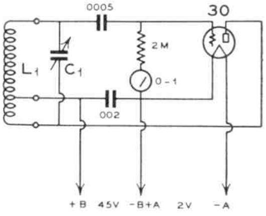
The Circuit

Referring to the schematic diagram it is seen that the coil has only one winding. Since any type of oscillator circuit is satisfactory, a separate plate winding could be used in the familiar "tickler" arrangement, but the advantages of a tapped coil lie in its ability to maintain constant grid current throughout the tuning range of the oscillator. It also provides greater mechanical rigidity, particularly when high-frequency coils are to be wound.

An oscillating tube, under normal conditions, produces grid current. When the tube is in a state of oscillation the grid swings far enough in a positive direction to attract electrons, which flow through the grid resistor. This grid current is then indicated by the d.c. milliammeter in the circuit. The essential characteristic of an oscillating circuit is evidenced by a decrease of grid current when energy is drawn from the tank circuit. The grid-dip meter, therefore, provides a direct means for indicating a load in the tank circuit. If the tank circuit of the grid-dip meter is coupled loosely to another tank circuit tuned to the exact same frequency, the grid current will take a pronounced dip. Hence if a frequency calibration of the tuning range is made, a device is then available for determining the exact frequency to which any L/C circuit is tuned. It can thus be seen that it is highly important that the grid current remains fairly



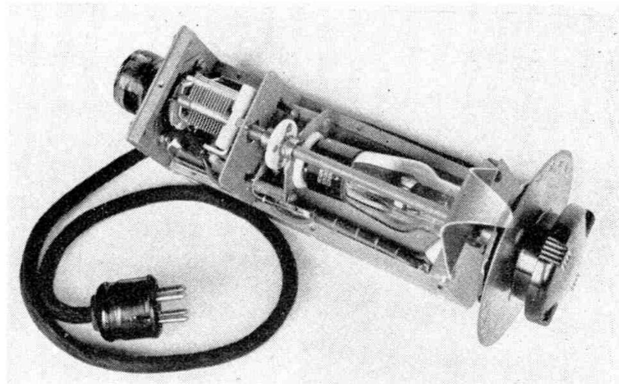
A more simple and less expensive grid-dip meter for amateur service.



The wiring diagram for a simple grid-dip meter for battery operation.

★

Professional laboratory construction of grid-dip meter. It includes a calibrated vernier dial and cable connector for external battery pack. The coil can be seen at the extreme rear of the instrument.



constant over the entire tuning range. The tap on the coil is the principal controlling factor for constancy of grid current throughout the tuning range of the coil in use. The value of grid-leak also has an important bearing upon the constancy of the grid current, but if a multiplicity of frequency ranges is to be covered with several plug-in coils a different grid-leak for each range is not practical. The value indicated in the circuit diagram is satisfactory for coils that cover any frequency range in which the tube will oscillate The size of the coupling condenser affects the value of grid current, but the value shown in the circuit diagram is satisfactory for all ranges of frequency.

The coil-condenser combination of the grid-dip meter is determined largely by the service it is required to perform. If the instrument is used primarily to check a certain wave-band, rather than some definite frequency in the band under measurement, it will not be necessary to have vernier band-spread tuning. On the other hand, the determination of resonant frequencies of antennas, particularly those of the beam type, requires that an accurate means of indication be available, and this calls for band-spread tuning of the condenser. This condenser should have a capacity of only 25$\mu\mu$f. for spreading any of the amateur bands with reasonable effectiveness, althaugh the coils for the lower frequency bands will require a considerable number of turns of small wire. The choice of L/C ratio is left with the designer.

●

Coil Design Table For 25$\mu\mu$f. Variable Condenser

160 Meters: 1½-in. winding length of no. 28 enameled wire on a 1¼-in. dia. form, tapped approximately ⅓ the way up from the plate end.

75-80 Meters: 1½-in. winding of no. 22 enameled wire on 1¼-in. dia. form, tapped ⅓ the way up.

40 Meters: 9/16-in. winding of no. 22 enameled wire, on 1¼-in. dia. form, tapped ⅓ the way up.

20 Meters: Approximately 12 turns of no. 22 enameled wire, space wound to cover a winding length of 1-inch, and tapped ⅓ the way up.

10 Meters: Approximately 6 turns of no. 22 enameled wire, space wound to cover a winding length of 1-inch, and tapped ⅓ the way up.

Note—The 20- and 10-meter windings are subject to variation and the coils should be carefully pruned in order to cover the desired range of frequencies before the dial is calibrated. Stray capacities in the circuit will affect the total capacity and hence determine the value of inductance for a given range. All of the above coil data is therefore of an approximate value only.

The condenser tuning dial should be calibrated carefully for each plug-in coil. The grid-dip meter produces a signal, which can be intercepted on a radio receiver by merely checking the calibration of the receiver dial against the dial of the oscillator.

The device has many practical applications, as follows:

(1)—For determining the correct value of inductance in conjunction with a condenser chosen at random, or vice versa.

(2)—To find the frequency to which a given L/C circuit is tuned, or to determine the tuning range of a given L/C circuit.

(3)—To find the frequency at which a random length of wire is naturally resonant.

(4)—For rough alignment of receiver circuits.

Elaborating on the foregoing, if a coil is wound for 80 meters, and operated in conjunction with a tank condenser, the condenser is then set to its maximum capacity and the grid-dip meter coupled to the coil. The dial on the grid-dip meter is tuned for a dip in grid current. The frequency indicated by the dial calibration is the lowest frequency to which the tank circuit can be tuned. This test should be made with the coupling as loose as possible, yet still enabling a reading to be taken on the meter. If the tank circuit is measured independently of the circuit in which it is to operate, allowance must be made for stray capacities of the tube and wiring which will later be connected to the tank.

To find the frequency at which a random length of wire is naturally resonant, such as a Marconi antenna for the low-frequency bands, usually a one-turn loop inserted between the antenna lead and ground will provide ample coupling to the grid-dip meter. The usual dip denotes that the oscillator is tuned to the frequency at which the antenna is resonant. It is obvious that the proper plug-in coil must be chosen for the frequencies to be measured.

The grid-dip meter will also prove valuable when difficulties are encountered in securing best performance from beam antennas. If an antenna will not draw a load, it is highly probable that it is not tuned to resonance. This holds particularly true in the case of antennas which require a shorting stub. If the grid-dip meter coil has sufficient hand-spread, such as one that requires 15 to 20 dial divisions of the condenser scale to cover the band, a shorting wire with a one-turn loop in its center can be coupled to the grid-dip meter. Resonance of the antenna is then determined as the shorting bar is moved up and down the stub. The frequency indicated by the dial calibration on the grid-dip meter makes it very simple to adjust the shorting bar for operating frequency of the antenna. If, for example, operation is desired from an "8JK" antenna at 14,220-Kc., the grid-dip meter is set at 14,420-Kc. and loosely coupled to a very small one-turn loop in the shorting bar. The bar is then moved up and down the stub until a dip is observed on the meter. It is probable that the loop in the center of the shorting bar may not be required. Sufficient coupling can usually be secured by merely placing the grid-dip meter coil close to the shorting bar.

In many cases of superheterodyne construction the first test fails to produce a signal, and a change of trimmer condenser setting is likewise without effect. This may be an indication that the oscillator and r-f coils were not correctly designed to cover the proper frequencies. With the receiver power turned off, the grid-dip meter can be brought into service and the actual frequencies determined. The remedy is obvious; turns are removed from or added to the coils.

Another feature of the grid-dip meter is its ability to check a transmitter circuit to determine whether it is doubling, or tripling, as the case may be. Harmonic oscillators can also be checked readily.

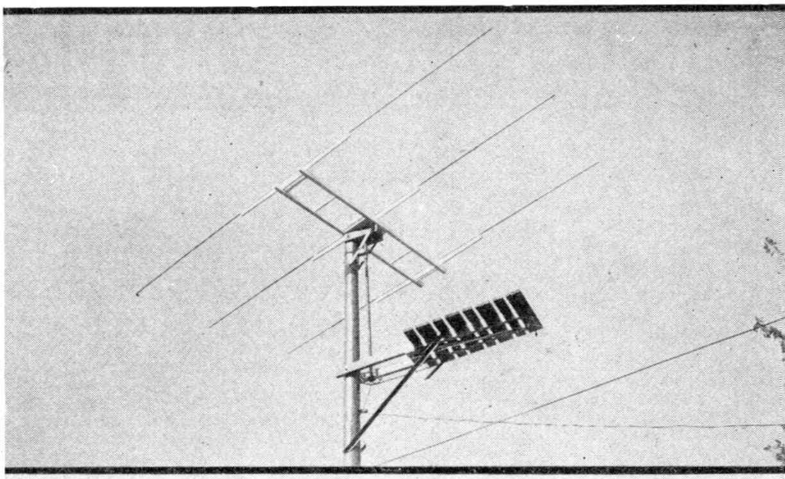
The photographic illustration shows a grid-dip meter for battery operation. A 45-volt B-battery and two flashlight cells and rheostat for the *A* supply are connected externally. The advantages of battery operation are evident when the instrument is used for checking antennas. Tubes other than the type shown can be substituted if desired. The type-1G4G is satisfactory and will operate from a single flashlight cell, although some of the circuit constants may require change.

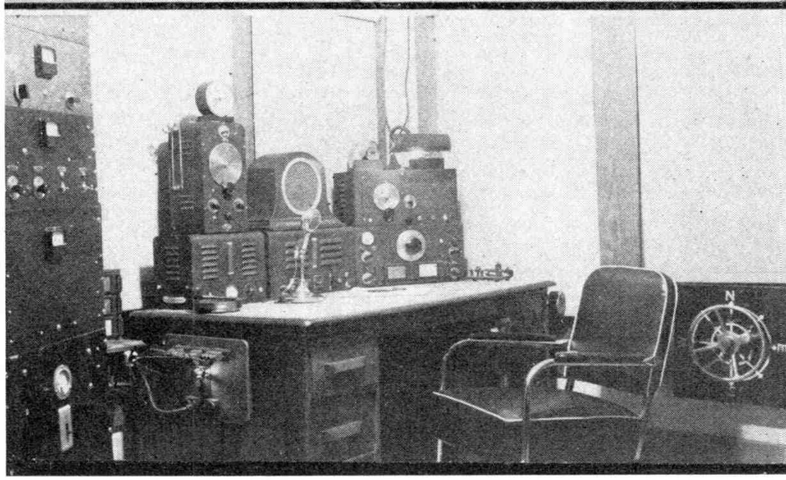
Care should be taken to secure all coil windings firmly with "dope" in order to make certain that the calibration of the instrument will at all times be reliable.

* * *

Effective 160-Meter Antenna Termination.

A R D A N E W S





Leader of Smoke Eater's Radio Club Joins A. R. D. A.

AMATEUR Radio Defense Association has been honored with an Application for Enrollment from Assistant Fire Chief Geo. L. Bird, of Pawhuska, Oklahoma. His amateur call is W5HGC. He is 42 years of age, has a 500-watt transmitter on the 10- 20- and 75-meter 'phone bands, an HRO receiver, Browning Frequency-Meter-Monitor, 3-element rotary beam, and an 18-watt emergency transmitter for mobile service. He has had considerable experience in public speaking and is anxious and willing to organize an A.R.D.A. unit among the amateurs in his vicinity. We have asked him to accept an apponitment of State Communication Officer for our Association.

From his letter we quote some highly informative data:

"We have organized a group of amateurs who devote their entire time to the Fire Service. I organized the club some time ago, and we now have 117 members, all licensed amateurs. I am working on a plan to organize a system which will function during any fire hazard or failure of land-line communication. The members of our club are firemen and licensed radio amateurs and we feel that our organiaztion can do much to aid the national defense in fire-fighting duties. Our plan is to be given a test in a large Eastern city soon. We publish a bulletin which is distributed among our members. Firemen-amateurs who read A.R.D. are invited to write for a copy. Our organization charges no dues, and the requirements for membership are that the applicant must be both a fireman and a licensed radio amateur."

Here is an opportunity for Amateur Radio Defense Association to cooperate extensively with the fire-fighters. Who knows but that the day may come when bombs will fall upon our own cities, and from what we have learned from the British it is evident that fire-fighting is one of the first lines of defense. With Ass't Fire Chief Bird's cooperation we can do much to increase the scope and value of our Association. Let's get behind this movement vigorously. It will help strengthen the amateur's position in the eyes of our Government. Communicate with W5HGC—722 East 10th St., Pawhuska, Oklahoma. Ask your firemen-amateur associates to do likewise.

ENGINEERING APPLICATIONS

1941 DE-LUXE MEISSNER SIGNAL SHIFTER

Models: 9-1057, 9-1058, 9-1059, 9-1060

General Information

● The Meissner Signal Shifter is a variable-frequency exciter permitting frequency control of a transmitter over the entire range of the amateur bands. Due to its inherent stability, flexibility, and ease and simplicity of operation, the Signal Shifter has rightfully earned its place on the amateur's operating table—beside his key or mike, in order that he can completely control the frequency of his transmitter.

The Signal Shifter uses a 6F6 metal tube in a high-C electron-coupled oscillator circuit operating on one-quarter of the output frequency, except on 160 meters where it operates on one-half the output frequency. The oscillator frequency is doubled in the tuned plate circuit of the 6F6, which is capacitively coupled to the grid circuit of a 6L6 metal tube. The 6L6 operates as a frequency doubler except on the 160-meter band, in which case it functions as a neutralized buffer.

The Signal Shifter has a self-contained power supply for operation on alternating current and will not operate on 110 or 220-volt direct current.

The Signal Shifter is arranged for the addition of a crystal oscillator unit known as the Meissner "Signal Spotter." A flexible cable and plug type connector is provided on the back of each Signal Shifter and when the Signal Spotter is added, it is only necessary to insert the plug type connector into the receptacle provided on the back of each Signal Spotter. No other connections are required. A two position switch, located on the Signal Shifter front panel directly below the pilot light, enables the operator to select the type output desired: either crystal output from the Signal Spotter or ECO output from the Signal Shifter.

Output—Bandspread—Frequency Range

● The Signal Shifter delivers a fundamental signal of approximately 7.5 watts on each of the commonly-used amateur bands, except 28 MC. For operation in this band, coils are supplied that cover 14 to 15 MC, permitting full dial-spread on the 28-MC band when the Signal Shifter is followed by a frequency-doubling stage.

The three coils used for each band are so designed that each amateur band is spread over approximately 90 per cent of the dial scale, thus permitting accurate calibration and setting of frequencies.

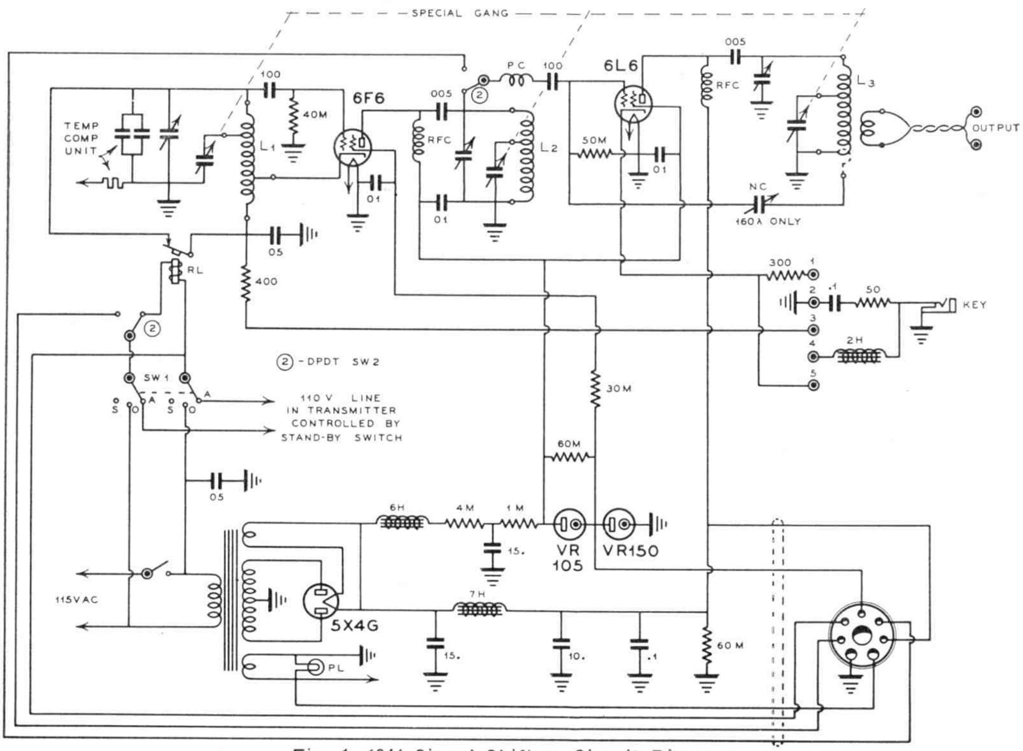


Fig. 1. 1941 Signal Shifter—Circuit Diagram

Stability

An extremely high order of frequency-stability in the Signal Shifter is achieved by the use of the 6F6, a tube which has a minimum of thermal frequency-shift, in a high-C circuit, using sturdy, high-quality components, together with temperature - coefficient condensers, and a "Stand-by" circuit which holds steady the currents flowing in the tube under either operating or "stand-by" conditions.

Adjustment

• In the event that it is found necessary to re-align the Signal Shifter, as when a new set of tubes is installed, it is suggested that the following procedure be used in making the preliminary test:

Turn the AC switch (left side of the panel) to OFF. Plug in the line cord to an AC outlet of suitable voltage and frequency.

A telegraph key or "bug," connected to an ordinary phone plug, is plugged into the key jack found on the back side of chassis. This jack is a "closed circuit" type and for phone operation, the plug is removed which permits the Signal Shifter to operate and eliminates the necessity of an extra switch or "strap" to close the keying circuit.

As shown in Figures 1 and 2, a five terminal strip is mounted on the back side of the chassis. This terminal strip enables the operator to select the desired method of keying the Signal Shifter. For oscillator keying, use short pieces of wire and connect terminal 1 with terminal 2 and terminal 3 with terminal 4. For amplifier keying, connect terminal 2 with terminal 3 and terminal 4 with terminal 5.

Place all tubes in their respective sockets, as shown on Figure 2. Place one complete set of coils, preferably that of the highest-frequency band to be used, in their respective sockets.

Turn the "operating switch" (right of panel) to "Stand-By," turn the "selector switch" (directly below pilot light) to the extreme clockwise position and turn the AC switch (left of panel) "On." This permits the tubes to warm up and places the entire unit in operating condition, but does not allow the oscillator to start.

NOTE: The two position "selector switch," located directly below the pilot light, is provided to permit the use of a Meissner crystal unit known as the "Signal Spotter." When the "Signal Spotter" is used with the Signal Shifter, this switch enables the operator to select the type output desired. In the left position (counter clock-wise), crystal controlled output from the Signal Spotter is available. In the right position (clock-wise), the Signal Spotter is cut-out and ECO output from the Signal Shifter is available. When the Signal Shifter is NOT used with a Signal Spotter, the switch should always remain in the right (clock-wise) position.

After a warm-up of fifteen minutes, turn the "operating switch" to "ON" and rotate the tuning dial to 90 degrees. Set a calibrated receiver, monitor or frequency meter on the high-frequency end of the band corresponding to the set of coils in the Shifter. Adjust the Band-Setting condenser until the output of the Signal Shifter corresponds to the end of the band. If a super-heterodyne receiver is used to locate the frequency of the Shifter, the receiver may give beat notes at several different points, but there should be no quetsion as to which is the correct signal, as it will be much stronger than the spurious signals caused by beats between harmonics. Before the Signal Shifter is actually placed in service, a calibrated frequency standard must be used to actually determine the frequency in use!

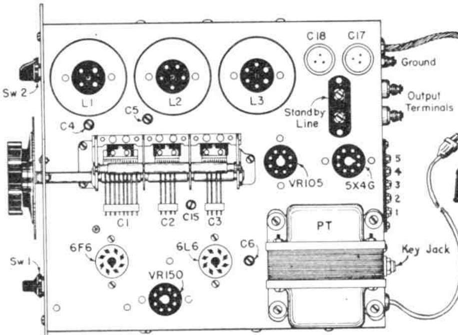


Fig. 2. 1941 De Luxe Model—Top View

Then with the KEY DOWN or with the key plug REMOVED from the jack (which automatically closes the keying circuit), adjust the trimming condensers to give maximum Signal Shifter output. The best indicator of Signal Shifter output is a grid milliammeter located in the grid circuit of the amplifier stage to which the Signal Shifter is connected. This meter will indicate the amount of grid driving power supplied by the Signal Shifter and trimming condensers should be adjusted to provide MAXIMUM READING on the grid milliammeter. If no amplifier is used with the Signal Shifter and the instrument is connected direct to antenna, a small neon bulb held against the antenna feeder or a flash-light bulb connected in series with one of the feeders, can be used to indicate Signal Shifter output. Trimming condensers should be adjusted to provide maximum glow.

Neutralization

• When 160 meter coils are used in the Signal Shifter, the instrument MUST BE NEUTRALIZED. This is readily accomplished in the following manner. Turn the front panel switch to "Stand-By"; then carefully adjust the neutralizing condenser (C-15 on Fig. 2), using a long screwdriver inserted through the chassis hole indicated. Adjust for minimum glow in a small neon bulb held on the output coil winding (L-3 in Fig. 2). A neon bulb is a good indicator for determining the condition of neutralization, since with the front panel switch in "Stand-By" position and the keying circuit CLOSED (Key down), almost no glow should be visible when the 6L6 is neutralized If a bright glow does occur, adjust the condenser (C-15) until the neon bulb goes out or becomes dim.

Neutralization is NOT required for operation on bands other than 160 meters and the neutralizing components are automatically switched out of the circuit on the other bands.

When tubes are replaced in the Signal Shifter, the instrument must be re-neutralized.

Frequency Calibration

• The Signal Shifter is now ready to calibrate. In order that the calibration will remain within desirable limits of accuracy, care must be taken

1941 DE-LUXE MEISSNER SIGNAL SHIFTER — Cont'd

to permit warm-up before the unit is to be used. Whenever coils are changed, the coil shields must be firmly seated to prevent mechanical shift of the oscillator frequency. The Shifter can be calibrated by any standard frequency-checking procedure as outlined in radio technical handbooks using heterodyne frequency meters which have been previously calibrated, a receiver and either an incoming signal of known frequency or a crystal-controlled frequency standard such as the Meissner Signal Calibrator.

A complete calibration curve (See Figure 11) should be drawn for each band to be used. Points should be drawn on graph paper using known frequencies at the ends of the band, and at as many other points as can be accurately recorded using frequency meter or frequency standard. It should be possible to draw a smooth curve (not necessarily a straight line) through all of the points. If no frequency-marking points are available at ends of the band the approximate band edges may be taken from the projected curve drawn from known frequencies inside the band. However, where the band edges are determined by a projected curve, extreme care should be taken in operating near band limits and exact band-edge operation should be avoided.

The high-frequency end of each band is found between 85 and 90 on the Signal Shifter dial. If the calibration curve places this point elsewhere on the dial, the band-setting condensers should be readjusted as described previously.

Calibration should be re-checked at frequent intervals and must positively be checked whenever tubes are changed or replaced.

Do not rely upon your frequency curve to determine your operating frequency. An actual check of the output signal frequency of your transmitter must be made to meet the requirements of the authorities controlling radio operation.

Coupling to the Transmitter

● After the Signal Shifter has been adjusted, aligned, and calibrated, it is then ready to be coupled to the transmitter. This may be done by any of the standard methods of coupling. In a medium- or low powered transmitter, the Shifter may be link-coupled to the grid coil of the output stage in the transmitter. The exciter may also be coupled by means of a link to the buffer stage of the transmitter or the grid or plate circuit of the tube previously used as a crystal oscillator. If the transmitter has crystal control with grid of the output stage capacity

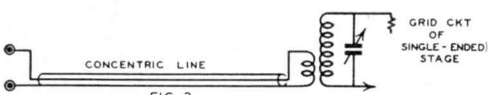


FIG. 3

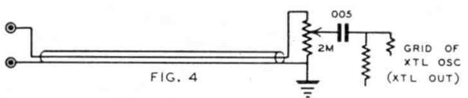


FIG. 4

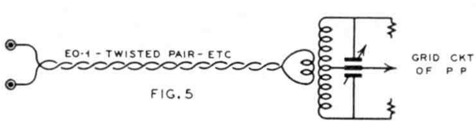


FIG. 5

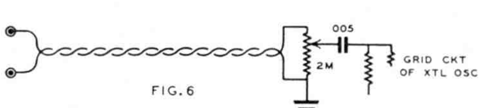


FIG. 6

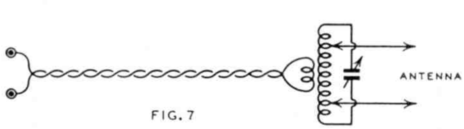


FIG. 7

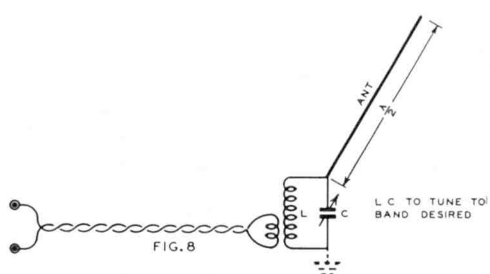


FIG. 8

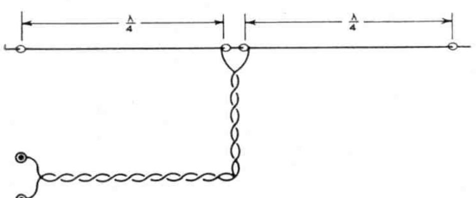


FIG. 9

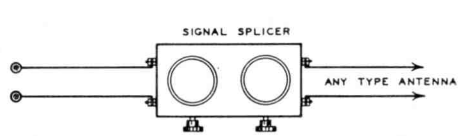


FIG. 10

coupled to the crystal plate tube, the link-coupling can be conveniently made to the plate circuit with the crystal tube removed and the plate circuit re-tuned. If the output of the Signal Shifter is linked to a buffer amplifier, care should be taken to prevent self-oscillation in the buffer stage by means of neutralization or adequate shielding in the case of screen-grid tubes.

The output terminals of the Signal Shifter may be coupled to the transmitter through special Meissner concentric cable, E01 cable, or any other good low-impedance transmission line, such as a pair of No. 14 rubber-covered wires twisted loosely. Special Meissner coupling cable is recommended when highest possible Signal Shifter output is desired. Type E01 cable is highly recommended. The inherent loss in such transmission lines will determine the length of line which can be used satisfactorily. Due to the relatively high output of the Signal Shifter, standard transmission lines can be used up to 25 feet without seriously reducing the input to the transmitter itself. Typical methods of coupling are shown in figures 3, 4, 5 and 6.

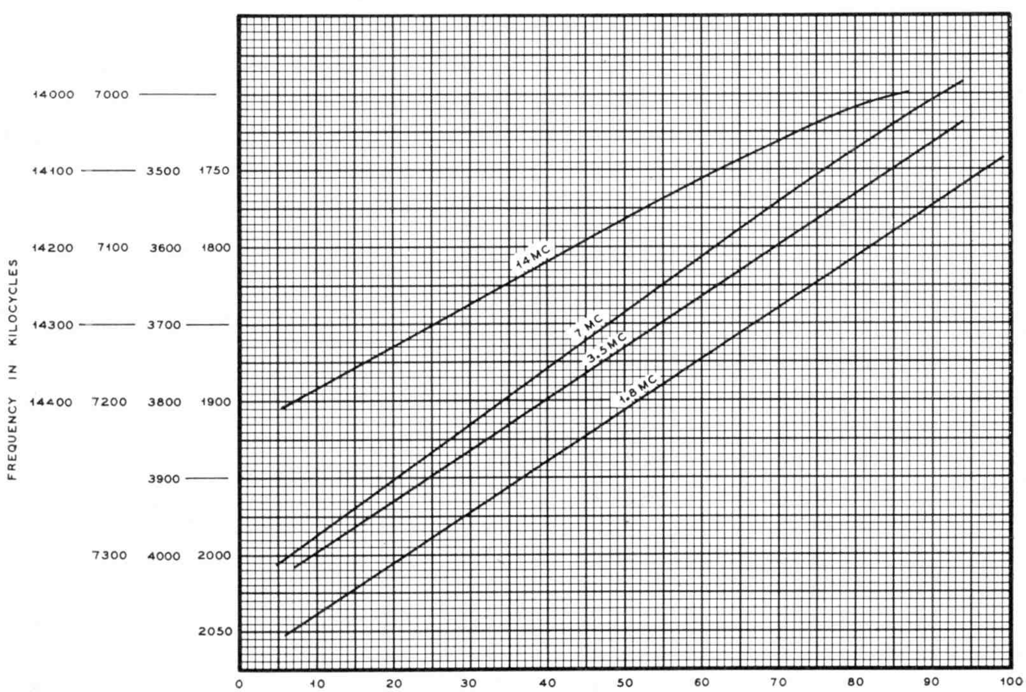
If possible, the degree of coupling between the Signal Shifter and a tuned circuit in the transmitter should be varied at the transmitter in order to obtain the maximum output of each band with the minimum of coupling to the transmitter. It will not be necessary to change the link-coupling turns on the output coil of the Signal Shifter, but better to vary the coupling at the transmitter by means of a variable coupling link-circuit or by the "cut and try" method.

Controlling the Signal Shifter

● There are four controls on the front panel of the Signal Shifter, the AC "On-Off" switch . . . (left hand side of the panel), the "Selector switch" . . . (located below pilot light), the "Operating Switch" . . . (right hand side of the panel), and the main Tuning Dial. A standby relay (RL) is incorporated in the Signal Shifter to permit automatic standby of the oscillator when the amplifier is turned off in the transmitter. This means the operator can control the Signal Shifter merely by operating the "on and off" switch of his transmitter.

In the "Automatic" position of the switch, the relay is connected to the twin terminal-strip near the rectifier (or power supply) socket at the rear of the chassis. For automatic operation these terminals should be connected across any line in the transmitter where 110 volts AC is controlled by the transmitter "stand-by" switch. This is usually the line to the primary of the high-voltage power supply. Thus, the "send-receive" switch simultaneously controls the transmitter and the "Signal Shifter."

In the "Automatic" position of the switch the relay contacts are open when the "final stage" is on, thus permitting the oscillator to function. In the "On" positoin, the relay is held down with the contacts open, by the 110 volts obtained from the power-line cord of the Signal Shifter.



TYPICAL CALIBRATION CURVES

FIG. 11

ENGINEERING APPLICATIONS

In this position of the switch, continuous operation of the oscillator is maintained regardless of whether or not the remainder of the transmitter is operating. This feature is very useful in calibrating the Signal Shifter, locating its position in the band and in furnishing a local signal for use as a frequency standard. The oscillator alone will furnish a weak signal in a receiver placed nearby.

In the "Standby" position, the relay contacts are closed, thus short-circuiting the oscillator in the Signal Shifter. Due to circuit balance, the current flowing on the 6F6 tube remains practically constant whether the tube is oscillating or not, thus preventing drift during the "Standby" period. The tube is thus kept at a constant temperature permitting instantaneous use of a desired frequency without warm-up or re-setting of the frequency control.

Adjusting Transmitter to Signal Shifter

● After coupling the exciter to a transmitter an adjustment should be made in the transmitter to provide efficient energy transfer from the Signal Shifter. While the basic idea of the Shifter is to provide single-dial, bandspread control of transmitter frequency, it is obvious that complete single-dial control (with all circuits in the transmitter and antenna network tracking) is impossible due to the wide variations in transmitter and antenna. It has been found that with the proper coupling from the Signal Shifter to the stage which is being excited, it is possible to operate over a wide frequency range in a given band without readjustment of the grid circuit of the stage under excitation. The plate circuit naturally must be retuned in the transmitter to provide maximum efficiency. The use of "flat-lines" in connecting the transmitter to the antenna will greatly eliminate tuning variations in the amplifier stage itself when operating over a wide frequency range.

The output of the Signal Shifter is practically constant over the entire frequency range of each band, but the exact decrease in power at the edges of the band (when originally tuned up in the center of the band) is a function of the number of circuits following the Shifter, and the degree of coupling between circuits.

Signal Shifter as Frequency Standard

● In using the Meissner Signal Shifter as a standard, care should be taken to accurately calibrate the various frequency bands. Extreme care should be taken in re-setting the dial to the calibrated or calculated point. It is not necessary to use the output (key down) of the Signal Shifter as a frequency standard as the harmonics of the oscillator will ordinarily provide sufficient signal strength for frequency measurements. The accuracy of the unit will be increased if care is taken to prevent mechanical vibration of the Signal Shifter, especially while being used as a frequency standard. Adequate warm-up should be provided for before attempting to use the unit as a frequency standard.

Signal Shifter as a Transmitter

● The Signal Shifter may be used as a low-powered or emergency transmitter by connecting the output terminals to a tuned circuit as shown in Figs. 7 and 8. Also, the output can be connected directly to a twisted pair feeder line, which in turn is connected to the center of a dipole antenna. The twisted pair can be of any normal length, without loss. This circuit is shown in Fig. 9. Another method, using the Meissner Signal Splicer as a coupling unit, enables the operator to employ ANY type antenna with the Signal Shifter. This arrangement is shown in Fig. 10.

Ethical Operation of an ECO

● With the Meissner Signal Shifter connected to a transmitter and the aligning, adjustment and calibration completed, the exciter is now ready to operate. It must be remembered that the operator of an ECO now becomes a part of his equipment. He can operate in a decent, sporting manner, turning off his carrier when placing his signal on the band, and by keeping a few kilocycles from the station called or he can "swish," park right on the weak DX station, or slide back and forth across the station already working the DX station, in the hope of attracting his attention.

Many paragraphs have been printed in the amateur technical journals pleading with the operators for sensible operation of ECOs. Nothing can be added except this—THE MEISSNER SIGNAL SHIFTER HAS BEEN SO DESIGNED AND SO CONSTRUCTED AS TO PERMIT TRANSMITTER OPERATION WITH AN ABSOLUTE MINIMUM OF INTERFERENCE AND ANNOYANCE TO OTHER OPERATORS. IN FULL ACCORD WITH THE BEST "HAM ETHICS" BUT IT NOW BECOMES THE DUTY OF EACH OPERATOR TO SEE TO IT THAT HIS OPERATION AT HIS STATION UTILIZES THESE FEATURES, AND THEREBY MEETS THE ETHICAL REQUIREMENTS!

What Makes 'Em Work?

• Beginning in the next issue of *"Amateur Radio Defense"* the technical staff will tell you how a complete transmitter is designed—from oscillator to amplifier—and why certain values are chosen for certain circuits. Step by step, the circuit will be analyzed and broken into essential requirements. You will gain a better understanding of transmitter circuit design when you read this interesting text . . . and you will know why certain specified values of resistance, inductance, capacitance, etc., are required for the successful operation of a well-designed job. The mathematical calculations will be shown, in complete form, and every consideration of the transmitter will be related in language you can understand. Then you will know how to get the most out of your tubes and other essential parts. This is information of a highly timely and valuable nature. Don't miss it!

Bliley

PRICED FROM $3.35 UP

QUARTZ CRYSTALS

For uniformly reliable operating characteristics there are none better than Bliley Crystal Units. Ask your Bliley Distributor for a copy of descriptive circular A-8.

BLILEY ELECTRIC CO., ERIE, PA.

RADIO OPERATORS WANTED

● The National Defense program is creating innumerable openings for Commercial Radio Operators. Now is the time to capitalize on your radio training and experience by obtaining a commercial operator's license and taking advantage of the many opportunities presented. The "RADIO OPERATORS' LICENSE GUIDE" has been especially prepared as a study and reference manual for those radiomen having considerable training and experience who are unfamiliar with the exact requirements for a commercial operator's license. Containing over 1,250 questions and answers to the new type examinations, it will aid you to successfully pass the tests. Only three dollars postpaid or purchase from your local parts distributor.

WAYNE MILLER

CHICAGO, ILL. THE ENGINEERING BLDG.

RADIO CODE PENCIL

• The International Morse Code, used by amateurs and commercial operators, is reproduced on a standard propeller-type pencil so that the user can refer to it at any time and thereby enhance his study of the code. This is a highly convenient and practical accessory for any person interested in a study of the code. Particularly suited for radio schools, military camps, etc.

Price, $1.00, postpaid

LES LOGAN CO.

646 Jessie Street

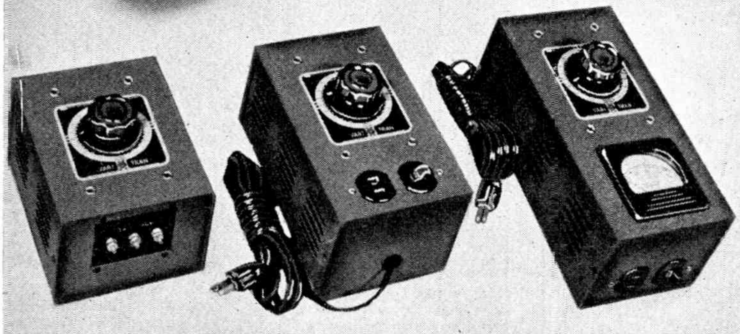
San Francisco, Calif.

Variable Voltage

FOR YOUR LABORATORY, YOUR PRODUCT, OR YOUR PRODUCTION LINE

UTC

VARITRAN



A B C

- ★ SMOOTH CONTROL
- ★ EXCELLENT REGULATION
- ★ HIGH EFFICIENCY
- ★ RUGGED CONSTRUCTION
- ★ WIDE RANGE (0-130 V.)
- ★ LOW TEMPERATURE RISE
- ★ ROLLER CONTACT
- ★ NO DISTORTION

VARITRAN CONTROL UNITS

For Controlling: Rectifier output, Motors, Heaters, Lights, Line voltage

METHOD OF OPERATION The UTC Varitran is a simple autotransformer with turns arranged on one layer so that every exposed turn may be used as a tap. A special non-fusing contact can be moved to any position on the winding, permitting the exact voltage desired to be obtained. The regulation and efficiency are excellent and no distortion of wave form occurs. The output voltage is independent of load.

Type	Input Voltage	Output Voltage	Watts	Max. Amps.	Figure	Net Price
V-0	115 volts	0-130	230	2	A	$7.50
V-0-B	230 volts	0-260	230	1	A	9.50
V-1	115 volts	0-130	570	5	B	10.00
V-1-M	115 volts	0-130	570	5	C	15.00
V-2	115 volts	0-130	570	5	A	9.00
V-2-B	230 volts	0-260	570	2.5	A	11.50
V-3	115 volts	0-130	850	7.5	A	14.00
V-3-B	230 volts	0-260	850	3.75	A	18.00
V-4	115 volts	0-130	1250	11	A	20.00
V-4-B	230 volts	0-260	1250	5.5	A	25.00
V-5	115 volts	0-130	1950	17	A	32.00
V-5-B	230 volts	0-260	1950	8.5	A	37.00
V-6	115 volts	0-130	3500	30	A	60.00
V-6-B	230 volts	0-260	3500	15	A	70.00
V-7	115 volts	0-130	5000	44	A	87.00
V-7-B	230 volts	0-260	5000	22	A	95.00

VARITRAN RATINGS

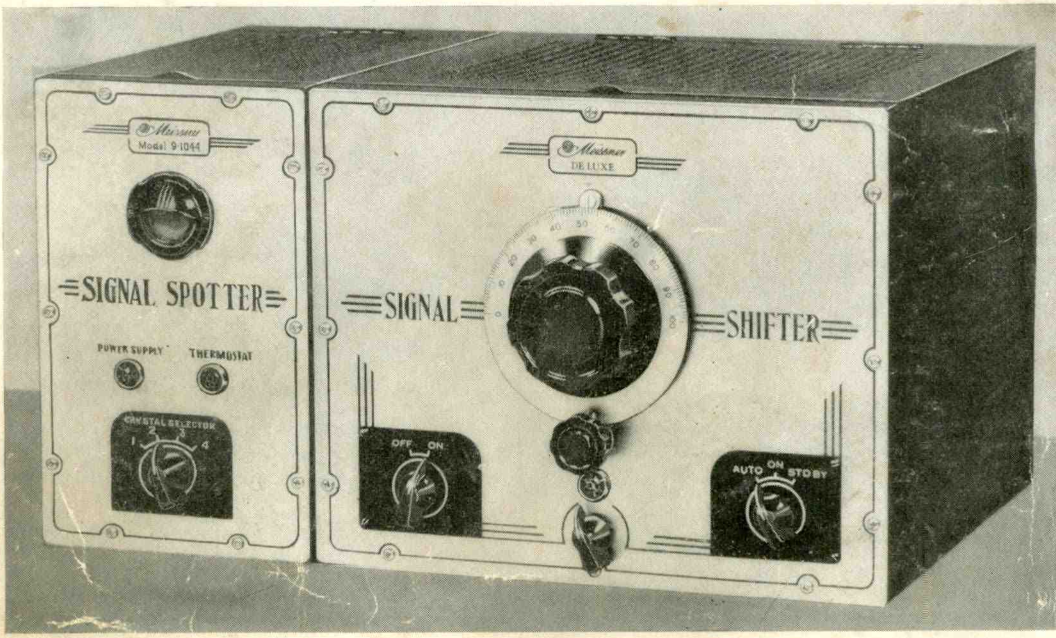
Standard Varitrans are designed for 115 or 230 volt service. The respective output voltages are 0-130 and 0-260 volts. The Varitran autotransformer current and wattage rating is based at 115 volts. The maximum current can be taken at any point from 0 to 20 volts and from 95 to 130 volts, tapering off to 50% of maximum at the 65 volt point.

UNITED TRANSFORMER CORP.

150 VARICK STREET ★ NEW YORK, N. Y.

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

Modernize YOUR Station



With this Outstanding Combination!

It's really surprising, the number of stations that are equipped with Meissner SIGNAL SHIFTERS! Of course we realize the instrument is "tops" but it's almost uncanny to get on the air and have station after station come back with, "I'm using a Meissner De Luxe SIGNAL SHIFTER."

We are proud of this unsolicited praise of our product by ACTUAL USERS! When we stop to realize that the SIGNAL SHIFTER is accepted as one of the highly important necessities in a well equipped station — we just wouldn't be human if we failed to mention the fact!

A few weeks ago, we announced a companion unit to the popular SIGNAL SHIFTER — known as the SIGNAL SPOTTER. This unit is basically a crystal oscillator assembly in which four crystals can be used and instantly selected by the turn of a switch. FOUR CRYSTALS for spot-frequency operation — on band edges, Army and Navy networks and on "traffic" channels. The required operating power is supplied by the SIGNAL SHIFTER. A two-position *control-switch enables the operator to instantly select the type of excitation desired: "ECO," for full-band flexibility, or "XTAL," for spot-frequency operation.

*NOTE — This control switch is factory-mounted in the new 1941 model Signal Shifter, No. 9–1058. For addition of the Signal Spotter to previous model Signal Shifters, the switch is supplied separately, at no extra cost, with simple instructions for installation.

The SIGNAL SHIFTER–SIGNAL SPOTTER Combination provides the LAST WORD in a precision type frequency control system for the Amateur Station! Appearance? The Boys tell us that the "combination," shown in the photo above, is the "best looking equipment on the operating table!"

It has never been our policy to introduce so-called "new models" that would make previous models obsolete or "out of date." The SIGNAL SPOTTER is designed for use with the FIRST SIGNAL SHIFTER, placed on the market three years ago, as well as with the LATEST SIGNAL SHIFTER to come out of our lab! Regardless of WHEN your SIGNAL SHIFTER was purchased, it may be effectively used with the SIGNAL SPOTTER.

Don't fail to see this modern "combination" at your local Parts Jobber's — TODAY! You will experience a new thrill when you see the attractive, clean-cut appearance of this equipment — and a greater thrill when you give it an actual "on-the-air" test! Join the fast-stepping gang who are proud to say, "Frequency is controlled with Meissner Precision-Built Equipment."

SIGNAL SPOTTER, complete with tubes and coils
No. 9-1044 Amateur Net $22.45

SIGNAL SHIFTER, New 1941 Model, complete with ECO-XTAL selector switch, tubes and coils for one band
No. 9-1058 Amateur Net $47.50

Write Today for New Amateur Catalog! Address Dept. AD-3

Meissner MT. CARMEL ILLINOIS

"PRECISION-BUILT PRODUCTS"