ELIMINATING RADIO "NOISE"

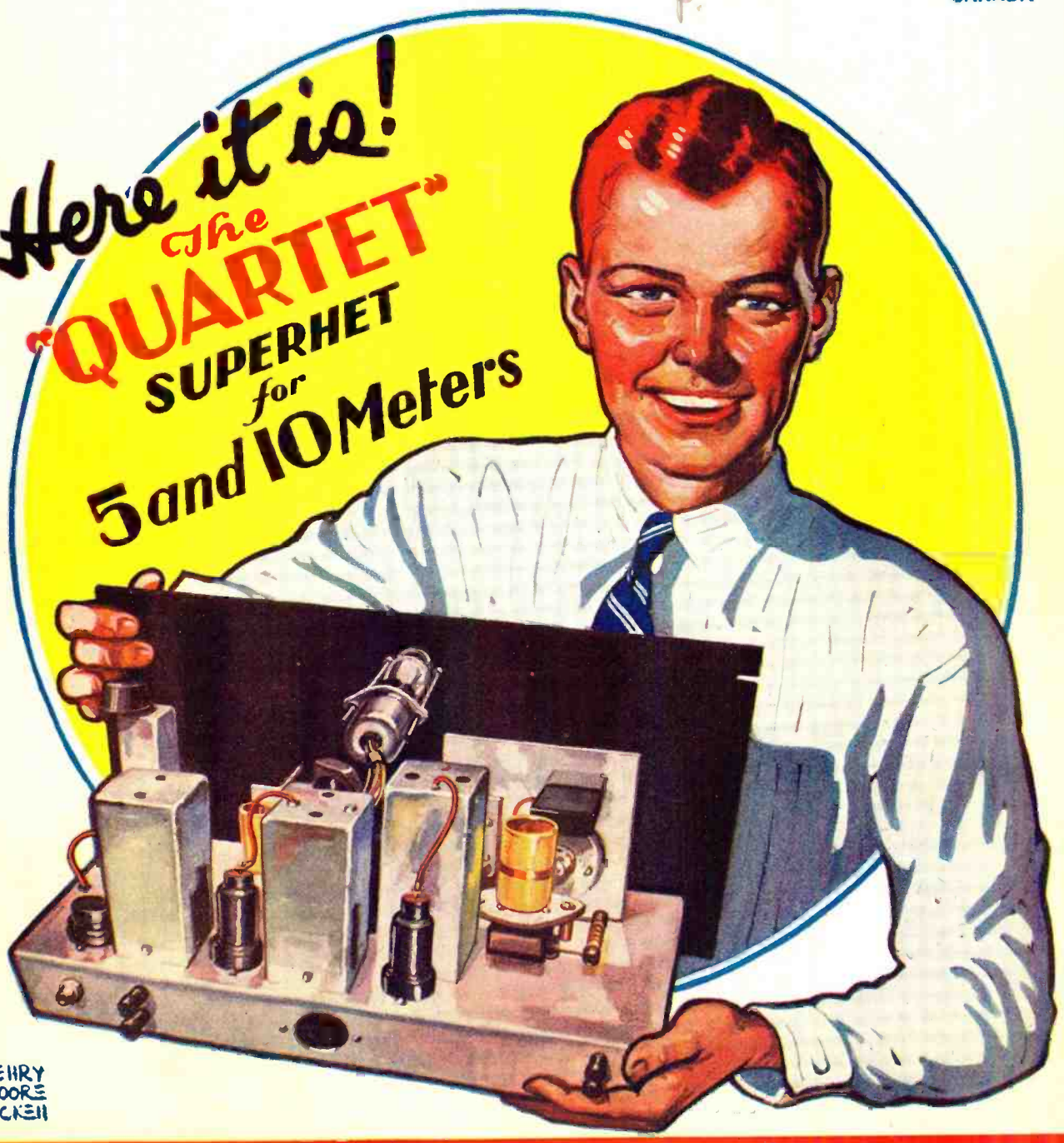
RADIO NEWS AND SHORT WAVE RADIO

SHORT WAVE TIME TABLE

MARCH

Million P. 570

25c
U. S. AND CANADA



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MODEL 1200-C

DEALER PRICE $24.33

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☆ FOR ALL RADIO MEASUREMENTS NOT REQUIRING A NO CURRENT DRAW VACUUM TUBE VOLTMETER

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RADIO NEWS

Vol. XVIII March, 1937

Edited by LAURENCE MARSHAM COCKADAY

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No. 9

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Published Monthly by **Teck Publications, Inc.,** *Washington and South Avenues, Dunellen, N. J.*

EDITORIAL AND EXECUTIVE OFFICES
461 EIGHTH AVENUE, NEW YORK CITY, N. Y.

Lee Ellmaker, *President and Treas.*
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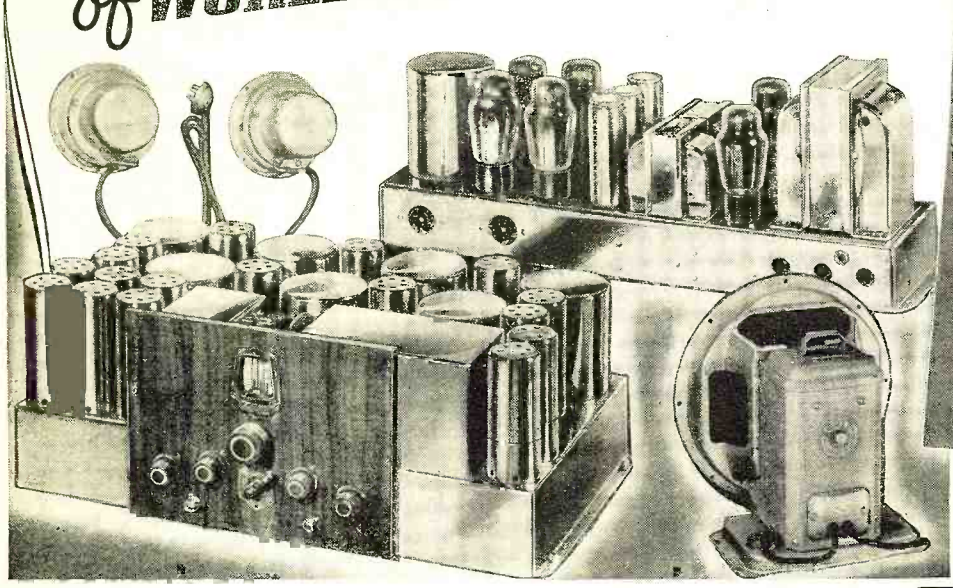
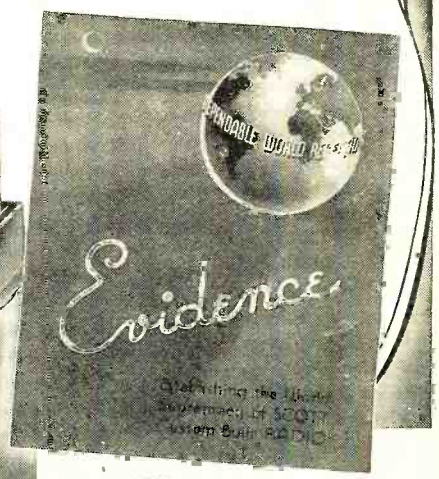
25c a copy. Subscriptions: $2.50 a year, $4.00 for two years; in Canada and Foreign Countries $3.00 a year, $5.00 for two years. Subscribers are notified that change of address must reach us five weeks in advance of the next date of issue.

Get this Conclusive Evidence of WORLD SUPREMACY of 23 tube SCOTT!





STORY after story—page after page—of unique and exciting experiences—written by SCOTT owners — makes this 24-page Brochure unquestionably the most fascinating book of its kind ever written:—It tells of a side by side performance comparison test of the SCOTT and other radio receivers in a large, interference-crowded New York apartment building! Of unprecedented reception piercing a network of static in the iron-ore hills of Washington State!

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Every radio enthusiast will want this brochure, for its the first of its kind. Your sending for it obligates you in no way. Your copy will be mailed to you FREE at once upon receipt of the coupon below. Fill it out and mail it now!

MAKE A SIDE BY SIDE COMPARISON TEST

Cultural interests have in many ways long since burst land and sea boundaries. Thousands have searched for years without *real* success for a radio that would bring in the endless procession of world music and news free from distortion of tone.

SCOTT receivers are not sold through dealers but direct from SCOTT Laboratories where each is custom-built to order. Only in this manner can any radio guarantee its owner the world-supreme performance for which SCOTT receivers are famous. In New York and Los Angeles I have direct branch Studios as well as a Studio at the Laboratories in Chicago; all are owned and operated by me. If you live near any of the studios call, and see and hear an actual living room demonstration of the SCOTT. Your order placed at any of the studios will receive the same immediate attention as though you had mailed it to Chicago. Studio addresses are below.

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In the new 23-Tube Full Range High Fidelity SCOTT you will find, for the first time, a glorious and perfect musical instrument that finally satisfies that deep and lasting pride of ownership that comes only from the knowledge that you have the best.

If, in addition to the book "EVIDENCE" you want complete information on the Custom Built SCOTT Radio itself, or want a "living room" demonstration in our New York, Los Angeles or Chicago Salon, simply place a check mark in the space provided for this purpose on the coupon.

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- ☐ Complete facts and prices on the SCOTT.
- ☐ Details of "living room" demonstration.

Name.....

Address.....

City.....*State*.....

Pages From A Serviceman's DIARY

MONDAY—Hoisted a snow shovel over shoulder and plodded out to the garage to start excavating the service truck, which had become interred during the blizzard over the week-end. Worked up a pretty good sweat in half an hour despite the cold. Found the battery wouldn't turn over the motor after all, so had to get a fresh one and, aided by a down-hill running push, finally got the chariot started. Loaded up with a supply of equipment and sallied forth on the day's calls.

Pulled up alongside a large brick house and found two servants already out clearing the snow from the sidewalk and putting ashes on the icy steps. Went up to the front door and rang the bell. A hard-boiled-looking old dowager came to the door, merely nodded to my "Good morning," and waited silently while I took off my rubbers and overcoat in the vestibule. Before letting me in, she pointed to a few drops of melted snow on the tube checker and asked me to wipe it off. Then looked me over carefully before leading me to the Philco in the sun-parlor.

"We bought this radio in the city about a year ago," she said, plumping down on a settee alongside the set, "and lately it squeals on some stations. I like to patronize our neighborhood tradesmen whenever I can, but your price on this set was so high I had to buy it in the city. I am giving you an opportunity to do this service for me, but you will have to be very careful. I do not want any scratches on the set and neither do I want the floor marred. Everything in this room has just been gone over and I am very particular."

A Tough Customer

"All of our customers are particular—that is why they come to us for service," I answered, giving her what was meant to be a reassuring smile.

"You know," she remarked, "I always distrust people who grin. They are usually deceitful and aim to cheat you at the first opportunity."

"I can't imagine anyone cheating you," I replied, wiping the grin off my face in a hurry and wishing I were out of the house. "You seem to have a nice, neat installation and your radio is a fine, two-speaker model."

"My son made the installation, not the dealer," she said, coldly, "and if you will take the trouble to look it over you will find the clamp on the radiator loose. My son is not a mechanic."

A radioman has to handle not only all kinds of sets, but also all types of customers. The latter job is often the hardest part of the work. A person who is nasty and exacting but who does not quibble over price should receive utmost consideration, without sacrificing one's self-respect. Likewise, such people should be charged liberally and plentifully for every service rendered. Others, who are overbearing in manner and "chiselers" like this particular party, should be put in their place.

Gave the set a brief operating test, noting "birdies" around the middle and low-frequency end of the range. Examined the ground clamp, which was of the strap type with the holes so diabolically placed that it is impossible for it to fit tightly any pipe which one is likely to encounter in radio work. Turned the set around and found that the dealer's installation man had left a note in the envelope. Opened it and read, "Oscillates—corrected by detuning r.f. stage." This, then, accounted for the "birdies," since the r.f. had become so broad that image frequency beat-notes appeared over the dial. Undoubtedly, too, WLW would interfere with WOR during the evening. She had apparently bought a "jimmied-up set" at a loss-leader sale, had been dissatisfied with it since she bought it and had soured on the whole industry as a result.

"Well," she said, impatiently, "do you think you can fix it?" Her tone and manner were just as disagreeable as ever.

"I'm afraid not," I said, "I don't believe I could do this or any other service for you, as long as you maintain your present attitude. You bought this set at a special sale from another dealer, out of town. Too late, you found it wasn't working properly. Also, you found that it cost double what we charge for your dealer to send a serviceman out here. That's why you condescend to patronize us. However, I will make a report at the store and perhaps someone else may offer to help you out."

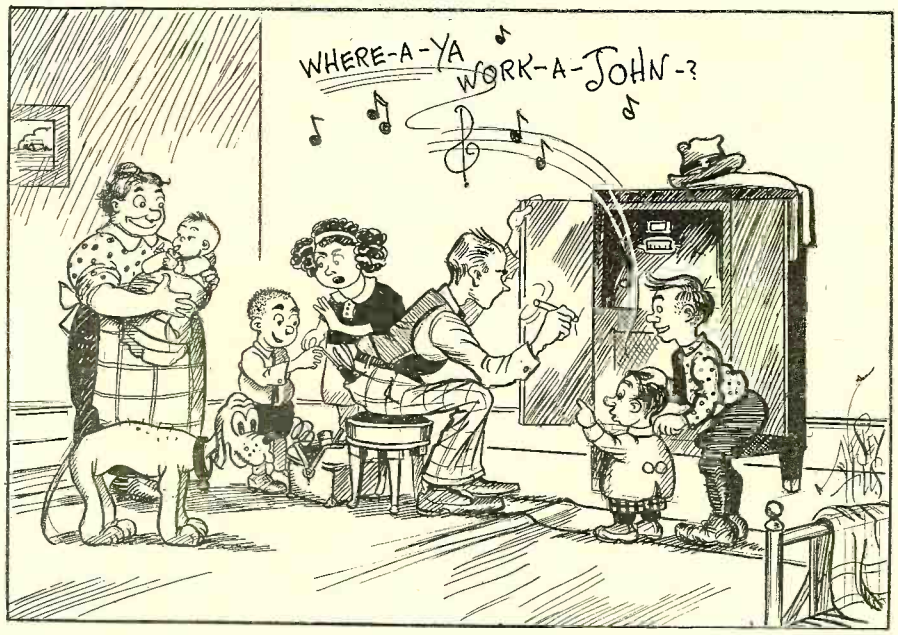
"Don't trouble yourself." She got up and stalked out of the room.

I drove right back to the store, gave the others the story and told them to expect a complaint from the customer. It came—almost before I finished talking. The boss promised her to call personally and investigate. We went up together around noon. When he got to the door, true to form, she said he would have to come back later, that she couldn't be bothered at lunch time. The boss snapped her right out of it, however. Told her it would have to be done right now or not at all. He got the job.

Had to step on it this afternoon to make up for all this lost time. Made temporary repairs on two antennas which came down during the blizzard. Our regular aerial crew will get busy and install real jobs which will stay put. A good blizzard is always a blessing to the aerial business.

Moved on to the Italian section. Found a Stromberg 14 in a little bedroom, with half a dozen sons and daughters of Italy swarming around it. Only tube trouble, so made the necessary replacements. Cleaned up the cabinet and called attention to some scratches on the front which the children had made. I carry a "scratch-remover," which has an oiled swab on one end and walnut coloring stain in stick form on the other end. Went over the scratches and they disappeared like magic before the admiring eyes of the owner. Asked me where it could be bought. Told her this was special and that none of the stores handle it. However, if she wished some, perhaps I might have an extra supply in the truck. She wished and she got it.

Dropped over to Dr. G.'s house and told him about the new RCA phonograph reproducing apparatus with the built-in volume expander and 2A3 output tubes. About the swellest job I had heard. He wants me to demonstrate it, using his special Proctor pick-up instead of the usual one. (It's a sure sale and a special job, as he won't have a cabinet in the house.) Well, off again!



EXTRA SERVICE MAKES SATISFIED CUSTOMERS

Servicemen can gain more confidence among their clientele if they will show some slight interest in the "extra" small jobs they do around the radio set, such as removing scratches from the cabinet, tightening up loose connections on the a.c. plug, cleaning up the metal parts on the receiver, etc. The customer feels that the serviceman has their interest at heart and these jobs take but a short time to complete anyway.

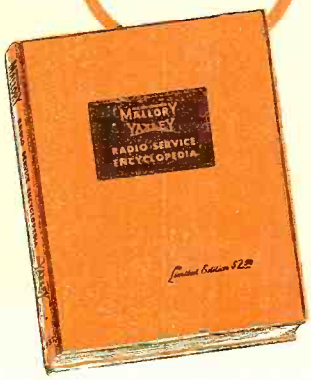
THESE records from an anonymous serviceman's diary should be of decided interest to veteran servicemen, as well as to those whose experience in the service field is more limited. Written by a man who "knows his stuff," and shot with an occasional outcropping of humor, these items provide many hints not found in text books. More of these pages will appear from time to time.

IT is waiting for you at your Mallory-Yaxley distributor. The biggest help you've ever had—and the easiest to use!

Here's the "All in One" Book for you—*all* the "Dope". In one book, on one page, on one line, you find the answer for any servicing problem for *any* radio set. When we say "any", we mean "any"—any of over 12,000 different models. All the information on—

Schematics—Circuits **I. F. Peak Frequencies** **Volume Controls**
Condensers **Vibrators** **Tubes** **Transformer Circuits**

MALLORY-YAXLEY
Radio Service Encyclopedia



Over 200 pages of exact information. Bound in waterproof, washable cloth and printed on paper that stands the gaff... it is a permanent working reference.

It's practical—educational. For the first time, accurate, detailed instructions are given on the thousands of receivers that ordinarily are headaches to the most experienced Service engineers. No need now to worry about the tough ones. This book always gives the correct answer. What's that worth to you? Boy, the sky is the limit.

Get it and you will discard all the jumbled mass of incomplete and often inaccurate data that now clutters up your desk. What a life saver in time and energy! There's just no limit to its value to your business.

We have prepared this Encyclopedia for you. Your Mallory-Yaxley distributor has your copy ready for you to examine. Your share of the cost is a trifle. Buy the book—if in a week it does not pay its way, if you would part with it for twice what you paid for it—return the book and get your money back. But act today; the edition is limited.

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Radio News
March, 1937

Italy's Progress in the VIDEO ART

With radio's future so definitely tied up with television development it is only fitting that progress in this art all over the world should be of foremost interest to the wideawake radioman. This short article tells of the progress Italian engineers are making with cathode-ray television and it is significant that in most countries this method is proving the one through which the best results are being obtained.

***By the* Television Reporter**

CONSIDERABLE activity and developmental improvement in Italy, in the "video" art, is now apparent to your reporter after an examination of their latest television instruments. The SAFAR organization, which is the only manufacturer in that country producing this kind of equipment, has recently demonstrated a new 15-tube television receiver using a huge cathode-ray tube that gives high-definition television reception in actual black-and-white images. The system used is that of Arturo Castellani, head of the Italian Laboratory for Television Researches. The development of this new receiver and of the transmitting apparatus, which uses wavelengths between 5 and 7 meters, follows a course somewhat parallel with those of Farnsworth, RCA and Philco in America, and Baird in England, Telefunken in Germany and other developments in France, Russia and Japan. The apparatus, however, has been worked out with such a regard to fidelity in reception and fineness of manufacture that it should be brought to the attention of television enthusiasts everywhere. This is evident from the illustrations accompanying this article.

Steady Progress

SAFAR first started its television activities in 1930 and its first successful tests were carried out at Milan at the National Radio Show of that year. The first transmissions and receptions employed Nipkow disks with a synchronization system using impulses transmitted along with the signal. These first images were of 60 lines and 25 frames per second.

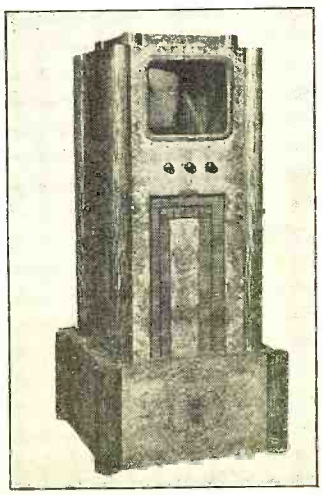
In 1931 the company instigated the establishment of experimental laboratories for the development of luminous gas lamps and other types of tubes for television. In 1932 a new disk receiver with a mercury-vapor lamp was demonstrated and a rather successful experimental service through the period the show was held. This included an ultra-short-wave television transmitter working on 7 meters with 100 watts power.

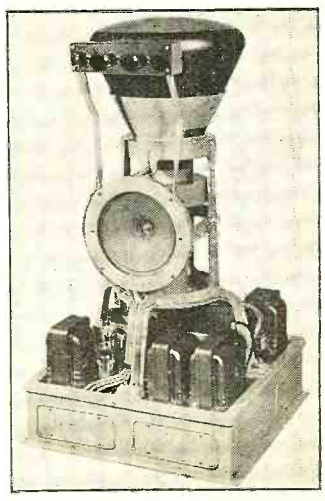
After that a 1 kw. transmitter was developed and installed and tests were made with various early types of cathode-ray tubes, including a whole series of experiments with different kinds of fluorescent substances. The first public demonstration of cathode-ray television in Italy was made with 130 and 240 line transmissions utilizing frequencies from 25 to 1,000,000 cycles wide. During 1933 and 1934 the researches were advanced and a 13-tube system was developed utilizing the SAFAR "Televisode" cathode-ray tube, with an image of 180 by 210 millimeters. In 1935 the development progressed to a point utilizing similar but improved equipment, with 240 lines and 25 frames per second.

(*Turn to page* 575)

NOTHING EXPERIMENTAL ABOUT THIS SET-UP

The two illustrations, below, show the external and internal appearances of the new SAFAR television receiver using a huge cathode-ray tube that projects images in actual black-and-white as well as reproducing the sound accompaniment for the visual program.





Setting YOUR WATCH *by* *Radio*

By Robert Hertzberg

ONE of radio's most useful functions is to answer that frequently and universally asked question, "What time is it?" Certainly there is no excuse for the owner of a radio receiver ever to be without the correct time.

STANDARD time in the United States is determined by the United States Naval Observatory in Washington, D. C. The method of measurement is one of great accuracy. In a general way, it involves the speed of the earth's rotation on its axis and the observation of distant fixed stars passing overhead at the zenith by means of a photographic telescope. Astronomy being an old science, the system has been developed to a high degree of accuracy and dependability.

The Elgin Observatory

There are of course many private astronomical observatories, but the only one besides the Navy's that furnishes time signals as a public service is the Elgin Observatory, owned and operated by the Elgin National Watch Company in Elgin, Ill. It has been in existence for 25 years and is a recognized institution.

The accompanying chart, Fig. 1, shows the complete operating schedules of the naval radio stations associated with the Washington observatory and also of W9XAM, the Elgin station. This is the most complete Radio Time-Table that has appeared in a radio publication in several years, and should prove extremely valuable to anyone who wants to be able to look at his clock with confidence.

The hours are given in both Greenwich and Eastern Standard Times, which are easily converted to Local Time. In the United States, it is only necessary to remember that Central Standard Time is one hour earlier than Eastern; Mountain Standard Time, two hours; and Pacific Standard Time, three hours. Thus, when it is 3 o'clock Greenwich or 10:00 p.m. E.S.T. in New York, it is 9:00 p.m. C.S.T. in Chicago, 8:00 p.m. M.S.T. in Denver and 7:00 p.m. P.S.T. in San Francisco. It is convenient to remember that 00.00 or 24 o'clock (midnight) Greenwich Time is 7:00 p.m. E.S.T. (5 hours difference.)

The transmission of signals begins five minutes before the hours indicated. Signals are sent on every second during that time, except that there is no signal on the 29th second, nor on certain seconds at the ends of the minutes, as shown in Figure 2.

The dashes shown in Figure 2 indicate the seconds on which signals are transmitted. The seconds marked "60" are the zero seconds of the following minutes. All seconds from 0 to 50, inclusive, are transmitted, except the 29th, as mentioned. The dash on the beginning of the hour, shown as 59 minutes 60 seconds, is much longer than the others. In all cases the beginnings of the dashes indicate the beginnings of the seconds; the ends of the signals are without significance.

Also note, especially, that the number of dashes sounded in the group at the end of any minute indicates the number of minutes yet to be broadcast. This is very useful, as it gives the listener an opportunity to make a rough adjustment of his clock (*Turn to page* 571)

TIME SIGNAL CHART

G.M.T.	E.S.T.	NAA	NAA	NAA	NSS	NPG	NPG	NPG	NPM	NBA	W9XAM
0	7:00 p.m.		113	9250		42.8*					
1	8:00 p.m.		113								
2	9:00 p.m.										
3	10:00 p.m.		113	9250	NOTE 2	42.8	108	12885	16180	46	
4	11:00 p.m.										
5	12:00 mid.	64*	113	4390							
6	1:00 a.m.		113	9250							
7	2:00 a.m.		113	9250							
8	3:00 a.m.		113	9250	NOTE 2	42.8	108	8590	8090		
9	4:00 a.m.		113	9250							
10	5:00 a.m.		113								
11	6:00 a.m.		113								
12	7:00 a.m.		113								
13	8:00 a.m.		113	9250							
14	9:00 a.m.										4797.5
15	10:00 a.m.		113	9250°							
16	11:00 a.m.										4797.5
17	12:00 noon	64*	113	NOTE 1	NOTE 2	42.8	108	12885	8090	46	
18	1:00 p.m.		113								4797.5
19	2:00 p.m.		113	9250							
20	3:00 p.m.		113								4797.5
21	4:00 p.m.		113	9250		42.8*					
22	5:00 p.m.		113								4797.5
23	6:00 p.m.		113	9250							
24	7:00 p.m.	SEE FIRST LINE									

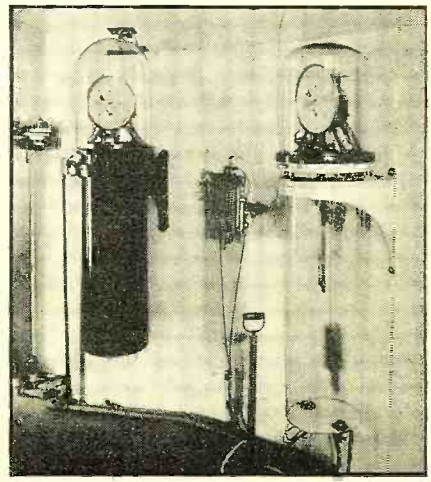
FIG. 1

FIGURES UNDER CALL LETTERS INDICATE FREQUENCIES IN KILOCYCLES
* TO BE DISCONTINUED WHEN 17.8 KC. TRANSMITTER IS PUT BACK INTO SERVICE
° NOT TRANSMITTED ON SUNDAYS
NOTE 1: 8150, 12225 AND 16300 KC. (ALL THREE)
NOTE 2: ONE ONLY OF THE FOLLOWING FREQUENCIES: 4015, 8030, 12045 OR 16300 KC.
NAA – U. S. NAVAL RADIO STATION, ARLINGTON, VA.
NSS – " " " " , ANNAPOLIS, MD.
NPG – " " " " , MARE ISLAND, CAL.
NPM – " " " " , PEARL HARBOR, T.H.
NBA – " " " " , BALBOA, C.Z.
W9XAM – ELGIN OBSERVATORY, ELGIN, ILL.

NAVAL RADIO TIME SIGNALS

MINUTE	SECOND	50	51	52	53	54	55	56	57	58	59	60
55		–		–	–	–	–					–
56		–	–		–	–	–					–
57		–	–	–		–	–					–
58		–	–	–	–		–					–
59		–										—

FIG. 2



WHERE "TIME" IS "MADE"

At left: The Elgin Observatory and the mast of radio station W9XAM. At right: The master clocks which control the time transmissions are sealed in glass jars and kept under a partial vacuum.

WHAT'S NEW in RADIO

By W. C. Dorf

YOUNGER GENERATION BECOMING RADIO AND AVIATION MINDED

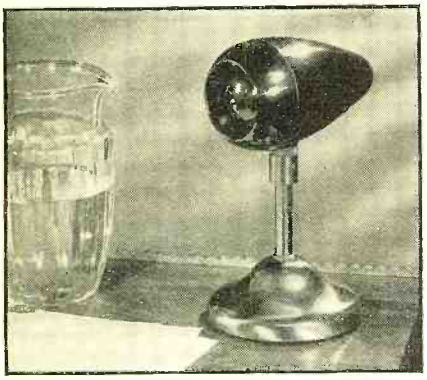
All over the world young people with some technical talents are turning to radio and aviation in schools which are helping them develop inventive ability along these lines. The photo shows two young inventors assembling a model radio-controlled airplane under the direction of an instructor at the Central Children's Technical School in Moscow.

Special Fuse for Aircraft Service

The Littelfuse Laboratories announces a new line of fuses developed especially for heavy duty service in the 110-volt 800 cycle line circuits of transport airplanes. This new "Hi-Amp" fuse, as it is called, is made with heavy brass 9/32 inch square end caps which have right angle lugs for mounting directly to the buss bar. The lugs and caps are welded together and cadmium plated to withstand all forms of adverse weather conditions. The body is of glass, the overall length of the fuse is 1½ inches and the unit weight one ounce. Standard ratings now in commercial use are from 40 to 100 amperes, and can be adapted for aircraft power circuits up to 110 volts.

Electro-Dynamic Microphone

The bullet-shaped instrument shown in the illustration is the new electri-dynamic microphone made by the Transducer Corp.



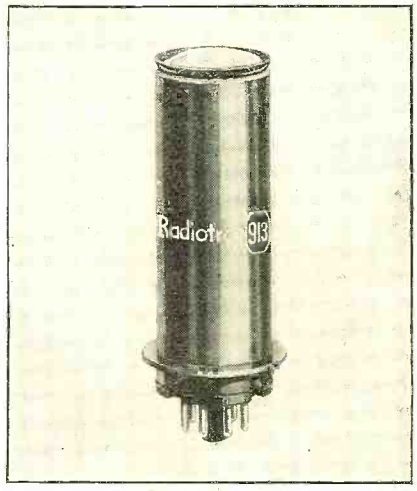
The microphone assembly is housed in a rugged double-shell molded bakelite case of unusual and modern design. This new microphone is especially designed for use with public-address systems, recording work and amateur use. It requires no polarizing voltage and the specifications show a sensitivity of minus 35 to 40 db. and an impedance of 10 ohms. A midget universal matching transformer is available to be spliced in the cable to match 50 and 200 ohm lines and grid input.

Special Relay

The Ward Leonard radio-frequency relay is designed for automatic switching of antennas or other r.f. circuits. It may also be used for switching directional antennas. These relays have special application in amateur stations where one antenna is used for both transmission and reception, where the frequency does not exceed 60 mc. By connecting the coil of the relay directly across the 110 volt, 60 cycle primary of the high voltage transformer, the antenna is automatically switched from the receiving to the transmitting position. The features of the relay are micalex insulation, moulded insulation base, silver-to-silver 15 ampere contacts, low-power consumption coils and laminated magnet frames.

New 913 Oscillograph Tube

NEW YORK, N. Y.—A new cathode-ray oscillograph tube with a screen of but 1 inch in diameter has been released by the RCA Radiotron Division of RCA Manufacturing Company. The tube has the same envelope as the 6L6. The new tube will be relatively low in cost and requires anode potentials of but 500 volts; it will even work with 250 volts. In spite of the small screen, it can be used for many tests. The characteristics are: heater voltage: 6.3 volts; heater current: 0.6 amp.; maximum anode potential: 500 volts; maximum focusing electrode potential: 125 volts;



control-grid voltage: never positive; maximum peak voltage between anode and any deflecting plate: 250 volts.

The sensitivity with 250 volts anode potential and 50 volts focusing potential is 0.15 millimeter per volt (d.c.) for plates D1 and D2; 0.21 mm. per volt (d.c.) for plates D3 and D4. When the applied voltages are 500 and 100 respectively, the sensitivity reduces to 0.07 mm. per volt (d.c.) for D1 and D2; 0.10 mm. per volt (d.c.) for D3 and D4.

The maximum input power to the fluorescent screen should not exceed 5 milliwatts. Interelectrode capacitances are: 10.5 mmfd. between control electrode and all other electrodes; 3.6 mmfd. between deflecting plates D1 and D2; 4.3 mmfd. between deflecting plates D3 and D4. Data for the above was supplied by R.C.A. engineers.

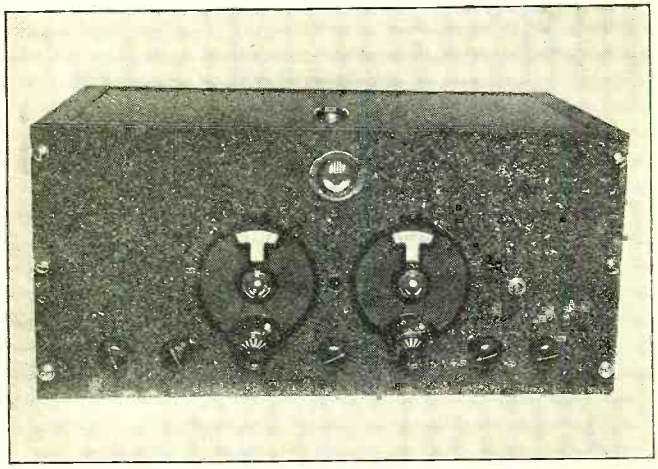
Variable Condensers for Ultra-High Frequency Apparatus

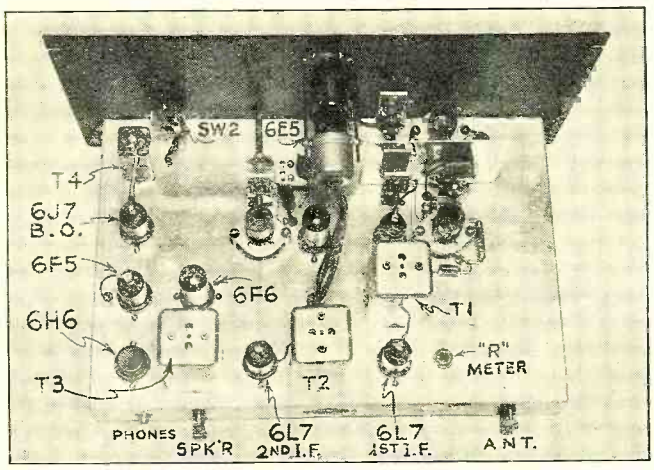
The Hammarlund Manufacturing Co. introduces a new series of ultra-high frequency variable condensers known as type HF. The series includes both single and dual models in capacities from 15 to 140 mmfd. The single unit is so constructed that any one of three different mounting methods can be used. Noiseless operation is a feature of the new condensers.

New Sound System of Wide Utility

The "St. Charles" sound distributing system illustrated in the accompanying photograph and produced by the Operadio Mfg. Company reproduces microphone, phonograph or radio programs. Handles from 10 to 60 loud speakers. The receiver employed is an 11-tube superheterodyne with a tuning range from 528 to 18,300 kilocycles. The attractive cabinet housing the sound system is made of steel and has a grained walnut finish.

(*Turn to Page* 562)





Meeting Today's Outstanding Receiver Need

The "QUARTET" for

5-and10-Meter Reception

By

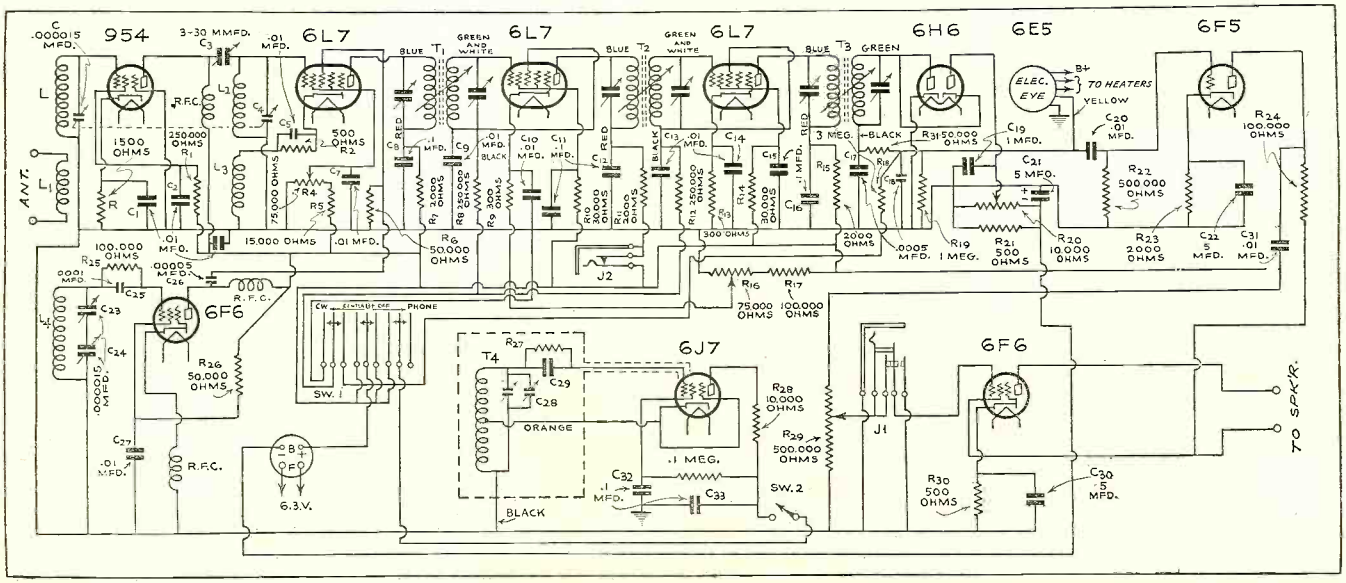
Chester Watzel
Willard Bohlen
S. Gordon Taylor
Laurence M. Cockaday

THE "Ham's" most pressing need today is for a 5-meter receiver capable of receiving understandably the frequency "wobbulated" signals from self-excited oscillators, yet selective enough to minimize Q.R.M. and above all, capable of overcoming the havoc wrought by auto-ignition noise at these ultra-high frequencies. That this need is admirably met by the R.N. "Quartet" 5- and 10-meter superheterodyne, herein presented for the first time, has been amply demonstrated by extensive tests at W2JCY and W2JCR.

The super-regenerative type of receiver is rapidly being outmoded by the increasing need for good selectivity, and because of the "rush" and "blooping" radiation of which most receivers of this type are guilty. Superheterodynes employing resistance-coupled intermediate-frequency amplifiers have rightly been enjoying increasing popularity. They offer greater selectivity and sensitivity than the super-regen but suffer badly from ignition noise and other electrical disturbances in localities where these evils are present. Moreover, the stability of transmitters used in the 5-meter range is improving so rapidly, and the number increasing so fast, that it will be a matter of a relatively short time before the relatively broad tuning characteristics of both these types will not only be unnecessary but likewise undesirable.

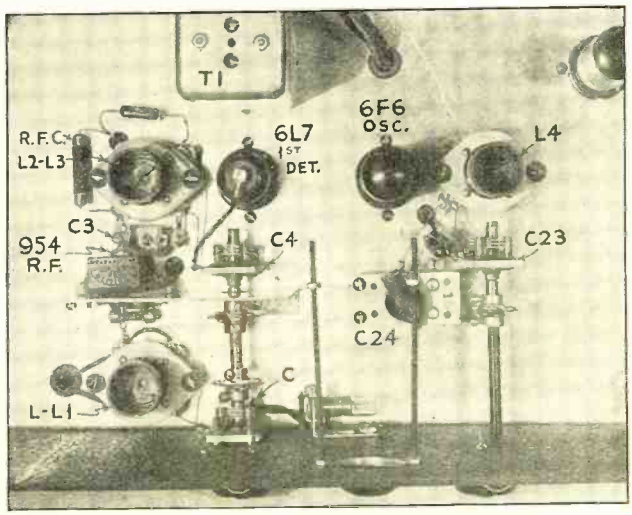
It was with these thoughts in mind that the four authors got together to consider the design of a 5- and 10-meter receiver which would provide highly satisfactory results under present conditions and which could be readily adjusted to provide greater selectivity as the improvement in 5-meter operating conditions advanced sufficiently to warrant. The result is the receiver shown and described in this article.

First we will consider a few of the highlights. In order that signals radiated by typical 5-meter, self-excited oscillators may be received with their original quality it is necessary that the intermediate amplifier of a superheterodyne pass a band of frequencies approximately 200 kilocycles in width. With



the band width reduced to about 70 kilocycles the majority are still understandable, but this is about the minimum band-width that can be used and still maintain intelligibility of the more unstable signals. From the standpoint of good selectivity, on the other hand, a band width of around 10 kc. would be nearer the desired value. A compromise must therefore be made somewhere between these values.

In the receiver under discussion a wide range of choice is permitted through the use of Aladdin iron-core i.f. transformers in which adjustable coupling is provided, and which are tunable over a range of approximately 3000 to 5500 kc. Using the proper degree of coupling for maximum gain, and with the i.f. transformers tuned to 4000 kc. the receiver band width is such that all but a few of the most unstable transmitters are understandable. The crystal-controlled and m.o.p.a. signals are all of good quality, as are many of the self-excited rigs. With the i.f. tuned to 5000 kc. all signals are understandable and a larger proportion have good quality. At 3000 kc. on the other hand, an appreciable number of the signals from self-excited oscillators cannot be understood at all. Varying the degree of coupling will of course further increase or decrease the band-width at any of these frequencies.



CLOSE-UP OF THE R.F. SECTION

The detailed layout of this critical portion of the circuit is shown here. Note the shield between the r.f. and detector stages. This is made from a 4 by 5-inch sheet of aluminum with one of the long edges bent back to serve as a mounting flange. The 954 tube projects through a ¾-inch hole in this shield.

Tuned I. F. Amplifier

After considerable experimentation the model receiver is now used with the i.f. adjusted to 4000 kc. and the coupling adjusted to provide maximum gain. This provides understandability on practically all signals and a degree of selectivity considerably exceeding that of either super-regenerative or resistance-coupled superhet receivers. The important consideration is that the flexibility of this i.f. amplifier permits it to be adjusted to meet the requirements of any individual or location. Eventually, when and if self-excited oscillators are banned from the air on 5 meters, the present transformers can be replaced with standard 465 or 456 kc. transformers to provide a higher degree of selectivity now used on the lower frequency ham and broadcast ranges. Also, if anyone intends to build this receiver for use only on 10 meters, the "Apex" broadcast stations, etc., such standard i.f. transformers can be used.

The Aladdin transformers specified are the double tuned type, tuned in the conventional manner with a screwdriver. Coupling is adjusted by rotating a nut reached through a hole in the side of each can. The selectivity can be varied over a wide range (about 3 to 1) by this means alone and an additional range of about 2 to 1 is obtained by varying the frequency.

An incidental yet highly important advantage of an intermediate frequency over 2000 kc. is that repeat points are widely separated. Using the 4000 kc. adjustment, for instance, the repeat point occurs 8 megacycles away from the normal oscillator condenser setting and therefore entirely outside of the 5-meter tuning range.

Ignition noise constitutes one of the most serious drawbacks to the use of a superheterodyne on the ultra-high frequencies. This obstacle is so completely overcome in this receiver as to be almost negligible. At W2JCR, for instance, it is possible to pull through 1st and 3rd district stations with 100 percent intelligibility which with the noise suppressor control turned "off," had been absolutely unreadable, and which never before had been logged in this location. Time after time weak signals, barely audible through the noise level, are cleared up by means of the noise-suppressor adjustment to a point where every word is clear and distinct.

The noise-silencer system originally proposed for use in this receiver was worked out by Watzel and Bohlen and employed three diode sections. With the assistance and suggestions of J. H. Potts, Associate Technical Editor of RADIO NEWS, the proposed circuit was further simplified by eliminating one of the diodes, resulting in the final form shown in the circuit diagram and discussed later. As it stands, this is believed to be the most simple system yet developed—and the most workable because of its sheer simplicity.

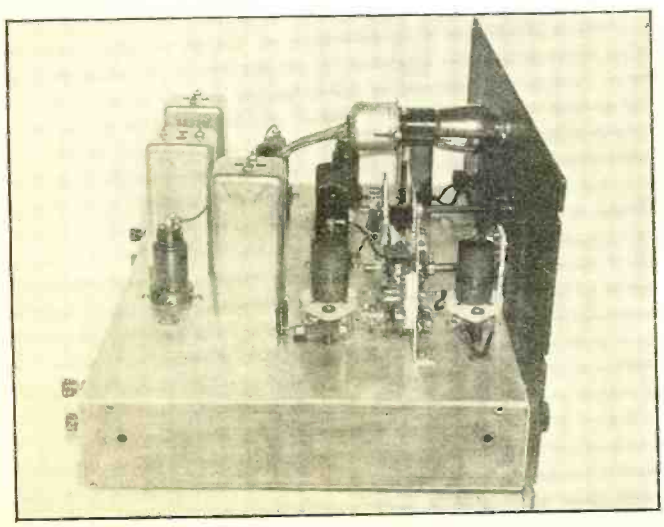
The Circuit

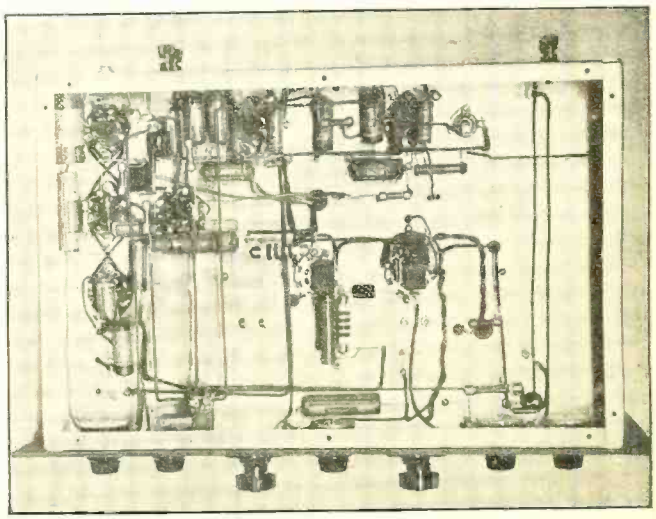
In general the "Quartet" circuit consists of one t.r.f. stage using a 954 acorn pentode, a regenerative first detector, a separate oscillator, two tuned i.f. stages, diode second detector, a.v.c. and noise suppressor; 6F5 audio amplifier, 6F6 power tube and a 6J7 beat-frequency oscillator. The r.f. and regenerative detector circuits are gang-tuned.

Separate tuning for the oscillator was considered desirable because of the complications involved (*Turn to page* 569)

CONSTRUCTIONAL VIEWS

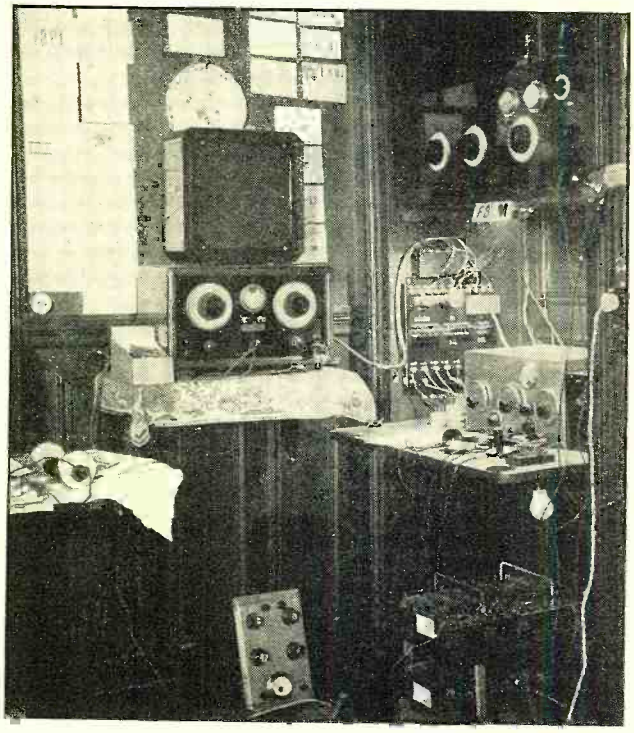
The two views below will provide information helpful to the constructor in layout and wiring.





The "HAM" Shack

Conducted by
Everett M. Walker
Editor for Amateur Activities



FRENCH 8LM
This is the CW station of Vicomte de la Brosse which operates on twenty meters contacting many W1's and VE's. The transmitter works on batteries and a tiny aerial as the station is situated in crowded quarters at Paris.

Limiting AMATEUR Side Bands to *Speech Frequencies*

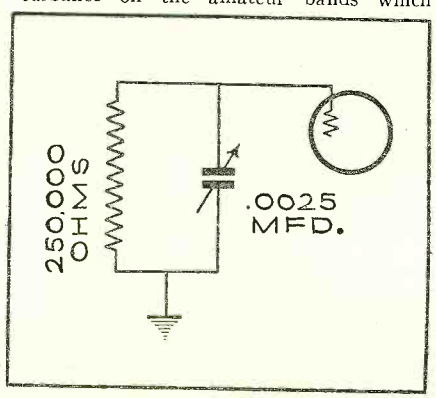
INTERFERENCE in the amateur phone bands is becoming an increasingly difficult problem. The Class A bands of 20 and 75 meters, in particular, are becoming more and more crowded. New stations are being heard every day and the older ones are continuing without any waning interest. All efforts to obtain more frequencies on these bands have failed. Now it remains for the amateur to find a solution to the problem.

PROBLEMS have been the amateur's lot on frequent occasions in the past. He, for the most part, has had to solve these by his own initiative and genius. One has but to recall the days of the loose-coupler and spark and the transition from them to the present to observe the amateur's resourcefulness in overcoming the problems of the past by technical improvement. Witness the inception of the c.w. transmitter and its gradual improvement from the crude, self-excited oscillators first used to the modern crystal-controlled unit; the development of the low-loss receiver followed by the application of the superheterodyne to amateur frequencies, and the gradual improvement toward greater selectivity culminating in the crystal filter.

All of these things might be called developments of necessity. Constant crowding necessitated greater selectivity in receivers, sharper signals from transmitters in order that the constantly growing number of stations might carry on satisfactory communication. It would be difficult to imagine the present 60,000 licensed amateurs operating with the equipment of yesteryear, today. The crowding would make communication impossible.

All this is by way of leading up to a suggestion that probably will not meet the approval of many amateur phone operators. That is to cut down the width of the side-bands of phone stations and thereby reduce some of the congestion on these bands. If all stations operating on the phone bands installed audio-filter networks to limit the response of their audio equipment to the voice frequencies, say from 200 to 3000 cycles, a lot of the side-band "hash" would be immediately eliminated. There would be less interference and more room would be made for the newcomers that are constantly changing to Class A phone operation.

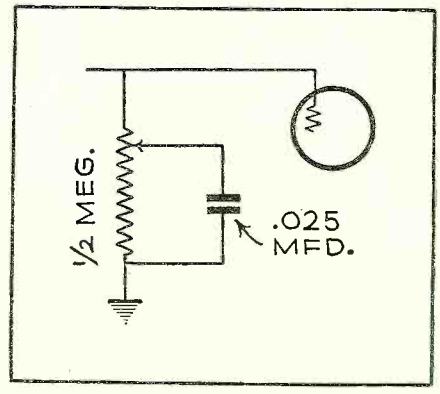
There undoubtedly are a number of phone men who would object to such limitation of audio frequencies, but it cannot be denied that such a step would be beneficial to all. There obviously is no need for "broadcast quality" on amateur bands, as the audio requirements for voice transmission are limited to a much narrower band than necessary to accommodate all of the frequencies of musical entertainment. Experts agree that from 200 to 3,000 cycles is more than ample to accommodate the average voice without in any way impairing the quality of the signal. But at the same time such limitation would automatically eliminate much of the disturbance on the amateur bands which manifests itself in the form of "buckshot" and side-band interference.



When this "benefit your neighbor" plan is analyzed, it will be observed there is much to be gained and little to be lost by the widespread adoption of limited side-band transmission. In the first place, most of the modern amateur receivers are not wide-band receivers. They are worthless to the amateur unless they limit reception to between two and five kilocycles.

Therefore, regardless of all "high quality" put out by an amateur transmitter, it is just so much wasted effort; it is choked off in the highly-selective intermediate stages of the superheterodyne receiver. But it does manifest itself on the air in the form of buckshot and side-band disturbance. As amateurs are limited by law to voice transmission (but are privileged to test modulation with music but not for broadcast entertainment purposes), it seems logical to ask: why bother to waste the power necessary to transmit the unnecessary side-bands?

In addition to benefiting "your neighbor," such limitation of audio frequencies also would benefit the station at which it was used. Modulation, of course, is limited to peaks of 100 percent, which means that the average level of modulation is probably less than 80 percent on voice transmission. By the use of a wide-band audio channel, obviously the average modulation is held down in order to avoid over-modulation on peaks. While the high audio frequencies do not require a tremendous amount of audio power, their elimination from the signal would be helpful because of the greater amplitude available for the normal voice frequencies, thus increasing the output power of the transmitter. It has been computed that by removing all audio frequencies between 3000 and 6000 cycles, results in a 2½-decibel gain, which obviously is no small amount of power. It would seem from this standpoint alone the higher audio-frequency elimination plan would be advisable for most amateurs.

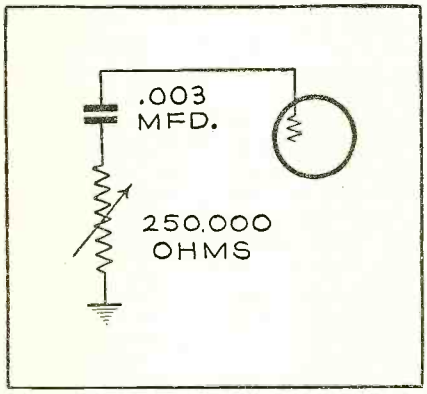


A low-pass filter might be installed to cut out frequencies, say below 200 cycles, but is not advisable to cut out any above this amount. Actual tests of this band transmission have been made by Robert Morris, director of development at the

¶ A Department for the amateur operator to help him keep up-to-date

National Broadcasting Company, and known to amateurs on 20 and 75 meters as W2LV. Morris has been using a filter on his audio equipment designed to cut out the frequencies between 3000 and 6000 cycles. He has not made general mention of this fact on the air. He has yet to receive a report that his quality is impaired. As a matter of fact, most of the reports he receives are of "broadcast quality." His signal has everything it needs for good quality. He too has been campaigning over the air, at amateur club meetings and conventions for the limitation of amateur side-bands. His idea is that it is good engineering.

There is much talk on the amateur bands about alleged over-modulation. Complaints are frequently heard that this is the cause of much of the buckshot and other forms of interference. As a matter of fact, there is surprisingly little over-modulation on the amateur bands. Listening to a number of the so-called offending signals with an oscilloscope attached to the receiver will show that there is no trace of over-modulation in the majority of cases. The point is, most amateurs load up their Class C amplifiers to the limit and even by driving their modulators to the limit they cannot make the grade to cause over-modulation. Most of the alleged over-modulation is caused by unfortunate



design and by the installation of audio filters to cut out the high frequencies, most of this disturbance would be eliminated.

Installation of a filter to cut out the highs is a simple task. Most any of the tone-control circuits used in audio amplifiers will serve quite adequately. These consist essentially of capacity and resistance units connected in the grid circuit of one of the audio amplifier circuits. Several of these circuits are illustrated here.

CALLS HEARD

By Grave M. Beck, 8033 Ellis Avenue, Chicago, Ill., on 20 meter 'phone: VP6AL, VP6YB, HK5AB and LU7AG.

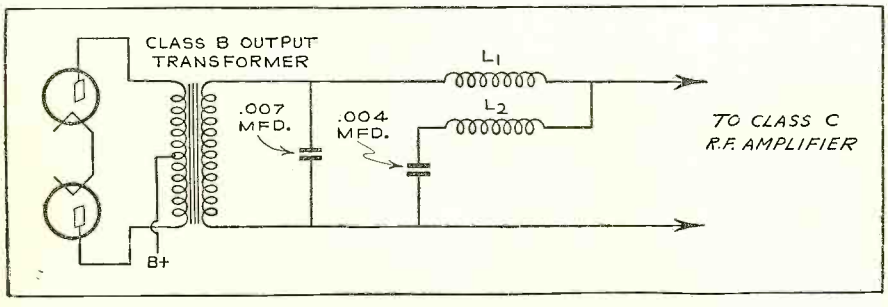
By Harry E. Kentzel, Averill Park, N. Y., on 20 meter 'phone (all new): CN8AA, K4UG, LU9PA, K6NTV, OA4AK.

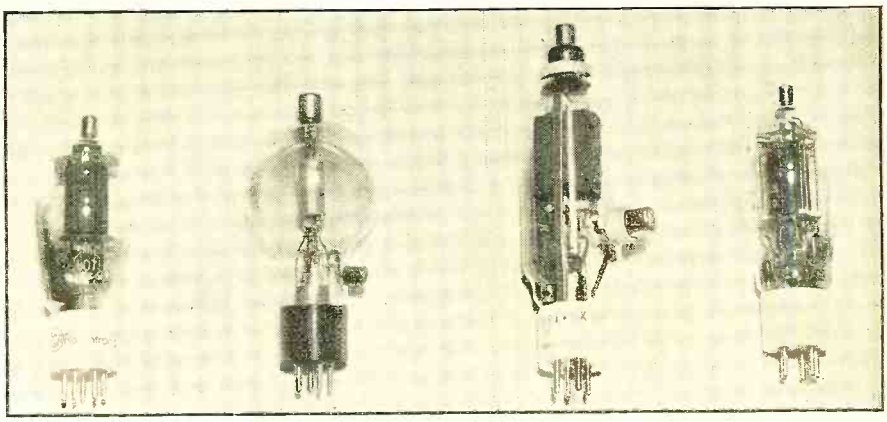
By Richard V. Brian, 2747 North Russell Avenue, Minneapolis, Minn. on 20 meter C.W.: SU1NK, SU1TM, SU1CH, SU1RQ, CN8AH, ZB1H, ZE1JV, FB8AB, FB8WS, ZS1AH, PK1BB, FB8AF, ES5C, HAF5D, U2AZ, U1AP, U0LE, I1RRA, I1ZZ, D4IJH, D4DYL, FT4AG, SM5SX, OH3NP, OH7NF, YM4AA, YT73E, YU7DX, ON4BL, ON4UE, ON4LV, OK2AK, OK3VA, G6TF, G5JO, G6XR, GI5UR, EI2J, EI8F, VK7AB, VK2JN, VK3VW, VK3WY, ZL2FX, ZL1DI, VK3JK, VS6BD, YR5OR, J2CC, J2LU, J2LO, J2CL, XU3CY, XU8NA, VU2BG, CX3AN, CX1CX, K7LZ, OX2Z, TF3G.

On 20 meter 'phone: CE1AR, LU6AP, PY2CK, OA4AK, XE1G, VE5OT, VO1I, G5NI, G5ML, ON4VK, LA1G, I1TKM, SU1CH, CR7KA, ZT6AK, VS6AK, XU3FK, PK4MY, VK2AP.

By H. F. Hamilton, Glenara, Shelvers Way, Ladworth, Surrey, England, on 20 meter 'phone: CE3DW, CO2JJ, 2KL, 7HF, 8YB, K4DDH, LU1EX, LU1ET, LU1HC, LU1UA, LU2AB, LU4AW, LU6DP, LU6KE, LU7AG, LU8AD, PK1PU, PK1MX, PY1AY, PY2AK, PY2CK, PY2EJ, PY8AD, TI2FG, VE2BK, VE2CR, VE2DC, VE2FG, VE2FZ, VE2HK, VE2KX, VE3AEL, VE3LK, VE4SS, VE9AS, VK2AW, VK2BA, VK2BG, VK2MV, VK3AM, VK3HM, VK3HS, VK3JJ, VK3LR, VK5HO, VK7JB, VP6YB, VP4TH, VP9R, XE2J, YV5AK, CX1CC, CX3BL, NY2AE, W10XDA, VE4WR, VE4LH, VE4GU, VO2Z.

By A. Petitjean, 272 rue Marcadet, Paris, France: W1IPE, W1BQQ, W1ABM, W1BLG, W1GED, W1GJX, W1FLH, W1EME, W1IKO, W1NW, W1CHJ, W1DMV, W1IKE, W1QJ, W1HGZ, W1BEO, W1AJZ, W2FBA, W2HCE, W2DH, W2DX, W2CT, W2CQV, W2BFB, W2CQW, W2MJ, W2HUQ, W2DOZ, W2GZZ, W2FF, W2FOA, W2DMR, W2PC, W2DNN, W2ETI, W2ZC, W2IAW, W2GQN, W3AKE, W3EMM, W3EDQ, W3AXC, W3ZX, W3CCN, W3PC, W3FH, W3APO, W3EXA, W3EGY, W3IUG, W3EWW, W3IH, W3FWK, W3FIH, W4EBW, W4BD, W4AWE, W4CVQ, W4BLH, W4CCR, W5BDB, W6BKI, W6ANL, W6LFU, W6ESX, W7FPD, W7BDY, W7HBD, W8BM, W8OBX, W8BRE, W8HFU, W8IKE, W8HEQ, W8DW, W8BFH, W8JYU, W8MWV, W8MPX, W8LFE, W8JIY, W8PRA, W9PYS, W9PXZ, W9BBU, W9MCV, W9ARA, W9FEV, W9KFL, W9PIL, W9PI, W9ROL, W9MCH, W9UVC, VE1BR, VE1AW, VE1AR, VE1BH, VE1BC, VE1BZ, VE1FG, VE2HY, VE2CA, VE2HM, VE2CR, VE2GA, VE2JJ, VE2FK, VE2FR, VE2HK, VE3NF, VE3ZR, VE3AG, VE3HC, VE3BD, VE3DF, VE3BK, VE3OL, VE3YY, VE3QJ, VE4BF, VE4SS, VE5OT, CO2KY, CO2IM, CO2AU, CO2EJ, CO2KC, CO2WZ, CO2QQ, CO2HY, CO8RQ, CO8YB, CO8LW, PY1CK, PY1EQ, PY1DK, PY2CK, PY2DK, PY2ET, PY2EJ, PY2BA, PY2CR, PY4AQ, LU1EX, LU1UA, LU3DW, LU4BH, LU5CZ, CE3AC, CE3CE, CE3DW, HI5X, HI7G, HK2RS, HK1Z, HH1Z, HH2B, HP1A, NY2AE, OA4AA, TI2FG, TI5CV, TI5JJ, VO1I, VO1J, VO4Y, VP2CD, VP3BG, VP7NA, VP9J, VP9R, VK2ABD, VK2BQ, VK7JB, VU2CQ, YV5AA, VE1CR.





PARADE OF NEW TUBES

THE parade of new tubes continues to march before the eyes of the amateur. The last year, particularly, brought forth a crop that fills to a "T" previous gaps in the roster. This Spring there undoubtedly will be much rebuilding of amateur transmitters. The trend is toward the reduction in number of tubes, and certainly this year's production offers many interesting applications of this trend.

The new tubes are designed for ultra-high frequencies and supplement those already available for this purpose. The group includes several low "C" triodes in the 50-watt category, that may be used on frequencies up to 350 megacycles. These offer many possibilities for all-band transmitters of medium power. In this category are the RK-35, HK-154, HF-100 and RCA-808.

In addition, two tubes utilizing the "electron beam" principle have been developed for transmitting. These are transmitting versions of the 6L6, which was designed primarily as an audio amplifier but was found to have many notable features for transmitting use. In this group are the RK-39 and RCA-807.

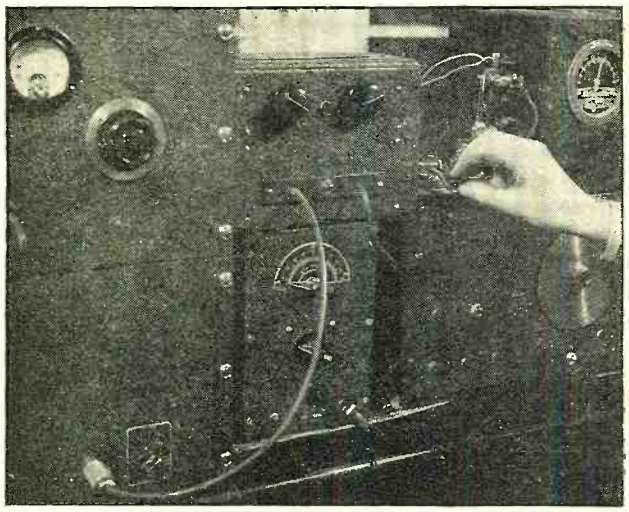
The characteristics of several of these tubes already have been presented on the pages of RADIO NEWS. For the sake of grouping the characteristics of these new tubes in one place, their respective features are discussed here.

The RK-39 and the RCA-807 are similar and may be used in the same types of circuits. Both have "electron beam" type structure. Their most desirable feature is that they require only a small amount of excitation power and give proportionally large outputs. For instance, both will give normal output with only four milliamperes of rectified grid current at normal bias. This alone makes them a valuable addition to the family of tubes. They offer many possible combinations for ultra-high-frequency transmitters or oscillator, doublers and amplifiers.

The basic characteristics of the RCA-807 follow:

Heater voltage	6.3 volts
Heater current	.9 ampere
Grid-plate capacity	.2 mmfd.
Input capacity	11.6 mmfd.
Output capacity	5.6 mmfd.
D.C. plate voltage	325 to 400 volts
D.C. screen voltage	250 to 300 volts
D.C. grid voltage	—200 volts
D.C. plate current	80 to 100 mills
D.C. grid current	4 to 5 mills
Plate input	25 to 40 watts
Plate dissipation	21 watts (maximum)
Average driving power	.2 watts
Average output	25 watts

(*Turn to page* 560)



SURROUNDED, BUT STILL "MASTER"

The top central unit is the CQ'er II, installed at W2JCY, with the 5-meter transmitter at the left, the monitor below and two 5-meter superhets at the right. The unit is small, but has a mightily powerful voice.

5-Meter Hams Note!

The CQ'er II

An I.C.W. Unit "Double-Barreled"

By Laurence M. Cockaday

THE July, 1936, issue of RADIO NEWS contained a short article on a CQ'er, a two-toned ICW unit for code work on the 5-meter band. So many readers wrote in asking for a simpler unit with the same features that the author called in John H. Potts and S. Gordon Taylor to talk over a new design. The unit described on this page was the result. It has proved to be "double-barreled" in producing a powerful two-toned signal of distinction that gains the quick attention of all listeners.

THE CQ'er is a two-toned oscillator for ICW use that can be plugged directly into any transmitter speech amplifier in place of the usual crystal microphone. It is completely shielded and gets away from the familiar trouble of "feedback" when such units are used on 5 meters. It has literally "jumped out of the junk box," as it was made with old discarded parts. It uses two type 30 battery tubes for the oscillators, with a couple of old (the older the better) push-pull transformers, a pair of 100,000-ohm variable resistors, a .1 mfd. condenser and a .01 mfd. condenser, as well as a 2-volt, 60-milliampere pilot lamp (usually used on air-cell receivers) and any kind of a toggle switch. It contains two 4½-volt C batteries (in place of an A battery) and one small 22½-volt B battery. As the pilot lamp is used in series with the filaments of the tubes, these batteries should last six months to a year, for ordinary usage.

Circuit is Simple

The circuit diagram, shown herewith, gives the simple circuit connections which should be followed explicity if the proper grounding and shielding is to be made effective. The three grounds shown on the diagram are made to the small metal box which serves as a container for the unit. The two double leads, one going to the shielded plug and the other going to the key, are of shielded microphone cable. The top output lead is the center conductor connected to the tip of the plug and the right-hand key connection is the center conductor of the shielded lead running to the bottom contact of the key. These two shielded leads are pulled through two close-fitting holes in the connection strip, upon which is also mounted the "on-off" switch and the leads are tied in a knot in back of the panel to prevent them from pulling through. The outer shield conductors of these two leads are grounded on the metal can at the two screws and nuts which hold the strip in place. These are shown on the upper photograph. The pilot light was added so that the operator would not leave the batteries "wasting away" after closing down the station. The two knobs on the front panel, controlling the variable resistances, will vary the pitch so that any combination of tones can be produced.

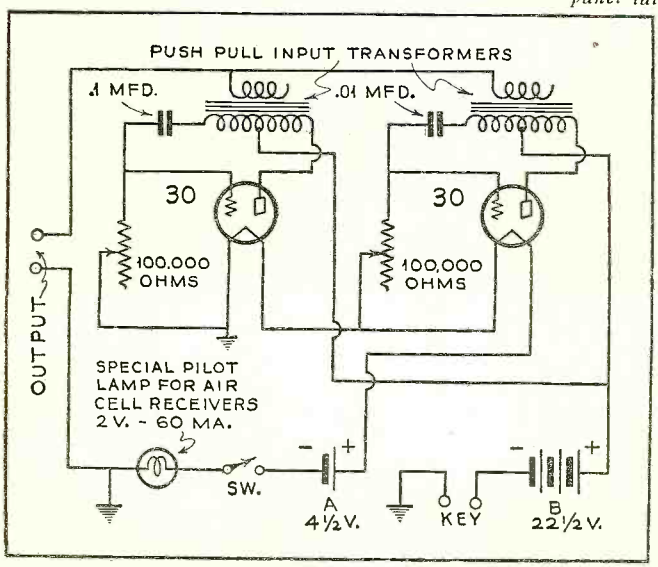
A Distinctive Signal

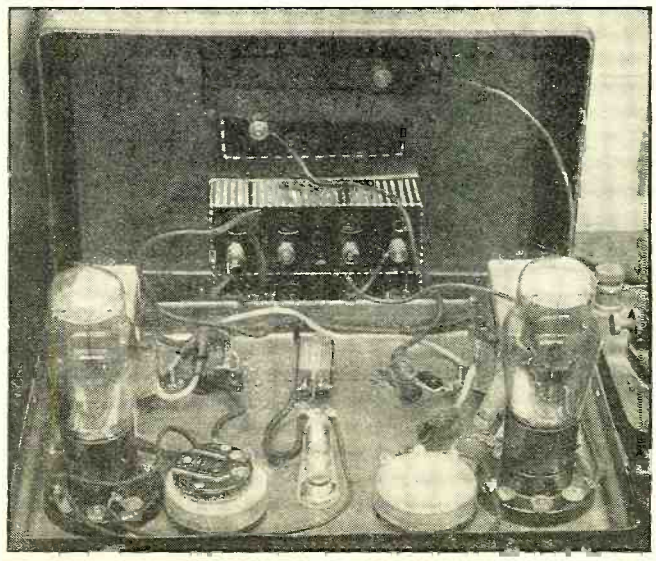
In actual use it was found that the left-hand control could be adjusted to a lower pitch and the right-hand control adjusted to a higher pitch, which produced the most harmonics (sometimes as many as 5 or 6) to make the ICW signal a rather full-toned note covering the whole frequency range. This gives the signal a quality of tremendous power and allows it to be read through interference of both high and low frequencies; the lowest frequencies cutting through ignition interference and "rush" and the high pitches being easily readable through interfering voice signals.

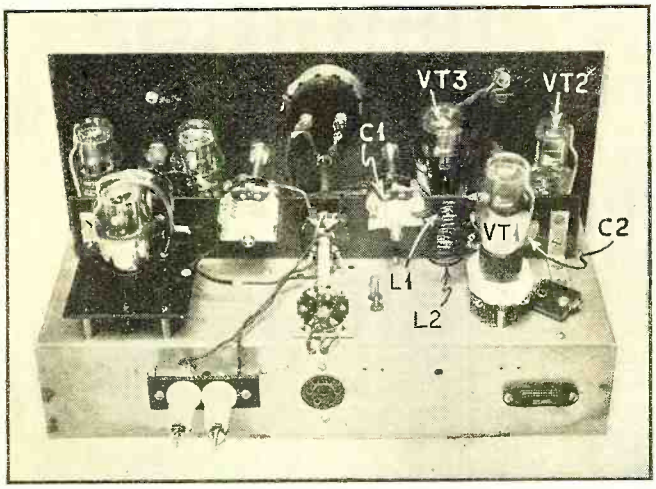
The parts for this (*Turn to page* 572)

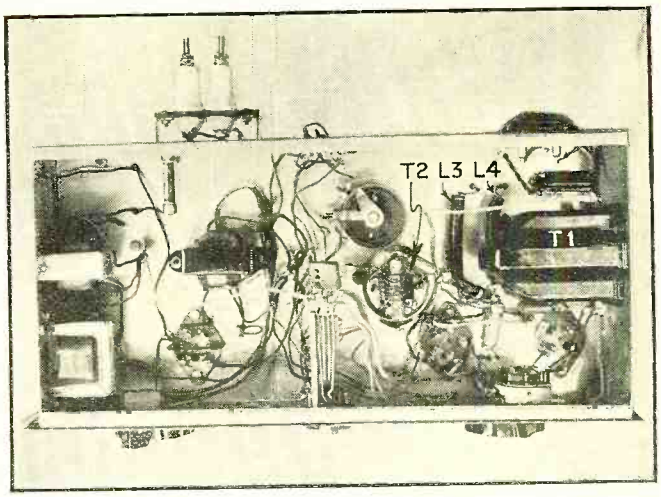
CONSTRUCTION DETAILS

At the lower left is the circuit diagram and at the lower right is a view inside the CQ'er unit with the front panel laid down flat.









THE AUTHOR'S PORTABLE RIG FOR 5-METER OPERATION

A combination transmitter-receiver used by W1EYM in car, boat or plane. The three tubes at the right end of the chassis constitute the receiver, while the oscillator, modulator and speech amplifier tubes are at the left. The "Transmit-Receive" switch in the center provides instantaneous change-over.

Here's The Dope You've Been Looking For On

SUPER-REGENERATIVE

Receivers for the U.H.F.

By Nat Bishop (W1EYM)

Part Three

THE present article covers a super-regenerative circuit for battery operation, a circuit which was designed particularly for portable mobile operation. In this receiver some of the refinements of last month's receivers are necessarily eliminated due to the practical requirements of compactness and simplicity.

This portable mobile circuit is used in a combination receiver-transmitter used by the author. The front view photograph of the combination was shown on page 403 of the January issue and a rear view appears herewith. Looking at this rear view, the receiver circuit is incorporated at the right-hand end of the chassis. The bottom view photograph shows the layout of wiring of the receiver portion. Figure 1 shows the schematic circuit and the complete list of materials appears at the end of the text.

This portable model differs from the one described last month as follows:

1. As the receiver is used only on short Zepp feeders, or twisted-pair transmission line, the 100-mmfd. input-matching condenser was not necessary.

2. The use of filament type tubes necessitates certain changes in the interruption and detector circuits which are evident on the schematic.

3. As the set is used mostly for portable mobile work, a low interruption frequency was chosen and no provision is made for using a higher i.f. The noise reduction ability of this receiver is excellent.

THE first article of this series, which appeared in the January issue, constituted a general discussion concerning the practical application of super-regeneration in the reception of ultra-high-frequency signals. The second article, in the February issue, gave complete constructional details of an a.c.-operated receiver in which the principles outlined in the first article were put into practice.

The same construction and operating principles are applied as outlined for the a.c. receiver last month.

One interesting point has been observed while using this receiver portable mobile. When the car is at rest, best results are obtained with the coupling so adjusted that the detector is on the edge of the "hiss condition." When the car is under way and the signal is varying in intensity, the detector should be operated further into the "hiss condition" in order to give good a.v.c. action and hence hold the signal level constant.

The battery drain of this receiver is very low—.24 ampere for the filaments and 12 to 15 milliamperes total B battery drain. In spite of this fact, the audio output is surprisingly good. It will operate a permanent-magnet dynamic speaker at levels entirely adequate for portable mobile use. Driving a car with earphones shutting out all external noise is not a safe procedure, so in the writer's case at least, loudspeaker operation was considered essential. It is hoped that a descriptive article covering the transmitter portion of this rig can be presented soon.—THE EDITORS.

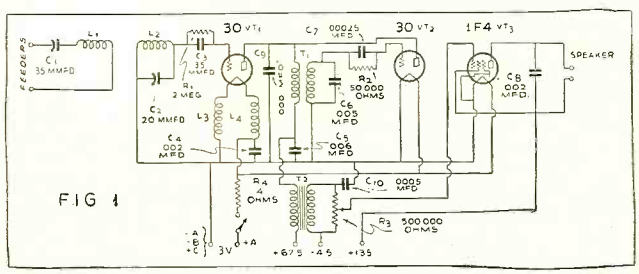
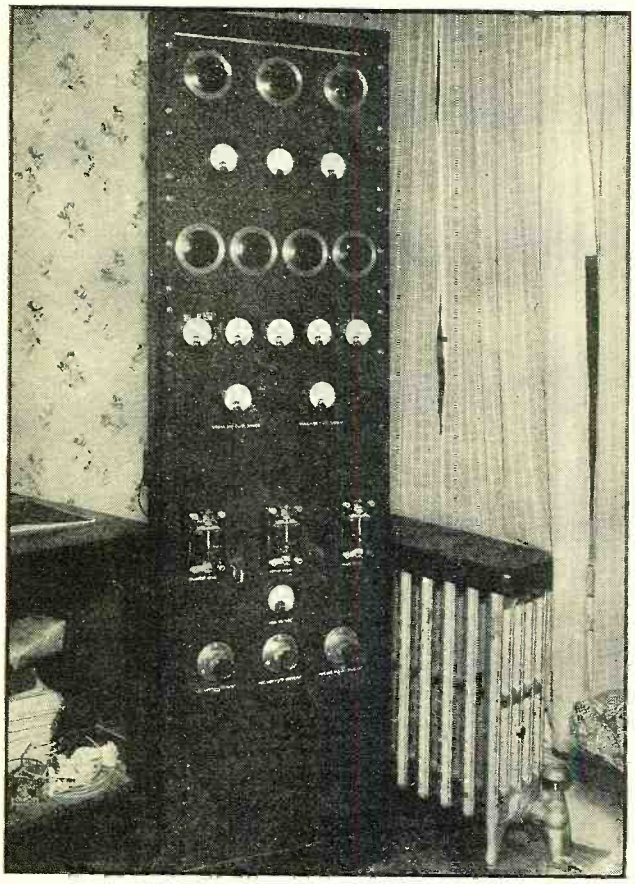


FIG 1

The Parts List

C1—35 mmfd. midget variable
C2—20 mmfd. midget variable
C3—35 mmfd. mica
C4—.002 mfd. or larger, mica or paper
C5—.006 mfd. mica or paper
C6—.005 mfd. mica or paper
C7—.00025 mfd. mica
C8—.002 mfd. mica or paper
C9—.0001 mfd. mica
C10—.0005 mfd. mica
L1—4 turns No. 12 enameled ¾" diameter
L2—5 turns No. 12 enameled ¾" diameter
L3—60 turns No. 20 enameled ⅜" diameter
L4—60 turns No. 20 enameled ⅜" diameter
R1—2 meg., ¼ watt
R2—50,000 ohm, ¼ watt
R3—500,000 ohm volume control
R4—4 ohms, 1 watt (or rheostat)
T1—175 kc. i.f. transformer, GE or RCA part No. 3637
T2—audio transformer, ratio 1 to 3



THE TRANSMITTER INSTALLED AT W2AMJ

Here is the author's complete rig mounted on a rack, with his previously constructed power units, an audio modulation system and relay panel picking up the bottom half. Next comes a meter section and the two top panels are the exciter and final stages.

THE REVISED CIRCUIT FOR THE EXCITER

Below is shown the corrected and revised circuit diagram for the Lestet oscillator, 6L6 quadrupler, 6L6 doubler and the double 6L6 Class C amplifier stage.

Frank Lester Tells You How

CRYSTAL Transmitter for

So universal has been the acceptance, the previous two articles on the ers have written in asking if they before it was published. But although the much needed information in

By Frank Lester

Part

AS there will doubtedly be quite a few of the amateur fraternity interested in higher power for the transmitter, despite what has been said previously on this subject, the final amplifier used by the author at his home station is being described herewith.

The illustration showing the arrangement and the diagram of the circuit of the final amplifier of this transmitter will supply practically all of the construction details for builders, as it is quite clear. Looking at the illustration from right to left, we see first the grid coil, which is plugged in, and mycalex strips supporting the necessary jacks, the coil being supported on another strip of mycalex. No provisions for plug-in links were made, as the same link may be employed on all bands, if this is desirable. The link circuit being used at the home station consists of two turns at each end. One end of the link is coupled to the exact center of the push-pull 6L6 plate circuit, the other being coupled to the exact center of the push-pull grid circuit of the final amplifier.

Referring to the illustration once again, looking at it from right to left, after the grid coil we have the Hammarlund split-stator, grid-tuning condenser, followed by the pair of

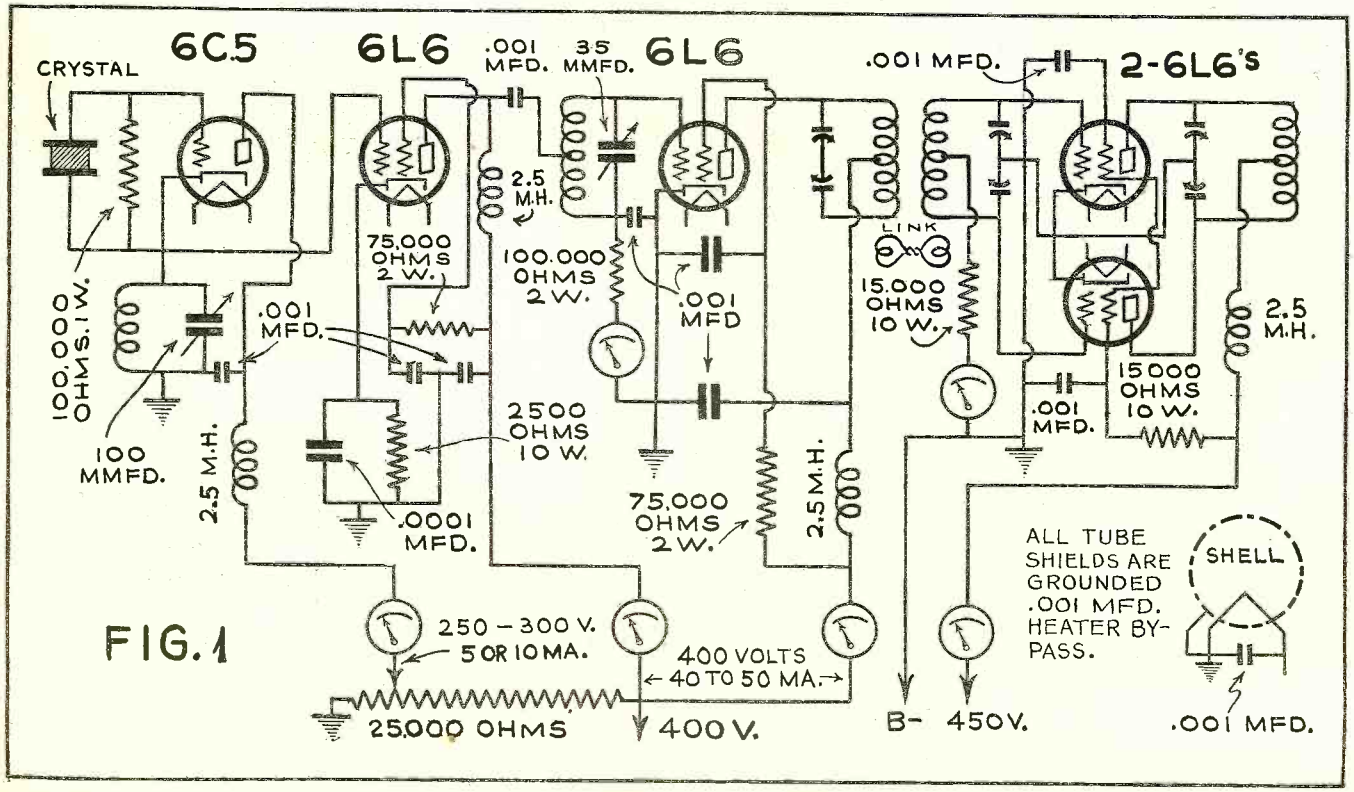


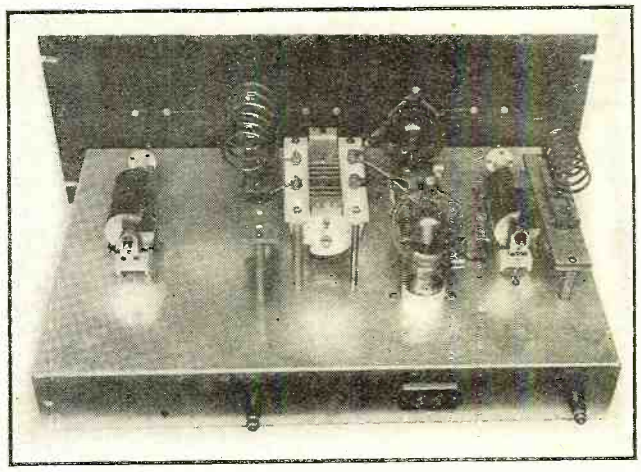
FIG. 1

To Construct And Operate A CONTROL 5-10-20 Meters

on the part of amateur readers, of author's transmitter that many read- could get the data on this final stage this could not be arranged, here is short, concise and informative style

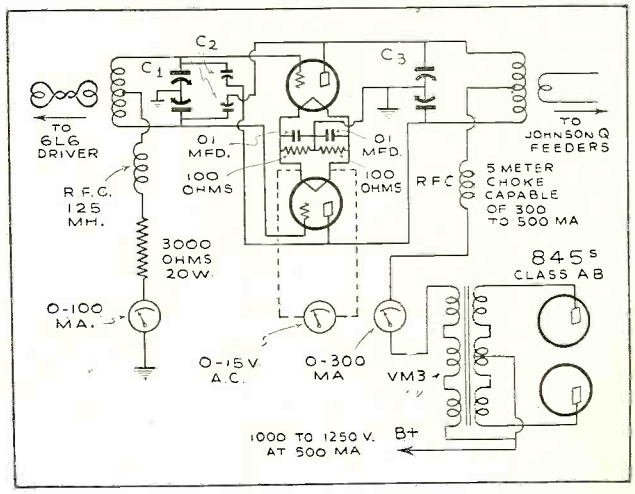
(Radio W2AMJ)

Three



THE FINAL HIGH-POWER STAGE

The photograph above and the diagram below give the construction and wiring details for the final push-pull Class C stage of the transmitter, capable of 150 to 300 watts input. Circuit also shows method of connecting the modulator.



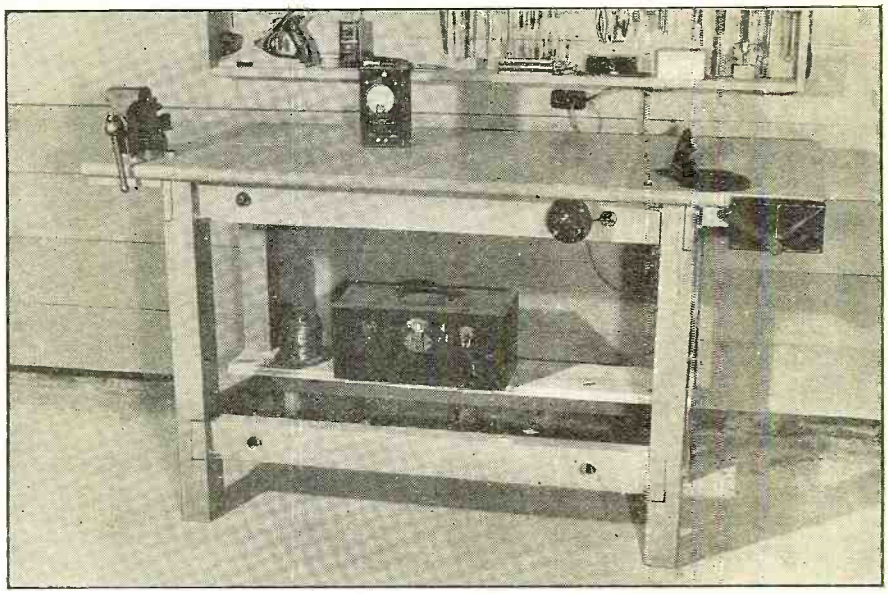
neutralizing condensers, which are mounted on another piece of mycalex. This assembly is located between the two tube sockets and for this reason is not visible in the illustration. The final amplified split-stator, Cardwell plate-tuning condenser is next, with the final amplifier plate-coil following. The other condenser on the chassis is Hammarlund, split-stator, double-spaced 35 mmfd. per section condenser, which is not employed by the author at this time. This condenser was added for increasing the flexibility of antenna coupling should any other but the Johnson "Q" antenna be employed.

It will be noted that the Cardwell type MP-35-GD plate-tank tuning condenser is mounted upside down. This was done in an effort to keep all wiring as short as possible, and at the same time to provide one ground point for this condenser. It will be noted that by mounting the Cardwell condenser upside down, the connections to the plate-tank coil are very short and also those to the plates of the tubes employed. The stand-off insulators are fastened to the condenser by removing the 6/32 screw, which enables the casein insulation, employed as a stand-off, to be drilled and tapped to fit onto the end of this screw.

When substituting the longer 6/32 screws, care should be taken to remove only one at one time, to avoid misalignment of the condenser. By removing one screw and immediately replacing it with one of sufficient length, no trouble will be experienced in this respect. The height of the stand-offs will, of course, depend on each individual layout, and the choice of tubes. The length used in the illustration was 2¼ inches. Three casein stand-offs are employed, the fourth support being ¼-inch brass rod, drilled and tapped at both ends, this being the one ground point referred to previously. All the remaining parts, such as bias resistors, r.f. chokes, filament by-pass condensers, etc., are located below the chassis.

Symmetrical Wiring

When wiring the final amplifier, care should be exercised in making sure that each lead, employed in the grid and plate circuits, is exactly the same length on one tube as the other. If this care is taken, a perfectly symmetrical push-pull final amplifier will result, which will neutralize very easily. This precaution also will prevent any unbalance in the circuit, which would tend to cause one tube to show more plate dissipation than the other. We might add at this time that this procedure (*Turn to page* 558)

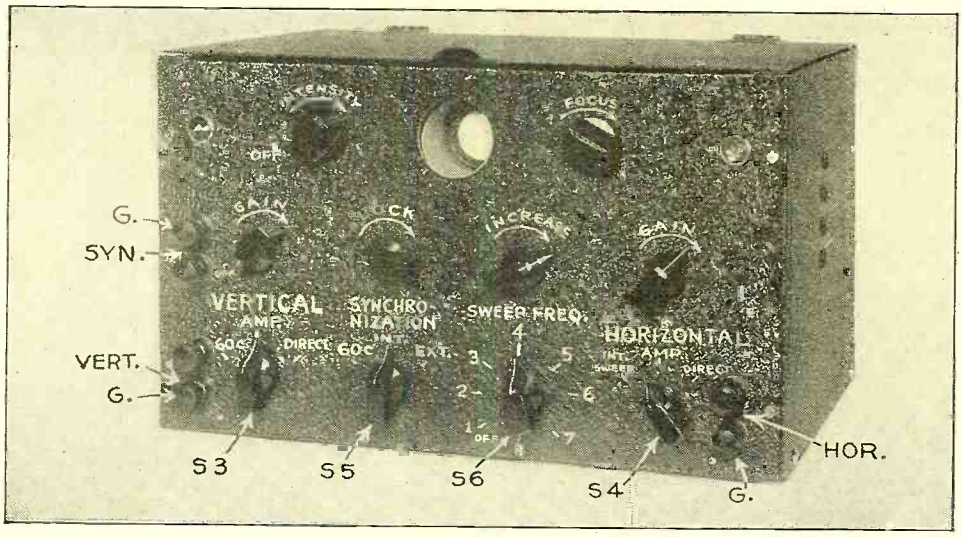


Build Your Own Work Bench

A day or two spent in building a strong, solid work-bench is an excellent investment of time by any radio serviceman or experimenter who expects to obtain real profit or pleasure from his work. No great carpentering skill is necessary, and the only tools needed are a saw, a brace, the necessary bits, a chisel and a hammer.

The bench illustrated is ideal for the small shop. The legs are made from 4 x 4 inch lumber 31 inches high. They are joined at the end in pairs. Flush with the tops, and 6 inches above the floor line, are

(*Turn to page* 550)



Build This "913" Cathode-Ray
OSCILLOSCOPE
With Amplifiers and Linear Sweep

By Gerard J. Kelley

THIS month a full-fledged oscilloscope is presented containing amplifiers for both the horizontal and vertical deflecting plates as well as a saw-tooth oscillator. The unit can thus be used for the same purposes as the larger and more expensive oscilloscopes, the only difference being in the size of the pattern.

One might consider an oscilloscope as a voltmeter and milliammeter for all frequencies. The instrument described today can be used as a v.t. voltmeter, to check distortion in amplifiers, observe characteristics of tubes, measuring modulation percentage, adjusting vibrators in power packs and may be used to indicate resonance curves in conjunction with a suitable "wobbulated" oscillator. The number of applications are too numerous to be mentioned in this article.

The design of an oscilloscope using the 913 cathode-ray tube involves design problems not given much consideration heretofore. These include half-wave rectifiers, amplifiers for saw-tooth voltage, and saw-tooth oscillators.

Half-wave rectifiers, due to poor regulation, have seldom been used in the past. But with the low drain of the cathode-ray tube and the simplicity of the half-wave rectifier is ideal, provided that the necessary bleeder for the cathode-ray tube does not load the rectifier to the extent of reducing the high peak voltage present across the single filter condenser, at low current drain. If this drain is too great, the rectified voltage will drop to a very low level with a high hum component. At the same time the total value of bleeder resistance must be kept reasonably low to prevent interaction of the adjustment controls of the cathode-ray tube. A drain of 1 ma. has been found satisfactory. As any of the present rectifier tubes would be suitable, the 1-V was chosen because the heater wattage is low. Due to the satisfactory performance of the Kenyon T207 transformer in the simple 'scope as described in the February RADIO NEWS, this transformer was used as the power supply for the 913 tube. With a 1-mfd. condenser and the 575,000-ohm bleeder used, a voltage of 540 volts was secured.

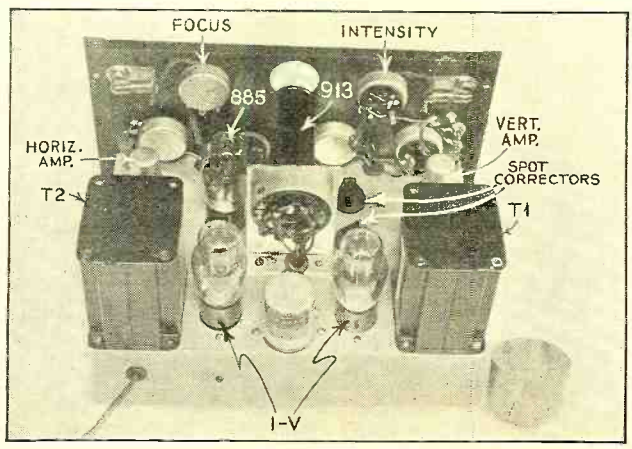
THE new inexpensive 913 tube brings the oscilloscope within the reach of many an amateur, experimenter or serviceman. Last month a simple oscilloscope was described consisting of the oscillograph tube and its power supply. This unit was suitable for checking modulation by the trapezoid method without any further accessories. However, for most cathode-ray work a linear sweep circuit is desirable and the sensitivity should be increased.

When the 913 is used with an anode potential of 500 volts it requires 140 volts peak for off-scale deflection of the D3 and D4 plates (normally vertical) and a peak voltage of 160 for off-scale deflection of the D1 and D2 plates (normal horizontal plates).

As it was desired to secure this necessary deflecting voltage from a single amplifier tube and still use a low coupling resistor in order to have a wide frequency range, it was necessary to have a high-voltage supply. So a second Kenyon transformer was tried with a 1-V rectifier and a filter of two 8-mfd. condensers and a 10,000-ohm resistance. This combination develops 360 volts at 9 ma. and the hum ripple is unnoticeable. In the vertical amplifier which is a 6J7, it was found necessary to use a small flashlight battery for bias, as tests showed that self-bias introduced distortion

TOP VIEW OF CHASSIS

The can in the foreground serves to cover the 913 socket, protecting the operator from shock.



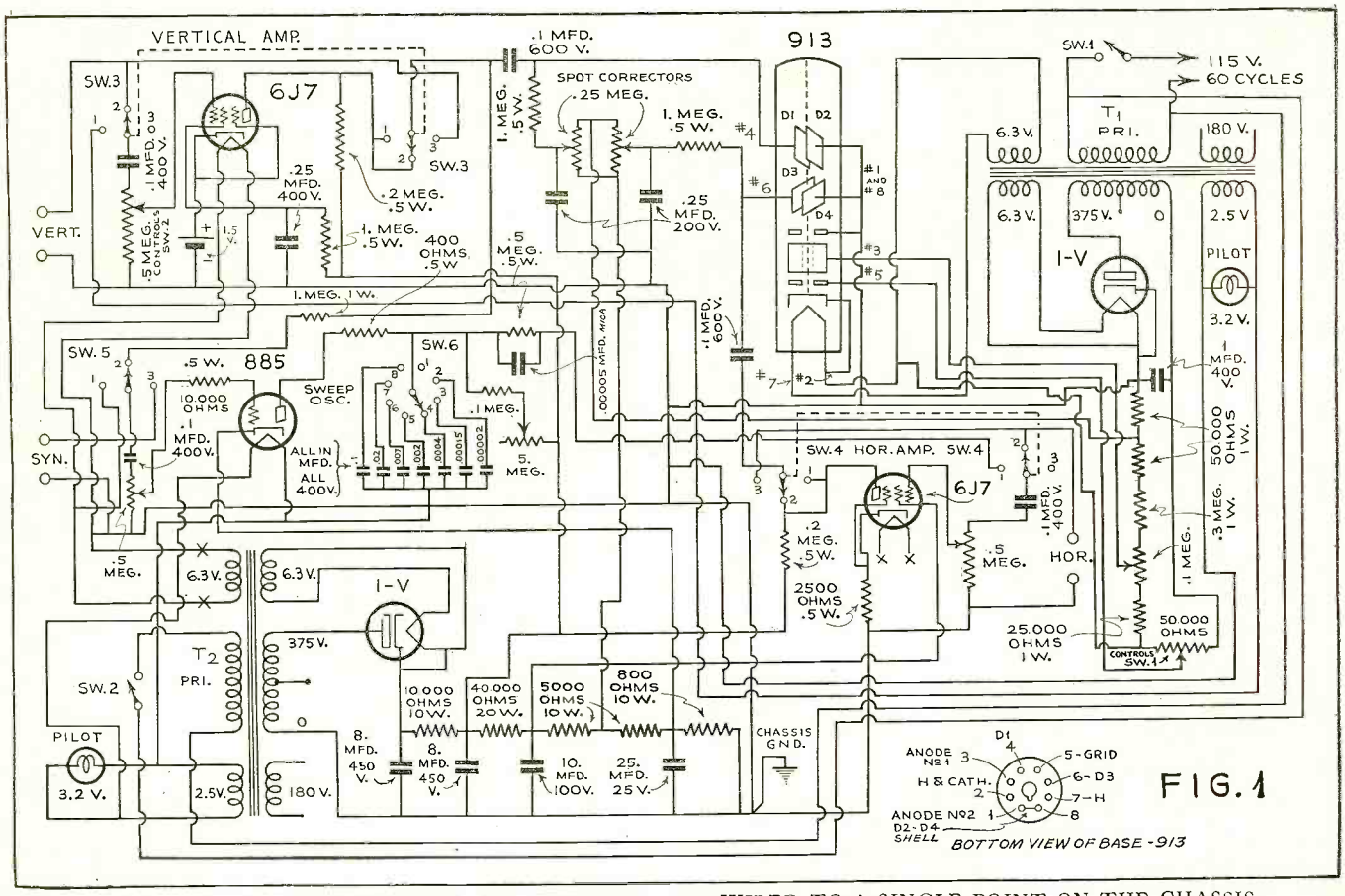


FIG. 1

FIGURE 1. IN THIS CIRCUIT ALL GROUNDS ARE WIRED TO A SINGLE POINT ON THE CHASSIS

even when by-passed by an extremely high value of capacity. It was also found best to use a series resistance in the screen grid to reduce the voltage to a suitable value instead of taking the screen-grid voltage from the bleeder. The series-resistance method gave a higher output voltage, with less distortion. But in the horizontal amplifier the second 6J7, self bias, without any by-pass capacity, was found best. In fact, for good definition on the higher frequencies it was found necessary to keep the capacity due to wiring across the bias resistor, etc., as low as possible. Also the bleeder was found to be the best form of screen-grid voltage supply. It should be noted here that the horizontal amplifier was specially designed to amplify sawtooth voltages and is not necessarily the best design for other wave shapes. The vertical amplifier was designed for general purposes, requires .4 volt for edge-to-edge patterns and is good to well over 100 kc.

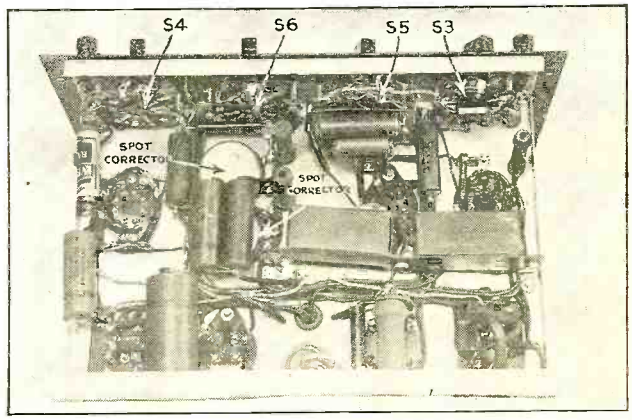
As the best wave form is secured from the 885 tube when the output voltage is low, the D3 and D4 deflector plates of the 913 were used for the horizontal deflection and D1 and D2 for the vertical deflection, which is the reverse of normal procedure.

In order to keep the output voltage low (on the 885) a bias of only 5 volts secured from the bleeder, the cathode of the 885 being positive with respect to ground. It is necessary to keep the stray capacity of the parts and wiring connected to the 885 low in order to prevent stray coupling to either amplifier tube and to allow high-frequency oscillation. The range of the sweep circuit is from 15-25,000 cycles.

In assembling the 'scope it is well to remember that a voltage of 900 volts is present between the negative of the 913 power supply and the positive of the amplifier power supply. Care should be taken at all times to make no adjustment or alteration of wiring while the unit is connected. This is one of the main reasons that a protective shield is placed on the 913 socket, due to the 500 volts.

BOTTOM VIEW

Note the "Spot Correctors" which serve to vary the location of the light spot all over the screen when at rest with no deflecting signal.



In assembling the 'scope, the sockets are first placed on the chassis, the two rectifier sockets being arranged so as to secure the shortest possible leads which means that the heater of one socket is nearest the back of the chassis while the plate of the other is nearest the back of the vertical amplifier socket, has its locating pin to the front of the chassis, while the horizontal locating points to the back. The plate of 885 tube socket should be toward the back of the chassis. The two power transformers should be mounted next with the primary to the back of the chassis. In wiring the filament the wires should be kept in a group and as free and clear of all points of high signal potential. Because of the switching number of controls necessary it is impossible to have all low-potential circuits as clear as they should be. The Eby socket for the 913, which is held in place by an Aerovox electrolytic condenser clamp, should have the prongs cut off short and the wires soldered carefully in place, leaving enough slack to allow the socket to rotate. The shield for the back of the 913 socket was made from an old shield can and a tube shield base, the base being held in place by the two screws on the socket clamp. The coupling condensers used with each volume control are mounted by drilling a hole through the chassis directly over the switch (*Turn to page* 562)

FIGURE 1

Showing the instantly mountable or demountable speakers that convert any sedan into a sound truck.

THE SERVICE BENCH

MOBILE Sound . . . Sales Tip . . . Oscillation and Noise . . . Farm Radios . . . Tropical Servicing . . . Rectifying Tubes . . . Condenser Shorts . . . Service Chat . . . SERVICING: G. E., RCA-Victor, Westinghouse.

Conducted by Zeh Bouck, *Service Editor*

VERSATILE MOBILE P. A. INSTALLATION

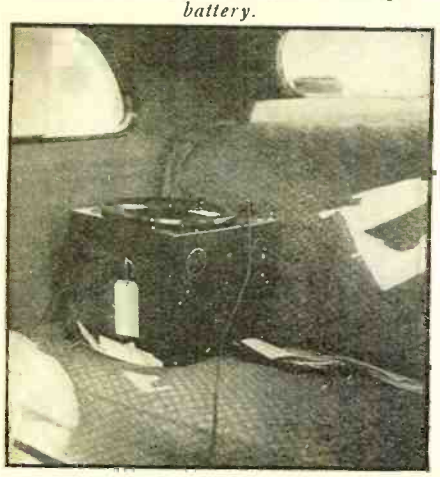
WHILE there is nothing new in renting mobile P.A. equipment, the design of special apparatus whereby any car can be converted into a sound truck in five minutes is new and presents definite money-making possibilities to the radio serviceman. Credit for the idea goes to Edward Scribner of Schoharie, N. Y.

The set-up is shown in Figure 1. The two 12-inch Rola speakers with 6-volt fields are mounted on a substantial board base which in turn is supported on two skids running lengthwise with the car. The skids are curved to fit the tops of the automobile and project about six inches on each side of the speaker platform. Blanket padding protects the top of the sedan from the skins. Webbing passes over the projecting ends of the skids, down and through the car windows and is strapped inside, holding the entire assembly firmly in place. The speaker platform will fit practically any standard sedan or delivery truck, which fact broadens the possibilities for mobile P.A. work. A delivery car, carrying its usual sales message on the sides, is instantly converted into a sound truck carrying visual advertising, in addition to announcements and music, without the necessity of special art work. A new model car, of any make, can be made to advertise itself by converting it temporarily into a sound truck with this equipment. So far, Mr. Scribner has leased this equipment for electioneering, for advertising the 1937 Pontiac and Chevrolet, a motion-picture theater and several other local enterprises.

The speakers are operated in conjunction with a 20-watt amplifier. Two 6L6's in the output are resistance-coupled to a 6J7 through a 6N7 phase inverter. The amplifier unit is shown in Figure 2, cushioned on the rear seat of the car. Astatic pick-up and microphone are used.

FIGURE 2

The Lafayette amplifier, turn-table and power supply unit. High voltage is obtained from a dynamotor operated from the automobile storage battery.



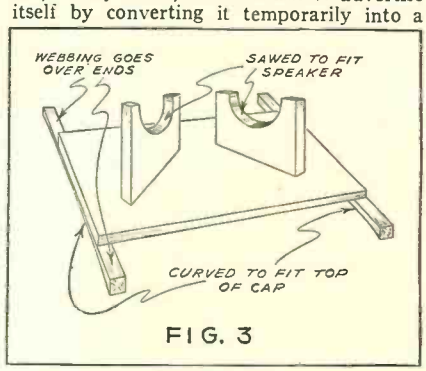


FIGURE 3

Constructional details of the speaker platform.

The mechanical details of the speaker platform are indicated in the drawing of Figure 3.

THIS MONTH'S SALES TIP

THE impression made by an advertisement is a true index of its efficiency. A sales message that is read and forgotten is little better than one that is not read at all. Circulars that reach the waste-basket before the eye represent money thrown away. An impression can be created easily by repetition. These observations establish the two fundamentals of circular advertising—the copy should be read; and read again. These two objects can be achieved by printing the sales message on something useful. The blotter is an old standby. Everyone needs a blotter, and every time one is used, if it carries an advertisement, the message is read consciously or unconsciously. The pencil is another excellent example of this type of advertising, and calendars have long been the vehicle of sales arguments. Both pencils and calendars are useful and are rarely discarded until their utility has been dissipated.

Ralph Mellon has combined two invariably welcomed novelties into a logical unit that is virtually a perpetual reminder that he is in the radio service business. Figure 4 illustrates the combination of a perpetual calendar and thermometer that carries his unobtrusive but none the less effective sales message. The "gadget" is artistically framed in bronze and the modernistics design of the card is printed in buff and sepia. The reminder is conceived and executed in such excellent taste that it will find a permanent place in almost any home. Mr. Mellon bought one hundred of these calender-thermometer combinations at 18 cents each, and considers the $18 investment well worth while. He writes: "I distributed these to people who bought radios from me or who had given me their service work over a period of time. While I was distributing these calendars, I was naturally contacting prospects for new radios. I gave quite a number of calendars to prospective customers and discovered that this inexpensive but really useful gift went a long way toward breaking down sales resistance, providing the radio came up to expectations. I was never refused a home demonstration after giving the prospect a calendar."

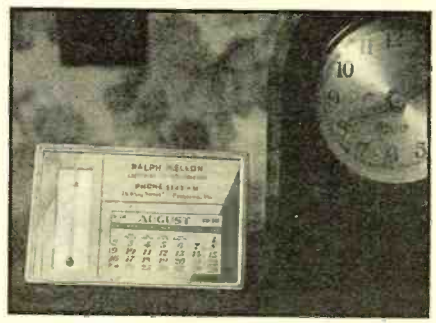


FIGURE 4

A useful and permanent reminder of where radio service can be obtained.

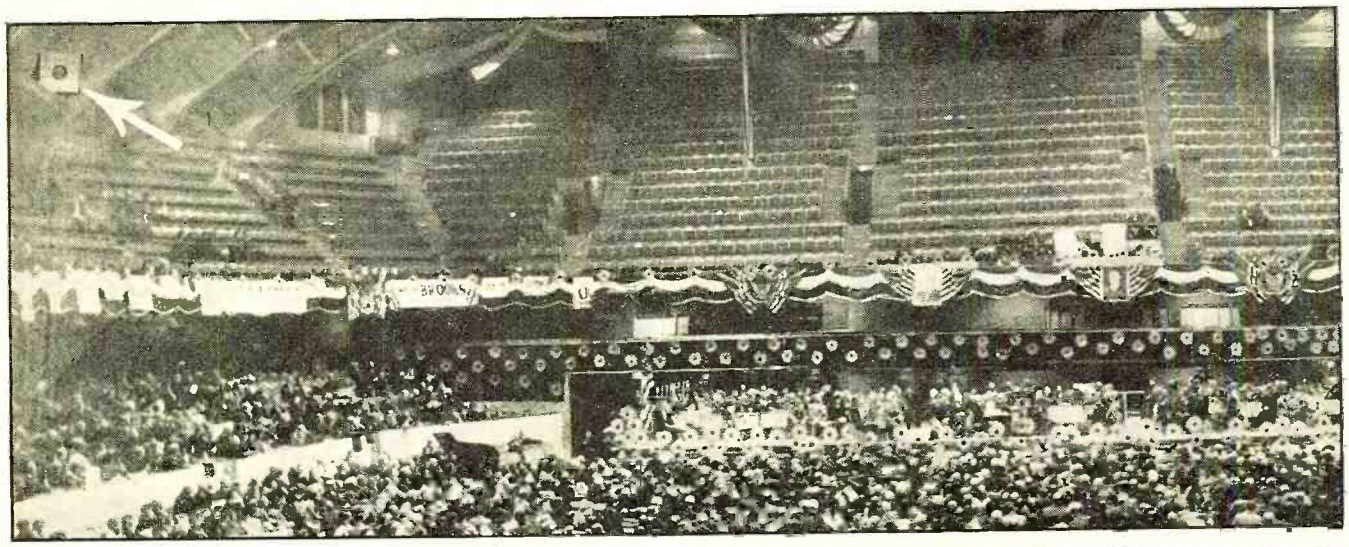
THE DAY'S WORK

HARRY D. HOOTON, of the Radio Service Company, Beech Hill, West Va., sends us the following notes from his service case book—

Oscillation and Noise in Supers

"Possibly the most annoying, and cer-

(*Turn to Page* 548)



Suggested Trends in P. A. DESIGN

Best known as a radio receiver designer, older sound experts will recognize the author of this article as having been responsible for much of the first moderately priced P. A. equipment, and as a consistent contributor to the advancement of sound technique.

By McMurdo Silver

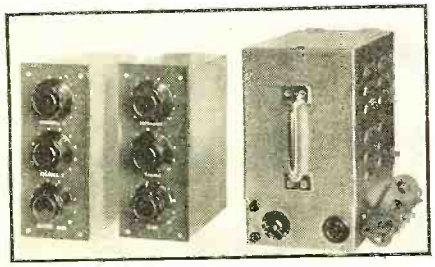
WITH public-address systems now an integral part of everyday life, the writer wonders how many readers ever stop to recall that in a popular sense the whole field of sound is not yet one decade old? Back in 1926 radio was just getting around to workable B eliminators, and to getting enough power economically from a B eliminator to allow a 171 or 210 tube to be kicked up to all of 7/10 to 1½ watts of audio power output. When we think that most table model radios today have 3 to 10 watts output, we wonder how we could ever have been thrilled and deafened by the puny 7/10 of 1 watt turned out by the 171 tube.

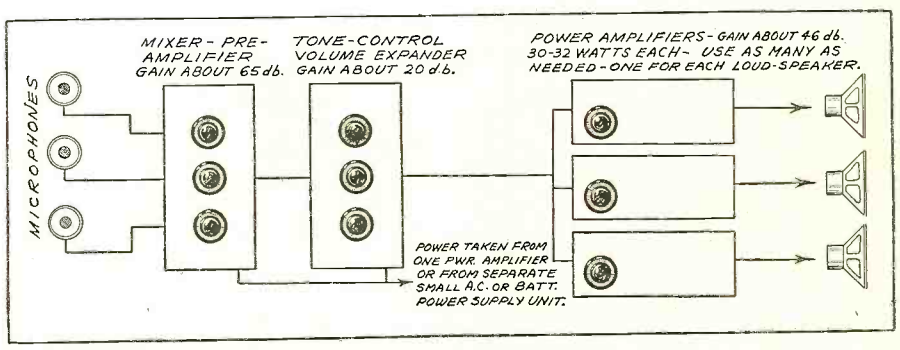
Then came indirectly heated tubes, with cathodes isolated from the hum source of a.c.-operated filaments, and came the dawn of p.a. as we know it today. Bigger, but not always better, power output tubes made their debut, and up climbed power possibilities from fractions of watts to watts, to tens of watts and finally to hundreds of watts—all in an effort to overcome the 95% power loss involved in electrical power to acoustic or sound power—this being even today the average measure of good loudspeakers—only about 5% efficiency!

Tone quality or fidelity of reproduction did improve tremendously, which was something to be thankful for. Microphones went forward and backward in one stride—forward in fidelity, and down and down in conversion efficiency, ever lengthening as they did so the long line of amplifier tubes between themselves and their final objective, the loudspeaker. And John Public demanded flexibility, so some way had to be found of mixing and fading microphone, phonograph record and radio inputs to p.a. systems. They heyday of "pads" was here—L-pads, H-pads, T-pads—and whom should we bless for saving us from attacks by Q-pads or Z-pads? The dear old pad almost beat the new deal to the gun at using up the alphabet. But at long last some inspired genius conceived the idea of electronic (*Turn to page* 572)

THE NEW STYLE P.A. AMPLIFIER

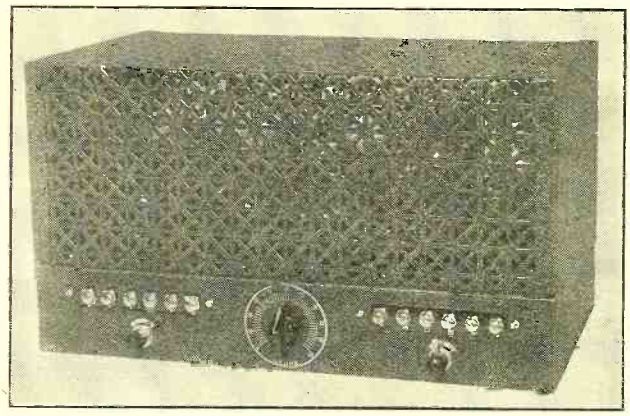
The unit at the left is the mixer and 65 db. gain amplifier. Next is the dual tone control and volume expander unit with 20 db. gain. At right is a 30-watt power amplifier which provides 46 db. additional gain. Several of these latter units may be driven by the other two, each in turn driving one of the new high-efficiency speakers.





10-Watt Amplifier OPERATES *from* 6-Volt Battery

By John H. Potts



ANYONE CAN BUILD IT AT HOME

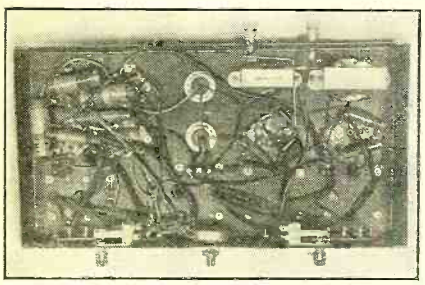
Only 14½ inches long, 8 inches high and 7½ inches deep, yet capable of delivering 10 watts output, drawing all power from a 6-volt storage battery

IN response to the ever-increasing demand for a simple, inexpensive, high-gain p.a. amplifier requiring only a six-volt storage battery for operation, this easily-built instrument has been developed and parts for same have been made available in kit form. It is a truly universal p.a. amplifier for mobile, marine and other applications where regular line power is unobtainable.

THE amplifier employs four tubes and has a rated undistorted output, at the voltages applied, of 10 watts. Metal tubes may be used but glass tubes of the types required are more readily obtainable at the present time. Operation is strictly class A and extraordinarily high gain is attained. In fact the performance has been considered remarkable by all who have heard it.

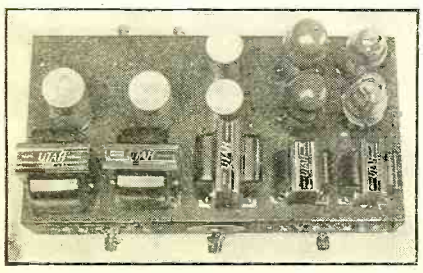
Ordinarily apparatus of this type has been operated from relatively expensive motor-generators. By careful design it was found possible to adapt the amplifier to vibrator operation at a considerable saving in cost, weight and size. While one could do the job with a single vibrator, two are used in this case so that the operator may be assured of long, trouble-free operation, since neither vibrator is over-loaded.

The input circuit is especially designed to accommodate any type of microphone or phonograph pickup. An input transformer, usually omitted on p.a. amplifiers, is mounted at right angles to the magnetic fields of the vibrator transformers to avoid induction hum and is tapped at 50, 200, 400 and 2,000 ohms. This provides an impedance match for single and double-button carbon, low and high impedance velocity and dynamic microphones as well as pickups. In addition a 2 megohm input circuit direct to the first grid is provided for crystal mikes of all types. The 2,000 ohm tap on the input transformer will be welcomed by those who have high impedance velocity mikes, since it enables a considerable gain ahead of the first grid.



THE CHASSIS

A neat and striaghtforward layout. The two cans at the left are the plug-in, shielded vibrators.



Circuit Details

Referring to the schematic diagram, Figure 1, the five primary leads of the input transformer are brought out to the terminals of the input terminal strip and the secondary "high" lead is connected to the movable blade of the switch S1 which is open-circuited in neutral position. This switch is employed to transfer the input transformer secondary to either the first or second tube, as required. The voltage step-up obtainable is so high that with some pickups the first stage would be overloaded. When the switch is in neutral, the transformer is out of the circuit. The control grid lead from the input 6C6 connects to the remaining terminal on the input terminal strip and is used for all microphones not requiring an impedance-matching transformer. It will be noticed that the switch, S1, has and extra section connecting the B supply to the plate and screen resistors of the first tube. When it is thrown so as to cut out the first tube and feed the secondary of T1 across the volume control, the high voltage supply to the first tube is opened to prevent stray electrostatic pickup when operating at full gain without any load.

The second 6C6 is operated as a triode to permit transformer coupling at high gain. The output 6B5's are "dynamic" coupled internally to give high power output class A operation.

Novel Power Supply

Tracing through the B supply circuits, it will be noted that the high voltages for the first two tubes as well as the input plates of the 6B5's are obtained from the one vibrator and transformer 6B-131. The total drain on this circuit is approximately 22 ma. at 250 volts. The output plates of the 6B5's require 66 ma. at 250 volts. This current is drawn from the second power supply circuit and vibrator.

The layout of the apparatus is shown in the photographs. It should be followed rigidly in building the unit. Starting at the left, the first transformer is the 6B-132 with its associated vibrator. Next comes the 6B-131 with its vibrator right behind. The output transformer, and the interstage and input transformers follow in order. It will be noted that these three latter transformers are mounted at right angles to the vibrator transformers to obviate hum pickup. (*Turn to page* 567)

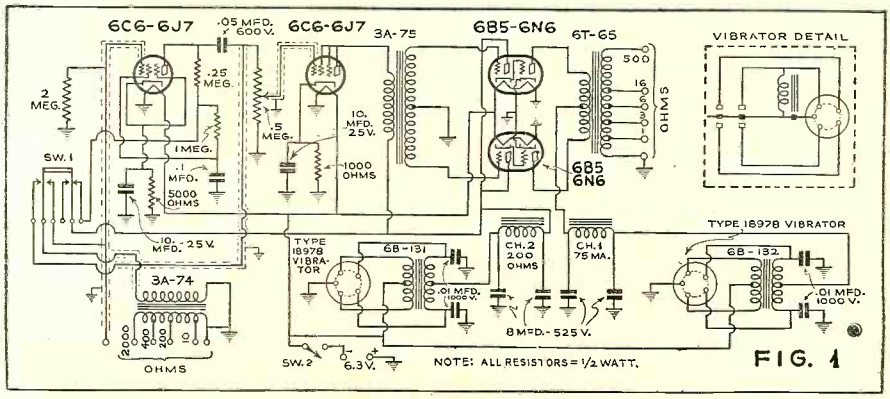


FIG. 1

The Necessity for Uniform MEASUREMENT STANDARDS And Reference Levels

By John M. Borst

MOST of the misconceptions in rating the merits and performance of amplifiers, microphones and receivers occur in the use of the decibel and the lack of a single standard zero level as a reference point.

It is not necessary, here, to go into the derivation of the decibel, but it would be best to restate its definition. The decibel is a unit which expresses the *ratio of one power level to another.* The power may be electrical power, representing sound, or acoustic power (power of sound waves). To be exact, the number of decibels gain or loss is equal to ten times the logarithm of the power ratio.

$$DB = 10 \log_{10} \frac{P_1}{P_2}$$

It should be particularly noted here that the decibel refers to a *ratio* and to *power.* It is *not an absolute unit of power level* and *not a unit expressing voltage ratios.* Sometimes, *when the impedance of the circuits is the same,* the ratio $\frac{P_1}{P_2}$ can be expressed in terms of voltage or current, because

$$\frac{P_1}{P_2} = \frac{R_2 E_1^2}{R_1 E_2^2} = \frac{R_1 I_1^2}{R_2 I_2^2}$$

This can then be substituted in the first equation and one gets an expression giving the number of db. to be found from voltage ratios direct, *if* $R_1 = R_2$. But this amounts to figuring out the power in each case and still the decibel expresses the *power ratio,* not the *voltage ratio.*

Since the decibel represents a ratio and not a number of watts, it cannot be used to refer to a given power level, directly, but it can be used to compare any power level with *an arbitrary standard power level.* As a reference level or "zero" level, 6 milliwatts is one of the most commonly used. Employing this zero level, a power of 6 milliwatts would be called "zero db."; 6 watts would be plus 30 db.; and .6 milliwatt would be —10 db. In all cases the *zero level must be known before the statement can have any meaning!* The use of 6 milliwatts as a level, however, is by no means universal; some of the largest broadcasting chains use a different level. One milliwatt, 10 milliwatts, 12 milliwatts, are also being used as reference levels. So it is necessary to make sure of the reference level before comparing such ratings given by different sources. As an example, suppose an amplifier has an output of 30 watts. When the zero level is 1 milliwatt, the output would be called 45 db., while a 10-milliwatt zero level would reduce it to 35.

Measurements of sound intensities in the air are also referred to various "zero" levels. At present, there seem to be two different levels in use: one starts at 1 millibar sound pressure (equivalent to 24.4×10^{-16} watts per square centimeter), and the other, which will presumably be come the standard, starts at 1×10^{-16} watts per square centimeter (equivalent to .207 millibar). Any level of sound energy when measured in the second scale will be 14 decibels higher than in the first scale. Again, it is important to know the zero level before the level in db. has any meaning.

Clarifying Terms

THE progress of the communication art has necessitated the engineer introducing new measuring units and new concepts of measurement. Always trying to save time, these are often expressed in conversation by abbreviated terms ("slang" if you wish) which do not tell the whole story. These terms may be perfectly understandable to the initiated, but they lead to all sorts of misconceptions and disappointments among the rank and file. Clarifying the meaning of engineering terms, as well as pointing to an agreement on standard levels, are the purposes of this article.

MEASURING AMPLIFIER PERFORMANCE

Figure 1—An economical way of measuring gain and frequency characteristics of receivers. R_1 is a decade resistance. The ratio R_1/R_2 is adjustable, while R_1 plus R_2 is the proper load for the oscillator.

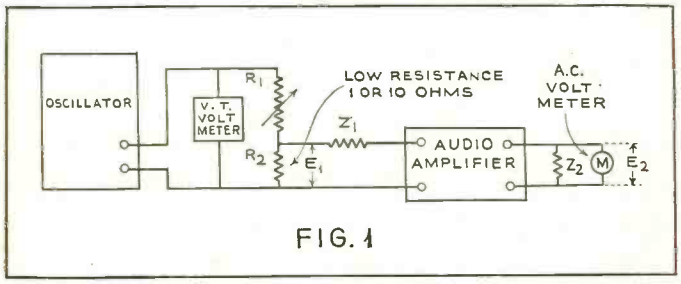


FIG. 1

There are all sorts of opportunities for misunderstanding when measuring the gain of amplifiers. The gain of an amplifier, in decibels, is simply "10 times the logarithm of P_2/P_1; where P_2 is the output power and P_1 is the input power. Since it is often customary to measure voltages only, one should not forget to take into account any difference in impedance. For example, taking an amplifier with transformer input and output; suppose the input impedance is 200 ohms, while the output impedance is 8 ohms (for a voice coil). Under measurement the voice coil will be replaced by an 8-ohm resistor, with a voltmeter across it. Similarly, the input circuit will be connected to the proper impedance network, again using a voltmeter. See Figure 1. After the measurements are taken, the gain in decibels is

$$DB = 20 \log \frac{E_2}{E_1} + 10 \log \frac{Z_1}{Z_2}$$

One should never forget to include the last term. When Z_1 equals Z_2, then the term can be omitted, for it will be equal to zero. This will happen when measuring amplifiers with transformer input and output if both are of the same impedance (both 500 ohms, or both 200 ohms, etc.).

Defect in System

There is an additional difficulty with resistance-coupled amplifiers. According to the definition, it is required to measure the input power, but on a resistance-coupled amplifier it would amount only to the power dissipated in the grid leak, for the tube itself does not draw any power. The result is that that rating depends on the size of the grid leak. The same amplifier, made by manufacturer A, can be made by manufacturer B, but changing the input grid leak from ½ megohm, to 5 megohms, he is justified to rate the gain 10 db. higher Yet, for all practical purposes, the gain remains the same. The trouble is with the system of rating. Let us take an example: an amplifier has a resistance-coupled input and a transformer output. The grid leak is ½ megohm and the transformer output impedance is 500 ohms. During a test it was found that .01 volt across the grid leak resulted in 100 volts across the 500-ohm load. Now the gain is:

(*Turn to page* 560)

GALA BROADCAST FOR RADIO NEWS

At the left is shown the control room of WJBO, Baton Rouge, La. Seated is Observer Golson, Chief Engineer and DX Announcer for this station. Standing, right, is L. P. O. Deterly, another Louisiana observer. Both will participate in the special broadcast described in the first column of this page. Standing, center, is Samuel J. Cashie, Jr., a member of the I. D. A.

THE DX CORNER

S. GORDON TAYLOR
(For Broadcast Waves)

An Outstanding DX Broadcast

WJBO, 1420 kc., 100 watts, located at Baton Rouge, Louisiana, will put on a special DX program on Sunday morning, February 7th, from 2 to 4 a.m., E.S.T. This will be dedicated to the RADIO NEWS DX Corner and its Official Listening Post Observers.

Wilbur T. Golson, Official RADIO NEWS Listening Post Observer, is also Chief Engineer and DX Announcer for this station and it was through his courtesy and cooperation that this dedication was arranged.

The program will be an outstanding one because of its variety and the excellent talent which will be presented. This is best described by a quotation from a recent letter from Mr. Golson:

"The first hour, 2-4 a.m., E.S.T., will come from the studios located in the Music and Fine Arts Building on the Louisiana State University Campus. L. A. Rice, University Broadcast Engineer, will have charge there and will present three of the campus dance orchestras, the pipe organ studios, the L. S. U. Radio Guild Players and the well-known L. S. U. Band. The L. S. U. School of Broadcasting has prepared this all-student hour to appeal especially to DX fans.

"The second hour, 3-4 a.m., will come from the studios, control room and around-the-town remote pick-ups, but will be conducted from the WJBO control room where I will direct the broadcast. 3-3:30 a.m.—remote from the Heidleburg Hotel Roof Garden, where Paul Goldman, WJBO's Program Director, will present music by one of the Hotel Circuit dance bands.

"At 3:30 a.m. I will take over the program to answer the DX mail and play the selections that the DX'ers want to hear. Many special features will be included in this last half hour of our DX broadcast, including interviews with local DX'ers and amateur station operators."

In another letter Mr. Golson reports that A. V. Deterly, another Official R. N. Listening Post Observer for Louisiana, will be a guest in the control room and will be on the air during the last half hour of the broadcast.

WJBO is making a special effort to produce a program which will be of outstanding interest to DX'ers. In return, it is hoped that every Official Observer or other RADIO NEWS reader who can possibly be at the dials during this period will try to tune in the program and will send a report to Mr. Golson. Every Official R. N. Listening Post Observer reporting will receive a folder containing twenty-four photographs of the Louisiana State Capitol, Louisiana State University, etc., and also a special verification card printed for this particular occasion. It is understood that these special verification cards will likewise be sent to any other DX'ers who report reception of this program. Finally, a one year's subscription to RADIO NEWS will be presented as a prize to the DX'er reporting from the greatest distance.

DX CALENDAR

BELOW are given lists of special DX broadcasts which are scheduled for February and March. The initials following an item indicate the organization to which the program is dedicated and where a RADIO NEWS special has been arranged for by an Observer, his name is given in the schedule.

Don't fail to tune in the RADIO NEWS specials on this list and as many others as possible—and above all, don't fail to report to each station tuned in, giving them as much information as you can concerning their signal strength, fading, quality, etc. Where verifications are desired it is always desirable to enclose return postage.

Hours shown are Eastern Standard Time and are all a. m. unless otherwise indicated.

Day	Hour	Kc.	Call	State	Kw.	Club
			FEBRUARY			
3	6-6:15	1270	WASH	Mich	.5	NNRC
	6:15-6:30	1270	WOOD	Mich	.5	NNRC
4	**2-3**	**1160**	**CMHJ**	**Cuba**	**.2**	**R. News**
7	2-3	980	TI4NRH	C.R.		NNRC
	2-4	**1420**	**WJBO**	**La.**	**.1**	**R. News Golson**
8	**2-2:20**	**1420**	**WJBO**	**La.**	**.1**	**R. News Golson**
	5:30-6:30	1320	KGMB	Hawaii	1.	NNRC
10	6-7	1310	WTRC	Ind.	.1	NRC
11	**4:20-4:40**	**750**	**KGU**	**Hawaii**	**2.5**	**R. News Atkins**
	5-5:20	1310	WTRC	Ind.	.25	NRC
13	4:30-5:30	1370	KVL	Wash.	.1	NNRC
17	5:30-6	1350	WAWZ	N. J.	.5	NNRC
	6-6:15	1270	WASH	Mich.	.5	NNRC
	6:15-6:30	1270	WOOD	Mich.	.5	NNRC
18	4:45-5:50	1160	CMHJ	Cuba	.2	UDXC
20	**6-7**	**1310**	**WTRC**	**Ind.**	**.1**	**R. News F. Smith**
21	1-3	1300	WHAZ	N. Y.	.5	ICCP
24	3-4	1400	KHBC	T. H.	.25	NNRC
27	**3-4**	**710**	**KMPC**	**Calif.**	**.5**	**R. News Atkins**
	3-4	1370	KFRO	Texas	.1	NNRC
28	2-5	930	CFLC	Ont.	1	GCDXC
			MARCH			
3	6-6:15	1270	WASH	Mich	.5	NNRC
	6:15-6:30	1270	WOOD	Mich.	.5	NNRC
4	2-3	1160	CMHJ	Cuba	.2	A. W. R.
8	**2-2:20**	**1420**	**WJBO**	**La.**	**.1**	**R. News] Golson**
	5:40-6:00	**1320**	**KGMB**	**Hawaii**	**1**	**R. News Atkins**
11	5-5:20	1310	WTRC	Ind.	.25	CDXR
17	6-6:15	1270	WASH	Mich.	.5	NNRC
	6:15-6:30	1270	WOOD	Mich.	.5	NNRC
18	4:45-5:50	1160	CMHJ	Cuba	.2	CDXR
21	3-5	1300	WHAZ	N. Y.	.5	ICCP
27	3-4	1370	KFRO	Texas	.1	NNRC
31	3-4	1400	KHBC	T. H	.25	NNRC

PERIODIC

Fridays—
5 a.m., 1000 kc., KFVD, Los Angeles, Calif., .25 kw., (R News) (tips)
Midnight, 980 kc., KDKA, Pittsburgh, Pa., 50 kw. (tips)
Saturdays—
12-12:05 a.m., 690 kc., CFRB, Toronto, Ont., 10 kw., (NNRC) (tips)
2:55 a.m., 780 kc., KEHE, Los Angeles, Calif., .5 kw., (R. News) (tips)
4:30 a.m., 1300 kc., KFAC, Los Angeles, Calif., 1 kw., (R. News) (tips)
Sundays—
12-6 a.m., 1210 kc., TGW, Guatemala City, Gua., 10 kw.
12:45 a.m., 1470 kc., WLAC, Nashville, Tenn., 5 kw., (NNRC) (tips)
1:15 a.m., 640 kc., KFI, Los Angeles, Calif., 50 kw. (tips)
Until 2 a.m., 1220 kc., PRE3, Rio de Janeiro, 10 kw.

International 6000-12,500 Mile Club's DX Contest

Oliver Amlie, President of the International 6000-125,000 Mile Broadcast-Short Wave Amateur Club, writes that the World Championship DX Contest sponsored by his Club is now getting under way. This contest will continue for two years, January 1st, 1937, to January 1st, 1939. Some unusual prizes will be offered. Among these will be a 20-tube McMurdo Silver Masterpiece V (photo on these pages) or its 1939 equivalent. This receiver will be awarded to the winner of the short-wave section of the contest. The second prize in this section will be a Hallicrafters "Sky Buddy" receiver. All prizes have not been decided upon as yet but there will be worth-while prizes for each section of the contest. Other prizes in addition to those mentioned above will be donated by the Burgess Battery Company,

HOW'D YOU LIKE TO WIN THIS?

The McMurdo Silver "Masterpiece V" custom-built receiver which is being offered as the grand prize in the short-wave section of the DX Contest sponsored by The 6000-12,500 Mile DX Club as described elsewhere in this department.

the United Transformer Corporation, the Newark Electric Company, the Hetro Electric Industries and others.

According to Mr. Amlie, the Club will issue to winners of the first, second and third prizes in each section of the contest large, colored certificates on which will appear a photograph of the winner and a photograph of the equipment used by him. The contest will include sections for short-wave listeners, broadcast-band listeners and amateurs, the latter to be divided into receiving and transmitting classes.

Further information on the contest will be published from time to time or can be obtained by addressing the Club Headquarters at 56 City Line Avenue, Overbrook, Philadelphia, Pennsylvania. The contest is open to DX'ers throughout the world.

The R. N. 1310 Kc. DX Frolic

The series of frequency check broadcasts by the different stations operating on 1310 kc. will be dedicated to RADIO NEWS and its Official Listening Post Observers. A frolic is being arranged by Bernard J. Clancy, Official Observer for Alberta, Canada, for the morning of March 13th. It is hoped that most or all of the seven stations broadcasting frequency checks between 2:30 and 5:20 a.m., E.S.T., on 1310 kc., that morning will participate. To date definite confirmation has been received from KIT, Yakima, Washington, 100 watts, 5-5:20 a.m., E.S.T., and KGEZ, Kalispell, Montana, 100 watts, 5:20-5:40 a.m., E.S.T.

The stations putting on frequency checks on 1310 kc. during this date are distributed throughout the United States and their reception will constitute an excellent test of a DX'er's ability.

CONSOLIDATED FOREIGN "BEST BETS"

FOLLOWING is a list of the foreign stations being heard by Official Observers in different sections of the U. S. and Canada. Wherever either an asterisk (*) or a number appears in a column it indicates that the station has been heard. Heavy numbers represent p.m. and light numbers a.m.

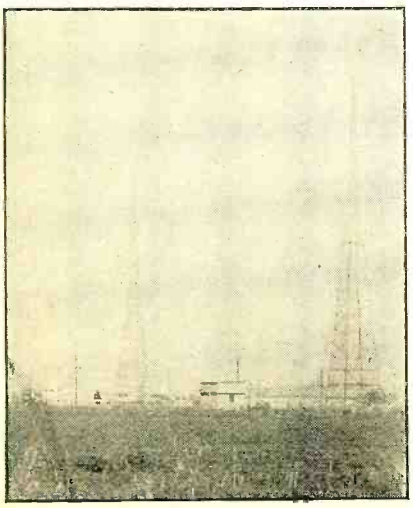
This list is made up from Observers' reports: Column 1 (Eastern States)—Observers Edlin, Massachusetts; Crowley, New York; Routzahn, Pennsylvania; Kocsan, Pennsylvania; Tomlinson, New York; Cleaver, Pennsylvania. Column 2 (Middle States)—Observers Parfitt, Ohio; Truax, Illinois; Meade, Missouri; Davis, Texas. Column 3 (Western States)—Observers Hunt, California; Clancy, Alberta.

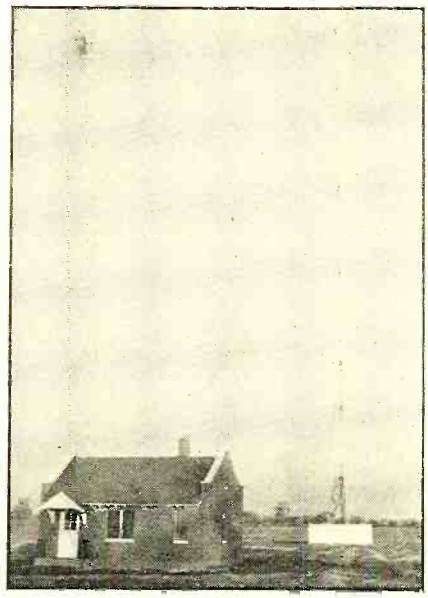
(NOTE: Official Observers and other readers are invited to send in a listing of foreign stations heard each month. In doing so it will facilitate matters if stations are reported in the same form as the list below, with the frequency, call, location, and hour (your own local time) when best heard.)

Kc.	Call	Location	1	2	3
546	HAL	Budapest, Hungary	2	..	..
556	Beromunster	Switzerland	5	..	..
570	2YA	Wellington, New Zealand	..	4	..
574	Stuttgart	Germany	2	..	..
583	Alpes-Grenoble	France	2	..	..
590	JOAK1	Tokyo, Japan	..	..	2
590	7ZL	Hobart, Australia	..	..	5
592	Vienna	Austria	2	..	..
610	I1FI	Florence, Italy	2	..	..
620	Brussels	Belgium	2	..	..
633	OKP	Praha, Czechoslovakia	5	*	..
640	5CK	Crystal Brook, Australia	..	4	..
648	Lyon-PTT	France	2	..	..
650	1YA	Auckland, New Zealand	..	4	..
658	Cologne	Germany	1	*	..
668	North Regional	Moorside Edge, England	6	..	..
668	Jerusalem	Palestine	1	1	..
670	LS4	Buenos Aires, Argentina	*	8	..
670	2CO	Corowa, Australia	..	4	4
677	Sottens	Switzerland	5	..	..
690	CX8	Montevideo, Uruguay	5	..	..
690	6WF	Perth, Australia	..	4	..
695	Paris-PTT	France	2	..	..
700	2NR	Lawrence, Australia	..	4	4
713	Rome	Italy	2	..	..
720	3YA	Christchurch, New Zealand	..	4	..
730	5CL	Adelaide, Australia	..	4	..
731	Tallinn	Estonia	2	..	..
740	Munich	Germany	2	..	..
740	2BL	Sydney, Australia	..	4	..
749	Marseille-PTT	France	2	..	..
750	KGU	Honolulu, Hawaii	4	2	1
750	JFAK	Taihoku, Japan	..	..	4
767	Scottish Regional	Westerglen, Scotland	2	..	..
770	JOHK	Sendai, Japan	..	5	..
770	3LO	Melbourne, Australia	..	4	..
776	Toulouse-PTT	France	2	..	..
785	Leipzig	Germany	2	..	..
790	JOGK	Kumamoto, Japan	..	5	..
790	4YA	Dunedin, New Zealand	5	5	..
795	Barcelona	Spain	6	..	..
795	Lwow	Poland	1	..	..
800	4QG	Brisbane, Australia	..	4	..
804	West Regional	Washford, England	6	..	..
810	JOIK	Sapporo, Japan	..	5	..
814	I1MI	Milan, Italy	2	..	..
823	Bucharest	Rumania	4	..	..
830	3GI	Sale, Australia	..	5	..
841	Berlin	Germany	2	..	..
859	Radio-Strasbourg	France	2	..	..
886	Graz	Austria	5	..	..
870	JOAK2	Tokyo, Japan	..	5	3
870	2GB	Sydney, Australia	..	4	..
877	London Regional	Brookmans Park, England	2	..	..
904	Hamburg	Germany	3	..	..
910	LR2	Buenos Aires, Argentina	..	8	..
913	Radio-Toulouse	France	5	..	..
922	Brno	Czechoslovakia	5	..	..
932	Brussels	Belgium	2	..	..
950	Breslau	Germany	2	..	..
950	2UE	Sydney, Australia	2	4	..
959	Poste-Parisien	Paris, France	3	..	..
960	YV1RC	Caracas, Venezuela	..	5	..
977	N. Ireland Regional	Belfast, Ireland	6	2	..
986	I1GE	Genoa, Italy	2	..	..
990	LR4	Buenos Aires, Argentina	*	..	..
990	2GZ	Orange, Australia	..	4	..
995	PFBI	Hilversum, Holland	2	..	..
1004	OKR	Bratislava, Czechoslovakia	5	..	..
1013	Midland Regional	Daventry, England	6	..	..
1020	2KY	Sydney, Australia	..	4	..
1030	3DB	Melbourne, Australia	..	4	..
1031	Konigsburg	Germany	2	..	..
1040	Rennes	France	2	2	..
1040	5PI	Crystal Brook, Australia	..	4	..
1050	JOHG	Kagoshima, Japan	..	..	3
1059	I1BA	Bari, Italy	5	..	..
1060	JOIG	Toyama, Japan	..	..	3
1070	LR1	Buenos Aires, Argentina	8	2	1
1077	Bordeaux-Lafayette	France	2	..	..
1095	EAJ7	Madrid, Spain	5	..	..
1100	7LA	Launceston, Australia	..	4	..
1110	2UW	Sydney, Australia	..	4	..
1113	Radio-Normandie	Fecamp, France	2	..	..
1120	4BC	Brisbane, Australia	..	4	..
1140	I1TO	Turin, Italy	2	..	..
1140	2HD	New Castle, Australia	..	4	..
1158	Kosice	Czechoslovakia	1	..	..
1176	Copenhagen	Denmark	2	..	..
1180	3KZ	Melbourne, Australia	..	4	..
1185	Nice-Cote d'Azur	France	2	..	..
1190	LS2	Buenos Aires, Argentina	8	8	..
1190	2CH	Sydney, Australia	..	4	..
1195	Frankfurt	Germany	2	..	..
1210	TGW	Guatemala City, Guatemala	*	*	..
1213	Lille-PTT	France	2	..	..
1220	4AK	Oakey, Australia	..	4	..
1222	I1BO	Bologna, Italy	2	..	..
1230	2NC	Newcastle, Australia	..	4	..
1231	Gleiwitz	Germany	1	..	..
1240	WKAQ	San Juan, Puerto Rico	*	*	..
1240	3TR	Sale, Australia	..	4	..
1267	Nurnburg	Germany	1	*	..
1270	2SM	Sydney, Australia	..	4	..
1276	Cote d'Azur	Juan-les-Pins, France	6	..	..
1285	PRG3	Rio de Janeiro, Brazil	5	..	..
1285	Dresden	Germany	1	..	..
1290	WNEL	San Juan, Puerto Rico	*	6	..
1290	4BK	Brisbane, Australia	..	4	..
1294	Dornbirn	Austria	1	..	..
1320	KGMB	Honolulu, Hawaii	5	3	..
1320	3BA	Ballarat, Australia	..	4	..
1340	2XN	Lismore, Australia	..	4	..
1350	3GL	Geelong, Australia	..	4	..
1366	Radio-l'Ile de France	Paris, France	5	..	..
1380	4BH	Brisbane, Australia	..	4	..
1390	2GN	Goulburn, Australia	..	4	..
1393	Radio-Lyon	France	5	..	..
1400	KHBC	Honolulu, Hawaii	4	3	..
1420	WPRP	Ponce, Puerto Rico	*	*	..
1420	3XY	Melbourne, Australia	..	4	..
1430	2WL	Wollongong, Australia	..	4	..

RADIO NEWS TIPS BROADCASTER

The station shown here is KFAC, Culver City, Calif., 1300 kc., 1 kw. Through the cooperation of L.P.O. Atkins a RADIO NEWS *tips broadcast takes place over this station each Saturday morning at 4:30.*





WTRC, 1310 KC., 250 WATTS

This Elkhart, Ind., station with its new RCA transmitter is well known for its special DX broadcasts. Tune in on the RADIO NEWS *special on February 20, 6-7 a. m. E.S.T.*

T. A. Starting Times

L. P. O. Tomlinson, Portchester, N. Y., has been having a swell time with the transatlantic stations this season. He offers the following information for the benefit of others who try for the T. A.'s. The data given is based on his personal observations in tuning in these stations this season:

"The Italians, for instance, all begin at 1:45 a.m. sharp with the Italian National Anthem, then into their gym class, going to news at 2 a.m. The Austrians all start at 1 a.m. instead of 2; the Czechs at midnight. I've sent reports to Kosice, Prague and Berne already. The Germans all commence at midnight sharp, except Hamburg, which starts at 12:30 a.m. most of the time and midnight Sundays.

"The Frenchmen after two weeks of checking all seem to start at 1:40 or 1:45—Rennes, Lille, Paris 695, Bordeaux, etc. Several mornings a week Rennes commences at exactly 1:05, soon as Hartford is off, and he has a wonderful signal. Fecamp, of course, is 2 a.m.; PP still 2:10 a.m.

"The Poles seem to start at 1 a.m. also,

(*Turn to page* 568)

WHO'S WHO

ON THE CHAIN NETWORKS

Arranged by Samuel Kaufman

NATIONAL BROADCASTING COMPANY

Basic Red Network

WEAF	New York	660
WNAC	Boston	1,230
WTIC	Hartford	1,040
WJAR	Providence	890
WTAG	Worcester	580
WCSH	Portland	940
KYW	Philadelphia	1,020
WFBR	Baltimore	1,270
WRC	Washington	950
WGY	Schenectady	790
WBEN	Buffalo	900
WCAE	Pittsburgh	1,220
WTAM	Cleveland	1,070
WIRE	Indianapolis	1,400
WWJ	Detroit	920
WSAI	Cincinnati	1,330
WMAQ	Chicago	670
KSD	St. Louis	550
WHO	Des Moines	1,000
WOW	Omaha	590
WDAF	Kansas City	610

Basic Blue Network

WJZ	New York	760
WBZ	Boston	990
WBZA	Springfield	990
WFIL	Philadelphia	560
WBAL	Baltimore	1,060
WMAL	Washington	630
WSYR	Syracuse	570
WHAM	Rochester	1,150
WEBR	Buffalo	1,310
KDKA	Pittsburgh	980
WGAR	Cleveland	1,450
WXYZ	Detroit	1,240
WCKY	Cincinnati	1,490
WENR	Chicago	870
WLS	Chicago	870
KWK	St. Louis	1,350
WMT	Cedar Rapids	600
KSO	Des Moines	1,430
KOIL	Omaha-Council Bluffs	1,260
WREN	Kansas City	1,220

Optional Basic Blue Network

WABY	Albany	1,370

Alternate Stations

WLW	Cincinnati	700
WCFL	Chicago	970

Optional Basic Service

WOOD	Grand Rapids	1,270
WCOL	Columbus	1,210

Canadian Group

CRCT	Toronto	840
CFCF	Montreal	600

Southeastern Group

WRVA	Richmond	1,110
WTAR	Norfolk	780
WPTF	Raleigh	680
WSOC	Charlotte	1,210
WWNC	Asheville	570
WIS	Columbia	560
WJAX	Jacksonville	900
WFLA–WSUN	Tampa	620
WIOD	Miami	1,300

Optional Southeastern Service

WFBC	Greenville	1,300
WCSC	Charleston	1,360

South Central Group

WAVE	Louisville	940
WSM	Nashville	650
WMC	Memphis	780
WSB	Atlanta	740
WAPI	Birmingham	1,140
WJDX	Jackson	1,270
WSMB	New Orleans	1,320

Southwestern Group

KVOO	Tulsa	1,140
WKY	Oklahoma City	900
WFAA	Dallas	800
WBAP	Fort Worth	800
KTBS	Shreveport	1,450
KPRC	Houston	920
WOAI	San Antonio	1,190

NETWORK broadcasting plays such an important part in the American radio scheme that, in answer to many queries from readers, RADIO NEWS herewith presents complete listings of the chains most mentioned in letters to the editor. There are numerous other state, interstate and localized hook-ups. Some stations have tie-ups at different hours with more than one chain. For example, WLW is on both the NBC and the Mutual rosters. The larger chains are subdivided into sectional groups making the individual hook-ups flexible for sponsors' and program requirements. Listings are given by call letters, location and frequency (kilocycles).

Optional Southwestern Service

KTHS	Hot Springs	1,060
KGBX	Springfield, Missouri	1,230

Northwestern Group

WTMJ	Milwaukee	620
WIBA	Madison	1,280
KSTP	Minn.-St. Paul	1,460
WEBC	Duluth-Superior	1,290
WDAY	Fargo	940
KFYR	Bismarck	550

Red Mountain Group

KOA	Denver	830
KDYL	Salt Lake	1,290
KVOD	Denver	920

Blue Mountain Group

KLO	Ogden	1,400

Pacific Coast Red Network

KPO	San Francisco	680
KFI	Los Angeles	640
KGW	Portland, Ore.	620
KOMO	Seattle	920
KHQ	Spokane	590

Pacific Coast Blue Network

KGO	San Francisco	790
KECA	Los Angeles	1,430
KFSD	San Diego	600
KEX	Portland, Ore.	1,180
KJR	Seattle	970
KGA	Spokane	1,470

Optional Pacific Coast Service

KTAR	Phoenix	620

North Mountain Group

KGIR	Butte	1,340
KGHL	Billings	780

Special Hawaiian Service

KGU	Honolulu	750

YANKEE NETWORK

WNAC	Boston	1,230
WAAB	Boston	1,410
WEAN	Providence	780
WICC	Bridgeport	600
WORC	Worcester	1,280
WMAS	Springfield	1,420
WDRC	Hartford	1,330
WLBZ	Bangor	620
WRDO	Augusta	1,370
WFEA	Manchester	1,340
WLLH	Lowell	1,370
WNBH	New Bedford	1,310
WATR	Waterbury	1,190

INTER-CITY GROUP

WMCA	New York	570
WIP	Philadelphia	610
WPRO	Providence	730
WMEX	Boston	1,500
WIXBS	Waterbury	1,530
WLNH	Laconia, N. H.	1,310
WCBM	Baltimore	1,370
WDEL	Wilmington	1,120
WOL	Washington	1,310

COLUMBIA BROADCASTING SYSTEM

Basic Network

WOKO	Albany	1,430
WCAO	Baltimore	600
WAAB	Boston	1,410
WEEI	Boston	590
WGR	Buffalo	550
WKBW	Buffalo	1,480
WBBM	Chicago	770
WKRC	Cincinnati	550
WHK	Cleveland	1,390
KRNT	Des Moines	1,320
WJR	Detroit	750
WDRC	Hartford	1,330
WFBM	Indianapolis	1,230
KMBC	Kansas City	950
WHAS	Louisville	820
WABC	New York	860
KFAB	Omaha-Lincoln	770
WCAU	Philadelphia	1,170
WJAS	Pittsburgh	1,290
WEAN	Providence	780
KMOX	St. Louis	1,090
WFBL	Syracuse	1,360
WJSV	Washington	1,460

Optional Basic Group

WADC	Akron	1,320
WBNS	Columbus	1,430
WHEC	Rochester	1,430
WSPD	Toledo	1,340
WORC	Worcester	1,280

Basic Supplementary Group

WPG	Atlantic City	1,100
WLBZ	Bangor	620
WNBF	Binghamton	1,500
WICC	Bridgeport	600
WSMK	Dayton	1,380
WMMN	Fairmont	890
WOWO	Fort Wayne	1,160
WHP	Harrisburg	1,430
WFEA	Manchester	1,340
WISN	Milwaukee	1,120
WMBD	Peoria	1,440
WSBT	South Bend	1,360
WMAS	Springfield	1,420
WIBW	Topeka	580
WIBX	Utica	1,200
WWVA	Wheeling	1,160
KFH	Wichita	1,300
WKBN	Youngstown	570

South Central Group

WGST	Atlanta	890
WBRC	Birmingham	930
WDOD	Chattanooga	1,280
WNOX	Knoxville	1,010
WREC	Memphis	600
WALA	Mobile	1,380
WSFA	Montgomery	1,410
WLAC	Nashville	1,470
WWL	New Orleans	850
WCOA	Pensacola	1,340

Southeastern Group

WBT	Charlotte	1,080
WDNC	Durham, N. C.	1,500
WBIG	Greensboro	1,440
WMBG	Richmond	1,210
WDBJ	Roanoke	930
WTOC	Savannah	1,260
WSJS	Winston-Salem	1,310

Florida Group

WMBR	Jacksonville	1,370
WQAM	Miami	560
WDBO	Orlando	580
WDAE	Tampa	1,220

Southwestern Group

KNOW	Austin	1,500
KRLD	Dallas	1,040
KTRH	Houston	1,290
KLRA	Little Rock	1,390
KOMA	Oklahoma City	1,480
KTSA	San Antonio	550
KWKH	Shreveport	1,100
KTUL	Tulsa	1,400
WACO	Waco	1,420
KGKO	Wichita Falls	570

(*Turn to page* 562)

The Latest "PRO" SUPER *Struts its Stuff*

By S. Gordon Taylor

LISTENING IN ON THE WORLD

The corners of the world were brought to the Bronx Listening Post during the "on the air" tests of the new metal tube "Super-Pro."

WHILE this article was intended to be a report on the "air" tests of the newest Hammarlund Super-Pro receiver, it is not destined to be that, in the sense that a log is to be presented of all the hundreds of stations heard on it. Instead it will be a description of some impressions gained in operating the receiver over a period just short of two weeks at the Bronx Listening Post (W2JCR).

So far as sensitivity and selectivity are concerned, these qualities can be logically dismissed with the simple statement that the receiver came up to the unusually fine standard indicated in the actual measured curves presented in the descriptive article last month—at least so far as it is possible to check characteristics by operating and listening to a receiver. The tests especially emphasize the excellent signal-to-noise ratio provided in the reception of weak signals. This is, of course, the underlying reason for the tremendous *usable* sensitivity. It is no trick to build fractional microvolt sensitivity into a receiver. The problem is to keep noise at such a low level *as to make the sensitivity useful,* and it is this problem that has been solved so effectively in the design of this set.

Variable Selectivity

With the band-width control (variable selectivity) set to pass a band of frequencies 6 kilocycles wide, the selectivity is comparable with that of many good receivers. *Yet this is only about half the selectivity of which the new Super-Pro is capable* (without using the crystal filter). In the 3-kilocycle (maximum selectivity) position of this control it is possible to do tricks of close tuning, both on the short waves and on the broadcast band, that are distinctly gratifying and helpful to anyone who has to pick his DX from the embracing clutch of R9-plus signals banked on either side.

Treble tone control is not provided in the form of a separate control for the simple reason that the continuously variable band-width control serves the same purpose. In the 16 kc. position, high-fidelity reception is provided, and as this control is backed off, increasing the selectivity, the highs drop out until, when the 3-kilocycle position is reached, substantially nothing above 2500 cycles is heard, and even tones of 1800 cycles are attentuated about 10 db. Thus, instead of allowing a wide band of frequencies to pass through the receiver and reducing the audio response range in the a.f. amplifier, the attenuation of "highs" is accomplished by radical reduction of the r.f. side-bands—a logical and highly practical scheme because it means that when attempting sharp tuning in DX work the superfluous high frequencies with their burden of noise are automatically eliminated.

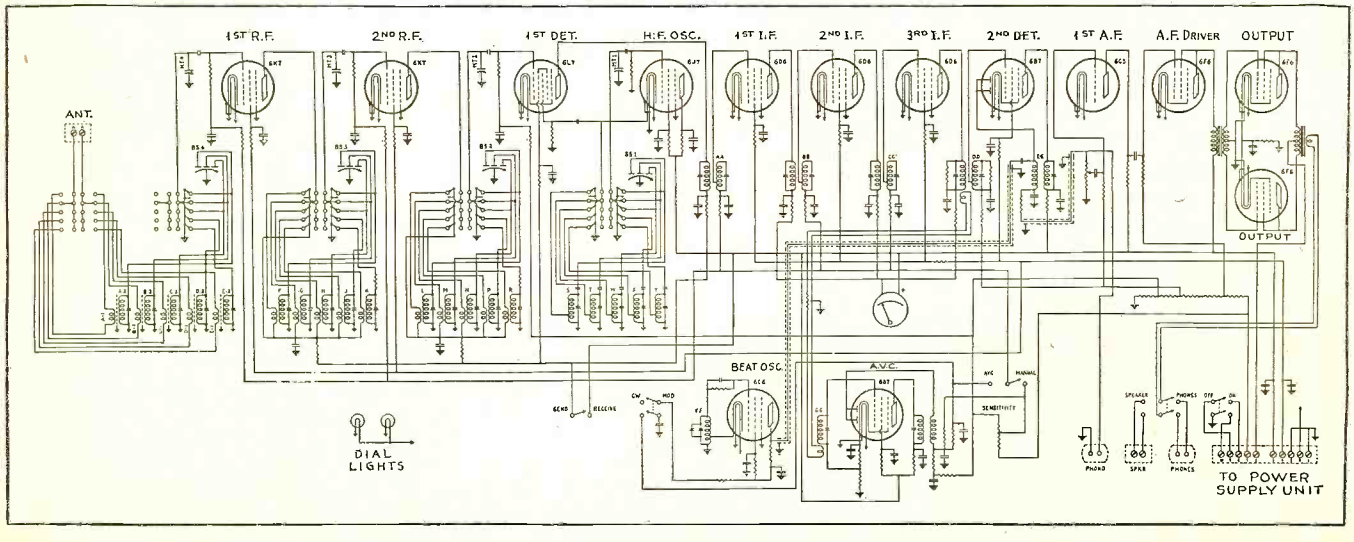
All-purpose Receiver

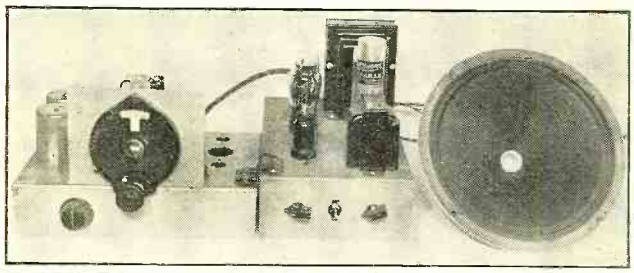
After putting this new receiver through its paces it is found to be a little difficult to classify. It is definitely a communications receiver in that it amply meets every requirement for this type of service—selectivity, sensitivity, band-spread on all short-wave ranges, crystal filter, beat-frequency oscillator, stand-by switch, signal-strength meter, a.v.c. on or off at will, manual gain control, etc. But it is just as definitely a B.C.L. and short-wave broadcast receiver because because in addition to the above features there are those of 30-8000 cycle high-fidelity reproduction and an extremely precise calibration of the main dial for all frequencies within the 540-20,000 kc. range of the set. Thus whether the desire is to listen to the artistically beautiful strains of a symphony from a local broadcast station or to pick out an elusive c.w. signal from the other side of the world when the channels all around are cluttered up with local signals, this receiver has what it takes.

Precision Built

Examination of the "innards" leaves no doubt as to the sturdiness and accuracy of every part of the design and construction. True, the owner of such a receiver does not put the inside on display—in fact, he probably will never see it. But all this is important to him nevertheless, because it means lasting good performance.

The author took (*Turn to page* 574)





BEAUTIFUL TONE QUALITY

The new tuner is shown here with the power supply-amplifier described earlier in this series. The combination provides excellent quality of reproduction with ample selectivity for local reception.

Practical Construction *The Radio*

This series of articles is presented
sire to obtain a working knowledge
have some theoretical knowledge
tical experience which is so essential

Part Nine—Tuned

By **John**

THE t.r.f. tuner described here, the circuit of which appears in Figure 1, when used in conjunction with the universal power pack and audio amplifier described in the August and September installments of this series, provides reception of excellent quality from local and medium-distant stations. The tuner has been constructed with a view towards later changing it into a super. Therefore, the chassis is not only drilled for the present layout but also for this later use. Also, the change-over to a super has been worked out so as to employ the present parts and require the minimum of new ones.

For the sake of stable operation, it was thought inadvisable to use more than two r.f. stages. On the other hand, sufficient selectivity had to be obtained. So the coils are of the "low-impedance" type, which means that they have primaries of only a few turns, increasing the selectivity. The detector circuit is tuned, too, making, in all, three tuned circuits.

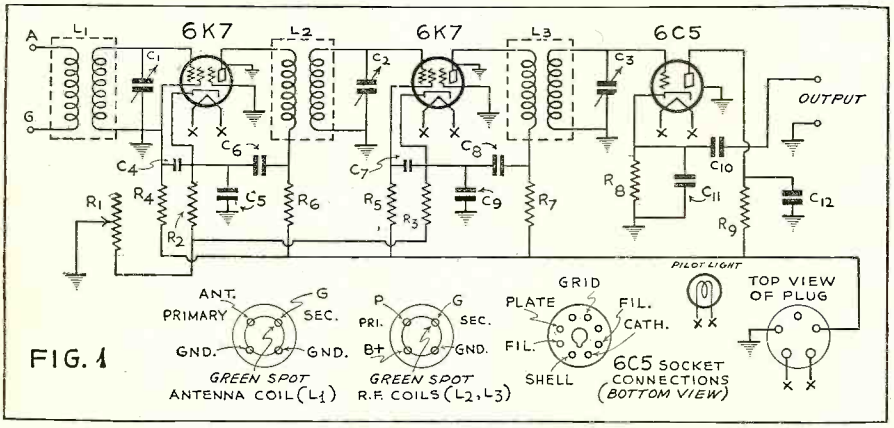


FIG. 1

In such cases one must be very careful to obtain the greatest benefit from the tuned circuits. Besides the variable condenser in the secondary, the tuning is affected by the primary circuit and also by the tube following the transformer. For instance, the coil L2 (Figure 1) has its secondary tuned by C2, but there is also the slight capacity between grid and cathode of the second 6K7, and the primary adds its influence which depends on the tube's plate resistance. Coil L1 is connected to the antenna, which may react on the circuit in such a way as to bring this circuit out of tune.

No matter how much trimming is done, it is usually impossible to get this first circuit in exact line all over the range. The condition may be helped by placing a small series condenser in the antenna circuit. To obtain the best value for the antenna used it is well to experiment with sizes between .001 and .0001 mfd.

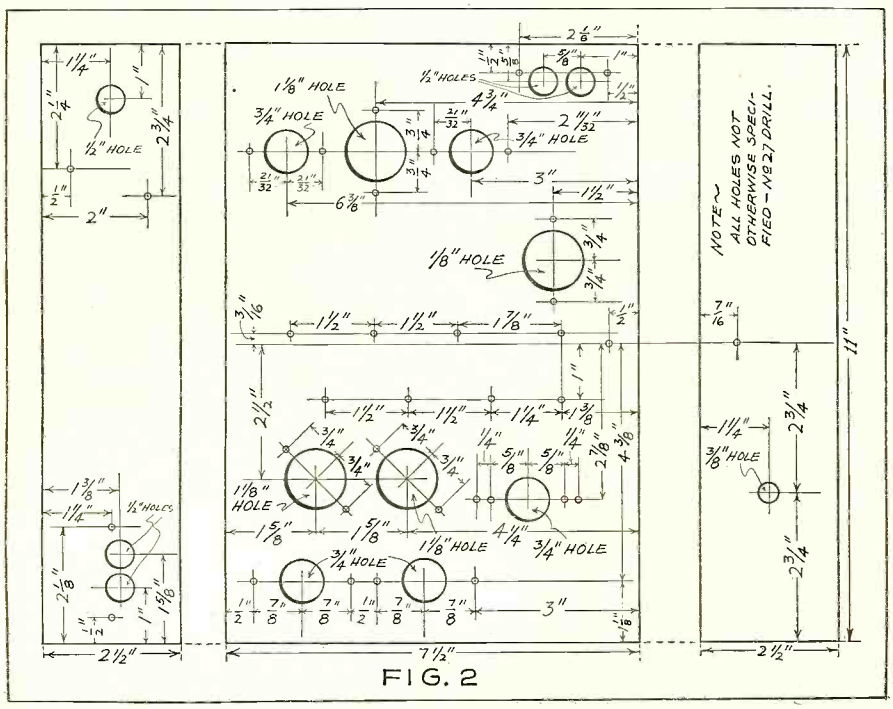


FIG. 2

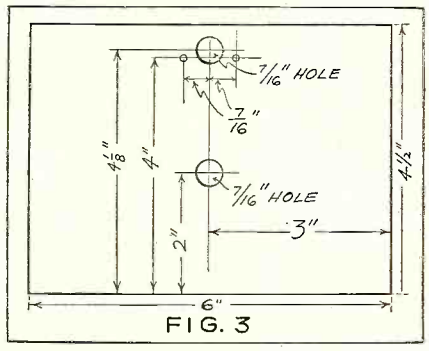
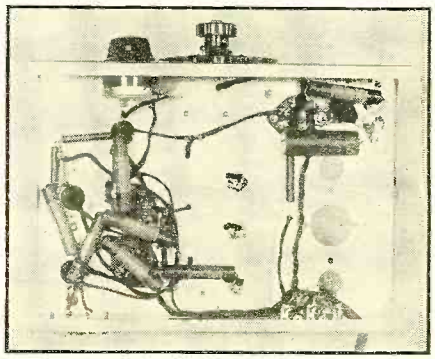


FIG. 3

AN UNDER-CHASSIS VIEW



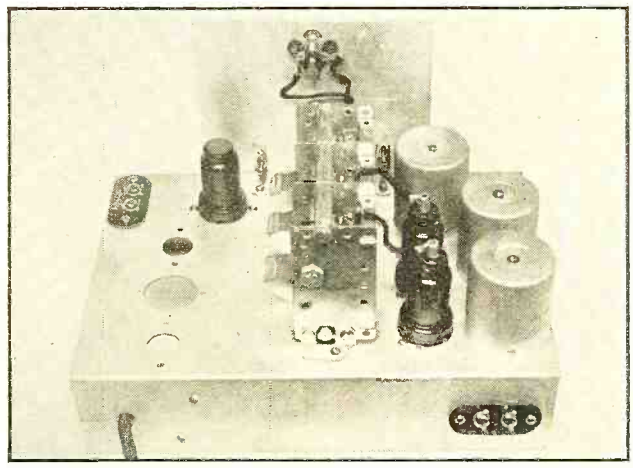
and Instruction for

Beginner

for the benefit of beginners who de- of radio, and also for those who of the subject but lack the prac- to thoroughly understanding radio

Radio Frequency Set

M. Borst



THE TUNER

Simple in layout and easy to wire—and a mighty nice tuner for anyone primarily interested in good quality reception of local stations.

Inasmuch as the antenna circuit is probably not going to track throughout the range, we must be sure that the third circuit, L3-C3, is not going to be out of line. This brings us to the choice of detector circuits. From the standpoint of best reproduction, the diode detector is preferred. But the diode detector, when connected across L3-C3 in the normal manner, as in Figure 4, would result in added capacity across C3 and this would tend to unbalance the alignment. Furthermore, the relatively low diode resistance makes tuning broad. To avoid these drawbacks it is an advantage to use a type of detector which does not "load" the circuit; one which does not draw any current from the tuned circuit. The only type which will do that is the "biased detector."

New Detector Circuit

The one employed here (see the 6C5 circuit in Figure 1) is a relatively new circuit, suggested by engineers of Sylvania. It is a biased detector with the load resistance in the cathode circuit. combining good fidelity with sensitivity, yet permitting the circuit L3-C3 to remain in tune with L2-C2. In fact, the circuits lined up so well that it was decided to omit the usual trimmers, since good enough results were obtained without them. The constructor may add these if he so desires.

The use of variable-mu pentodes for tuned radio-frequency stages is already familiar to the reader. Resistance-capacity filters are placed in all screen and plate leads to prevent instability.

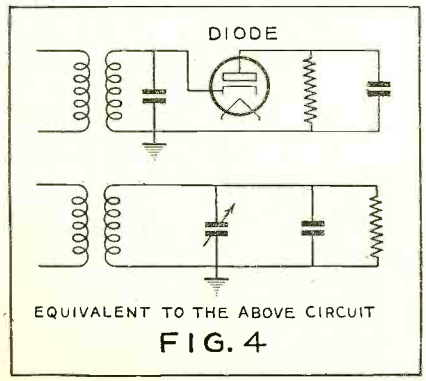


FIG. 4

The filter C12-R9 is included to prevent any tendency toward motorboating. The sensitivity control in the cathode circuit to adjust the sensitivity according to requirements; this is *not* a volume control. Best results will usually be obtained with the sensitivity control at the lower settings in order not to overload the tubes.

Construction

The tuner is constructed on a chassis which will fit the Insuline type 3828 cabinet employed for the all-wave, regenerative tuner described in Parts 6 and 7 of this series. This cabinet has dimensions 12 x 8 x 7 inches. The chassis used this month can also be obtained from the same company with the large holes already drilled, or it can be had without holes.

After completing all the holes in the chassis and panel according to Figures 2 and 3, mount the coils, the sockets and the terminal strips. First make all the connections to the coils; the antenna coil can be distinguished from the others by the type number and it is also marked "antenna coil." The terminals are identified by referring to Figure 1. Before mounting the coils, solder long enough leads to the terminals and bend the lugs so as to prevent them from touching the chassis. All wires from the coils should be run close against the chassis.

Mounting Tuning Condenser

Now solder leads to all the rotor lugs of the condenser gang and another lead to the front stator lug (on the bottom). Thread the leads through the holes, place the condenser and bring up the grid leads from the coils through the proper holes, then (*Turn to page* 563)

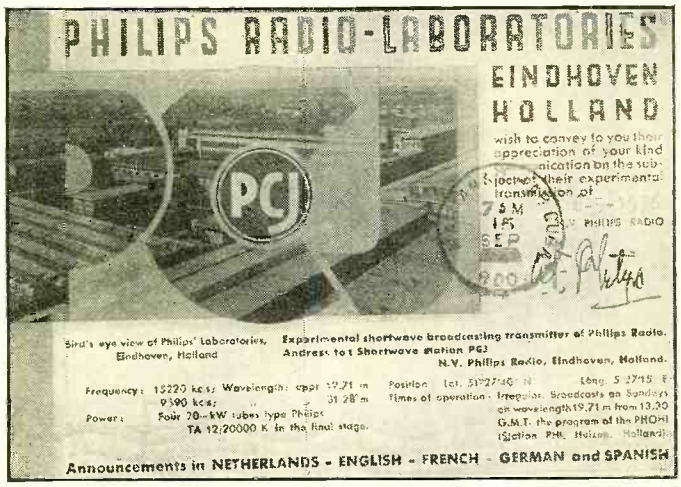
A TIME SAVER *for DX Listeners*

By John Strong

FOR the short-wave listener or DX'er who is in the habit of thumbing through perhaps fifteen or twenty pages in a log book to obtain information on a desired station, the "Roto-Log" represents a distinct time saver—and what's more, it provides comprehensive information on each station, including the power, frequency, location, chain affiliations and verification policy.

As indicated in the illustration, the device consists of a neat metal case containing two windows and two knurled disks. Behind the larger window the station list moves, propelled by the large disk which projects edgewise through the top of the case next to this window. The station lists are printed on a tape which is wound over two rollers in much the same way as the film in a camera. The main difference is that in the "Roto-Log" these rollers move with complete freedom. The knurled disk is of heavy material and acts as a flywheel to provide a free-wheeling action. As a result, three or four flips of this wheel with a thumb causes the entire ribbon to move past the window, thus any desired station can be located instantly.

(*Turn to page* 568)



A FAMOUS DUTCH STATION

This is the "veri" card from PJC at Eindhoven. It was received by Jose Lopez, Official Observer for Cuba.

The DX *for the*

Conducted by

Laurence

THE forty-eighth installment of the DX Corner for Short Waves contains the World Short-Wave Time Table for 24-hour use all over the world and Official Observers' reports of stations heard this month. Consult these two items regularly and make your all-wave set pay big dividends!

Expansion and Progress

With the forty-eighth installment of the DX Corner, including its Short-Wave Time-Table and Consolidated Reports of Listeners all over the world, we find ourselves at the beginning of the fifth consecutive year of what we believe will be increased endeavor and success in short-wave DX. It is only fitting that the Directors of the DX Corner should extend a cheery word of greeting and a figurative "handshake" to each and every member of the group with thanks from all to each particular Observer who has been so loyal and helpful in reporting new stations heard from various points on the globe. By the time this copy is in your hands appointments for 1937 Official Observers will be in the mail. The Editor's wish is—A great year of DX'ing for every reader!

Reappointment Reminder

We wish to remind Listening Post Observers that if they desire to be reappointed for 1937 they should send in a separate card along with their report stating that they wish reappointment. No Observers will be carried over to next year unless such a request is made, so, fellows, don't forget to apply soon.

New Observer Appointments

Newly interested enthusiasts who would like to qualify for appointment as an Official Observer will find a one-page article elsewhere in this issue which gives the aims and details of this Organization of Listening Posts. Everyone with a real interest in this work is cordially invited to make application.

Reports of Listening Post Observers and Other Short-Wave Readers of the DX Corner

LISTED in the following columns is this month's consolidated reports of short-wave stations heard by our wide world listening posts. Each item is credited with the Observer's surname. This allows our Readers to note who obtained the information. If any of our Readers can supply Actual Time Schedules, Correct Wavelengths, Correct Frequencies and any other Important Information (in paragraphs as recommended), the DX Editor, as well as our Readers, will be grateful for the information. On the other hand, Readers seeing these reports can try their skill in pulling in the stations logged and in trying to get complete information on these transmissions. The report for this month, containing the best information available to date, follows:

EUROPE

DJP, Zeesen, Germany, 11855 kc., 1:30 p.m. (Azevedo, Davenport); 11 a.m. to noon (Partner); 11795 kc. (Rudolph, Shamleffer).

DJM, Berlin, Germany, 6079 kc., 4:10-4:35 p.m. (Hodgkyns, Rudolph).

DZG, Berlin, Germany, 15360 kc., 5:45-6:15 a.m. (Hodgkyns).

DFB, Berlin, Germany, 31.38 meters, 5:15-5:25 a.m. and 4:50-5 p.m. (Hodgkyns).

DJO, Berlin, Germany, 25 and 19 meters, Sundays 1:30-2:10 (Stabler); 11975 kc. (Azevedo); 11 a.m. to noon (Partner); 11795 kc. (Rudolph, Shamleffer).

DZH, Zeesen, Germany, 20.75 meters, 2:20 p.m. (Atherton); 14460 kc. (from veri) (Rudolph, Shamleffer).

DJR, Zeesen, Germany, 15340 kc., daily 8-9 a.m. (from veri) (Dressler, Hodgkyns, Rudolph, Shamleffer).

DJT, Zeesen, Germany, 19.52 meters, 11:35 a.m. (Atherton, Shamleffer).

DZA, Berlin, Germany, 9675 kc., 8-8:10 a.m. and 4:40-5 p.m. (Hodgkyns, Shamleffer).

DZE, Zeesen, Germany, 12130 kc., 2 p.m. on, on Sundays. (Shamleffer, Kentzel).

HBO, Geneva, Switzerland, 26.31 meters, daily. (Vassallo); 11407 kc., 4:27 p.m. (Rudolph).

HBP, Geneva, Switzerland, 7799 kc., every Monday 8-8:30 p.m. (Stabler); 7:30 p.m. (Hodgkyns, Foshay, Shamleffer).

HAT4, Budapest, Hungary, 9120 kc., Sundays. (Kemp); 6:15 a.m. (Moore, Wilson); Sundays 6-7 p.m., chimes and code signals. (Dressler, Bishop).

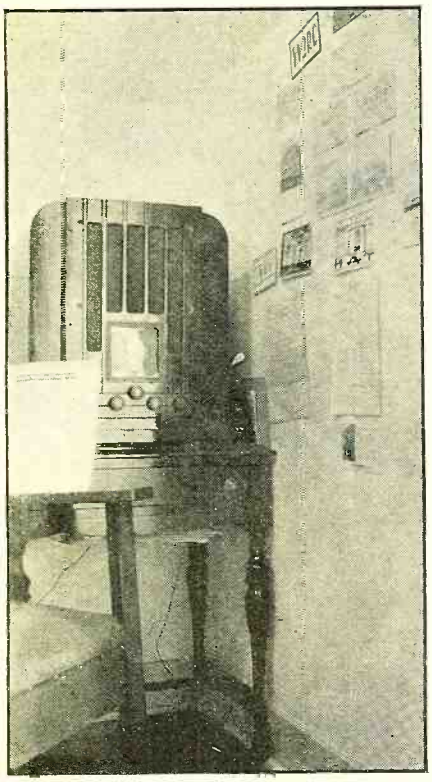
HAS3, Budapest, Hungary, 15370 kc., every Sunday 9-10 a.m. (Dressler, Azevedo).

LZA, Sofia, Bulgaria, 14970 kc., until 10 a.m. Sundays. (Howald); 14920 kc., 12 a.m. Sunday's. (Azevedo).

SPW, Warsaw, Poland, 13250 kc. (Alfred); 8-9 p.m. (Coover); 12:10-12:50 p.m. (Atherton); 13635 kc., Mondays, Wednesdays and Fridays at 11:30 a.m.-2:40 p.m. (Azevedo); Veri cards are incorrect in frequency due to error. (Partner).

TFJ, Reykjavik, Iceland, 12235 kc., 10 a.m. and on Sundays 1:40-2:32 p.m. (Bird, Wilson, Walker, Azevedo, Hodgkyns, Partner, Shamleffer).

OLR, Prague, Czechoslovakia, 6010 kc. (Allison); daily at 9 a.m. (Howald,



SHIPSHAPE DX CORNER

At left: The Listening Post of Official Observer Fred Cox of Victoria, Canada, and at right: Short-wave listener Morgan Kennedy shown listening in at Haddonfield, New Jersey. His shack is made of packing cases based by wooden poles.

Corner SHORT WAVES

M. Cockaday

Kemp); 2:30 p.m. (Atherton); 6025 kc. (Azevedo); Excellent reception. (Messer); Sundays on 11830 kc. at 11:50 p.m. (Smith); Mondays, Wednesdays and Thursdays, 7-9 p.m. for U. S. (Partner, Rudolph); 19698 kc. (Foshay, Bishop).

ORK, Ruysselede, Belgium, 11330 kc. (Greaves); 1:30-3 p.m. daily. (Fallon, Azevedo, Partner, Stabler, Shamleffer).

OXY, Skamlebaek, Denmark, 6060 kc., 2-6:30 p.m. (Azevedo).

Radio Belgrade, Yugoslavia, 6100 kc., 2-5:30 p.m. (Azevedo).

BINWA, Holland, 80.78 meters, 3:05 p.m. (Hodgkyns).

PADK, Holland, 79.55 meters, 1-1:15 p.m. (Hodgkyns).

PGB, Kootwijk, Holland, 8185 kc. (Rudolph).

SM5SX, Stockholm, Sweden, 11705 kc., 1:30 p.m. (Azevedo); schedule—11 a.m.-5 p.m. on Saturdays and Sundays, 7 a.m.-5 p.m. on Wednesdays, week ends from 5-6 p.m. (Partner, Millen). Address: Royal Technical University.

LKJ1, Jeloy, Norway, 9525 kc., daily 3 p.m. (Azevedo); 5:15-5:25 p.m. (Hodgkyns); 8:35 a.m. and 10:50 a.m. (Smith, Millen).

OER2, Vienna, Austria, 6072 kc., 11:35-11:45 a.m. (Hodgkyns).

GSI, Daventry, England, 15260 kc. (Greaves, Piorko); testing near 1 a.m. (Partner); 12:15-4 p.m. (from veri). (Rudolph).

GSO, Daventry, England, 25.53 meters (Greaves, Piorko, Kemp); 3:50-4 a.m. on 9580 kc. (Hodgkyns); 15180 kc., testing near 1 a.m. (Partner, Rudolph).

GSF, Daventry, England, 15140 kc. (Allison, Piorko, Kemp, Hurley); 6-8:45 a.m., 9 a.m.-12 p.m. and 4:05-5:45 p.m. (from veri). (Rudolph).

GSG, Daventry, England, 17790 kc., 8-9 a.m. (Hartman).

GSH, Daventry, England, 21470 kc., 6-8:45 p.m. (Piorko); noon (Howald, Kemp); 9580 kc., 4-4:10 a.m. (Hodgkyns, Partner); 6-8:45 a.m. and 9 a.m.-12 p.m. (from veri). (Rudolph).

GSP, Daventry, England, 15310 kc., 4-8 p.m. (Piorko, Hodgkyns, Rudolph).

EAQ, Madrid, Spain, 9860 kc., best at 7:10 p.m. (Staley); 6 p.m. (Coover, Zarn, Wilson); 5:30-9:30 p.m. (Fallon, Atherton, Azevedo); 3:30-4:15 p.m. (Stabler, Partner); Wednesdays. (Lopez, Kuprec, Harris). Slogan: "La Voz de España."

EA7AZ, Coruna, Spain, 7350 kc., irregularly in evenings. (Betances).

EAT, Spain, 13550 kc., announced as permanent frequency by Spanish government. (Millen).

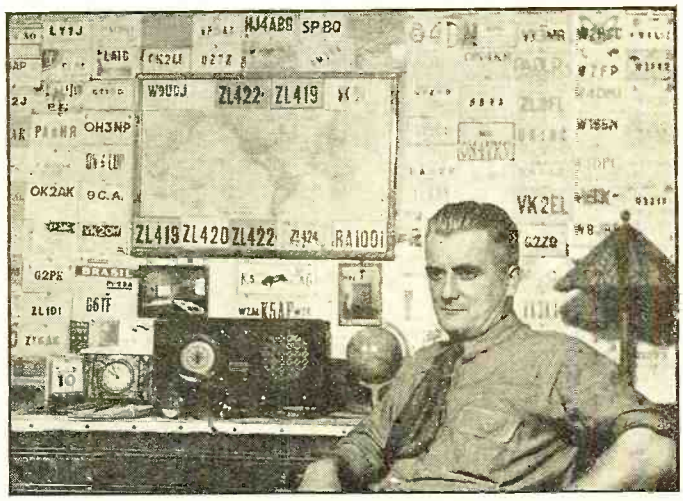
PSE, Barcelona, Spain, 42.20 meters, 4-4:10 p.m. (Hodgkyns).

ECNI, Barcelona, Spain, 42.79 meters, 5:40 p.m. (Hodgkyns). Spain, 9480 kc., gives out war news irregularly. (Houghton). Announcement: "U.G.T. 1, Union General de Trabajadores."

CT1AA, Lisbon, Portugal, 9650 kc., Tuesdays, Thursdays and Saturdays, 4-7 p.m. (from announcement). (Arichx); 9750 kc. (Shamleffer, Betances, Beck, Hodgkyns); 9700 kc. (Dressler, Bishop); three cuckoo calls during intervals. (Geneve). Slogan: "Radio Colonial."

CSW, Lisbon, Portugal, 9930 kc., irregularly, wants reports (Arickx); 6:30-7:10 p.m. (Sands); daily, 4-7 p.m. (Adams, Mott); 9940 kc. (Bower, Wood, Markuson, Dressler, Grees, Beck, Geneve); reported as CFW by Coover, Zarn, Atherton, De Ment, Hartman; Sundays 2 p.m. (Stabler, Azevedo, Rodriguez, Bills, Bower, Partner, Harris, Carothers, Kentzel). Address: National Broadcasting Station, Emisora Nacional, Lisbon, Portugal (from announcement).

CT1GO, Parede, Portugal, 6185 kc.



MINNEAPOLIS DX'er

Richard Brian and his good wife Irene certainly keep the air waves in his home town busy. They use a 6-tube home-made set, an All-Star receiver and a Doerle "V".

(Houghton); 3:20-3:30 p.m., 6198 kc. (Hodgkyns).

RV96, Moscow, U.S.S.R., 15180 kc., 1:30-2 p.m. (Kemp); no longer in use on 19.88 meters (Bower).

RNE, Moscow, U.S.S.R., 12000 kc., 6-7 a.m. on Sundays and Wednesdays, 10-11 a.m. on Sundays and 4-5 p.m. on Sundays, Mondays, Wednesdays and Fridays. (Bower, Coover, Azevedo, Hodgkyns).

RV59, Moscow, U.S.S.R., 6000 kc., 9-10:30 a.m. (Howald).

RAN, Moscow, U.S.S.R., 9600 kc., daily 7-7:30 p.m. (Bower); 9-10:30 a.m. (Howald, Zarn, Wilson, Boussy); 2 p.m. with QRM. (Azevedo, Messer, Block, Partner).

RV59, Moscow, U.S.S.R., 17.59 meters, 9:30-9:45 a.m. (Hodgkyns).

RKI, Moscow, U.S.S.R., 7520 kc. (Howald); 15080 kc. in a.m. irregularly. (Kemp, Wilson).

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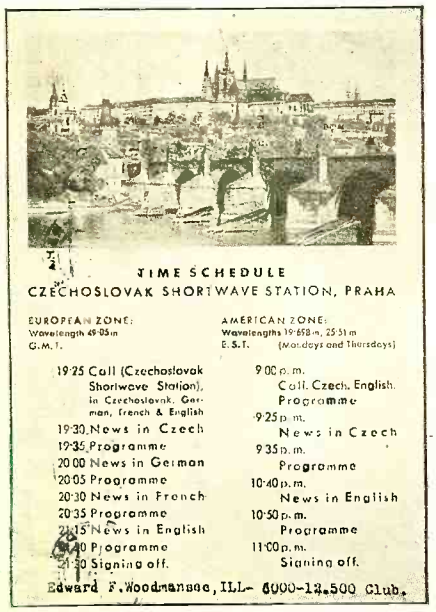
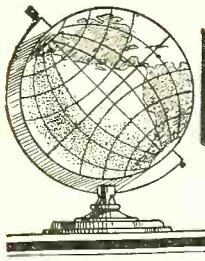
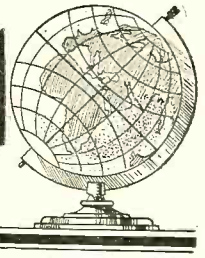


DO YOU HEAR OLR?

At left: The verification card of the new Czech short-wave station, received by E. F. Woodmansee, of Springfield, Illinois. At right: Ventura Victor hears them all in Buenos Aires, Argentina.



WORLD SHORT WAVE TIME-TABLE



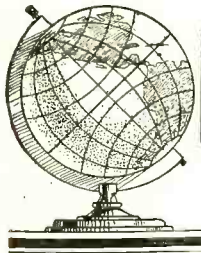
Compiled by LAURENCE M. COCKADAY

Hours of transmission for the World's Short Wave Broadcast Stations

												FILL IN LOCAL TIME											
8	9	10	11	M	1	2	3	4	5	6	7	EASTERN STANDARD TIME	8	9	10	11	N	1	2	3	4	5	6	7
01	02	03	04	05	06	07	08	09	10	11	12	GREENWICH MEAN TIME	13	14	15	16	17	18	19	20	21	22	23	00

HOURS OF TRANSMISSION

Wave-length Meters	Call Letters	Frequency Kc.	City Country	HOURS OF TRANSMISSION
13.93	W8XK	21540	Pittsburgh, Pa.	D
13.94	W2XE	21520	New York, N. Y.	D D D D D D
13.97	GSH	21470	Daventry, England	D D D D
16.86	GSG	17790	Daventry, England	D
16.87	W3XAL	17780	Bound Brook, N. J.	D D D D D D D D
16.89	DJE	17760	Zeesen, Germany	D D D
19.56	DJR	15340	Zeesen, Germany	D
19.57	W2XAD	15330	Schenectady, N. Y.	D D D D D D
19.62	LRU	15290	Buenos Aires, Arg.	D D D D D D
19.63	DJQ	15280	Zeesen, Germany	D D D S S
19.65	W2XE	15270	New York, N. Y.	D D D D D
19.66	GSI	15260	Daventry, England	D D D D
19.68	TPA2	15243	Pontoise, France	D D D
19.71	PCJ	15220	Eindhoven, Holland	V W W
19.72	W8XK	15210	Pittsburgh, Pa.	D D D D D D D D D
19.74	DJB	15200	Zeesen, Germany	D D D S S
19.75	ZBW4	15190	Hong Kong, China	D D Sa
19.76	GSO	15180	Daventry, England	
19.82	GSF	15140	Daventry, England	D D D
19.84	HVJ	15121	Vatican City	I
19.85	DJL	15110	Zeesen, Germany	D D D D D D D
20.00	SV1KI	15000	Athens, Greece	XS XS XS XS XS
20.04	LZA	14970	Sofia, Bulgaria	S S S U U S S
20.55	JVH	14600	Nazaki, Japan	D Z
22.16	SPW	13653	Warsaw, Poland	C C C S S S
22.95	VPD	13075	Suva, Fiji Islands	
24.52	TFJ	12235	Reykjavik, Iceland	S S
25.00	RV59(RNE)	12000	Moscow, U. S. S. R.	S
25.24	TPA3	11885	Pontoise, France	D D D D D D D
25.27	W8XK	11870	Pittsburgh, Pa.	D
25.34	OLR	11840	Podebrady, Czech.	H G G G Th Th Th Th Th Th Th AM
25.36	W2XE	11830	New York, N. Y.	D D
25.36	W9XAA	11830	Chicago, Ill.	D D D D I I D D I
25.40	I2RO	11810	Rome, Italy	D D D D D
25.49	DJD	11770	Zeesen, Germany	D D D D D D D D D
25.53	GSD	11750	Daventry, England	D D D D D D D D
25.58	PHI	11730	Huizen, Holland	P P P
25.58	CJRX	11730	Winnipeg, Canada	D D
25.60	TPA4	11720	Pontoise, France	D D
25.62	HJ4ABA	11710	Medellin, Colombia	D D I D D
26.24	COCX	11435	Havana, Cuba	D D D D XS S S
26.60	HIN	11280	Trujillo, D. R.	XS
27.35	HS8PJ	10955	Bangkok, Siam	M M D I
27.93	JVM	10740	Nazaki, Japan	E
28.14	JVN	10660	Nazaki, Japan	I D
29.04	ORK	10330	Ruysselede, Belgium	D D I I
30.43	EAQ	9860	Madrid, Spain	S S D D
30.75	COCQ	9750	Havana, Cuba	D D D D D D D D D D D D
31.00	CQN	9677	Macao, Asia	K
31.07	YNLF	9655	Managua, Nicaragua	D D D D D D D
31.09	CT1AA	9650	Lisbon, Portugal	G G G I
31.10	HH3W	9645	Port-au-Prince, Haiti	D D
31.14	I2RO	9635	Rome, Italy	XS D D D D D XS XS
31.25	RAN	9600	Moscow, U. S. S. R.	D
31.25	HJ1ABP	9600	Cartagena, Colombia	D D D D D D D
31.27	HBL	9595	Geneva, Switzerland	Sa Sa
31.28	W3XAU	9590	Philadelphia, Pa.	D D D D D D D D
31.28	VK2ME	9590	Sydney, Australia	S S S
31.28	PCJ	9590	Eindhoven, Holland	T AG V
31.28	HP5J	9590	Panama City, Pana.	S S D S D
31.32	VK3LR	9580	Lyndhurst, Australia	XS
31.32	GSC	9580	Daventry, England	D D D D
31.33	HJ2ABC	9575	Cucuta, Colombia	D D D D
31.35	W1XK	9570	Millis, Mass.	D D D D D D D D D D D D D
31.38	DJA	9560	Zeesen, Germany	D D D D D D D
31.40	TIPG	9559	San Jose, C. R.	D D D D D D
31.45	DJN	9540	Zeesen, Germany	D D D D D D D D
31.48	W2XAF	9530	Schenectady, N. Y.	D D
31.48	LKJ1	9530	Jeloy, Norway	D D D D D D
31.49	ZBW3	9525	Hong Kong, China	D D Sa
31.55	GSB	9510	Daventry, England	D D D D D D D D D D D D
31.55	HJU	9510	Buenaventura, Colom	C C
31.55	VK3ME	9510	Melbourne, Australia	
31.56	XEFT	9505	Veracruz, Mex.	D D D D D D
31.58	HJ1ABE	9500	Cartagena, Colombia	D XA XA S S S D XS XS
31.75	TGWA	9450	Guatemala City	I I
31.82	COCH	9428	Havana, Cuba	D D D D D D D D D D D D
31.35	HS8PJ	9350	Bangkok, Siam	M M
32.88	HAT4	9125	Budapest, Hungary	S
33.53	HCJB	8948	Quito, Ecuador	XM XM XM XM
34.62	CO9JQ	8665	Camaguey, Cuba	
38.48	HBP	7797	Geneva, Switzerland	Sa Sa
39.95	JVP	7510	Nazaki, Japan	D D AM
41.80	CR6AA	7177	Lobito, Angola, Afr.	W W L L L
42.80	EA8AB	7010	Tenerife, Canary Is.	C C
43.48	HI3C	6900	La Romana, D. R.	D D D
43.99	XGOX	6820	Nanking, China	D D XS XS
44.14	HIH	6796	San Pedro, D. R.	AC AC S AC
44.44	JVT	6750	Nazaki, Japan	Z
44.71	TIEP	6710	San Jose, Costa Rica	I D D
45.00	HC2RL	6667	Guayaquil, Ecuador	S S S
45.25	HIT	6630	Trujillo, D. R.	XS XS D D
45.34	PRADO	6618	Riobamba, Ecuador	T T
45.38	RV72	6611	Moscow, U. S. S. R.	I



WORLD SHORT WAVE TIME-TABLE

(Continued from the Previous Page)

Hours of transmission for the World's Short Wave Broadcast Stations

FILL IN LOCAL TIME											
8	9	10	11	M	1	2	3	4	5	6	7
EASTERN STANDARD TIME											
01	02	03	04	05	06	07	08	09	10	11	12
GREENWICH MEAN TIME											

HOURS OF TRANSMISSION											
D	D										
D	I										
D	D	D	··I	I	I						
D	D										D
I	I	Sa	Sa								
I	I	I									
XS	XS										
	D	D									
D	D										
XS	XS	XS									
L	L	L									
AM											
D	D	I	I	I							
D	D	D		D	D	M					
D	D	D									
										XS	XS
D	D	D	D								
			Sa	Sa							
D	D										
D	D										
	D	D	D								
		D	D	D							
								XS	XS	XS	
D	D	D									XA
D	D	D	D	D	D						
D	D	D	D								
D	D	D									
		D									
		D	D								
					D	D		S	S	S	D
AH	AH	AH	AH	AH							
			XSa	XS							
D			XS	XS			XS	D	XS	XS	S
D	D	D									
	S	S	D	D	D		AM	D	D	D	D
D	D	D	D								
XS	XS	XS									
XS	XS	D									
									XA	XA	
D	D	XS	XS								
D	D	D	D							D	D
											XS
	XS	XS	XS	XS	XS	XS	XS	XS	Sa	Sa	
D	D										
			D	D	D	D					
D	D	D									
D	D	D	D								
D	D	D									
	D										
XS	XS	XS		Sa							
							D	D	D	D	
F											
D	D	D									
D	D	D									
			D								D
		S	S	S	S					N	N
D	D	D	I								
			Sa	Sa							
D	D	D	D		I						
D											D
				Sa							
D	D	D	D	D							
Z	Z	Z									S
D	D	D									
D	E	E	E								
Xsa	D	Sa	Sa								
XS	XS										
D	D	S	S								
D	D										
D	D										
D	D										
D	D	XS									
	AH	AH	AH								
D	D	D	D	D	D	D	D	D	D	D	D

Wave-length Meters	Call Letters	Frequency Kc.	City Country
45.80	HI4D	6550	Trujillo, D. R.
46.01	YV4RA	6520	Valencia, Venezuela
46.08	HIL	6510	Trujillo, D. R.
46.66	HI1S	6430	Puerto Plata, D. R.
46.91	HI8Q	6395	Trujillo, D. R.
47.06	YV5RF	6375	Caracas, Venezuela
47.24	HRP1	6350	SanPedroSula,Honduras
47.54	HIZ	6310	Trujillo, D. R.
47.62	YV4RD	6300	Maracay, Venezuela
47.77	HIG	6280	Trujillo, D. R.
47.77	COHB	6280	Sancti Spiritus, Cuba
48.05	HIN	6243	Trujillo, D. R.
48.11	HRD	6235	La Ceiba, Honduras
48.15	OAX4G	6230	Lima, Peru
48.19	HJ1ABH	6225	Cienaga, Colombia
48.50	HI1A	6185	Santiago, D. R.
48.54	COKG	6180	Santiago, Cuba
48.70	XEXA	6160	Mexico, D. F.
48.70	VPB	6160	Colombo, Ceylon
48.70	CJRO	6160	Winnipeg, Canada
48.78	VE9CL	6150	Winnipeg, Canada
48.78	HJ2ABA	6150	Tunja, Colombia
48.78	YV5RD	6150	Caracas, Venezuela
48.78	HJ5ABC	6150	Cali, Colombia
48.86	W8XK	6140	Pittsburgh, Pa.
48.88	CR7AA	6137	Lourenzo Marques, A.
48.94	VE9HX	6130	Halifax, N. S.
48.94	COCD	6130	Havana, Cuba
48.96	HJ3ABX	6128	Bogota, Colombia
49.02	HI1ABB	6120	Barranquilla, Colom.
49.02	W2XE	6120	New York, N. Y.
49.10	XECW	6110	Xantocam, Mexico
49.18	"Beograd"	6100	Belgrade, Yugoslavia
49.18	W3XAL	6100	Bound Brook, N. J.
49.18	W9XF	6100	Chicago, Ill.
49.20	ZTJ (JB)	6098	Johannesburg, Africa
49.22	HJ4ABE	6095	Medellin, Colombia
49.26	ZBW2	6090	Hong Kong, China
49.26	CRCX	6090	Toronto, Canada
49.30	HJ5ABD	6085	Cali, Colombia
49.31	HJ3ABF	6084	Bogota, Colombia
49.32	VQ7LO	6083	Nairobi, Kenya, Afr.
49.34	HP5F	6080	Colon, Panama
49.34	W9XAA	6080	Chicago, Ill.
49.34	ZHJ	6080	Penang, S. S.
49.40	OER2	6073	Vienna, Austria
49.42	YV1RE	6070	Maracaibo, Venez.
49.50	W8XAL	6060	Cincinnati, Ohio
49.50	W3XAU	6060	Philadelphia, Pa.
49.50	OXY	6060	Skamlebaek, Denmark
49.59	HJ3ABD	6050	Bogota, Colombia
49.59	HI9B	6050	Trujillo, D. R.
49.63	HJ3ABI	6045	Bogota, Colombia
49.65	HJ1ABG	6042	Barranquilla, Colom.
49.67	VDA	6040	Tandjong Priok, Java
49.67	W1XAL	6040	Boston, Mass.
49.75	HP5B	6030	Panama City, Panama
49.83	DJC	6020	Zeesen, Germany
49.83	XEUW	6020	Veracruz, Mexico
49.85	ZHI	6018	Singapore, Malaya
49.90	HJ3ABH	6012	Bogota, Colombia
49.92	COCO	6010	Havana, Cuba
49.95	HJ1ABJ	6006	Santa Marta, Colom.
49.96	CFCX	6005	Montreal, Can.
49.96	HP5K	6005	Colon, Panama
49.96	VE9DN	6005	Montreal, Canada
50.00	XEBT	6000	Mexico City, Mexico
50.00	RV59	6000	Moscow, U. S. S. R.
50.17	HIX	5980	Trujillo, D. R.
50.25	HJN	5970	Bogota, Colombia
50.25	XEWI	5970	Mexico, D. F.
50.26	HVJ	5969	Vatican City
50.50	TG2X	5940	Guatemala City
50.72	HH2S	5915	Port au Prince, Haiti
50.76	HRN	5910	Tegucigalpa, Hond.
50.85	YV3RA	5900	Barquisimeto, Venez.
51.15	HI1J	5865	San Pedro, D. R.
51.46	TIGPH	5830	Alma Tica, Costa Rica
51.72	YV5RC	5800	Caracas, Venezuela
51.90	OAX4D	5780	Lima, Peru
70.21	RV15	4273	Khabarovsk, Siberia

HOURS OF TRANSMISSION											
8	9	10	11	N	1	2	3	4	5	6	7
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				S	S						
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XS	XC	V	V	Sa							
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			D								XS
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	S	S	D	D	S	S	S	D	D	D	D
	AN	AN	AN								
D	D								D	D	D

List of Symbols

A—Thursday, Sunday
C—Monday, Wednesday, Friday
D—Daily
E—Tuesday, Thursday
F—Friday
H—Sunday, Monday, Wednesday, Friday
G—Tuesday, Thursday, Saturday
I—Irregularly
J—Tuesday, Thursday, Friday, Sunday
K—Monday, Friday
L—Wednesday, Saturday
M—Monday
N—Monday, Wednesday, Thursday
O—Monday, Tuesday, Wednesday, Friday
P—Except Tuesday, Wednesday
S—Sunday
T—Tuesday
Th—Thursday
U—Sunday, Monday, Thursday
V—Sunday, Wednesday
W—Wednesday
Z—Tuesday, Friday
AC—Monday, Thursday, Saturday
AG—Tuesday, Sunday
AH—Monday, Wednesday, Saturday
AL—Except Monday, Sunday
AM—Monday, Thursday
AN—Tuesday, Saturday
Sa—Saturday
XA—Except Saturday, Sunday
XB—Except Tuesday, Thursday
XC—Except Tuesday, Thursday, Sunday
XM—Except Monday
XS—Except Sunday
XY—Except Tuesday, Sunday
XSa—Except Saturday

GREETINGS FROM PORTUGAL

At right: Observer Alvaro Azevedo in his Listening Post at Lisbon, Portugal. At left: The verification card of HJ1ABE submitted by J. L. Lopez of Havana, Cuba.

The DX Corner

(Short Waves)

(*Continued from page* 543)

AFRICA

EA9AH, Tetuan, Spanish Morocco, 7025 kc., early evenings with music and news, (Betances), 14,000 kc., as amateur, (Bower, Millen), 6:30-7:00 p.m., calling Argentina and Mexico, (Kentzel), "Radio Tetuan."

Tunis, Africa, 6185 kc., 1 p.m. and 7:30 a.m., (Houghton), call known as "Ici Tunis, Poste Prive Escpermental."

Algiers, Algeria, Africa, 9860 kc., contacting TYA-2, 12:30-1:30 a.m. and 4-5:30 p.m., will verify in about six weeks, (Croston, Partner), Address: Service Algerien des P.T.T., Direction des Services technique Regionaux et Speciaux, 137 Rue de Constantine, Algiers.

ZMB, Mafeking, Africa, 5900 kc., daily noon to 2 p.m., government station of British Bechuanaland protectorate, (Westman).

ZUD, Pretoria, S. Africa, 5000 kc., tests irreg. and requests reports, (Craston), Address: c/o Chief Engineer, G.P.O., Pretoria.

EA8AB, Tenerife, Canary Islands, 7010 kc., (not 7210 kc), latest schedule Monday, Wednesday, Friday and Saturday 3:15-4:15 p.m. (Croston).

EAJ43, Radio Tenerife, Canary Islands, 10360 kc., evenings with news (Betances), 6-8 p.m. (Bower), irreg. around 3:40 p.m. (Ozenedo), daily 2:15-3:50 p.m., 6-7 p.m., 7-8 p.m. (from veri) (Yoshimura, Harris).

IDU, Asinara, Eritrea, 13380 kc., 1 p.m. and irreg. calling Rome (Brown), woman calls "Pronto Roma."

ZEB, Bulawayo, S. Rhodesia, 48.8 meters (Greaves).

ZEC, Salisbury, S. Rhodesia, 50 meters (Greaves).

CR7AA, Laurenco Marques, Mozambique, 48.8 meters, daily at same time except Sunday (Greaves).

OCEANIA

VPD2, Suva, Fiji Islands, 9540 kc., daily (Foshay).

VK6ME, Perth, West Australia, testing at 7 a.m. (Millen).

VK3ME, Melbourne, Australia, 9510 kc., testing on Tuesdays at 3-4:30 a.m. (Brown), with improved reception (Howald, Kemp).

VK2ME, Sydney, Australia, 9590 kc., improved reception (Howald, Kemp), 5:30 a.m. (Gallagher).

VK3LR, Lyndhurst, Australia, 9580 kc., improved reception (Howald, Kemp), 3:30-4:50 a.m. (Bishop), well after 7:30 a.m. (Hartman, Gallagher).

KIO, Kahuku, Hawaii, 11680 kc., test early in a.m. (Greaves), 8:15 p.m. talking with KKQ (Atherton, Shamleffer, Gallagher).

FO8AA, Papeete, Tahiti Island, 3100 kc., Tuesday and Friday 10-12 p.m., in French and English (Howald, Wilson), Wednesday and Saturday, 12-1 a.m. (Harris, Gallagher), "Radio Club Oceanien" opening number is the "Marseillaise."

ASIA

PLP, Bandoeng, Java, 11000 kc., will not verify reports after January 1, 1937 (from veri.), (Mackuson, Wilson), irreg. from 6 p.m. (Ozenedo), week days 5:30-11 a.m., Sunday 5:30-10:30 a.m. (Rudolph, Carothers).

PLV, Bandoeng, Java, 9400 kc., will not verify reports after January 1, 1937 (from veri.), (Markuson), 4-8 a.m. (Rudolph), 10 a.m. (Gallagher).

PMN, Bandoeng, Java, 10260 kc., will not verify reports after January 1, 1937 (from veri.), (Markuson, Wilson), daily from 6 p.m. (Ozenedo), 8:30-10:30 a.m. (Smith).

YDC, Bandoeng, Java, 15150 kc., 5:30-10:00 a.m. (Fallon), relays PMN, 8:30-10:30 a.m. (Smith, Rudolph).

YDB, Bandoeng, Java, 9650 kc., 10 a.m. (Wilson, Gallagher).

PMA, Bandoeng, Java, 19350 kc., 10 a.m. (Gallagher), records played (from KDKA DX tip program) (Rudolph).

JIB, Tyureki, Japan (Formosa), 10535 kc., 4:30-4:35 p.m. (Hodgkyns).

JVI. Tokio, Japan, 13560 k.c., 3:45 a.m. (Hodgkyns).

JVD, Nazaki, Japan, 15860 kc., 1:00 a.m. (Black), on various dates around 5 and 8 p.m. (Gallagher).

JVM, Nazaki, Japan, 10720 kc., testing until 10:30 a.m. (Howald, Brown), 10800 kc. (Weikal), Tuesday and Friday on 10740 kc., 2-3 p.m. (Ozeneda, Partner, Gallagher).

JVT, Nazaki, Japan, 6750 kc., testing until 10:30 a.m. (Howald, Brown, Tarr), 5:30 a.m. (Gallagher, Foshay).

JZJ, Nazaki, Japan, 11800 kc., testing until 10 a.m. (Howald, McKay), excellent reception on 14280 kc. (Messer), 4-5 p.m., Monday and Thursday (Bowes), 12-1:45 a.m. (Rudolph, Herzog, Partner, Tarr), Address: Nazaki B.C., Tokio.

JZK, Nazaki, Japan, 15160 kc., testing at 10 a.m. (Howald), 16160 kc., Tuesday-Friday 2-3 p.m. (from announcement), (Arickx, Bower), Monday and Thursday 4-5 p.m. (Partner, Scala).

JVN, Nazaki, Janpan, 10660 kc., 12-1 a.m. (Howald, Brown), 5-7 a.m. (Miller, Wilson), 1:30-2:20 a.m. (Rudolph, Gallagher).

JZI, Nazaki, Japan, 9535 kc., Tuesday, Friday 2-3 p.m. (from announcement), (Arickx), 4 p.m. (Elkes, McKay, Bower), Monday and Thursday 4-5 p.m. (Partner, Scala, Herzog), Address: Nazaki B.C., Tokio).

JVH, Nazaki, Japan, 14600 kc., 12-1 p.m. (Brown, Greaves, Zarn), 12-1 a.m., will change to JZJ on 11800 kc. in near future (Boussy, Dressler, Wilson), 6:45 p.m. (Messer), Tuesday and Friday 2-3 a.m. (Ozenedo, Black), 10-11 p.m. (Howald), call letters JOAK used, overseas program now seldom heard (Gallagher, Kentzel, Scala).

VUB, Bombay, India, 9565 kc., Wednesday, Thursday and Saturday (Greaves), Address: Sprott Road, Bombay, Ozenedo.

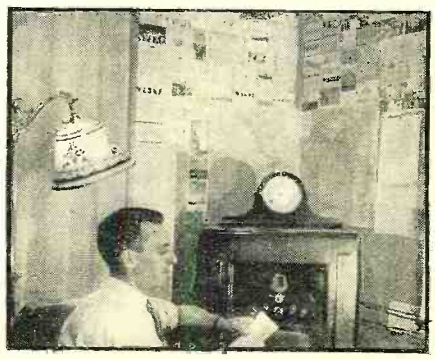
VPB, Colombo, Ceylon, India, 6070 kc., 10 a.m., identity not certain (Gallagher).

HSG2, Siam, 19016 kc., 15530 kc., testing from 9:15-10:15 a.m., (Houghton).

HSP, Bangkok, Siam, 17700 kc., 12 noon (Gallagher).

MEET "BILL" HERZOG

Located at Center Moriches, New York, Bill covers the short waves for RADIO NEWS and its host of readers.



(*Turn to page* 554)

THE SERVICE BENCH

(*Continued from page 532*)

tainly one of the hardest-to-locate troubles encountered in modern radio service work is manifested by uncontrollable oscillation and an extremely high noise level. This seems to be particularly true of receivers in which the i.f. transformers have been replaced with those of the new high-gain iron-core type. This fact, however, does not necessarily mean that the trouble lies in this part of the circuit.

"The writer recently had three sets in the shop which were noisy and oscillated despite every precaution in r.f. shielding, filtering and by-passing the plate and screen leads. In all cases it was noticed that the oscillations ceased when the volume control was turned down, suggesting that the trouble might be found in the first audio stage. Accordingly the filter circuit shown in Figure 5, consisting of two 8-millihenry chokes and a 500-mmfd. mica condenser was tried. This completely squelched all oscillations and reduced the noise to about 40% of its original value. Most of the remaining noise was eliminated by shielding all of the leads in the first a.f. grid circuit, as shown. All three sets were of different makes, and the results obtained with the filter were identical in each case. While the circuit shown in Figure 5 may not be encountered in every instance, it is typical, and illustrates the principles of filtering and shielding.

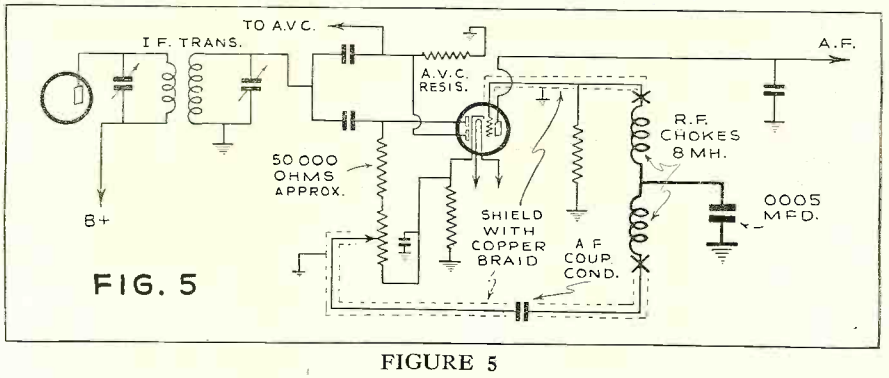


FIGURE 5

Showing shielding and filter arrangement for stabilization and noise reduction.

Noise in 6-Volt Farm Sets

"The writer has had several complaints of noise with new 6-volt farm radios as the battery begins to drop. Investigation has shown that most of this trouble is due either to a poor battery or corroded connections to the power cable. Few set owners care to invest in a new battery, and corrosion can only be temporarily corrected. I find that the noise can usually be eliminated by connecting a *paper condenser* of 6 mfd. or better, directly across the terminals of the 6-volt battery. In extreme cases I have employed the condenser in conjunction with two r.f. chokes consisting of 75 turns of number 18 wire on 1-inch forms—one choke in each leg of the battery." (The battery being a power source, a condenser filter arrangement should be effective in reducing noise—exactly as it is with line-power operated receivers. This should be particularly the case when the battery is being more or less constantly charged by a wind-driven generator where commutator and ring noises may be introduced. Noisy batteries are usually the result of mistreatment. While it is possible to get away with ordinary tap water in large cities, for long periods of time, the drinking water available on most farms is absolutely unfit for electrolytic purposes. Most spring and well water contains large percentages of mineral salts which rapidly build up deposits in the battery resulting in stray discharge currents, sulphating and noise. The farmer should be instructed to use only distilled water—or rain water collected, preferably, in a special barrel or other receptacle set aside for battery use. It goes without saying that the terminals should be inspected every so often, cleansed with ammonia or a solution of washing soda, greased and tightened.—Ed.)

A Tip for the Tropics

From Eugene C. Drobeck, of the Gold Pocket Mining Company, Papaya, Nueva Ecija, Philippine Islands, comes the following items which will be of use to hundreds of our servicemen readers functioning in humid climates: "One trouble experienced out here is the formation of mold on the enclosed wiring in test equipment. A few days of tropical rain will build up a mold 1/16th inch thick on cotton- and silk-covered wire if enclosed. There are two remedies. One is to wipe the wire dry and clean with a cloth and permit the wiring to be exposed for several hours at a time every few days or so during the rainy season. The other and more strenuous cure is to rewire with enamel-insulated or a bare conductor." (While operating in the environs of the equator, we ran into this same trouble. Another cure is to clean and dry the insulation, and then rub it thoroughly with a wax candle, paraffin or beeswax. This is a good precaution when servicing receivers in the tropics.

G. E. Model K-63

"A. G. E. model K-63, 6-tube super (same chassis as the RCA-Victor 120 and the Westinghouse WR-36) played by 'jerks' at high volume—that is, with rapid fading and some distortion. It was also rather insensitive, it being impossible to pick up noise between stations. The trouble was discovered in a shorted bias resistor for the r.f. and i.f. tubes. This resistor is located immediately adjacent to the i.f. socket. The leads had become bent and shorted to the chassis. The analyzer reading is not accurate due to the high resistance test in the grid circuit. Using the point-to-point resistance test between r.f. cathode and ground, it should show about 600 ohms. A shorted by-pass condenser could, of course, cause the same trouble with identical symptoms." C. S. Morse, Manager, Morse Radio Service, Canton, Ohio.

(*Turn to page 572*)

RCA ALL THE WAY

RCA Radio News

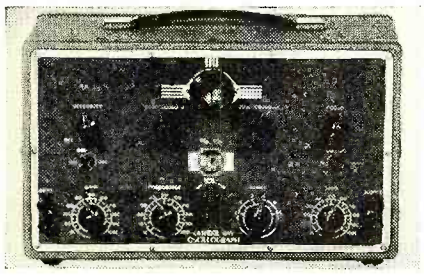
RCA Manufacturing Company, Inc. • Camden, New Jersey
A Service of the Radio Corporation of America

EVERYTHING IN RADIO—MICROPHONE TO LOUDSPEAKER

To the consumer, RCA means high quality performance at low cost . . . To the radio man, RCA means easier selling, higher profits

RCA VALUES FOR MARCH!

New RCA Test Equipment . . . at prices never before so low!



RCA Cathode Ray Oscillograph

Stock No. 151 **Net Price $47.50**

FEATURES

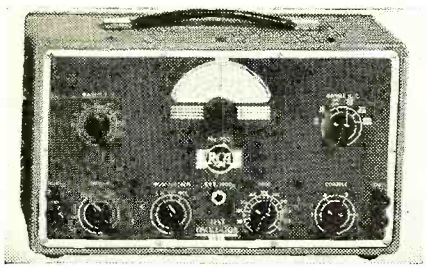
1 COMPLETE oscillograph using new RCA-913 Cathode Ray Tube.

2 High sensitivity—1.75 volts R.M.S. for full-scale deflection.

3 Both vertical and horizontal amplifiers—individual gain controls—Flat 30-10,000 cycles.

4 Linear Timing Axis—30-10,000 cycles.

5 Light shield and calibration screen.



RCA Electronic Sweep Test Oscillator

Stock No. 150 **Net price $64.50**

FEATURES

1 No moving parts. Variable electronic sweep—1 to 40 kcs.—at any r-f or i-f frequency—sweep rate, 120 times per second, eliminates screen flicker.

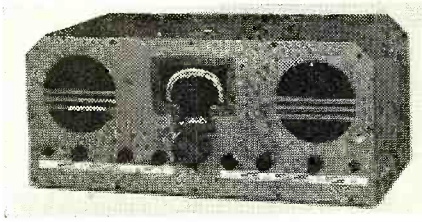
2 Wide frequency range 90 kcs. to 32,000 kcs.—fundamental frequencies—400 cycle modulation—JACK FOR EXTERNAL MODULATION.

3 Large direct-reading dial—4 inches diameter—indirect illumination—projected zero indicator lines eliminates parallax—two vernier ratios, 2:1 and 5:1.

4 AC operated—no batteries or motor.

ACR-155
A New, Moderately-Priced, General Purpose Communication Receiver

Amateur's Net $74.50 f.o.b. factory



The ACR-155 is a moderately-priced communication receiver capable of superior performance under modern operating conditions. It provides a number of features not usually found in receivers of its price class.

1 Continuous frequency coverage from 520 to 22,000 kcs.

2 Nine Metal RCA Radiotrons for improved high-frequency performance.

3 Improved, large tuning knob with crank handle for smooth, easy tuning. 100 to 1 band-spread tuning drive.

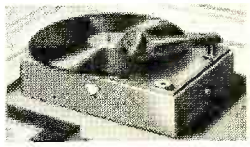
4 Improved, adjustable, air-dielectric trimming capacitors. Magnetite core i-f transformers.

5 Calibration-spread dial for accurate logging.

6 Electrically stabilized oscillators.

In addition to the performance and convenience features shown above, this receiver also provides antenna rejection filter to reduce interference . . . A.V. C. at will . . . Six-inch, dustproof electrodynamic speaker for high-quality reproduction...Preselection for better signal to noise ratio, lower image response.

Small, Low-Cost Record Player Converts Radio into Phonograph-Radio!



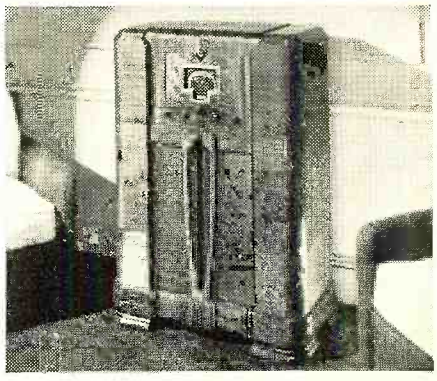
The smart looking RCA Victor Record Player, R-93, shown at right, is ideal for the radio owner who also desires recorded music. Attaches quickly and easily to any electrically operated radio, and converts the set into a phonograph-radio!

It's small in size, can be placed in any small space—costs less than $20—available in a walnut finish, or, at slightly higher prices, in red, black, ivory.

In the field of radio, RCA Victor offers you more for your money in 1937 than ever before! Model 9K-3, shown below, is typical of the entire new line. It's easy to look at . . . easy to buy . . . and a real pleasure to hear!

These radios offer you, in addition to the many great features led by Magic Voice, Magic Brain, Magic Eye and Metal Tubes—the magic of radio that's RCA ALL THE WAY. Designed by men equally familiar with broadcasting and reception (for RCA designs most of the broadcasting equipment used by radio stations), they are the finest radios you can buy. Hear them today! There's a model and a price to please you. Easy payments through C. I. T. Corp.

RCA Victor Console Model 9K-3 ...with Magic Voice, Magic Brain, Magic Eye and Metal Tubes. Tuning range from 530 to 22,000 kcs. Beam Power Amplification. Selector Dial. 9 tubes. Automatic Volume Control. Automatic Tone Compensation. 12 watts output. Superb Cabinet.



RADIO PHYSICS COURSE

ALFRED A. GHIRARDI

Lesson 60—Filters

A PRACTICAL application of the low-pass filter is in the B power supply unit in electric radio receivers. In this case, the pulsating "rectified" direct current is passed through the choke coils with some opposition but, since direct current cannot pass through a condenser, the direct current is kept in the correct path. The choke coils tend to oppose any pulsations in the current. The high-capacity condensers in the filter absorb the pulsations in this direct current. This leaves the output current free of all pulsations which would otherwise cause "hum" in the receiver.

In most B power units a two-section filter is employed, comprising two choke coils and two or three filter condensers, as shown in (A) of Figure 1. Assuming that the 30-henry chokes and 2-microfarad condensers are used, a filter of this type will pass all currents having a frequency of less than about 20 cycles, including direct current. This filter will block all currents which have frequencies above 20 cycles, however, which includes the 60-cycle hum-current which we wish to eliminate, and also practically all of the "line" noises which are present. Such a filter is ideal for the purpose for which we wish to use it. A 30-henry filter-choke and an electrolytic condenser-unit are used in a filter of this kind.

At (B) of Figure 1 is shown the simple low-pass filter arrangement commonly used in the plate circuit of the detector tube in a radio receiver. The r.f. choke coil is an air-core coil of about 85 millihenries inductance, designed to offer low impedance to the passage of audio-frequency currents from 0 to about 10,000 cycles through it. It does, however, present a high impedance to the flow of radio-frequency currents (about 20,000 cycles—up). The by-pass condenser, usually of from .0001 to .0005 mfd. capacitance, acts as a by-pass for all radio-frequency currents which exist in the plate circuit of the detector tube.

At (C) is shown an improved form of detector plate filter which is now being used in many receivers. It has two condensers instead of one. This forms a "pi" section filter which is more effective for this purpose than that shown at (B), since the condenser on the right also helps to by-pass the radio-frequency currents. An 85-millihenry r.f. choke coil and .0001 mfd. by-pass condenser are actually used for this purpose.

Low-pass filters are also used as tone controls for suppressing the high-frequency audio currents in audio amplifiers, and in interference eliminators for suppressing extraneous electrical disturbances. In some electro-dynamic loudspeakers, high-pass filters are used to suppress any 60-cycle hum which may be present, but they pass through all audio frequencies above this. These will be considered in detail later at appropriate places.

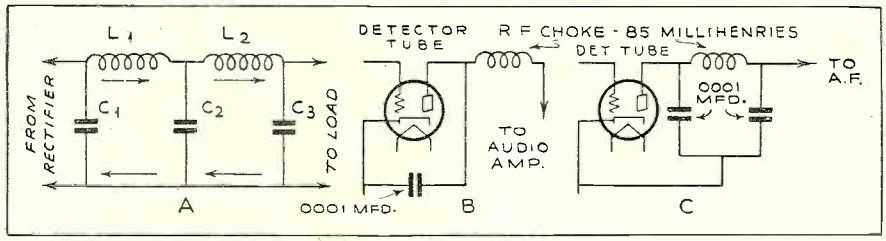


Figure 1. (A) A type of low-pass filter section commonly used in B-power units of a.c. electric radio receivers. (B) Low-pass filter section following the detector tube in a radio receiver to keep the r.f. currents out of the audio amplifier, but pass the lower frequency audio currents through. (C) Improved form of the filter at (B).

Build a Work Bench

(*Continued from page* 529)

4 x 4 inch cross pieces 21 inches long, cut to form simple half lap joints. Five-inch long carriage bolts, ¼ inch in diameter, hold these pieces in place. The long rails, running flush with the tops of the legs and also six inches above the floor (to meet the bottom half-lap joints) are "2 by 4's", each 44 inches long; four pieces are required. Now here is the whole secret of the excellent solidity of this bench: the rails are held against the inside surfaces of the upright legs by carriage bolts 6 inches long and ½ inch in diameter. The bolts run through the legs and endwise into the rails, the nuts being applied over their ends in 1¼-inch holes which are bored through the face of the rail about 4 inches from the ends as shown in the photo. To line up the legs and rails while boring the ½-inch holes, nail them together temporarily; remove the nails after the bolts are tightened.

The top of the bench consists merely of 2 pieces of "step boards," measuring 5 feet long by 11½ inches wide, centered over the framework and fastened by twelve 5-inch carriage bolts ¼ inch in diameter. These bolts run clean through the front and back rails and side rails.

The completed bench is given three coats of orange shellac to prevent absorption of moisture and possible warping. Important: don't forget to turn the table over and let the shellac soak into the end grain of the legs. Vises, electric outlets, shelves, etc., are readily installed to suit the builder's requirements. The total cost of materials for the bench was under five dollars.

A few don'ts: Don't use nails, thin legs, ordinary soft "shelving" boards or knotty lumber. Follow the specifications and you'll have a sturdy workbench that will give you many years of service.

ROBERT HERTZBERG,
Jackson Heights, N. Y.

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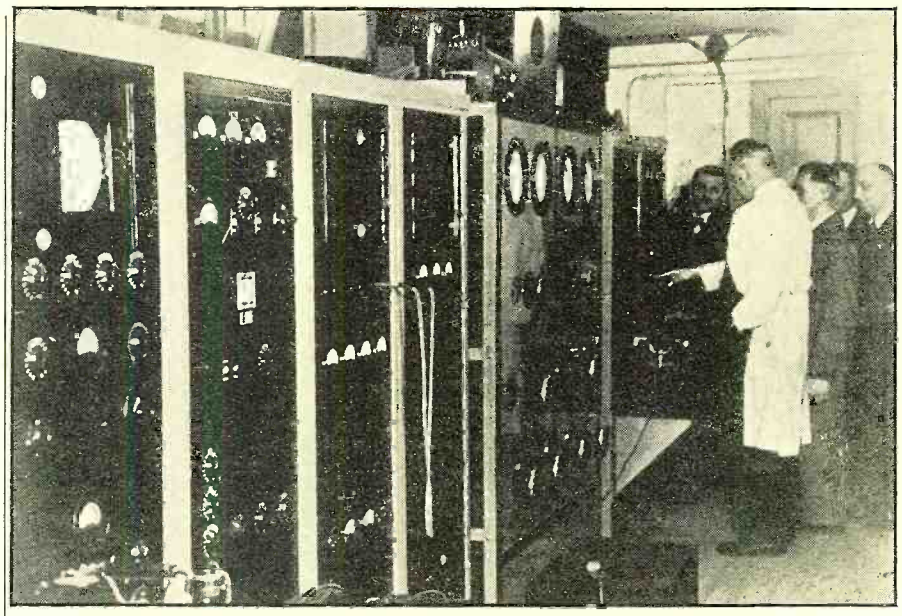


QRD? QRD? QRD?

CONDUCTED BY GY

WELL, here's your sleuthing editor sitting in the warm sunlight of the much advertised state of California. It is positively scandalous the easy life here knocking out my column in this warm, soft climate whilst the rest of humanity cuddles closer and closer 'round the fireside trying to keep from freezing in the blue, breezy, battering, blankety blank blizzardy winter weather. And we're not even on the payroll of the high-flying weather publicity hounds! Watching those Tunaboats come sliding into harbor with holds bulging with fish and crews laughing, in high joy over their share of the money to be collected, is a sight that only a radio op who has been through a tuna trip can appreciate.

SPEAKING of Tunaboats, we recently met up with the skipper of the *Vasca De Gama*—a tunaboat which went through one of the worst disasters ever to have hit one of these little seagoing boats. Everyone has read of the explosion which sent that sturdy craft down to the bottom and of the crew jumping into the water and being picked up by a British freighter, but one thing which may not be generally known was "there was no radio man aboard." The skipper, Walter Robertson, was the only white man in a crew of eleven men, and he says that they might not have had to go through the hell of waiting for some boat to pick them up—of the sinking despair when boats passed them by—if a radioman had only sent their position report in an SOS. Captain Robertson, after that experience, has not gone back to sea, but insists that *radio ops should be included in every personnel which goes to sea!*

This West Coast has had a grand time with the strike tie-ups and the heavy conversations being indulged in by the "bosses" of the different factions. The representative for Uncle Sammy has had his hands full trying to placate and smooth over the causes of disagreement and has not had an easy time of it. Our Westcoaster's reports have occasioned plenty of pros and cons by ye reading public and so with due regard for the interest shown by the ops, we hied ourselves to this area to see the actual battleground ourselves. So imagine our surprise, chagrin and what-have-you, when interviewing prospective sources of news, at their noncommittal replies to questions and their "passing the buck" to others. Perhaps these men cannot be blamed, as it may be a new policy of the organization of the ARTA not to give out any information unless it be properly drawn and censored by those who know how. But we are in hopes of breaking through the outer shell of reticence and getting the lowdown on the situation on this coast. So hang on, me hearties, for the next serial punch.

Radio operators the world over look forward to the day when there will be hundreds of television transmitters to be maintained. Heading photo shows the new Berlin television transmitter.

Another bright thought for the month has been received in a recent letter coming in at this desk. Quote: "The Radio Engineers have the IRE—the Servicemen have the Service Institute. How about the Radiops having a Radio Operators Society? Three grades of membership: Fellow—holder of 1st class teleph. and 1st class teleg. with 10 years of experience and use bug and mill; Member—1st class license and 5 years experience; Associate—2nd class license or higher and one year experience. Dues—four bits or a buck a year. Magazine—Read QRD? column. Purpose—a society whose membership was limited to men of known ability who could proudly display a membership card with their photo and a pin so that they could be looked up to. To differentiate between the ops and the lids. Membership requirements—First 50 sponsored by themselves only. Afterwards: 50 on up must have good service records in radio operating work which we know requires use of mill and bug. It is a sad state of affairs when a radio operator is allowed to call himself one and yet can't use a bug and mill. Imagine the WU asking a prospective Morse man if he can use a mill." Unquote. This idea sounds good to us, but such a society must be run without any thoughts

to politics and personal ambitions of a political nature. No salaries should be paid to any officeholder. The more we think of this idea, the better we like it and we await the word of you-all to enlarge, break-down and try to gather together a constitution for this organization. Our co-operation is gladly extended in whatever manner we may be of service to help along in the consummation of such an organization.

Our Westcoaster continues to report that in the Broadcast field there has not been much change in jobs but that really experienced men are few and far between and that there are some stations with applications on hand from only inexperienced men. Increased power is making more vacancies, but it also requires some knowledge of theory which the average op does not possess. As heretofore suggested, better dig up textbooks and enroll for a systematized course of study. It will pay dividends!

The IBEW does not consider Broadcast ops in Southern California are worth organizing. They feel that no organization can help men who are not willing to help themselves and at present the ops are seemingly disinterested. The main trouble seems to be that the average op makes $25 to $35 per week, dresses like a clerk in a store and talks big. Then calls himself an "engineer"! Disinterested organizations interested in public welfare, such as the U. S. Civil Service Commission, do not consider Broadcast operators. experience as qualifying experience in their examinations for radio ops. Vocational experts rate radio operating as a trade, the same as electrician, and if ops will place themselves on the same level as an electrician or semi-professional worker they can perhaps increase their chances of getting trade wages, viz.: $8 to $10 per day.

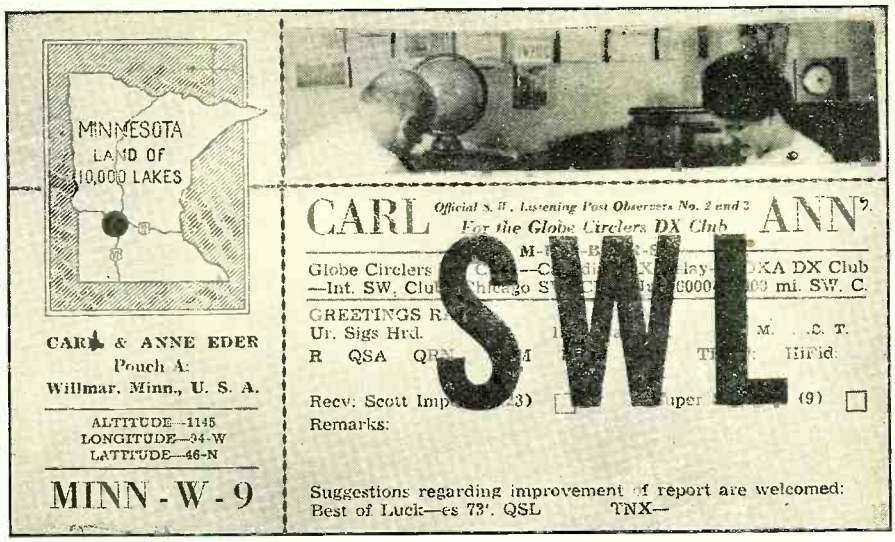
Sounds cockeyed, but here it is. The Marine situation has one fundamental point on which the whole thing rests—inflicting of penalties against unions when unions violate the agreement. At the present time time there is no way to punish a union whose autocratic delegate calls a strike and ties up a ship, all in violation of an agreement. The employer is penalized by lost profits. Neutral hiring halls also are requested to give some form of merit basis to job-dispensing.

And so, me hearties, to bed with a main thought on the whole viewpoint—whether or not it is good policy to follow a line of thought without having gone into the minutest details to see whether that thought is right. And so, with another punch for study and more midnight oil burning, we say 73, ge. . . . GY.

Ship-Harbor Radio Telephone Operator's License

In a communication from the Federal Communications Commission to RADIO NEWS, it is noted that under Sections 301 and 318 of the Communications Act of 1934, a station license and a licensed operator are required for the operation of ship-harbor radio telephone stations or, in fact, for any licensed radio station. The lowest operator's license valid for ship-harbor radio telephone work is known as a Radio Telephone Third Class Operator's License. It is non-technical in character, covering only matters of law and regulation and is not more difficult to obtain than an automobile driver's license.

Examinations for this class of license are held in the Committee's Washington Central office and in twenty-one District offices.



The DX Corner (Short Waves)

(*Continued from page* 546)

HS8PJ, Bangkok, Siam, 19020 k.c., instead of 10955 kc., Monday 8-10 a.m. (from announcement), Thursday on 9350 kc. (Howald, Houghton, Wilson), 2:10-2:30 p.m. (Hodgkyns, Gallagher).

RVI5, Khabarovsk, U.S.S.R., 4273 kc., odd days of month at 1:20 a.m. in English (Howald, Croston, Hodgkyns, Tarr).

CQN, Macao, Asia, 9550 kc., as late as 8:20 a.m. (Gills).

ZCK3, Hong Kong, China, 9540 kc. (Yoshimura).

XGN, Shanghai, China, 17600 kc., 10 a.m. (Gallagher).

XQAK, or XQAJ, Shanghai, China, 9480 kc., irreg., (Gallagher).

XGW, Shanghai, China, 10420 kc., 10:15 a.m. (Black), 9480 kc. (Gallagher).

ZBW5, Hong Kong, China, 17790 kc., 4:30-10 a.m. (from KDKA DX program), (Rudolph).

ZEK, Hong Kong, China, 9520 kc., daily until 10 a.m., better signal than on 8750 kc. (Howald).

XOJ, Shanghai, China, 10750 kc., 6:30 a.m., heard calling London, working.

GBA, (Brown), 15,800 kc., (Kemp), 15,800 kc., calling San Francisco, (Croston).

ZBW, Hong Kong, China, 9530 kc., 5:30 a.m., (Kemp, Messer), 6 a.m. to 12 noon, verifications to cease January 1, 1937 (Holman, Gallagher).

XGOX, Nanking, China, 6820 kc., 10 a.m. (Moore, Partner).

ZBW2, Hong Kong, China, 6090 kc., 4:30-10 a.m. daily (from announcement). (Houghton, Rudolph).

ZBW3, Hong Kong, China, 9525 kc., daily 4:30-10 a.m. (from announcement) (Houghton, Rudolph, Partner, Tarr).

ZBW4, Hong Kong, China, 15190 and 17755 kc., 4:30-10 daily (from announcement) (Houghton, Rudolph, Partner).

F3ICD, Saigon, Indo-China, 11730 kc., 7:30-9:30 a.m. (Millen, Gallagher). Address: Radio Saigon, P. O. Box 295.

NORTH AMERICA

XECW(?), Mexico City, Mexico, 6040 kc., announces frequency as 6110 kc., irregular (Gallagher).

XETW(?), Mexico City, Mexico, 6110 kc. (Lopez), "La Voz Del Oguila Ozteca," P. O. Box 8403, 6045 kc. (Tarr).

XECU(?), XETU(?), Mexico City, Mexico, 6120 kc., 12-1 a.m. (Gallagher).

XEBT, Mexico City, Mexico, 5990 kc., regularly 8:50 p.m. (Ozenedo).

XEXA, Mexico City, Mexico, 6171 kc., daily 8-12 p.m. (Ozenedo), moved from 6180 kc. to 6160 kc. (Gallagher).

XEUW, Vera Cruz, Mexico, 6020., relays XEU, (Lopez, Foshay), "El Eco De Sotanento Desde Veracruz."

XECR, Mexico City, Mexico, 7380 kc., 7:30 p. m. (Weikal), 8 p.m. (Ceever), 7400 kc. (Boussy), 5-6 p.m. (Sesina), every Sunday 6-7 p.m. (Ozevedo, Rudolph)

XEDQ, Guadalajara, Jalisco, Mexico, 9520 kc., 10-12 p.m., (Gallagher).

XEWI, Mexico, D.F., Mexico, 11900 kc., 10:01 p.m., (Staley), daily until 11 or 12 p.m., desires reports, (Howald, Hausen, Sesina), Monday, Wednesday 3-4 p.m., Friday 3-4 p.m. and 9-12 p.m., Saturday 9-10 p.m., Sunday 1-2:15 p.m., Tuesday and Thursday, 7:30-8:45 p.m., (Chimes, Rudolph).

VE9CS, Vancouver, B. C., Canada, 6070 kc., until 11 p.m., (Howald).

WIXAL, Boston, Mass., 25 meters, (Allison), 49.6 meters, Sunday 5-7 p.m., Monday, Tuesday and Friday, 7-9 p.m., 25.4 meters, daily 6-6:15 p.m., Saturday 4-6 p.m. and occasionally Sunday 11 a.m., 19 meters, Sunday 11 a.m., 13.97 meters, no schedule, exact frequencies 6040, 11790, 15250, 21460 kc., (Atherton, Ozenedo, Hodgkyns, Shamleffer).

W9XAZ, Milwaukee, Wis., 26400 kc., Sunday 6-7 p.m., (Howald).

KEJ, Bolinas, Calif., 9010 kc., 11:15-12 testing, (Bishop).

KEE, Bolinas, Calif., 7715 kc., testing 11:15-12:00, (Bishop), relaying programs to Hawaii, (Rudolph).

W9XAA, Chicago, Illinois, 6080 kc., 12 midnight, (Weikal), 11,830 kc., 5 p.m., Tuesday, (Atherton), 8 a.m., (Brown).

W9XF, Chicago, Illinois, 6100 kc., 11:30 a.m., (Weikal, Allison, Hurley, Wilson, Hodgkyns).

W9XE, Chicago, Illinois, (Greaves).

WET, Rocky Point, N. Y., 11,670 kc., (Brown), 10:30-11:30 p.m., with Pan American Salute, (Atherton), 9470 kc., (Black, Rudolph).

W2XAF, Schenectady, N. Y., 31 meters, (Allison, Wilson), 6:15 a.m., (Atherton), 9530 kc., daily at 5 p.m., (Ozenedo, Hodgkyns. Lopez, Davenport, Brown), "The Voice of Electricity", No. 1 River Road.

WQO, Rocky Point, N. Y., 6725 kc., experimenting at 2 a.m., (Rudolph).

WEST INDIES

HI8A, Trujillo City, Dominican Republic, moved to 6479 kc. (Betances). Reported Sat.

A NEAT REPORT CARD

Carl and Ann Eder have evolved an interesting report card, with their pictures shown listening at the top, and a map of their location at the left. The "SWL" is in a bright red.

9:45-10:20 p.m. Address: P. O. Box No. 1213, Trujillo City (Stabler).

HI8Q, Trujillo City, Dominican Republic, heard around 6190 kc. (Betances) 6260 kc., 8:20 p.m. (Azevedo).

HI5N, Santiago, Dominican Republic, 48.78 meters, desires reports,—not on until 10 p.m. (Houghton).

HIG, Trujillo City, Dominican Republic, 6080 kc.—playing of tops. (Boussy); daily at 9 p.m., (Azevedo).

HIZ, Trujillo City, D. R., 6316 kc., daily 11:10 a.m.-2:25 p.m. and 6:10-8:40 p.m., (from veri), (Azevedo).

HI1S, Santiago de los Caballeros, D. R., 6420 kc., heard irregularly at 6:25 p.m. (Azevedo), will increase power (Stabler). Slogan: "La Voz de Hispaniola".

HIL, Trujillo City, D. R., 6500 kc. heard irregularly at 6:45 p.m. (Azevedo).

HI3U, Santiago, D. R., 6015 kc. heard 8:30 p.m.. (Azevedo).

HI1J, San Pedro de Macoris, D. R., 5865 kc., 8 p.m. (Azevedo). Address: P. O. Box No. 205, (Rudolph).

HII, Dominican Repeublic, 14940 kc., 9:50 a. m. (Black).

HIX, Trujillo City, D. R., 6340 kc., Friday 8:10-10:10 p.m. (Cindel), heard 5:30-5:50 p.m. (Hodgkyns).

HH3W, Port-au-Prince, Haiti, moved from 9595 kc. to 9645 kc. (Bower, Wilson), daily 8-8:30 p.m. (Azevedo).

CMOX, Havana, Cuba, 1320 kc. heard on the 13th of each month at 3:10-4:50 a.m. (Grabowski).

CMCG, Havana, Cuba, 6801 kc. heard at 5 a. m. (Grabowski).

COCH, Havana, Cuba, 11500 kc. (Greaves), 9428 kc., at 10:20 p.m. (Weikal, Sawtelle, Kemp) at 9 p.m. (Coover, Hartman, Hansen, Wilson) daily from 3:30 p.m. (Azevedo). Bugle calls. (Rudolph, Harris).

CMCX, Cuba, 6010 kc., same schedule as COCO. (Beck).

COKG, Santiago, Cuba, moved from 6145 kc. to 6180 kc. (Betances). Schedule 9:30-10:30 p.m. daily and after 8 a.m. daily (from announcement). (Stabler, Azevedo).

CMKG, Santiago, Cuba, 6190 kc. Schedule 9:30-10:30 p.m. and after 8 a.m., daily. (From announcement). (Stabler).

CO9JQ, Havana, Cuba, 8665 kc. heard Sunday at 4:30, (Sesma).

CMA5, Havana, Cuba. 11630 kc., 9-9:40 p.m. 14600 kc. 7-8 p.m., (Stabler).

CENTRAL AMERICA

TGS, Guatemala City, Guatemala, 5740 kc., 8:40-10:40, English and Spanish announcements, (Beck).

TGWA, Guatemala City, Guatemala, 9450 kc., 8:08-10 p.m. (Beck, Atherton, Stabler, Partner), daily 12 a.m.-2 p.m. and 8-12 p.m. (Foshay). Slogan: "Radiodifusora Nacional".

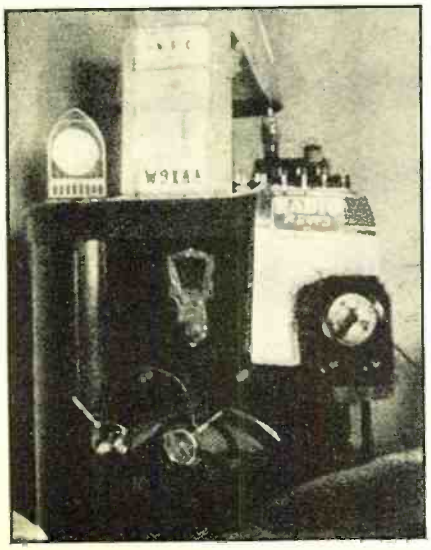
TG2X, Guatemala City, Guatemala, 5940 kc. (Rudolph), daily 3-9 p.m. (Foshay).

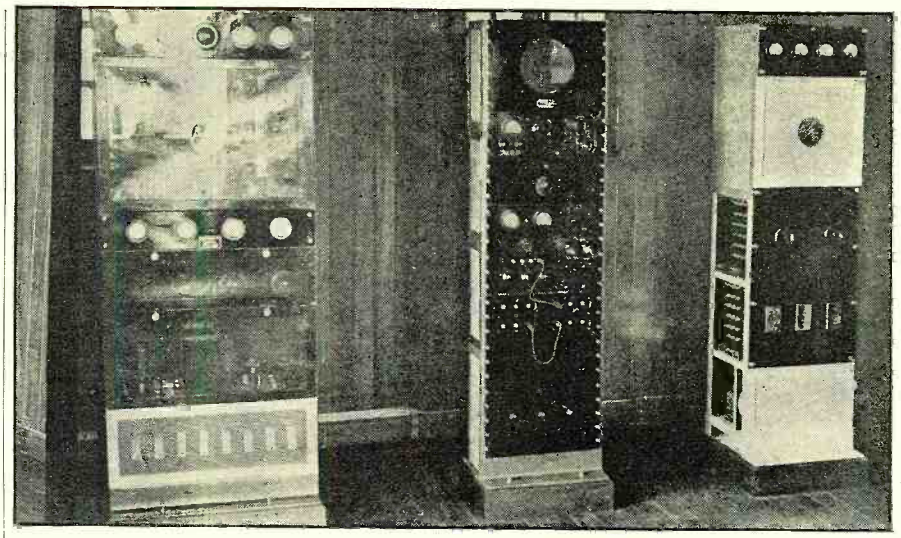
HRD, La Ceiba, Honduras, 6235 kc., 10:45-11 p.m. (Sands, Weikal) at 8 p.m., (Coover, Wilson), daily 8-10:30 p.m. (Azevedo, Dressler); uses gong, (Rudolph). Sunday 3-5 p.m. (from veri), (Lopez, Shamleffer). Slogan: "La Voz de Atlanta".

HRPI, San Pedro Sula, Honduras, 6351 kc. signing off at 9:30 p.m. (Atherton), heard irregularly, (Rodriguez).

WHITE PLAINS HEARD FROM

Curtis Purdy, listener of that town, sends in this photo of his equipment. Evidently he reads RADIO NEWS.





CHINESE SHORT-WAVER

This is the transmitter of short-wave station CQN of Macao; at the left is the transmitter, center, the amplifier and at right the rectifier.

YNOP, Managua, Nicaragua, 5758 kc. 8:30-9:40 p.m., English and Spanish announcements, (Beck, Rodriguez). Slogan: "La Voz de la Bayer".

YNOPB, (?) Managua, Nicaragua, 5558 kc., 7-9 p.m., ((Alfred).

YN1GG, Managua, Nicaragua, 6500 kc. (Betances), reported on 6530 kc., (McKay).

YNLF, Managua, Nicaragua, 7545 kc., (McKay).

TIRCC, San Jose, Costa Rica, 5830 kc., 8:50 p.m. (Azevedo).

TI5HH, San Romon, Costa Rica, 5500 kc., 5-6:45 p.m., (Partner).

TI8WS, Pentarenas, Costa Rica, 7550 kc., heard irregularly from 7-10:15 p.m., (Partner).

TIVL, San Jose, Costa Rica, 6795 kc., testing, (Betances).

T14NRH, Heredia, Costa Rica, 30.94 meters, heard 9:20 p.m., (Messer).

HP5J, Panama City, Panama, 9605 kc., heard daily 9 p.m., (Azevedo).

HP5L, Chiriqui, Panama, 11740 kc. (David), will go on air about January 15. Address: Apartado No. 129, (Oxrieder).

SOUTH AMERICA

YV1RH, Maracaibo, Venezuela, 6360 kc., (Betances), relays YV1RS "Waves of the Lake" (Atherton), reported on 6380 kc. (Fallon), requests reports, on air until 10:30 p.m., (Walker, Hansen, Miller, Azevedo, Stabler, Atkinson, Black, Gallagher). Address: P. O. Box No. 261, Slogan: "Philco Broadcasting".

YV5RC, Caracas, Venezuela, 6270 kc. "La Voz de Philco," 8-9:45 p.m. (Sahlbach), requests reports, (Mott). Address: Box No. 508.

YV15RV, Maracay, Venezuela, 5775 kc., heard 12:30-2 a. m., (Alfred), also 9570 kc. (Lopez), 5910 kc. (Partner).

YV9RC, Caracas, Venezuela, 6400 kc., irregularly from 7-11 p.m., (Sands, Wilson, Atherton, Azevedo).

YV1RG, Valera, Venezuela, 6345 kc., 5-10 p.m., (Betances, Gallagher).

YV8RB, Barquisimeto, Venezuela, 5895 kc., daily 6:30-10 a.m. (Azevedo).

YV3RC, Caracas, Venezuela, 6160 kc., heard regularly at 6 and 8 p.m. (Azevedo). 12:10-2:15 p.m. (Hodgkyns, Tarr).

YV4RD, Maracay, Venezuela, 6300 kc., irregularly at 8:30 p.m. (Azevedo), Sunday 6:30-7 p.m. (Smith).

YV1RV, Valera, Venezuela, 6343 kc., irregularly in evenings, (Rodriguez).

YVQ, Maracay, Venezuela, 22.48 meters, relaying message at 8:15 p.m. (Atherton).

YVR, Maracay, Venezuela, 18295 kc. working DHO at noon. (Kemp).

YV2RC, Caracas, Venezuela, 51.72 meters, 6 p.m. (Coover, Wilson, Hurley), 5800 kc. (Azevedo).

YV4RC, Caracas, Venezuela, 47.06 meters, 8 p.m. (Coover), 6370 kc., heard testing at 9 p.m. (Atherton).

YV1ORSC, San Cristobal, Venezuela, 5720 kc. heard 6-8:30 p.m. (Bower, Azevedo, Rodriguez). Slogan: "La Voz del Tachira", (from veri).

YV5RMO, Maracaibo, Venezuela, 5850 kc., testing with W2SAF from 12:05 to 2 a.m., (Bishop); at 6:15 p.m., (Azevedo, Rudolph, Gallagher).

YV1RS, Maracaibo, Venezuela, 6350 kc., (McKay).

HJ4ABH, Caldas, Colombia, 9525 kc. daily from 7 p.m. often from 6 p.m., (Arickx, Betances, Rodriguez, Lopez); 9520 kc., (Partner). Slogan: "Voice of Armenia."

HJ4ABD, Medellin, Colombia, moved from 5760 kc., to 6140 kc. (Betances), reported on 6030 kc. (from announcement), heard 10-11:30 p.m. (Stabler, Foshay). Slogan: "La Voz Catia".

HJ4ABP, Medellin, Colombia, 6030 kc., heard 6-11 p.m., (Fallon, Wilson, Atherton, Dressler, Foshay, Gallagher). Slogan: "Emisora Philco."

HJ4ABL, Manuyales, Colombia, 49.47 meters, 5:55 p.m., (Hodgkyns).

HJ1ABB, Barranquilla, Colombia, 6135 kc., 9:40 p.m., (Weikal), 7-10 p.m., (Lopez); 9560 kc. at 8 a.m., (Foshay). "La Voz de Barranquilla."

HJ1ABE, Cartagena, Colombia, 9500 kc., daily 6-10:30 p.m., (Sands, Wilson, Coover, Boussy, Staber, Azevedo, Partner).

HJ1ABJ, Barranquilla, Colombia, 6025 kc., heard regularly at 8 p.m. (Azevedo).

HKV, Bogota, Colombia, 8796 kc., heard irregularly, (Betances).

HJ2ABC, Cucuta, Colombia, moved to 9575 kc. (Betances) heard at 8 p.m. (Coover, Azevedo, Foshay). Slogan: "Lo Voz de Cucuta."

HJ2ABD, Bucaramanga, Colombia, 9625 kc., testing, (Betances) heard regularly from 6:20 p.m., (Azevedo) irregularly on 9785 kc. (Rodreguez), 9580 kc. (from veri), (Foshay). Slogan: "Radio Bucaramanga".

HJ4ABU, Pereira, Colombia, 6150 kc. (Millen) on 6140 kc. at 9 p.m., (Azevedo). Slogan: "La Voz de Pereira".

HJ4ABB, Manizales, Colombia, 6105 kc. irregularly at 8 p.m. (Azevedo).

HJ4ABE, Medellin, Colombia, 6092 kc. heard at 9 p.m., (Azevedo, Tarr).

HJ4ABA, Medellin, Colombia, 11799 kc., poor reception at 8:30 p.m., (Azevedo).

HJ1ABG, Barranquilla, Colombia, 6025 kc., irregularly at 9 p.m., (Azevedo), daily 11 a.m.-11 p.m., Sunday 11 a.m.-8 p.m., (from veri); (Foshay). Slogan: "Emisora Atlantico."

HJ1ABH, Barranquilla, Colombia, 7074 kc., 5:25-5:40 p.m. (Hodgkyns).

HJ3ABX, Bogoto, Colombia, 6122 kc. irregulaly from 6:30-10 p.m., (Azevedo, Tarr).

HJ5ABD, Cali, Colombia, 6085 kc. heard 8:30 p.m. (Azevedo).

HJ3ABX, Bogota, Colombia, 6122 kc. irregularly at 6:50 p.m., (Azevedo).

HJ3ABD, Bogota, Colombia, 6050 kc., 7-11 p.m., (from veri), (Lopez, Foshay).

HJN, Bogota, Colombia, 5950 kc., regularly from 6:30-10:30 p.m., (Azevedo).

VP3MR, Georgetown, British Guiana, 6019 kc., Sunday 7:45-10:15 a.m., weekdays 4:45-8:45 p.m., (Piorko), daily 3:45-7.45 p.m. (Elkes, Walker, Wilson, Azevedo, Foshay, Shamleffer). Slogan: "The Voice of Guiana."

VP3BG, Georgetown, British Guiana, 6300 kc. irregularly at 6 p.m., (Azevedo).

HC1PM, Quito, Ecuador, 7070 kc. (Beck). Slogan: "Estacion el Palomar".

HC2JSB, Guayaquil, Ecuador, daily 6-11 p.m. (Dressler).

OAX5A, Ica, Peru, 11800 kc. 7-8 p.m. and irregularly, (Partner). Slogan: "Radio Ici."

OAX5B, Ica, Peru, 11796 kc. daily 10-12 a.m. and 4-10 p.m. from announcement, (Geneve). Address: Estafeta de Correos. Slogan: "La Voz de Ica para toda la Republica."

PRF5, Rio de Janciro, Brazil, 9501 kc. daily 4:45-5:45 p.m., (Arickx).

CB615, Santiago, Chile, 6150 kc., 5-6 p.m., desires reports, (Rodriguez). Address: P. O. Box No. 761.

CE3DW, Santiago, Chile, received veri, (Beck).

LRX, Buenos Aires, Argentina, 9640 kc., 5:50 p.m., (Weikal, Piorko), reported 9660 or 9670, (Shamleffer) irregularly after 6 p.m. (Stabler, Wilson, Azevedo), 9 p.m. (Atherton), 9580 kc., (Foshay, Shamleffer). Slogan: "Radio el Mundo".

LSX, Buenos Aires, Argentina, 10350 kc., at 9:48 p.m., (Weikal), daily 6-7:15 p.m., (Sands), 7-8 p.m. (Brown, Arickx, Howald, Betances, Shamleffer). 8:45 p.m. (Atherton, Stabler, Rodriguez, Partner, Black, Dressler), irregularly 5-12 midnight, (Foshay, Gallagher, Shamleffer). Slogan: "La Voz de Argentina."

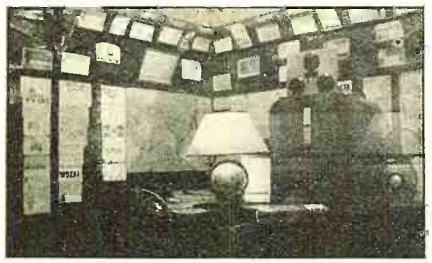
LRU, Buenos Aires, 15280 kc. (Piorko), 4-4:30 p.m. and 5:30 p.m., (Shamleffer, Hansen, Wilson, Azevedo, Black, Foshay). Address: Calle Maipu 555, Buenos Aires. Slogan: "Radio el Mundo."

LSN2, Buenos Aires, Argentina, 9892 kc. daily 8:45-9:30 (from announcement); desires reports, (Stabler, Messer, Howald, Gallagher, Shamleffer).

LSN, Buenos Aires, Argentina, 30.33 meters, 8:30-9, requests reports, (Stabler), 14530 kc., (Messer), 9890 kc. (Black), 14480 kc. (Shamleffer).

LSN3, Buenos Aires, Argentina, 9892 kc. 8 p.m.-1 a.m. (Gallagher).

LSL2, Buenos Aires, Argentina, 9890 kc., 8:47 p.m., (Brown). Address: S. W. Station LSL2, c/o Dept. of Propaganda, Buenos Aires,



AT ST. JOHN'S, QUEBEC

This is the Short-Wave Listening Post of Li Chi Chiang, an Official Observer of Canada

Readers Who Are Awarded "Honorable Mention" for Their Work in Connection with This Month's Short-Wave Report

J. Weiss, Paul C. Bird, Grace M. Beck, Charles E. Owen, Jr., G. Hampton Allison, Francis Beuke, Jackie Wakefield, Jack Staley, Joseph Brown, Jr., R. J. Rogers, L. W. Skipper, Ralph E. Weikal, Reuven Sokolovsky, Charles C. Norton, A. S. Mather, E. R. Greaves, Rene Arickx, Clayton D. Sands, Werner Howald, H. Kemp, M. J. Markuson, Judson Greer, Fred Atherton, Howard Adams, R. F. Shamleffer, A. C. Sawtelle, Jr., Leon Stabler, Leslie Mott, Edgar J. Vassallo, Fay O. Wood, P. Piorko, A. B. Coover, Harold W. Bower, Fred W. Alfred, Manuel E. Betances, Fletcher W. Hartman, R. B. Oxrieder, Arthur Hill, Anthony C. Tarr, A. Shirley Brown, Morgan Foshay, Gilbert L. Harris, Harry E. Kentzel, Joseph Rudolph, J. Wendell Partner, E. Scala, Jr., John Carothers, Frank W. Krysiec, Walter E. Bishop, G. C. Gallagher, William F. Heerzog, Jose L. Lopez, Eddie Davenport, Paul W. Wirtz, C. W. Bourne, Norman E. Levin, Carroll H. Weyrich, Armen Altman Beer, Roderick U. Hammer, Robert Wetmore, Robert D. Wade, Roy Harding, Robert Katzenberg, Joseph Scaretti, R. C. Messer, Alvaro Azevedo, J. R. Hodgkyns, Cecil Mellanby, Shokichi Yoshimura, Jose Rodriguez, R. Anton, J. Cindel, Peyton Black, Kenneth Dressler, Matthew Bills, H. H. Flick, N. C. Smith, Lester Harlow, J. T. Atkinson, E. Geneve, Charles E. Hansen, Abraham Sutker, Stanley Dymek, Lee Peterson, John Hartshorn, Wilbur Croston, Arthur F Hartmann, H. A. McCormick, D. R. Dewitt, Li Chi Chiang, Morton W. Blender, Philip Fitzsimmons, Tom Bunch, D. E. Shyte, John E. Moore, Thomas Elkes, D. A. Harley, Jr., Charles R. Wilson, A. J. Waker, Roy E. De-Ment, Ed. N. McKay, Armand A. Boussy, W. Croston, Synde G. Millen, H. R. Miller, Thomas, Fallon, Barry Sesma, R. S. Houghton, Eddie C. Zarn.

New York-Paris Radio Circuit

WASHINGTON, D. C.—The American Telephone and Telegraph Company has opened a new radio telephone circuit between New York and Paris. This is the first direct telephone link between America and the European continent. The American transmitter is at Lawrenceville, N. J. and the receiver at Netcong, N. J. The French transmitter is at Pontoise, the receiver at Noiseau. Connection to the Bell System telephones is made at 32 Sixth Avenue, New York City, in the Long Distance Building. A three-minute call from New York to Paris costs $21.00 on weekdays, $15.00 at night and on Sundays.

Crystal Control

(*Continued from page* 529)

should be followed when constructing any ultra-high-frequency, push-pull amplifier, for the slight addition of time involved in taking this precaution is more than repaid by the trouble-free performance of the final amplifier when it is completed. In addition to this, the appearance is also improved, although this is of minor nature, for it is results that count.

As mentioned previously in other installments of this article, the push-pull 6L6 stage is capable of driving a rather large variety of tubes. The choice of tubes, therefore, will depend upon the available power-supply equipment, or the amount of money that is desirable to invest. The author, having only one power supply available, which was capable of delivering either 1000 or 1300 volts out of the filter under load, chose the Raytheon RK-35, as this tube worked into the picture very nicely. The new RK-37 was not available when this transmitter was first put into operation. However, this tube is what is being used at present. The Raytheon RK-35 and the 37, as well as other tubes that are now available, and which may be employed, has the grid lead coming out of the side of the tube envelope, which makes it possible to mount the sockets underneath the chassis in an effort to keep all of the hot r.f. above the chassis and all other wiring of low potential below the chassis. This results in a shield between the hot r.f. leads and the low potential leads, which tends to keep the r.f. where it belongs and out of circuits it should not be found in.

When the RK-35's were used, a bias supply was employed instead of grid-leak bias, for due to the low MU of these tubes, grid-leak bias was not safe, for should excitation fail, the tubes would be subjected to a tremendous overload, due to the high value of plate current that would flow, due to lack of bias. Using the RK-35's, 380 volts of bias, obtained from a small power supply, was used. When the final amplifier was perfectly neutralized, and loaded to 150 watts input, it was possible to drive these tubes to 45 mils of grid current, with the 6L6 push-pull buffer stage loaded only to 115 ma., combined plate and screen current. When the RK-37 tubes were installed, due to their higher amplification factor, or MU, the C bias supply was no longer required, for now grid-leak bias could be employed without fear, for should excitation fail at any time, the plate current would not be excessive. A 3000-ohm, 20-watt, wire-wound grid leak was employed, although this did not seem to be very critical as to its value. With the RK-37 loaded to 150 watts input, the rectified grid current was 45 mils, but now due to the lower driving power required, the push-pull 6L6 buffer stage was loaded only to 75 ma., combined plate and screen current. It can therefore be assumed that the RK-37's require approximately half of the driving power the RK-35's required, which is just about what the manufacturer claims for this new tube.

Something that struck the author as being very novel was noticed pertaining to driving power and grid current which we are mentioning at this time. Undoubtedly, the majority of readers have had experience with other types of tubes, and have always noted that when the input to the amplifier was increased, the tendency was always for the rectified grid current to decrease, which means that more excitation or driving power was required, if you were working near the critical point. In this transmitter, using both the RK-35's and the RK-37's, once the transmitter was loaded, it was possible to change from 100 watts input to 240 or 250 watts input, without the slightest change of grid current. This is undoubtedly due to improved tube design, in addition to good driver regulation and circuit design.

Inputs as high as 250 watts (and slightly more) were employed in an effort to see just how well the tubes performed, all of these tests being made on 57 megacycles. Despite the fact that the manufacturer only rates these tubes at approximately 100 watts input, at no time was excessive plate dissipation noticeable, nor did the tubes have any tendency to be in any way erratic, or "get up and walk out." It is advisable, however, not to exceed 150 to 200 watts input, especially at 5 meters, as this will result in longer tube life and eliminate waste of power. On all tests that were made, increasing the power input from 150 watts to 250 watts resulted only in a very slight increase in signal strength and was not at all worth-while when the increased electric bill was considered.

As mentioned previously, a Johnson "Q" antenna was employed, which loaded the final amplifier very nicely, merely by coupling to the final plate tank, by means of a 2-turn pick-up coil, which was coupled to the center of this coil, by merely shoving it in between the center turns until the desired plate current was obtained. Other types of antenna coupling may, of course, be used to advantage, when different types of antenna systems are employed. These need not be gone into at this time, as they were taken up in the previous installment.

The modulator employed by the author consists of a pair of 845 tubes, operated in Class AB, which are supposed to deliver a good 200 watts of audio when they are fully driven. Nowhere near this amount of audio power was ever required to modulate the final amplifier, for when taking measurements with the cathode-ray oscilloscope, it was found that approximately 25 to 33⅓ per cent of the DC plate power input to the final amplifier was more than sufficient audio for 100 per cent modulation. To make this a little clearer, if the final amplifier was loaded to 150 watts input, approximately 50 to 75 watts of audio was ample for 100 per cent modulation. The common belief that 50 per cent or half of the power input to a Class B amplifier is required, for its complete modulation is probably the cause of the abundance of overmodulation that is present on all bands at the present time. Unfortunately, all of us cannot afford cathode-ray oscilloscopes, nor are they at our disposal. Before the oscilloscope was taken home by the author, the Class AB plate current of the 845 was usually somewhere in the vicinity of 125 to 150 mils on speech peaks. When making tests (one night with 2JQX of New Rochelle, who had a 5-meter superhet equipped with an R meter originally described in RADIO NEWS and which is a very good overmodulation indicator) it was found that the gain control had to be retarded until the 845 AB plate current was somewhere in the vicinity of 100 mils on peaks, at which time 2JQX reported very much improved quality and what he thought was 100 per cent modulation. This low plate current on the part of the modulators was a bit hard to understand, for in spite of previous experience, the thought that first came into our minds was the possibility that the final amplifier was not linear and therefore could not take the full 100 per cent modulation. To eradicate this doubt, an oscilloscope was carried home over a week-end, despite its rather back-breaking capabilities when it has to be carried over a block. Immediately, upon

setting up the oscilloscope, the amplifier showed that it was linear for a perfect trapezoid was apparent on the screen in addition to *more than 100 per cent modulation!* The gain control was reduced, whereupon it was found that for 100 per cent modulation instead of 125 to 150 mils, the 845 class AB plate current was averaging 75 mils. When constant tone from a Neon oscillator (used for ICW) was fed into the modulator, approximately 90-100 mils plate current resulted in 100 per cent modulation.

Before closing this article, a few more hints pertaining to constructional details and general operation might not be amiss. When selecting the 6L6 tubes for the push-pull final amplifier or buffer, try to get two tubes that are "matched." This may be accomplished by using the previous stage in the transmitter as a test circuit, picking two tubes that draw exactly the same plate-screen current, etc.

The plate connection to the RK-35's or 37's (or any other tube of similar design) should not be soldered. Use a small bolt and nut to secure the plate lead to whatever plate terminal is employed. This is necessary for the plate connection becomes very hot during operation, and will actually melt solder if this is used.

Whatever tube is employed in the final amplifier, be sure and measure your filament voltage, which should always be at least what the manufacturer calls for, and if anything, a trifle more. Approximately ¼ of a volt higher filament voltage will result in longer tube life. Loss of filament emission, which is brought about by the high velocity of the electron stream that is to be contended with on all of the ultra-high-frequency bands is thus eliminated.

Use good insulation where it is required, such as mycalex or insolantite, as this will save considerable trouble in the long run in addition to getting all of the power into the antenna instead of it being wasted, burning or bubbling poorer insulation.

Results on DX work with this transmitter will not be gone into as we are all aware at this time that location and height of the antenna govern these. We might mention, however, that the consistent night range of this transmitter (on 5 meters) is approximately 75 miles, while on the other bands, almost anything is possible.

List of Parts

1—8¾" x 19" Steel Panel.
1—17" x 11" x 2½" Blank Cadmium Plated Chassis.
3—4" Metal Etched Dials, marked. (Amplified Grid) (Amplifier Plate) (Antenna).
3—3" KK knobs for use with above.
2—Hammerlund MC P35 MX.
2—Cardwell ZS4SS
1—Cardwell NP 35 GD.
1—Hammarlund 2.5 mh. r.f. choke.
1—5-meter choke for plate circuit return. consists of 50T No. 26 DSC on ¼" form.
2—4-prong Isolantite tube sockets, Hammarlund.
1—100 ohm. Filament centre tapped resistor.
2—.01 Filament Bypass Conds., Mica.
1—2-Terminal Bakelite strip.
2—Feedthru Insulators.
A Few Mycalex strips for Coils and Coil Bases, Hardware, etc.

Coil Data For Final Stage

5 meters: Grid 6T No. 12 enamelled wire, 1" dia., spaced to make 3" long.
5 meters: Plate 6T No. 10 enamelled wire, 1½" dia., spaced to make 3" long.
10 meters: Grid 12T No. 12 enamelled wire, 1" dia., spaced to make 3" long.
10 meters: Plate 10T No. 12 enamelled wire, 1½" dia., spaced to make 3" long.
20 meters: Grid 16T No. 12 enamelled wire, 1½" dia., spaced to make 3" long.
20 meters: Plate 14T No. 12 enamelled wire, 2" dia., spaced to make 3" long.

Prosperity on the Way?

WASHINGTON, D. C.—The U. S. Bureau of Labor Statistics shows that radio factor employment for August increased 8.9 per cent. over July and 19.3 above August 1935. Radio factory payrolls increased 14.9 per cent. over July and were 28.6 per cent. over August 1935.

The Ham Shack

(*Continued from page* 525)

It is advisable to use the lower values if the tube is to be plate modulated. The screen also should be modulated simultaneously with the plate. This may be done by using a series-dropping resistor to obtain the screen voltage. The normal ratings may be used up to 60 megacycles.

Basic characteristics of the RK-39 are:

Heater voltage	6.3 volts
Heater current	.9 ampere
Grid-plate capacity	1 mmfd.
Input capacity	12 mmfd.
Output capacity	7.5 mmfd.
D.C. plate voltage	500-750 volts
D.C. screen voltage	250 volts
D.C. grid voltage	130 volts
D.C. plate current	80 to 100 mills
D.C. grid current	4 to 5 mills
Plate input	25 to 40 watts
Plate dissipation	14 watts
Average driving power	.2 to 1 watt
Average output	25 to 35 watts

Both tubes operate exceptionally well as either crystal or electron-coupled oscillators at all amateur frequencies. With normal input very high efficiency from an oscillator may be obtained. It is possible to get as much as 30 watts out of one of these at the lower amateur frequencies despite the manufacturers' ratings and slightly less that amount at 5 meters. As amplifiers, greater efficiency may be obtained. As doublers they are excellent, the second harmonic output in a properly designed circuit providing nearly as much power as a straight buffer or amplifier. They also are quite capable as quadruplers. In the case of an electron-coupled oscillator operating with the grid at 20 meters, it was possible to drive another electron beam" tube with its grid tuned to 5 meters.

The tubes in the low "C" group and their ratings follow:

RK-35

Filament voltage	7.5 volts
Filament current	3.25 amperes
Grid-plate capacity	2.7 mmfd.
Input capacity	3.5 mmfd.
Output capacity	.4 mmfd.
D.C. plate voltage	1000 volts
D.C. grid voltage	320 volts
D.C. plate current	96 m.a.
Plate dissipation	35 watts
D.C. grid current	15 m.a.
Required driving power	6.5 watts
Power output	61 watts

HK-154

Filament voltage	5 volts
Filament current	6.5 amperes
D.C. plate voltage	1500 volts
D.C. grid voltage	675 volts
D.C. grid current	25 m.a.
D.C. plate current	175 m.a.

HF-100

Filament voltage	10 volts
Filament current	2 amperes
Grid-plate capacity	4.5 mmfd.
Input capacity	3.5 mmfd.
Output capacity	1.4 mmfd.
D.C. plate voltage	1500 volts
D.C. grid voltage	—425 volts
D.C. plate current	110 to 125 m.a.
D.C. grid current	15 to 25 m.a.

RCA-808

Filament voltage	4 amperes
Filament current	3 mmfd.
Grid-plate capacity	5 mmfd.
Input capacity	.2 mmfd.
Output capacity	1500 volts
D.C. plate voltage	—400 volts
D.C. grid voltage	125 m.a.
D.C. plate current	35 m.a.
D.C. grid current	105 watts
Power output (approx.)	7.5 volts

All of these are designed especially for ultra-high-frequency operation. The RCA-808, the RK-35 and the HK-154 are similar in characteristics and design. They have tungsten filaments and tantalum plates. All are triodes and, of course, are excellent Class C amplifiers. Any one may be driven from a single buffer or doubler using an RK-39 or 807.

Also they are excellent Class B modulators. When used with properly designed transformers, audio powers up to about 250 watts may be obtained from a pair of any of these tubes.

The number of possible combinations for a transmitter drawing solely from these new tubes is almost infinite. For instance, a good all-band transmitter may be constructed around a pair of RK-39's and a RK-35 or any comparable tubes. Using one of the RK-39's as a crystal oscillator in a "tri-tet" circuit, sufficient output may be obtained in the plate circuit at five meters to drive the second RK-39 as a buffer. This in turn will supply sufficient power to drive the single RK-35 as a straight amplifier at 5 meters. Such a transmitter will operate even more efficiently on lower frequencies. Other combinations undoubtedly will suggest themselves.

Measurement Standards

(*Continued from page* 535)

$$DB = 20 \log \frac{100}{.01} + 10 \log \frac{500{,}000}{500}$$

$$DB = 20 \log 10{,}000 + 10 \log 1000$$

$$DB = 20 \times 4 + 10 \times 3 = 110 \text{ db.}$$

But if the grid leak is changed to 5 megohms, the result will still be: .01 volt across the input delivers 100 volts across the output, and the gain is

$$DB = 20 \log \frac{100}{.01} + 10 \log \frac{5{,}000{,}000}{500} =$$

$$20 \times 4 + 10 \times 4 = 120 \text{ db.}$$

Obviously, the type of rating should be different, and this is a good thing to remember when comparing the merits of resistance-coupled amplifiers. A suggested remedy is to agree on a standard value of grid resistor for measurement purposes. (Some firms are doing this and use 150,000 ohms) An alternative way would be to rate amplifiers in terms of power sensitivity like power tubes.

When making the frequency characteristic of an audio amplifier, it makes a difference at what gain it is made. A fidelity curve made with the volume control all the way advanced will not look as good as another one with the volume control part way up. It also makes a difference whether the input or the output is being kept constant during the test. So it is very well that two individuals will obtain different results when measuring the same amplifier and they can both be right. The method of measuring should be indicated if one is to interpret it intelligently.

Another fallacy common among users of audio equipment is that adding an amplifier to another always results in adding the db. gain. When the two are perfectly matched, that would be true, but if they are not of the same impedance there will be a loss.

Finally, there is the great bugaboo, rating microphones. Many manufacturers are rating their microphones as "so many db. down." Trusting amateurs and P.A. men construct their amplifiers figuring that they need the difference between that figure and the desired output in db. (6-milliwatt zero level). Of course, that doesn't work. Such a rating of microphones *does not mean anything* until it is known what zero level is employed and how loud a sound must be made to get the stated output.

All that was originally taken care of because the zero level was defined as "output of 1 volt at open circuit with a sound pressure of 1 bar." This zero level does not mean very much to the average user, for he does not know how loud one bar is

and the 1 volt across open circuit will become considerably less when the microphone is connected to a load. As a matter of information, 1 bar is +74 db. in the scale with zero level at 10^{-16} watts per square centimeter. According to Dr. E. E. Free, it is equal to "average conversation."

Supposing that a new zero level of 6 milliwatts were to be established, it would be necessary to state the sound energy required and also how the microphone is to be connected. The connection and the value of the load may result in a loss. For instance, suppose a condenser microphone delivers a stated voltage on open-circuit, at a standard signal. The impedance of the microphone may be 80,000 ohms at 1000 cycles and it is mostly capacitive reactance. If the load has an impedance which is very much higher, it is possible to obtain most of the voltage across the load, otherwise there will be a loss in the microphone itself. To get the maximum voltage for resistance coupling, the resistance should be high, anywhere from 3 to 10 times the impedance of the microphone. This means that 1 megohm would be good for 1000 cycles in the above example, but it is not high enough for the low notes, because then the impedance of the same microphone would be 800,000 ohms and at 30 cycles it would be 2.4 megohms. Consequently, a still higher load is desirable to obtain the low notes. At 10,000 cycles the impedance of the microphone is only 8000 ohms, so the transfer of voltage will be most efficient here. Of course, the cable connecting the microphone causes losses, too, because it places a condenser across the load, lowering its impedance.

The above description of microphone characteristics also applies to crystal microphones which have a capacitive reactance. A useful zero level could be established if each microphone manufacturer would specify the output of his microphone in "db. down" *below the following reference level:* Zero level should be 6 milliwatts in a load resistance to be specified and at a sound intensity of one bar.

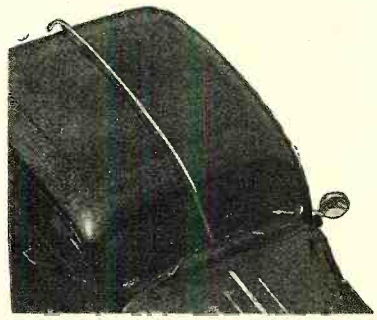
The manufacturer would then specify the input circuit to be used with that microphone and then the required gain of the amplifier can be found very simply. For example, if the output of such a microphone was said to be "65 db. down" and the output required was 6 watts (30 db. up), the required gain would be 95 db.

What's New in Radio

(*Continued from page* 521)

Streamline Motor Car Antenna Easily Installed

The auto-top aerial illustrated below is a new product of the Wedge Manufacturing Company. As illustrated, it fastens to the top of special rubber vacuum posts



mounted on the car roof. This new aerial is said to provide greater sensitivity and to minimize interference from the car ignition system.

Highly Sensitive "Mike" for Detective Equipment

The single diaphragm crystal microphone known as model 218, developed by the Astatic Microphone Laboratory, Inc. for

wide angle uni-directional pickup is ideal for concealed placement in use with de-

(*Turn to page* 567)

Oscilloscope

(*Continued from page* 531)

so that this condenser acts as the shortest possible lead between the switch and volume control. In order to have the best shielding, the chassis is only grounded at one point; all other ground connections are made by a wire direct from each individual circuit to this common ground point. It is partly due to this that such stable operation has been secured.

The condenser necessary for the sweep frequently oscillator is mounted directly on the switch. The small mica condensers are held directly in place on the switch-connecting prong and the paper condensers are mounted on a strip of bakelite which is fastened on the two frame screws of the switch. The .007 mfd. condenser was built up of one .002 and one .005 mfd. condenser. The .0004 mfd. condenser was also built up, using .00015 and .00025 mfd. condensers in parallel.

Parts List

T1, T2—Kenyon power transformer, type 207
1 Yaxley volume control, type N with No. 9 switch, 500,000 ohms
2 Yaxley volume controls, type N, 500,000 ohms
2 Yaxley volume controls, type Y250MP, 250,000 ohms
1 Yaxley volume control, type Y100MP, 100,000 ohms
1 Yaxley volume control, type Y50MP with No. 9 switch, 50,000 ohms
1 Special volume control, 5 megohms
2 Yaxley 2-gang, 3-position switch, type 1315
1 Yaxley single-gang, 3-position switch, type 1316
1 Yaxley single-gang, 8-position switch, type 1311

I. R. C. Carbon Resistors
½ watt
4 1 meg.
1 10,000 ohms
1 .5 meg.
1 2500 ohms
2 .2 meg.
1 400 ohms

1 watt
1 1 meg.
1 300,000 ohms
2 50,000 ohms
1 25,000 ohms

I. R. C. Wire-Wound Resistors
1 10,000 ohms, 10 watt
1 40,000 ohms, 20 watt
2 5,000 ohms, 10 watt
1 800 ohms, 10 watt

Aerovox Tubular Paper Condensers
4 .1 mfd., type 484, 400 volts
1 .25 mfd., type 484, 400 volts
2 .1 mfd., type 684, 600 volts
2 .25 mfd., type 284, 200 volts

Aerovox Tubular Paper Condensers
Type 484, 400 volts
1 1 mfd.
2 .002 mfd.
1 .02 mfd.
1 .005 mfd.

Aerovox Mica Condensers, Type 1460
1 .0004 mfd.
1 .00005 mfd.
1 .00015 mfd.
1 .00002 mfd.
1 Aerovox electrolytic condenser, type PB25, 25 mfd., 25 volts
1 Aerovox electrolytic condenser, type PB100, 10 mfd., 100 volts
1 Aerovox electrolytic condenser, type 2GL5 (short type), 8-8 mfd., 450 volts
2 Aerovox electrolytic condenser clamps, 1⅜ inches diameter
1 Eby socket, type 12E, 8-prong
2 Eby wafer sockets, 4-prong
2 Eby wafer sockets, 8-prong
1 Eby wafer socket, 5-prong
6 Eby Junior binding posts
2 Yaxley dial lights, type 310, green and red, 3.2 volts
8 Yaxley bar knobs, type 366, 1¼ inches
4 Kurz Kasch bar knobs
1 I.C.A. steel cabinet, 12x8x7 inches
1 I.C.A. chassis, 11x7½x2½ inches

Chain Networks

(*Continued from page* 538)

Northwestern Group

WOC	Davenport	1,370
WCCO	Minneapolis	810
KSCJ	Sioux City	1,330
WNAX	Yankton	570

Mountain Group

KVOR	Colorado Springs	1,270
KLZ	Denver	560
KOH	Reno	1,380
KSL	Salt Lake City	1,130

Canadian Supplementary Group

CKAC	Montreal	730
CFRB	Toronto	690

Pacific Coast Network

KHJ	Los Angeles	900
KOIN	Portland	940
KGB	San Diego	1,330
KFRC	San Francisco	610
KOL	Seattle	1,270
KFPY	Spokane	890

Pacific Coast "Bonus" Stations

KERN	Bakersfield	1,370
KMJ	Fresno	580
KFBK	Sacramento	1,490
KDB	Santa Barbara	1,500
KWG	Stockton	1,200
KVI	Tacoma	570

Pacific Coast Supplementary Stations

KFBB	Great Falls	1,280
KGVO	Missoula	1,260

Special Hawaiian Service

KGMB	Honolulu	1,320

MUTUAL BROADCASTING SYSTEM

Basic Mutual Stations		
WOR	New York (Newark)	710
WGN	Chicago	720
WLW	Cincinnati	700
CKLW	Detroit	1,030
Colonial Network (New England)		
WAAB	Boston	1,410
WEAN	Providence	780
WICC	Bridgeport	600
WTHT	Hartford	1,200
WLBZ	Bangor	620
WFEA	Manchester	1,340
WSAR	Fall River	1,450
WSPR	Springfield	1,140
WNBH	New Bedford	1,310
WLLH	Lowell	1,370
WATR	Waterbury	1,190
WORC	Worcester	1,280
Added Eastern Mutual Stations		
WFIL	Philadelphia	560
WBAL	Baltimore	1,060
WCAE	Pittsburgh	1,220
WRVA	Richmond	1,110
WGAR	Cleveland	1,450
WSM	Nashville	650
WGR or	Buffalo	550
WKBW	Buffalo	1,480
WIRE	Indianapolis	1,400
Added Western Mutual Stations		
KWK	St. Louis	1,350
WHB	Kansas City	860
KSO	Des Moines	1,430
WMT	Cedar Rapids	600
KOIL	Omaha	1,260
KFAB	Lincoln	770
KFEL	Denver	920
Southwest Mutual		
KTAT	Ft. Worth-Dallas	1,240
Pacific Coast—Don Lee		
KHJ	Los Angeles	900
KFRC	San Francisco	610
KGB	San Diego	1,330
KDB	Santa Barbara	1,500

The Radio Beginner

(*Continued from page* 541)

cut these leads to correct length and solder them to the remaining stator lugs. The condenser can now be bolted down. The leads from the rotors should be soldered to the chassis close to the hole through which they pass. It is very important to individually ground each of the three sections. Depending on the frame of the condenser for a ground causes a common path to be used in all three circuits and oscillation may result.

Next mount the insulated terminal strips and finish all wiring possible without putting in any resistors and condensers. Then connect the resistors in place and finally the condensers. Doing the last job, the grounded foil should always be connected to the ground side and the leads kept as short as possible. Finally connect the cable, sensitivity control and pilot light and mount the dial. The dial, most of the bypass condensers and some other parts can be salvaged from the previous construction job.

Before trying out the unit, plug the cable into the power pack and measure the resistance from B+ (at the cable terminal in the tuner) to ground. This should be about 22,000 ohms. If it is found to be zero there is an error in the connections to the plug.

When it is established that there can be no short circuit, complete the connections between the units and connect the antenna.

In case there is no response, check the tuner stage by stage. Connect a condenser of .00025 mfd. to the antenna and touch the free end of the condenser to the stator of C3. If there is no station coming in, the defect is in the detector stage. After obtaining results there, move the antenna to the stator of C2 and so on. The defect can thus be isolated. Watch for shorts between leads and chassis at places where the

(*Turn to page* 576)

THE TECHNICAL REVIEW

CONDUCTED BY THE TECHNICAL EDITOR

The Radio Amateur's Handbook, Fourteenth Edition, by the Headquarters Staff of the A. R. R. L.; published by the American Radio Relay League, 1936. The "Handbook" hardly needs introduction to many readers of RADIO NEWS. For those not acquainted with it, let us say that it aims to give the amateur complete information on the theory and construction of radio receivers, transmitters, antennas as well as hints on the efficient operation of his station. It is a collection of practical information which the "ham" will want to keep on hand.

The new edition differs from the previous one by a review of many chapters especially the one on tubes. The equipment described has been changed in several cases, making use of newer tubes which have appeared since. The tube table was brought up-to-date. Each subject is first described from a theoretical standpoint and this is followed with a chapter giving actual constructional data. The following is a brief summary of the subjects covered: What is amateur radio—learning the code—licenses—laws of radio circuits and wave fundamentals—vacuum tubes—receiver circuit design—construction of receivers—transmitter design—building transmitters—keying methods—modulation and phone transmitter circuit design—building phone transmitters—receivers for ultra-high frequencies—ultra-high frequency transmitters—power supplies — antennas — instruments and measurements—assembling the amateur station — operating a station — message handling—league operating organizations—Q code—charts, tables—U. S. amateur regulations.

The subject of microphone ratings has been treated in a sensible way, giving the constructor something definite to start from. On the other hand, some of the equations in the power supply chapter do not agree with well-known authorities.

Jones Radio Handbook, 1937 Edition (Formerly the "Radio Handbook"), by Frank C. Jones, distributed by Pacific Radio Publishing Company. This is the third edition of the "Radio Handbook" but the name is changed since the publisher is no longer connected with the magazine "Radio." This edition, containing over 400 pages of text, has numerous additions and revisions as compared to the second edition.

The book is a comprehensive treatise on the design, construction and operation of amateur equipment; receivers, transmitters, antennas, testing instruments. For the first time, chapters on diathermy and television have been included. Amateurs will be pleased by the unusually complete tube data containing many sample diagrams of the tubes, in use, giving values of resistors, etc. The antenna chapter has been enlarged and gives data on directional arrays, tilt antennas, special 10-meter antennas and all kinds of the usual transmitting antennas. There are descriptions of numerous pieces of equipment which were especially built for this book. Among these are exciters working several bands with but one crystal and one tuned circuit. This reviewer, however, cannot agree with some of the theoretical sections, for instance, the decibel chapter, ratings of microphones and definitions of Class A, B and C amplifiers.

Following are the chapter headings: Electrical Phenomena and Radio Theory—Vacuum Tube Theory—Decibels, Logarithms and Data Charts—Radio Code Instruction — Antennas — Radio Receiver Theory and Construction—Receiver Tube Characteristics, Circuits and Charts—C. W. Transmitter Theory — Transmitter Frequency Control—C. W. Transmitter Construction—Transmitter Tube Characteristics, Circuits and Charts—Radiotelephone Theory — Radiotelephone Construction — Ultra-High-Frequency Communication — Radio Therapy—Cathode-Ray Television—Test Instruments—Power Supplies—Laws and Regulations. A supplement to the handbook will be made available later.

Jones Antenna Handbook, 1937 Edition, by Frank C. Jones, distributed by Pacific Radio Publishing Company. This is a separate edition of the antenna chapter in the above described Handbook.

Television, by S. A. Moseley and H. McKay; Oxford University Press, 1936. This book aims to acquaint the general reader with the principles of television. It presupposes a little knowledge of radio and explains the various systems of television in non-technical language. The authors have included many of the mechanical systems involving mirror screws and mirror drums which have not found favor in this country. They should be of interest to the type of reader for whom the book is intended. Cathode-ray systems are described also. The following are the chapter headings: How a picture is "scanned"—Mechanical scanning—Electronic scanning: the Iconoscope—The Electron-Image Camera—The Elements of Reception—Light Modulation—The Kerr Cell—More about the Cathode-ray Tube—The Modern Cathode-ray Receiver—Mechanical Systems—The Problem of Light-Control—Large-Screen Pictures—British Television Transmitters: Baird and Marconi—E. M. I. Systems—Television terms.

A Guide to Reception of Short-Wave Broadcasting Stations, by L. C. F. Horle; Dept. of Commerce, Bureau of Foreign and Domestic Commerce. A booklet designed to help the radio listener obtain the best

possible results from his equipment. It contains instructions on the installation of the set and the erection of an aerial. The properties of short-waves are discussed, explaining the variations of effects in daylight and at night, skip-distance, etc. There is a distance chart, giving the distance and direction from Washington, D. C. to any point on earth. Time difference is made clear by means of a time zone map. In addition there is a list of the most important short-wave stations, of international call letter assignments and a chapter on the actual tuning procedure. The book is written in non-technical language and will be useful to anyone owning a short-wave receiver.

Review of the Proceedings of the Institute of Radio Engineers for December, 1936

Application of Conventional Vacuum Tubes in Unconventional Circuits, by F. H. Shepard. Tubes can be used to perform many useful functions, measuring light intensity, operating relays, etc. Care must be taken to design the circuit so as to insure a reasonably long tube life. The author shows recommended circuits for several devices working directly from the a.c. line and using a minimum of parts. A capacity relay, current amplifier, amplifier relay circuits for photocells are described.

Thermocouple Ammeters for Ultra-High Frequencies, by J. H. Miller. Thermocouple ammeters are shown to have errors at frequencies from 10 to 100 mc. depending almost entirely on the skin effect in the heated member. The use of a tubular heater of suitable dimensions is shown to reduce the error to acceptable values.

Combination Horn and Direct-Radiator Loudspeaker, by H. F. Olson and R. A. Hackley. Description of a loudspeaker consisting of a long, folded horn coupled to the back of a small cone for the radiation of low frequencies. The front of the cone radiates the middle and high frequencies directly. Theory and performance curves are given.

Review of Contemporary Literature

The following are reviews of articles appearing in recent issues of technical magazines; the name of the magazine and its date are given after the title of each article. Copies of these articles are not included under the "Free Booklets"—they are available from your bookdealer or direct from the publishers. Addresses of publishers will be furnished on request.

Ignition Disturbances, by Leslie F. Curtis, Proceedings of the Radio Club of America, October, 1936. Explains in detail the origin of interference in the circuits of a typical battery ignition system.

Some Aspects of Interference and Noise Reduction in Communication Type Receivers, by James Lamb, Proceedings of the Radio Club of America, November, 1936. Discussing the ways of reducing interference: crystal filters, Mr. Lamb's silencer and diversity reception.

A Voltage Quadrupling Circuit, by F. Dickey, QST, December 1936. A short article giving a circuit employing two 25Z5 tubes and four 8 mfd. condensers.

Coupled Circuits and Reflected Resistance, by W. E. Bonham, Radio Engineering, December, 1936. A review of the subject for those who wish to brush up on it.

Impedance Chart for R. F. Lines, by A. E. Teachman, Electronics, December, 1936. The chart shows the impedance of parallel-wire transmission lines for different size wires and spacings from 1 to 20 inches.

Using the Slide Rule for Radio Calculations, Aerovox Research Worker, November, 1936. Showing the shortest way of obtaining answers to the most frequently occurring radio problems.

FREE BULLETINS

Latest Parts Catalog

The 1937 catalog of the Tobe Deutschmann Corp. has been prepared so that the numerous types of condensers, Filterettes and other products listed therein could be

found easily and quickly. There is a chart to aid in selecting the correct interference eliminating Filterette for application to any source of man-made static. Readers can obtain a free copy of this book by simply sending in their requests to RADIO NEWS, 461 Eighth Avenue, New York City.

Test Equipment Catalog

The Clough-Brengle complete line of service and test equipment, which includes over 20 instruments, is described and illustrated in their new catalog. The contents includes information on their new signal generators, oscillographs, etc. Free copies are available to our readers. Send your request to RADIO NEWS, 461 Eighth Avenue, New York City.

Free Bulletin

RADIO NEWS offers through the courtesy of the Ken-Rad Tube & Lamp Corp. an engineering bulletin on 6L6 operation showing effects of power supply regulation. It is a 7-page manual with valuable information to radio engineers, technicians and servicemen. Send your request for a free copy to RADIO NEWS, 461 Eighth Avenue, New York City.

RADIO NEWS Booklet Offers Repeated

For the benefit of our readers, we are repeating below a list of valuable technical booklets and manufacturers' catalog offers, which were described in detail in the September, October, November, December, 1936, January and February, 1937, issues. The majority of these booklets are still available to our readers free of cost. Simply ask for them by their code designations and send your requests to RADIO NEWS, 461 Eighth Avenue, New York, N. Y. The list follows:

S3—Cornell-Dubilier Corp. Folder on New Service Condensers. Free.
S4—Webster Company Catalog on Sound Systems and Accessories. Free.
S5—Transformer Replacement Catalog. United Transformer Corp. Free.
O2—Transformer Guide, Johnson Transformer Co. Free.
N1—Transmitting Tube Guide. Free to Amateurs and Station engineers. Taylor Tubes, Inc.
N2—Free Tube Base Chart. Weston Electrical Instrument Corp.
D1—Latest Radio Parts Catalog of Allied Radio Corp. Free.
D2—Catalog on Replacement Volume Controls, Switches, Vibrators, etc. Yaxley Mfg. Company. Free to servicemen and dealers.
D3—Resistor Catalog, Free. Atlas Resistor Company.
D4—Public Address Bulletin of United Sound Engineering Co. Free.
Ja1—1937 Radio Parts Catalog of Wholesale Radio Service Co. Free.
Ja2—Free. Monthly booklet "Brush Strokes" published by Brush Development Co. Send request in on letterhead.
F1—Special "Bargain Flyer" catalog. Wholesale Radio Service Co. Free.
F2—Speaker Bulletin. Free. Wright-DeCoster, Inc.
F3—Instrument Catalog of Weston Electrical Instrument Corp. Free to servicemen, dealers and engineers.
F4—Free Condenser and Resistor Catalog. Aerovox Corp.
F5—New Centralab Parts Catalog. Free.
F6—Triad Tube Manual. Free to service men, dealers and engineers.

The RADIO WORKSHOP

¶ Items of interest for beginners, experimenters and radio constructors.

Conducted by The Associate Editor

Handy Containers and a Real Time Saver

A practical and time-saving container for small nuts, bolts, washers, soldering lugs, clips, etc., are ordinary muffin tins, obtainable for a dime apiece on the household-goods counter of any chain store. The six-muffin size is just right. Black molded-composition button trays are also very good.

Keep only one type or size nut, bolt, etc.,

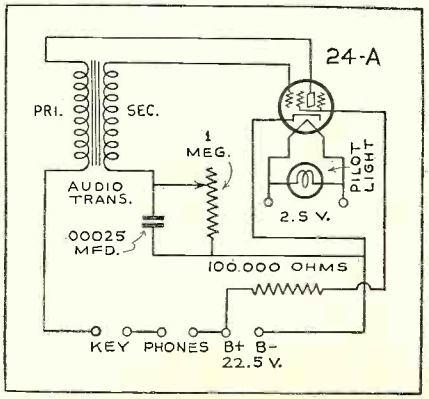
in each compartment and you will never have to fumble around when you're looking for that particular piece of hardware. The open tins also tell instantly when your stock is getting low, and you'll order replenishments before you find yourself stuck with a service job that can't be finished because one nut is missing. Another advantage is that the muffin tins stack well where space is at a premium.

Glass jars, cigar boxes and little wooden chests look nicer, but the muffin tins are much more practical.

ROBERT HERTZBERG,
Jackson Heights, N. Y.

Home-Made Code Practice Oscillator

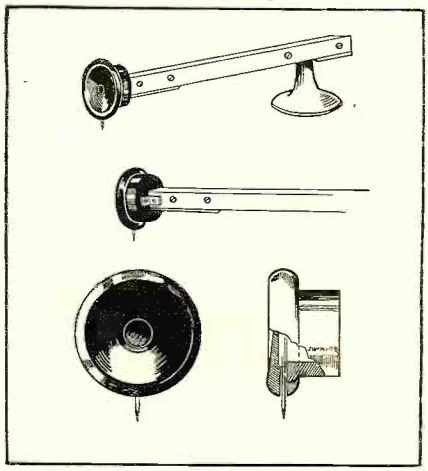
In the past six months RADIO NEWS has described several simple practice code oscillators featuring variable tone which was obtained in several ways, by varying the filament voltage, etc. For my brother experimenters I am submitting herewith a code oscillator which has proved very successful. By adjusting the one megohm control, connected from the cathode of the tube to the "F" terminal of the secondary side of the transformer, the pitch or tone of the oscillator can be varied over a wide range. The instrument is easily constructed and all parts employed are standard and mostly available from one's junk box. Using the 24A type tube and applying 22.5 volts volume is more than enough for headphones. A 2.5-volt filament transformer with sufficient current for the tube and a 2.5 pilot light can be purchased for as low as fifty cents.



MAX HOLLABAUGH,
Spencerville, Ind.

Home-made Phono-Pickup

Recently my phonograph pickup was found to be defective and in checking it over I discovered that the winding was open circuited. With no hope of immediate



repair, I thought of the idea of using a single headphone as a phono pickup. In my junk box there was a pair of headphones with one defective unit and my idea provided an occasion to use the good one to advantage.

To convert the headphone to a pickup was very simple. Remove the diaphragm from the receiver, then cut a very small slot in its edge just wide enough to accommodate a phonograph needle as shown. Then solder the needle securely to the diaphragm, use a needle of the long play-

ing type, some of them are made with a sapphire point and can be used 200 or 300 times before being discarded. A hole is drilled through the edge of the case and cover as shown in the drawing. This hole should be slightly oversize to allow freedom of the needle.

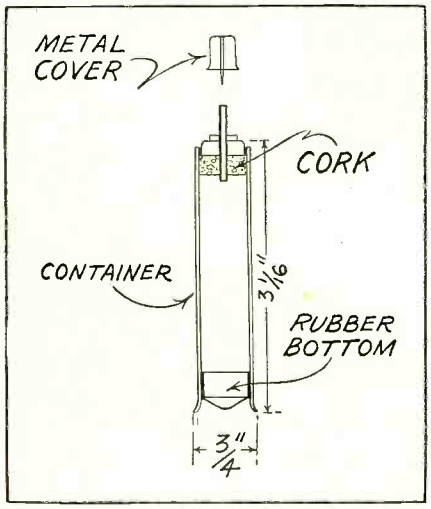
Mounting the converted pickup on the arm of my old phonograph unit was easy in my case. Two small improvised metal angles were screwed to the sides of the arm and to the back cover of the receiver. The two leads from the headpiece are connected to the amplifier or the receiver phonograph jack in the same way as the original pickup.

W. C. CHELSEA,
Chicago, Ill.

Service Gadget

Servicemen and experimenters who prefer to use liquid soldering flux will find excellent service for this easily made "fountain-pen type" flux dispenser.

Take an empty Pelikan's drawing ink tube, pull out the rubber bottom and after washing the tube thoroughly, fill it with



the prepared soldering flux, and replace the rubber stopper. If desired a tiny brush may be fastened to the outlet tube. When the bottom stopper is lightly pressed the flux will flow from the outlet stem at an even rate. One part of pure rosin in four parts of alcohol make a very good non-corroding flux for soldering very delicate wires.

PEDRO SAPOJKIA, JR.,
S. Paulo, Brazil

New "Beam" Tube

OWENSBORO, Ky.—A new beam-power amplifier, the 6V6G, has been announced by Ken-Rad. It is a tetrode built on the same principles as the 6L6 but requiring less filament and plate power which makes it suitable for automobile receivers. The heater drain is only .45 ampere. A single tube will deliver 4.25 watts with 250 volts on plate and screen at 5% total distortion. Only 8.5 volt r.m.s. is required on the grid for full output. Two tubes in push-pull Class AB service can deliver 8.5 watts with a 250-volt plate supply, and 13.0 watts with a 300-volt plate supply. The total harmonic distortion is then 4 per cent.

10- Watt Amplifier

(*Continued from page* 534)

The filter chokes for each vibrator circuit are shown underneath the chassis, the larger choke, 75 ma., connecting to the larger transformer.

The vibrator sockets are standard 5-prong vibrator types and should be mounted with soft rubber bushings under the socket mounting holes. These will prevent the slight mechanical vibration which otherwise occurs when the apparatus is operating. The vibrator buffer condensers should be mounted close to the socket prongs.

After all parts have been mounted in place, the filament wiring may be done, then the resistors, by-pass condensers and transformers. Leave the vibrator sockets for the last, then wire one at a time. Try connecting the primaries and secondaries one way; if there is no voltage output on test, reverse the secondary winding and try again. When one transformer is properly connected, repeat with the next.

Care should be taken that the grid leads on the first two tubes are carefully shielded and the shielding grounded. The input 6C6 tube should have a complete shield also. All the points shown at ground potential should be connected together; don't depend on the chassis to act as the sole conductor, though it should of course connect to the positive A lead.

The maximum no-load voltage from each power supply does not reach a very high level, so no bleeder load was included. If desired as a further measure of filter condenser protection, a 100,000-ohm, 1-watt resistor may be shunted from each filter output to ground.

The "hot" A battery lead should preferably be shielded. It was found during early experiments that some "hash" would be picked up if the external "hot" A lead ran close to the chassis. When it is run directly away from the chassis, or when the bottom of the chassis is shielded, the output is free from objectionable hum even at maximum output levels. It is so quiet, in fact, that it may be used for modulating mobile transmitters.

The kit of parts for this apparatus is being made available by the Utah Radio Products Company, together with full constructional data.

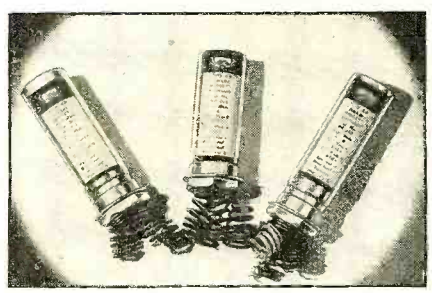
What's New in Radio

(*Continued from page* 562)

tective apparatus. It measures 2⅛ inches in diameter by ⅞ inch thick. The manufacturer advises that its output level is approximately minus 56 db. using a 5.0 megohm load. The interior assembly is cushion mounted, thus permitting use under adverse conditions of vibration. Provided with spring clip for attachment.

New Line of Midget Dry Electrolytic Condensers

The unusual compact size of the new Cornell-Dubilier type KR dry electrolytic condenser is made possible by a patented etched foil process. An idea of its small size may be had from the fact that a triple



8-mfd. unit at 450 volts d.c., measures only 1½ inches in diameter by 4⅜ inches high. The new condensers are particularly suitable for use in small receivers.

The DX Corner (Broadcast Band)

(*Continued from page* 537)

for I've heard Lwow at 1:05 and reported him. Brussells starts at 1:37, the same as last year. Budapest starts at 12:45 a.m. sharp, with gym class for 15 minutes, announcement at 1 a.m., then recordings for 15 minutes, leaving between 1:15 and 1:18 every morning. He's been very good of late.

"All this of course can be checked against Reichardt and Roberts, the two best T.A. men on this coast, up in Mass."

BUENOS AIRES STATIONS

The following up-to-date list of Buenos Aires, Argentina, stations with street addresses is submitted by L. P. O. Tomlinson.

Call	*Kc.*	*Name*	*Street Address*	*Kw.*
LS10	590	Radio Callao	Callao 664	6
*LS3	630	Radio Ultra	Cordoba 653	5
LS4	670	Radio Portena	Belgrano 1841	7
LS1	710	Radio Municipal	Teatro Colon	5
**LRA	750	Radio del Estado	Dept. of State	10
LR10	790	Radio Cultura	Florida 570	10
LR5	830	Radio Excelsior	Maipu 462	29
LR6	870	Radio Mitre	Sante Fe 2043	26
LR2	910	Radio Argentina	Bolivar 1356	12
LR3	950	Radio Belgrano	Belgrano 1841	31
LR4	990	Radio Splendid	Callao 1526	16
LR9	1030	Radio Fenix	Sante Fe 1174	5
LR1	1070	Radio El Mundo	Maipu 555	50
LS5	1110	Radio Rivadavia	Callao 1526	5
LR8	1150	Radio Paris	Cangallo 860	7
LS2	1190	Radio Prieto	Bolivar 1356	30
LS8	1230	Radio Stentor	Florida 8	15
LS9	1270	La Voz Del Aire	Maipu 550	6
LS7	1310	?	?	10
LS6	1350	Radio Del Pueblo	Cordoba 1586	6

* LS3 recently changed hands, note the new call, "Radio Ultra."

** LRA on 750 operates with transmissions of an official nature only, no advertising. As yet there are no fixed hours of transmissions. Station belongs to the Government of Buenos Aires.

Some Tips for Listeners

L. P. O. Parfitt of Cleveland lists the following stations which may interest Eastern early-morning listeners. The hours given are morning hours, Eastern Standard Time.

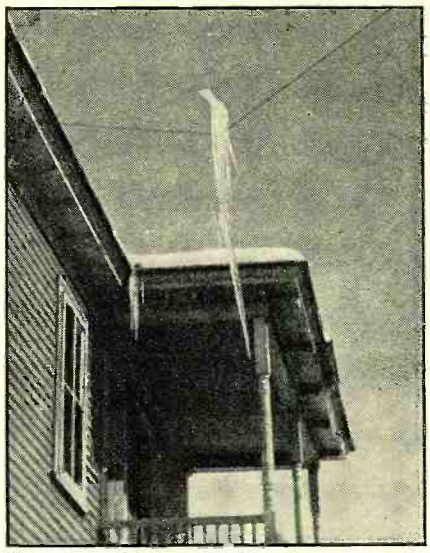
Call	*Kc.*	*Kw.*	*Location*	*Hours*
KSFO	560	1.0	San Francisco	1-5
KROW	930	1.0	Oakland, Calif.	1-5:30
KJBS	1070	.5	San Francisco	1-6
KGFJ	1160	.1	San Francisco	1-6
KYA	1230	1.0	San Francisco	1-5
XEOK	760	.25	Tijuana, Mex.	1-4(?)
XEBG	820			1-2
XEK	990	.1	Mexico City	1-2
KPMC	1550	1.0	Bakersfield, Cal.	1-2

L.P.O. Davis Tickles the Aussies

Following is an interesting extract from the Australian weekly magazine *Teleradio*:

"The last American mail brought to the 4BK-4AK mailbag a number of reports from American listening posts that have afforded the management of these stations extreme pleasure.

"Perhaps the most pleasing was that from Mr. Isaac T. Davis, of Elkhart, Texas, U. S. A.: 'As I reside in about the most static-stricken region of the U. S. A., it is very difficult to receive any foreign signals. However, I wish you to know that yours is one of the very few reliable distant stations to be received through the terrific static that is always present here. On April 23 I tuned into your transmission, when the weather was cloudy with a heavy north wind blowing, when the temperature was about 45 degrees above zero Fahrenheit. It was two days past new moon. . . . No headphones were needed, so loud was your signal. Your signal fades hardly ever, and then never very deep. Your quality is excellent, considering the distance traveled (9,500 miles or more than 15,000 kilometers). Your volume is often louder than many U. S. A. stations.' (Then follows a long list of accurate programme details.)"



THE DX PHANTOM

Must be the DX Bird! Actually a peculiar icicle formation photographed by Mr. Leon Gallant of Manchester, N. H.

Correspondence Wanted

L. P. O. Atkins would like to correspond with DX'ers anywhere in the world except the U. S. A. and New Zealand. Those who would like to respond to this invitation may address their letters as follows: Dudley Atkins III, 123 South Edinburg Avenue, Los Angeles, California, U. S. A.

Time Saver

(*Continued from page* 541)

On the ribbon the broadcast stations of North America, Cuba, Mexico, Central America, Australia and Japan are listed in two columns. In the left-hand column the stations are all arranged in alphabetical order while in the right-hand column they are listed in the order of frequencies. Below these two columns the short-wave stations of the world are listed by frequencies. These stations include not only the short-wave broadcast stations but also the commercial, telephone and experimental stations between 21.54 and 4.1 mc.

The smaller window shows the time difference between any two parts of the world. It does this by indicating the time at any place in the world corresponding to 1 o'clock (a.m.) at the International Date Line.

The entire device is neat in appearance and is available in a variety of finishes. Its overall size is 2½ inches high, 3½ inches wide and 4½ inches from front to back.

In order to keep this device up to date, new ribbons are made available from time to time. When a "Roto-Log" is purchased, a card is supplied with it by means of which the purchaser can register his name with the manufacturer. Thereafter he receives a notice every time a new tape is made available.

Capacitor vs. Condenser

NEW YORK, N. Y.—The name "condenser" is not the proper one to use because of the possible confusion between electrical and mechanical devices according to the Aerovox Corporation. The name "capacitor" is therefore urged which is also accepted as standard by the I.R.E.

The "Quartet"

(*Continued from page* 523)

in ganging this with the two other circuits, and also to permit changing the intermediate frequency as desired without having to worry about the r.f. alignment being thrown out. The oscillator works on 10 meters, its second harmonic being used in 5-meter reception. This is done to take advantage of the greater stability obtainable at the lower frequency. By employing a power tube the harmonic is strong enough to provide good conversion power. An acorn tube was selected for the r.f. stage because of its superiority over standard tubes in gain.

6L7 tubes were used for the i.f. stages because, in addition to their high gain, they are more readily controlled by an a.v.c. system which does not resort to separate amplification, and therefore tend to make for greater simplicity.

The switch S1 combines several functions. When in the left-hand position the receiver is ready for normal operation, with the a.v.c. and plate supply "on" but the beat oscillator "off." In the center position all plate supply circuits are open. Turned to the right, the a.v.c. is off and the beat oscillator is on as required for c.w. reception. A separate toggle switch (S2) is also provided to cut off the beat oscillator if desired, when S1 is in the latter position.

Referring to the front-view photograph, the controls, left to right, are: i.f. gain, regeneration, r.f. tuning, noise suppression, oscillator tuning, phone-standby-c.w. switch, beat-frequency oscillator switch and a.f. gain. The "off-on" switch is in the separate power supply unit.

Although the design of an ultra-high-frequency superhet closely parallels that of the usual short-wave super, there are several problems arising which, although of negligible value in the standard super, become of increasing concern in the ultra-high-frequency super. The methods of solving some of these problems already have been described. Space does not permit a more detailed discussion of them, but needless to say, all were carefully considered in the design of the receiver.

Three separate and distinct functions are handled by the single 6H6 second detector. The first is detection, the second is generation of a.v.c. voltage and the third is noise silencing. In the diagram it will be noticed that the diode section at the left is connected in the usual detector-a.v.c. circuit. The junction of the 50,000-ohm resistor and the 1-megohm resistor provides audio feed to the grid of the first audio stage and a.v.c. voltage to the grids of the 6L7 i.f. tubes, this a.v.c. voltage also operating the electric eye.

The diode section at the right provides the noise-silencing action, or "noise-damping," to be more correct. The cathode of this diode section is connected to the plate of the other section. The plate of the noise-damping section runs to the arm of a 10,000-ohm potentiometer, which varies the potential of this plate from about minus 20 or 30 volts to ground potential. With the arm set near the "negative" end of the potentiometer the plate of the noise-damping diode will be more negative than its cathode and this diode will therefore present a relatively high impedance across the detector-diode section of the 6H6. But with the potentiometer arm set toward the ground end, and a strong signal or noise pulse coming in, the polarity of the noise-damping, diode-section reverses. This causes the noise-damping section of the 6H6 to "damp," or "short-circuit," the detector section, blocking the receiver completely for the duration of noise pulses being received. The result is an unbelievably simple yet extremely effective noise-silencing action.

The beat oscillator uses a 6J7 tube. A "twisted wire" coupling condenser may be used for feeding the beat oscillator output from its plate to the detector diode plate. However, it will most likely be found that more than enough incidental coupling is obtained without this. In fact, it will probably be necessary to shield the grid lead and cap of the 6J7 to avoid overcoupling. Too much coupling will render the noise damping less effective and will decrease sensitivity.

The two-stage audio amplifier furnishes quite high gain. Connection of the phone jack as shown permits the use of the audio volume control when earphones are used, as well as short-circuiting the input to the 6F6 to eliminate all speaker output in this position. No direct current will appear in the phones, which is of considerable advantage. Any speaker with a built-in transformer designed to work from a pentode power tube may be used.

Care should be taken when marking the mounting holes for the two tuning dials, since the tuning condensers for the detector and oscillator stages are fastened directly to the chassis, making it imperative that the dials be of the same exact height as the condenser shafts. It is also necessary that the panel project a quarter of an inch below the chassis edge if the receiver is to fit into the cabinet. It is well to check these carefully before drilling. The high-frequency section of the receiver requires careful attention if the short leads so vitally necessary for ultra-high-frequency operation are to be realized. The location of parts, clearly shown in the top view photos, represents the arrangement arrived at after many tentative layouts were tried. The coil sockets are mounted above the chassis.

The 954 r.f. stage acorn tube is mounted through a hole in the shield separating the detector and r.f. stages. No trimmer or padding condensers are used on either of these two stages, tracking being effected by adjustment of the spacing of the turns of the two coils. This eliminates a source of long leads and unnecessary parallel capacity. The r.f. stage tuning condenser is mounted directly on the panel with four countersunk bolts, while the detector tuning condenser is mounted by a bracket (furnished with the condenser) directly to the chassis. Two flexible couplings and a short length of brass or bakelite ¼-inch shaft permits of extremely smooth control of these condensers with the left-hand dial.

The two-dial tuning system permits of a simplified system of oscillator band-spread. The 5- and 10-meter bands each occupy approximately 20 degrees on the r.f.-detector dial. An extra condenser (C24), however, is mounted on the chassis alongside the oscillator tuning condenser (C23) and is connected in series with it. By proper adjustment of this extra series condenser band-spread of any desired degree can be obtained on the oscillator dial. Both dials provide high-ratio drive.

If wider coverage is desired with this dial, as would be the case if this receiver were used to tune frequencies other than the 5- and 10-meter bands, this extra series condenser may be short-circuited, or left out.

In wiring of the i.f. section a ground bus of No. 12 tinned wire is run parallel to the back edge of the chassis, about two inches away and a half inch from the bottom. The various by-pass condensers for the i.f. amplifier section are then run directly to this bus. This bus should be grounded to the chassis in three or four

places. All other by-pass condensers should run to the nearest ground point on the chassis from where they are connected to the various parts.

The separate power supply using "Stancor" components is a heavy-duty unit that should be useful for other purposes as well. It will furnish, under load, approximately 250 volts, 140 ma., and will be described next month. The heater voltage is 6.3 volts.

Lining-Up

In lining up the receiver a test oscillator that will cover the 5- and 10-meter bands, as well as the intermediate frequency, will save a considerable amount of work. If no such oscillator is available the oscillator of a superhet, or its harmonics, will be satisfactory.

A lead which is inductively or capacity-coupled to the oscillator being used for a signal generator should be first clipped to the grid of the second i.f. tube. With this generator tuned to around 4000 kc., the diode input transformer should be tuned to resonance, as indicated by the electric eye. The lead should then be clipped to the first i.f. tube grid cap and the second i.f. transformer tuned to resonance. If the eye closes too much, reduce the coupling to the test oscillator. The lead from the generator may finally be connected to the grid of the first detector and the input i.f. transformer aligned.

This temporarily completes the alignment of the i.f. amplifier and the high-frequency section is now ready for adjustment. Condensers C3 and C24 should be set at maximum capacity and an antenna connected to the input. Now tune the two dials until noise is heard, indicating resonance. By means of the test oscillator or its harmonics the frequency of resonance can now be determined.

With the r.f. detector dial tuned, these two stages should be temporarily forgotten and attention turned to the oscillator stage. C24 should be gradually turned down from maximum capacity, retuning C23 to keep in resonance. As this procedure is gone through it will be found that the band will occupy more and more space on the oscillator dial and it may be necessary to adjust the spacing of turns on the oscillator coil to keep the desired range centered on the dial. It is possible to spread the band over the full 100 degrees if this procedure is carried far enough, but a spread of 50 to 75 degrees is sufficient.

The r.f. and detector can be now tracked. This should be done on 5 meters first. The set-screws in the front flexible coupling should be loosened so that the detector tuning condenser may be temporarily tuned, independently of the r.f. condenser, by turning the rear coupling. The receiver should now be tuned to the test signal by operating both dials and the coupling connected to the detector condenser. It will probably be found that the r.f. and detector condensers will not set at the same capacity when tuned independently to resonance. The inductance of the r.f. and detector coils should now be varied slightly by moving the coil turns a bit until the r.f. and detector condensers tune to the test signal with the same capacity settings. The front coupling may now be tightened, as the two stages are tracked closely enough for covering the band, especially if the test is in the middle of the range.

The setting of C3 and cathode-winding adjustment of the detector coil decide the point on the regeneration control at which oscillation of the detector stage will occur. This point should be at from half to three-quarters on this control if maximum gain is to be realized from the r.f. and detector stages. Varying the distance between the cathode and grid windings on the detector coil will change the degree of regeneration. It will probably be found best to leave C3 at full capacity.

The 10-meter coils should be next plugged in, the test oscillator set on 10 meters and the same procedure followed as above. While these adjustments of the high-frequency section may sound a trifle complex, they can actually be accomplished in a short time. Finally, with the test oscillator tuned to provide a signal in the 5- or 10-meter bands, recheck the i.f. alignment carefully.

The 6E5 electric eye tube is connected directly into the second-detector, diode circuit and is of value in tuning to exact resonance and making comparative checks on the strength of incoming signals, whether the a.v.c. is "on" or "off."

However, as a further refinement, an insulated jack is provided on the chassis for an "R" meter which may be an 0-1 ma. meter, shunted by a 25-ohm rheostat. With such a meter plugged in, the rheostat should be adjusted for full-scale deflection when no signal is tuned in. Then as each signal is tuned in it will retard the meter according to its strength—providing an accurate basis for "R" reports, an exact check on different antennas and adjustments, etc.

An article next month will cover further details of the receiver and its power supply, together with operating suggestions, etc.

List of Parts

Cornell-Dubilier condensers:
C1, C2, C5, C7, C27, C34—.01 mica, type 3L-5S1
C8, C10, C11, C12, C14, C15, C16—.1 mfd. tubular, 400 v.
C9, C13, C20, C31—.01 mfd. tubular, 400 v.
C17, C18—.0005 mfd. midget mica
C19—1 mfd. tubular, 200 v.
C21, C22, C30—5 mfd., 50 v. electrolytic
C25—.0001 mfd. midget mica
C26—00005 mfd. midget mica
C32, C33—.1 mfd. tubular, 400 v.

Other condensers:
C, C4, C23, C24—National 15 mmfd., type UM15
C3—National 3-30 mmfd., type M30
C28, C29—Included in beat osc. can.

IRC resistors:
R—1500 ohms, ½ w.
R1, R8, R12—250,000 ohms, ½ w.
R2—500 ohms, ½ w.
R5—15,000 ohms, 1 w.
R6, R31—50,000 ohms, ½ w.
R7, R11, R15, R23—2,000 ohms, ½ w.
R9—300 ohms, ½ w.
R10, R14—30,000 ohms, 1 w.
R13—350 ohms, ½ w.
R17, R24, R25, R28—100,000 ohms ½ w.
R18—3 megohms, ½ w.
R19—1 megohm, ½ w.
R22—500,000 ohms, ½ w.
R26—50,000 ohms, 2 w.

Other resistors:
R4, R16—Centralab 75,000 ohm potentiometers
R20—Centralab 10,000 ohms potentiometer
R29—Centralab 500,000 ohm potentiometer
R21, R30—Ward Leonard 500 ohms, 10 w.
R27—Included in beat osc. can.

RCA tubes:
1 type 954 acorn pentode
3 type 6L7
1 type 6H6
1 type 6F5
1 type 6C5
2 type 6F6
1 type 6E5

Miscellaneous:
J1—Yaxley phone jack, type 705
J2—Yaxley single-circuit closed jack
1 Yaxley pilot light bracket with bullseye
S1—Yaxley t.p.d.t. jack switch, type 763
SW2—S.p.s.t. toggle switch
1 National acorn tube socket, isolantite
2 National isolantite octal sockets
3 National type TX—10 shaft couplings
6 National type XR-1 coil forms
3 National 4-brong isolantite tube sockets (for coils)
2 National type B dials with 0-100-0 scales
3 National r.f. chokes, type R-100
T1, T2—Aladdin type A-3500 interstage i. f. transformers
T3, Aladdin type A-3502 diode i.f. transformer
T4—Aladdin type 3550 beat frequency oscillator
1 Lafayette black crackle steel cabinet, type W-22194
1 Lafayette aluminum panel, black crackle, 8¾ by 19 inches, type W-22204
1 Lafayette chassis, cadmium-plated steel, 17 by 11 by 2½ inches, type W-22157
6 octal wafer sockets

1 4-pronged wafer socket
4 Eby binding posts with insulating washers
1 Amphenol electric eye holder
6 ICA bakelite knobs
1 piece sheet aluminum, 4 by 5 inches

Coil Data

5 Meter Coils

R.F. { L—2 ¼T, ¼″ long
L1—1 ¼T, close wound, 1/16″ below L
Det. { L2—2 ¼T, ¼″ long
L3—¾T, 1/16″ below L2
Osc. L4—7 ¼T, 5/16″ long

10 Meter Coils

R.F. { L—3 ¼T, spaced 1 diam., 1/16″ below L
L1—6 ¾T, ⅜″ long
Det. { L2—5 ¾T, 5/16″ long
L3—1 ¾T, sp. 1 diam., ⅛″ below L2
Osc. L4—5 ¾T, 5/16″ long

All Windings of No. 22 enamelled wire, on 1-inch diameter National forms.

Time by Radio

(*Continued from page* 520)

before the final dash comes through.

During the transmission of the time signals from the Naval Observatory, the radio stations at Arlington and Annapolis are automatically controlled by the observatory's clock transmitting device. The NPG signals are controlled by a similar instrument, located at the Mare Island Navy Yard, which is synchronized with the Washington impulses by means of a stroboscopic dial and rotating motor coils. The signals from NPM and NBA are automatic rebroadcasts of NAA-NSS.

"Spot" announcements of time are made by a majority of the broadcasting stations of the United States all through the day and night, under the sponsorship of watch manufacturers and jewelers. While these are useful for approximate settings, they do not compare in accuracy with the signals of Figure 1. The police stations also include mention of the time with their alarms.

Probably the best time services on the broadcast band are the "beep" tone offered by station WOR, Newark, N. J., and KSL, Salt Lake City, Utah, in conjunction with the Western Union Telegraph Company. By means of direct wires to the Naval Observatory in Washington, Western Union maintains master clocks in these cities, and in many others as well. About one minute before each hour, an audio-frequency oscillator in each station is automatically turned on and given a chance to warm up. Then exactly on the hour, a one-second impulse comes over the wire from Western Union and releases the oscillator's tone on the air.

This service has become so popular that the tone is permitted to sound the correct time regardless of what program is on the air, and without pre-announcement of its meaning.

The average error of the time signals of the Naval Observatory is a little more than hundredth of a second. While this accuracy is more than sufficient for ordinary commercial purposes, a higher degree is often required for scientific uses. In order to meet these requirements, the Observatory issues special correction sheets, which are obtainable without charge.

The 956 Tube—A New Acorn

NEW YORK, N. Y.—The third in the acorn-tube line, type 956, has now been made available by RCA. It is a variable-mu pentode in an acorn tube envelope. Its mechanical construction is similar to the 954 but the characteristics resemble those of the 6D6 or 6K7.

The Service Bench

(*Continued from page* 548)

We again hear from J. O. Roberts, of Roberts' Radio Service, St. Louis, Mich., who sends us the following datum on the—

RCA-Victor C-15-3

"The symptoms are a rough sound and occasional cutting out at low volume. The remedy is to replace the volume control with a genuine RCA 5-terminal unit. The set will then operate better than when new.

Metal Rectifying Tube Failures

Voltage fluctuation causing the failure of the 5W4 and 5Z4 metal rectifiers. Substitute a 4-prong socket and a 5Z3 rectifying tube, correctly wire the filament and plate terminals—and your troubles are permanently over."

Mr. Roberts continues with—

Tuning Condenser Shorts

"To correct shorting of variable condensers, as a result of small metallic particles which occasionally get stuck between the plates in the course of servicing, place a high voltage across the condenser. This burns the particles completely." (In applying voltage, watch the plates carefully for the spark. Then insert a piece of fine sand-paper or emery cloth to remove the slight burr usually left by the discharge. This method is particularly useful in locating the points of contact when a condenser shorts over part of the tuning range. However, for dust and dirt, metallic or otherwise, compressed air is the best method of cleaning. Where the air is not available, the old reliable pipe cleaner does an excellent, if slower, job. By the way, compressed air can be had without the cost of an expensive compresser. We know a serviceman who took a discarded fire extinguisher to a local machine shop and had it drilled and tapped for a standard tire valve at a cost of 25 cents. The valve was salvaged from an old inner tube. The short hose and nozzle on the extinguisher were retained. Every few days or so, this serviceman visits his favorite filling station and borrows about fifty pounds of air. He also uses the gadget for spraying lacquer, paint and shellac.—Ed.)

SERVICE CHATS

American servicemen who have been mentally taxed with the advent of octal bases, plugged and unplugged holes, etc., have nothing on their British brothers, according to E. H. Meadows, who writes us about it from Bankside, Beech Alton, Hampshire, England. There is no standardization whatsoever of tubes in England. While over here a Sylvania 6C6 could be substituted for, say an RCA 6C6, no comparable substitution could be in London town. The type designations are not even the same, and a Mullard FC2 equals a Marconi X21. Many tubes of different manufacture but of identical characteristics are not interchangeable due to variations in the mechanical design—some tubes having one arrangement of prongs, another tube a different layout, perhaps with a plate cap instead of a grid cap! As for such a simple thing as a battery, there are hundreds of different types, different voltages and different combinations of different voltages in B and C battery units.

Sylvania's "Auto Radio Installation and Servicing" is a 70-page booklet which every serviceman should have at hand. (It can be secured through your Sylvania jobber or RADIO NEWS.) It contains a wealth of general and specific information, such as service and installation tips, a list of cars with built-in aerials, data on battery grounds, suppressor and by-pass dope on individual automobiles, an interchangeable tube chart, drill tap and die sizes, tube tables for practically all makes of auto radios, etc.

Just because a radio serviceman may operate as an independent, one-man business is no reason why he should conduct his affairs in an unbusiness-like way. If he does so, he may find himself in a considerably less independent position. Every serviceman should read "Radio Service Business Methods," by John F. Rider and J. Van Newenhizen, and published by the RCA Manufacturing Co. as part of the RCA 3-Point Service System. Rider confines himself largely to general business procedure, and Mr. Van Newenhizen develops a simple but comprehensive system of accounting for the radio serviceman.

The CQ'er II

(*Continued from page* 526)

unit were actually resurrected out of the lab junk box and not much extra expense was incurred outside of the two shielded leads, the shielded plug and the small metal cabinet.

Since the unit has been on the air at W2JCY, so many amateurs have inquired as to its circuit and construction that we were just forced to write this short article about it. The arrangement of the parts is shown in the lower photograph with the two push-pull transformers at the two lower corners of the front metal cover and the two tubes at the opposite corners. The three batteries are mounted in the can, proper, with flexible leads running to the rest of the circuit.

Amateur operators who are interested in building a CQ'er too can easily make one and have it working in an hour or so. The double-barreled "pep" of the two-toned oscillator produces some real "authority" when heard calling out a CQ and it is quite usual to have five or six stations answering a CQ at once, where an earlier single-tone oscillator used at this station might have been passed over.

The "gain" from this unit is somewhat greater than that from a crystal microphone and the gain control on the transmitter itself can be retarded so that hum pick-up is no problem at all. And it is certainly refreshing to use the unit without having to worry about feedback which, with ordinary units, sometimes takes many hours of experimentation to eliminate.

As a word of precaution, it is mentioned that the grounding of this circuit on the can should be done exactly as shown in the diagram and then no external grounds are necessary, as the whole unit is then grounded at the input to the speech amplifier, by simply plugging in the shielded plug to the microphone jack.

All that is necessary to do to change from phone to ICW is to pull out the phone plug and push in the CQ'er's shielded plug. Beep-beep! Let's go!

P. A. Design

(*Continued from page* 533)

mixing, and it became possible to retreat to the old and therefore happily remembered measures of simple gain control potentiometers. Only by this time noise was realized to exist, and the simple "volume control" was metamorphosed into the "step attenuator," almost as imposing, and

"Exposing Radio Service Gyps" Reprints Now Available At Cost!

Many servicemen have requested reprints, for distribution to their customers, of the articles on Radio Service Gyps which appeared in the December 1936 and January 1937 issues of RADIO NEWS. Therefore, we have printed copies of these articles in a four page folder (8½" by 11½"), on a good grade of paper, folded to fit a No. 10 business envelope. Reprints will be supplied at cost to our readers on the graduated price basis below. Remittance MUST accompany all orders. All reprints sent postpaid.

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usually as paralyzing of the pocket nerve, as the alphabetical pads.

And so we come today to p.a. as it is. But where does it go from here?

While in this reminiscent frame of mind, the writer had the good fortune to associate with the M. I. T. trained sound engineers of one of the major political parties. In two short months these men had lived, eaten and slept (when they could!) with sound and network broadcasting. This intensive grind had proven that sound worth the name had to be sound, not silence, whenever it was needed. To insure this they had worked out foolproof and flexible set-ups that pointed a logical path for commercial p.a. development and improvement. Having to get into operation in different cities all over the country in matters of minutes from their campaign trains, they evolved fool-proof and flexible methods of doing so, and of simultaneously getting the political speakers "on the air," come what might.

Summarizing, they broke down p.a. into its fundamental components of microphones or other input sources, mixing and control, high voltage amplification, power amplification and loud speakers, and came out with a new and eminently sensible picture.

The block diagram shows it fundamentally. Examination indicates the intelligent physical segregation of microphone control and mixing in one small, handy unit having required voltage amplification at a point easy of access and well isolated from the hum inducing annoyances of heavy power amplifier a.c. power supply components. With from 65 to 100 db. gain at their control points, they could use small power supplies of negligible field, small bulk and small cost—and have either a.c. or battery power as needed.

Such a level was high enough to "pipe" through 500-ohm lines to power amplifiers intelligently located close to loud-speakers so as to lose no expensive and costly power in invariably too light lines used to connect low impedance, high current voice coils. Equally sensibly, they concluded that a few dollars invested in, by comparison, super-efficient loud speakers, would save many dollars in developing audio power and in saving hum-inviting additional gain.

The net result made good garden variety horse sense. An example of its efficacy is seen in the photos herewith. The larger photo shows a portion of the immense Chicago Stockyards International Amphitheater, which was perfectly covered by one mixer-preamplifier, and two 30-watt power amplifiers, each located on the baffle carrying one 18-inch 35% efficient Super-Giant loud-speaker (one is visible at upper left of photo). The control position below the speaker's rostrum used two mixer-preamplifiers powered by a.c. supplies visible in carrying cases beneath the control bench, one feeding the two power amplifiers through twisted lamp cord feeding out of 500 ohm transformers, the second feeding the broadcast station network.

The net result was that considerably less than the full output of this system covered this immense amphitheater, with no trace of reverberation in the broadcast pickup, and so that everyone in the audience heard clearly and distinctly as never before, and so well that this set-up was re-engaged for the Automobile Show—and again for the Livestock Show, replacing equipment costing nearly five thousand dollars. Yet the set-up illustrated could be bought in essence for considerably under $200 in terms of the new equipment designed by the writer with the collaboration of these M. I. T. engineers, small basic units of which are illustrated herewith!

The "Pro" Super

(*Continued from page* 539)

the trouble, for instance, to check the calibration of the dial on all ranges. In all a total of 111 checks were made with the following results: In the 540-1160 kc. range the maximum deviation from the calibration was 2 kc.; 1160-2500 kc. range, maximum 10 kc., average of 16 frequencies checked, 7.3 kc.; 2500-5000 kc. range, maximum 10 kc., average of 18 frequencies checked, 8.06 kc.; 5000-10,000 kc. range, maximum 20 kc., average of 21 frequencies checked, 4 kc.; 10,000-20,000 kc. range, maximum 20 kc., average of 20 frequencies checked, 7.3 kilocyles.

This most unusual record of calibration accuracy is typical of the precision of the receiver—from the lowliest switch contact to the final assembly. The accuracy of the calibration means that the receiver can be pretuned with the volume control off, to any desired station whose frequency is known, with a good degree of assurance that when the volume is turned up that particular station will be heard, providing it is on the air. This was tried time and time again on the 31, 25 and 19-meter broadcast ranges and 90 percent of the attempts met with success. On the lowest frequency range it never failed.

The signal strength meter is an added refinement which is a distinct asset in accurate tuning, in checking tubes, in selecting the most suitable antenna, and in giving signal strength reports. It is not calibrated in terms of "R", presumably because of a lack of standardization in the interpretation of the "R" scale. However, actual measurements made of signal input against readings of this meter were made and are shown in Figure 2. The actual microvolts input for a given meter reading may vary somewhat with different receivers, due to slight variations in tubes, but the ratios shown in Figure 2 will hold

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very closely for all these receivers. The value of this little chart to owners is that they can determine, in terms of relative voltage inputs, improvements wrought through changes in antennas; or they can make up "R" scales according to their own interpretations, but based on actual ratios. The degree of fading of any given signal can also be recorded (a record greatly appreciated by broadcast stations when receiving reports from DX listeners).

The band-spreading system, which is automatically cut in on the three high-frequency ranges, is invaluable to the operator. So effectively does it spread stations that tuning in the short-wave ranges is no more critical than in the regular broadcast range. With the main dial set at 10 megacycles, in the 5.0-10.0 range, for instance, the 100-degree band-spread

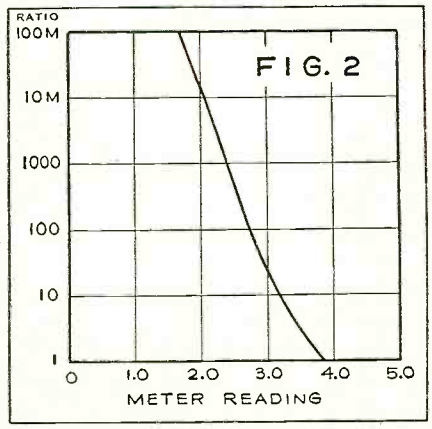


FIG. 2

dial tunes from 10.0 mc. down to 9.12 mc., a range of 880 kc. or an average of a little under 9 kc. per division. Thus the 31-meter broadcast stations operating on adjacent 10-kc. channels in this range are just about 1 degree apart on the dial. In most of the other popular tuning ranges the band-spread is even greater than this, in some cases being as much as 1.4 kc. per division.

This article does not attempt to describe in detail all of the features which impress one who operates the new Super-Pro. Instead the effort has been to present some of the outstanding impressions of features that are out of the ordinary.

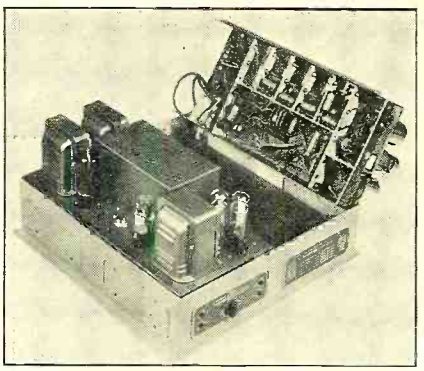
Italian Television

(*Continued from page* 519)

This development was continued through 1936 and resulted in the present apparatus which transmits and receives scenes, in artificial or ordinary daylight and gives a dimensioned picture of 240 by 220 millimeters using 375 lines and 25 frames per second in a perfectly black-and-white picture. The system transmits and receives the television signals on 7 meters with the sound accompaniment on 6.7 meters.

In the newest receivers the large cathode-ray tube is mounted, as can be seen in the illustrations, on a rigid metal frame (duralumin) into which it sets, with the fluorescent screen at the top. A 45-degree mirror projects this image so that it can be seen through an opening in the upper-front portion of the cabinet. There are three controls used in this system, which are shown in the illustrations. The loud-speaker is also mounted on this frame.

The receiver itself is made in two parts, which are hinged so as to be easily serviced, each part folding down into one-half of the receiver chassis proper. One portion contains the power apparatus and the sweep circuits, etc., and the other con-



TELEVISION RECEIVER PROPER

This is the receiver unit which tunes in both sight and sound programs. The r.f. amplifiers are on a hinged chassis which may be tipped up for easy servicing.

tains the r.f. receiving circuits. This latest job uses a total of 15 tubes. The price of the complete receiver runs somewhere between $450 and $500 at the present rate of exchange. The cathode-ray tubes are priced at about $60 and are guaranteed to give 2500 hours of operation. The whole receiving apparatus weighs slightly over 120 pounds.

Further experimentation and development is being carried on with the idea of establishing a chain of television stations employing the Castellani system throughout the length of the Italian Peninsula, possibly connected by a coaxial cable, for transmission of both sight and sound programs. According to present plans, each station will have a practical working range of approximately 20 to 25 miles.

The Radio Beginner

(*Continued from page* 563)

leads pass through holes. You should be able to receive all the local stations and many distant ones. The original model brought in stations in Philadelphia in the daytime without any difficulty and that was in a noisy downtown location.

Parts List

R1—Electrad, type 280, potentiometer, 25,000 ohms.
R2, R3—500 ohms
R4, R5—1000,000 ohms
R6, R7—1,000 ohms
R8, R9—¼ megohm
} I.R.C. carbon resistors, ½ watt.
C1, C2, C3—Meissner, 3-gang variable condenser, type 15122, .00035 mfd.
C4, C5, C6, C7, C8, C9, C10—Cornell-Dubilier, type BA-4P1 tubular paper condensers, .1 mfd., 400 volts.
C11—Cornell-Dubilier, type 2W-5T25 mica condenser, .00025 mfd.
C12—Cornell-Dubilier, type BB-4P25 tubular paper condenser, .25 mfd., 400 volts.
L1—Meissner, type 1085 low impedance antenna coil.
L2, L3—Meissner, type 1084 low impedance r.f. coil.
1—National, type C, dual-range velvet-vernier dial with illuminator and 6.3 volt pilot light.
3—octal sockets, wafer type, mounting centers spaced 1½ inch.
1—I.C.A. chassis, type 1531, cadmium plated steel, 11x7½x2½, with large holes punched.
1—aluminum panel, 4½x6 inches, 1/16-inch thick.
1—I.C.A. terminal strip, type 2419, marked "A. & G".
1—I.C.A. terminal strip, type 2418, marked "output".
4—insulated terminal strips, two terminals each.
1—insulated terminal strip, three terminals.
1—shaft reducer, ⅜ inch hole, ¼ inch shaft.
2—angle brackets.
2 feet 5-wire battery cable.
1—five-prong plug.
1—grommet for ½ inch hole.
1—knob for sensitivity control.
2—grid clips for metal tubes.
2—6K7 tubes.
1—6C5 tube.

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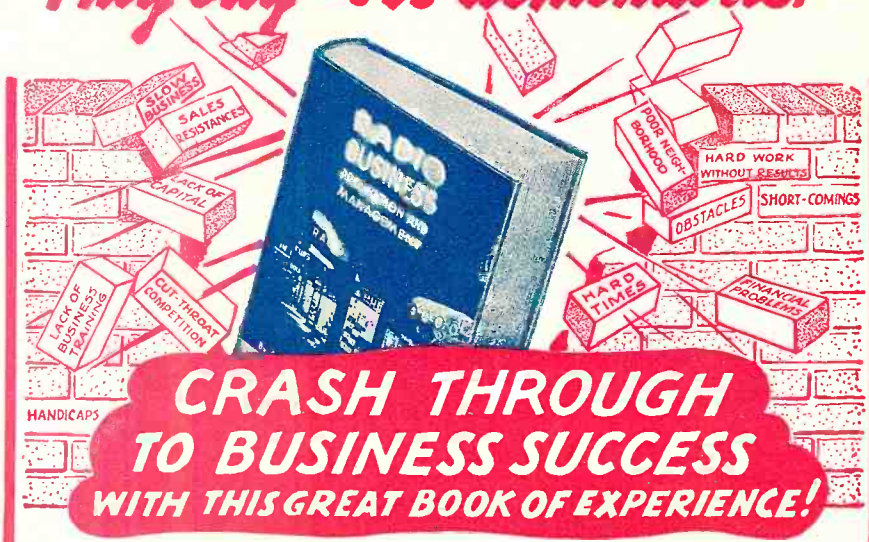

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