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RADIO NEWS AND SHORT WAVE RADIO

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AMATEURS

EXPERIMENTERS

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Practically every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio repair jobs that you can cash in on quickly. Throughout your training I send you plans and ideas that have made good spare time money—from $200 to $500 a year—for hundreds of fellows. I send you special Radio equipment and show you how to conduct experiments and build circuits which illustrate important Radio Principles. My Training gives you practical experience while learning.

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Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays as much at $200 to $500 a year—full time servicing jobs pay as much as $30, $50, $75 a week. Many Radio Experts own and operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay and see the world besides. Automobile, police, aviation, commercial Radio, and loud speaker systems are newer fields offering good opportunities now and for the future. Television promises many good jobs soon. Men I have trained are holding good jobs in these branches of Radio.

Find Out What Radio Offers You—Get My 64-Page Book Free

Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to anyone over 16 years old. It describes Radio's spare time and full time opportunities and those coming in Television; tells about my Training in Radio and Television; shows you actual letters from men I have trained, telling what they are doing and earning; shows you my Money-back Agreement. Find out what Radio offers YOU! MAIL THE COUPON in an envelope, or paste it on a penny postcard—NOW!

J. E. SMITH, President
National Radio Institute, Dept. 7HR
Washington, D. C.

MAIL FOR 64-PAGE BOOK FREE

J. E. SMITH, President, Dept 7HR
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out the spare time and full time opportunities in Radio and explains your 50-50 method of training men at home in spare time to become Radio Experts, and start their own Radio business without capital. (Please Write Plainly.)

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RADIO NEWS

Vol. XIX August, 1937 No. 2

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A New Department

NEXT month a new department, "The Amateur Observer," will make its initial appearance. This department will be devoted to Amateurs and Short-Wave Enthusiasts whose special interest lies in the "Ham" bands. Included will be a monthly list of Amateur Calls Heard and this new department will provide a medium for the exchange of information by those interested in this field. Official Observers will be appointed as rapidly as applications can be approved and certificates prepared. Look for this new department!

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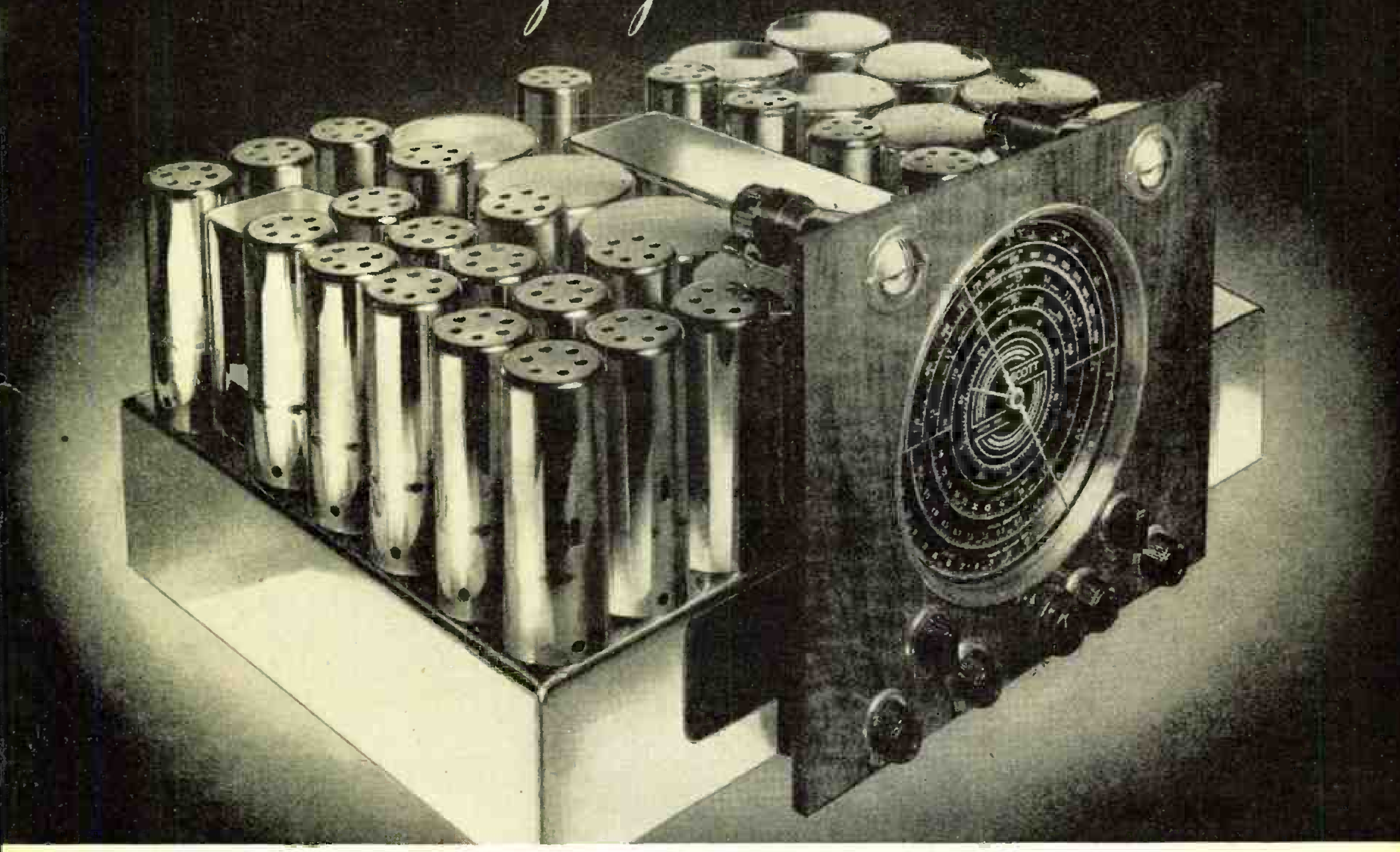
THE *Amazing* NEW SCOTT *Philharmonic*



More FOREIGN STATIONS *with* *Less Noise* *and* *Greater Volume* THAN EVER BEFORE

The sensational long distance performance and perfection of tone achieved by the New Custom-Built Scott "Philharmonic" is due to a large number of exclusive developments perfected in the Scott Research Laboratory.

Increased Wave Length Range From 3.75 to 2000 Meters Tunes Every Broadcast on the Air

The Scott "Philharmonic" has a tuning range from 3.75 to 2000 meters, making possible the reception of special Experimental and Television sound broadcasts on the Ultra-Short Waves—Foreign stations in all parts of the world on the Regular Short Wave Band—All of the stations on the Standard Broadcast Band—Aviation and Weather reports on the Long Wave Band—*covering efficiently a greater wave length range, we believe, than any other radio receiver in the world today.*

Super-Powered for QUIETER Foreign Reception from All Parts of the World

When you hear Foreign stations coming in on the New Super-powered 30 Tube "Philharmonic", you find it impossible to believe you are listening to stations thousands of miles away—*The extremely high degree of usable sensitivity on all wave bands is largely due to the efficiency of the highly developed Two Stage R.F. Amplifier—The Four Stage I. F. Amplifier—and the 40 Watt Class A Audio Amplifier.*

New Variable Wide Range Band-Pass Selectivity

On the New "Philharmonic" an exclusive method developed in our Research Laboratory continuously varies the Selectivity from 2 to 16 Kc., *enabling you to reach out and bring in weak distant stations which ordinarily would be completely blanketed by interference from powerful local stations on adjacent channels.*

Scott Demonstration Salons

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Los Angeles — 115 No. Robertson Blvd.
Laboratories
Chicago—4440 N. Ravenswood Avenue

Four New Developments Revolutionize Tone—Amazes the Music World

Unquestionably, one of the *most* outstanding features of the Scott "Philharmonic" is the almost unbelievable realism of its tone. This is due largely to a number of recently perfected developments, among them: (1) New Scott R.F. Amplifier development (Scott Patents Applied For) which automatically band-passes the R.F. stages to 18 Kc. (on broadcast band) and variable I.F. Selectivity, *enables all frequencies up to 16,000 cycles to be reproduced, securing true high fidelity reception.* (2) NEW Scott Bass Bi-Resonator System (Scott Patents Applied For) *which provides perfect reproduction of bass or lower tones without muffling reproduction of speaking or singing voice on higher frequencies.* (3) Special Tone Balanced Volume Control *scientifically designed to follow response of ear to all frequencies at varying degrees of volume.* (4) New Inverse Feed-back System which automatically *cuts down "peaks" and brings up "dips" of loud speaker, giving finer and more natural reproduction.*

Perfected Push-Pull Built-In Volume Range Expansion

A special Push-Pull Program Volume Range Expansion circuit developed in the Scott Research Laboratory provides a range of 15 db enabling the dynamic variations of all programs to be restored to their original volume range. *Until you have heard this new development, which restores the dynamic volume, it is impossible to realize how fine both radio reception and phono reproduction can really be.*

Newly Developed Circuit Suppresses Scratch On Phonograph Records

A development of the Scott Research Laboratory (Scott Patents Applied For) at last makes possible the *full* enjoyment of phonograph reproduction, for *it automatically suppresses the scratch on the record, but does not affect the full reproduction of the higher frequencies at normal volume.* This very outstanding development for phonograph record reproduction cannot be realized until one has actually listened to a phonograph record played in the ordinary way, then with the record scratch eliminated. This is undoubtedly one of the most outstanding developments in phono reproduction.

Guaranteed for 5 Years Against Defects

The "Philharmonic" is custom-built in limited numbers, with such extreme precision and with such high quality parts, by highly skilled laboratory technicians with many years of experience in the construction of Scott Receivers, that it is guaranteed against defects (except tubes) for FIVE YEARS—20 times longer than the usual 90-day guarantee of production type receivers.

Prices No Higher Than Many Ordinary Radios

Contrary to general opinion, Scott Receivers are priced no higher than many ordinary radios. They are sold only direct from the Scott Laboratories—there are no dealers—thus saving you the distributor and ordinary radio dealer's profit.

30 Day FREE Trial . . . Liberal Terms

Try the Scott "Philharmonic" in your home for 30 days! If it is not finer and better in every way, you can return it at any time during this period and your money will be promptly refunded. You can buy on our liberal Budget Plan terms; if desired.

SEND COUPON NOW FOR SPECIAL OFFER DURING NEXT 30 DAYS

E. H. SCOTT RADIO LABORATORIES, INC.
4440 N. Ravenswood Ave., Dept. 5N7, Chicago, U. S. A.

Your brief description of a few features of the New "Philharmonic" has interested me. Send full details, prices and special offer you are making during the next 30 days. (Not sold thru dealers—sold only direct from Scott Laboratories).

Name..

Street.................................... State.............

Pages From A Serviceman's DIARY

SERVICEMEN, LIKE POLICEMEN, MEET "QUEER" INCIDENTS

In the line of regular duties, servicemen sometimes find they have to help with things other than service work but these often, as in this case, tend to break the monotony as well as help to establish better relations between the radioman and his clientele.

"JUST in time," said Jerry, as I walked in. "You're wanted on the phone." He pushed it toward me.

"This is Dr. Blank," a voice said. "I made arrangements last night to have you help us out at the Annual Banquet of the Faculty of the University. I trust you will find it convenient to come as soon as possible. There is much work to be done and as the success of our entertainment depends upon the proper functioning of our sound equipment, we want to have everything installed and tried out well ahead of time. You have been highly recommended and we are depending on you." I glanced at the appointment schedule and noted it had already been filled in for this job. Told him I should be delighted to come immediately.

"You see," I told Jerry, "with all their engineers and scientists to choose from, still the University had to pick me for this important job. Not that I want to brag—

"No," he interrupted, "you always were a shrinking violet."

"I might add," I emphasized, "that he said I had been highly recommended. Just try and laugh that off!"

Highly Recommended?

Jerry looked up. "I recommended you," he said. "Dr. Blank dropped in last night and said he wanted a fellow who knew enough to turn a switch "on-and-off" when told to, able to operate a volume control, husky enough to jackass a lot of heavy equipment around and yet so dumb that he wouldn't understand what was going on when the professors let themselves go. Try to make a good impression when you snap the switch and don't fall over the equipment. You needn't worry about anything else."

I was just thinking up a nice, snappy come-back, but two of the professors arrived with the University truck and asked me to load some of our apparatus in with their sound equipment. When we had finished, they sent their driver on his way and asked me to come along with them.

We hailed a taxi and climbed in. I asked Professor Smith, the larger of the two, what we had to do first.

"First," he said, "we'll have to stop off and pick up some dummies." I looked at him sharply. After all, I had had about all I could stand from Jerry this morning. Was this bird also getting fresh with me? He had seemed so friendly, too. But he said no more.

Dummies Galore!

We pulled up before a theatrical supply house in the heart of the city and loaded up eight stuffed, full-size dummies. There wasn't room in the cab for more than four of them, so the driver strapped the others outside the cab, and tucked a couple of stray legs behind the license plate bracket. Then we wedged ourselves into the car. I had to take one of the dummies in my lap, a big fellow dressed up in convict's stripes. I wondered what they were for but asked no more questions.

The taxi threaded swiftly through the heavy mid-town traffic, amid occasional cheers from onlookers. A little girl, standing on the back seat of a sedan in front of us, gazed at us through the back window with a puzzled frown. I waved the convict's arm and she laughed delightedly. A drunk on the sidewalk stared unbelievingly, reached into his back pocket and pulled forth a half-finished bottle of whisky, hesitated a moment, then cast it against the curb and rushed blindly into a drug-store. As we made a left turn, the broad back of a traffic cop presented itself within easy reach. I tapped it with the convict's arm. He turned, horror and amazement flashed across his ruddy face, then slowly dissolved into a sheepish grin. Professor Smith dozed, the other Professor, whose name I did not catch, stared straight ahead. Both were seemingly unconscious of the proceedings.

Lots of Equipment

We pulled up at the service entrance of a large building and unloaded. The truck also arrived shortly and what a pile of equipment we had! Two P. A. amplifiers and speakers, two turn-tables, one pre-amplifier and three mikes and an electronic mixer. Since this was a d.c. location, they had also brought along a 1 kw motor-generator. These, along with cables, tools, etc., we carted up to the banquet hall.

The place was nicely laid out for p.a. work. The main hall had a sliding partition so a small, closed-off room could be formed at one end of the hall, Here we installed everything but the speakers. At the other end of the hall, the two speakers were installed; one under a long table and the other on a large baffle, at the far corner of the room. Both were concealed by drapes. 500-ohm lines were run back from each speaker to the main amplifier, a 60-watt job with push-pull 6L6 tubes in the output stage. The output of a Western Electric mike fed into a battery-operated pre-amplifier, then into an attenuator and into the 500-ohm high level amplifier input. A similar method coupled the turn-table pickups to the amplifier, without, of course, the pre-amplifier.

Tests showed that far more gain could be had than was necessary when operating the mike, without acoustic feedback, even when the partition was slid back a couple of feet. The loudspeakers were about 150 feet away. We tried out the sound effects —chimes formed by two pieces of short, heavy brass tubing—and a dial telephone assembly connected in series with a bell. All okay. I wandered into the banquet hall to see what the professors had done about decorating the place.

The dummies had been dressed in caps and gowns and were seated at the speakers' table, four on each side of the vacant center chair, which was reserved for the speaker. It looked strangely like the Supreme Court with its normal peace-time quota of nine. I noted that the space formerly occupied by Justice Van Devanter had been filled by a female figure, closely resembling Madame Perkins. But I shouldn't think it fair for the President to go to such extremes to force resignations. And he promised us young ones, too.

Horses, Horses, Horses!

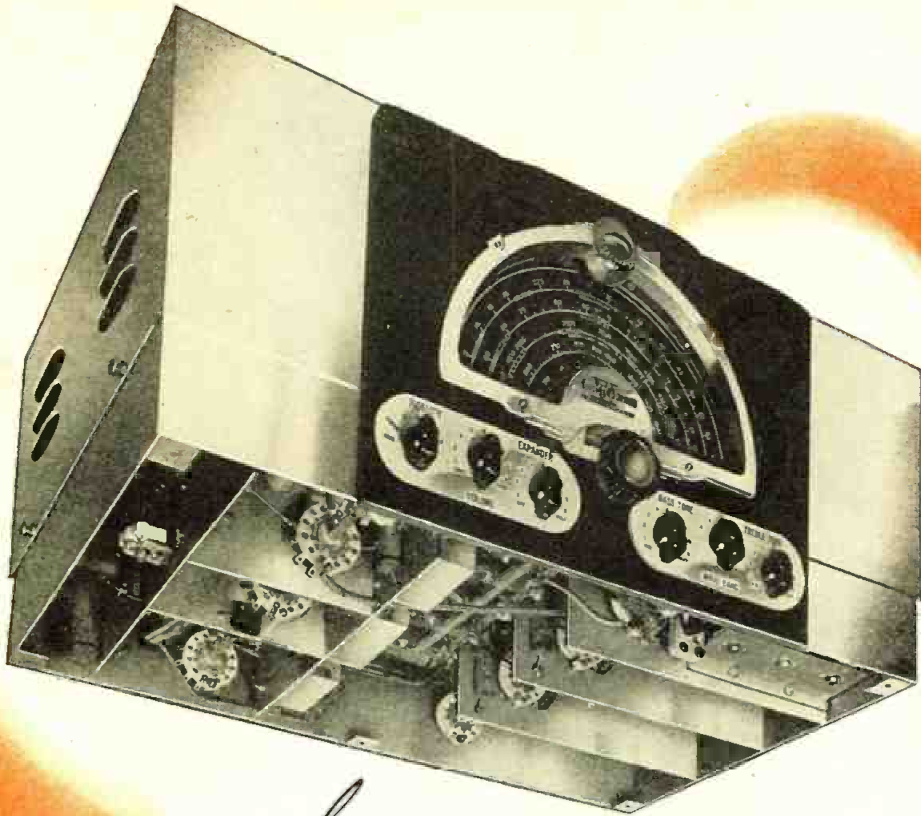
Behind the speaker's table, Professor Smith was hanging a painting, the southern view of a horse headed north. A rather unconventional representation, but I thought it very good. The head was turned and the teeth bared in a cheerful grin. The eyes were bright and rolled roguishly upward.

"How do you like our horse?" Professor Smith asked.

I told him I thought it very fine.

"Can you think of a good title for the picture?" (*Turn to page* 105)

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.



Announcing THE *Exciting* NEW MASTERPIECE VI

A spectacular new custom-built radio with performance and construction features found in no other receiver ever built...the entirely new MULTIBAND interlocking selectivity system . . . the exclusive BIFARIAN theory of sound waves...new Electronic Volume Expansion... unheard of freedom from noise. So super-sensitive it gets the world using only an ice-pick for an antenna! And *you* can own one built to your individual specifications on easy terms. Write or mail the coupon for complete detailed information on the greatest achievement in radio history—the *new* MASTERPIECE VI.

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Please rush me detailed information on the *NEW* MASTERPIECE VI.

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Radio News

August, 1937

Hard-to-Get TUBE DATA

This symposium of tube operating data on all available tubes used in America for transmitting and receiving makes this issue of the magazine the most useful of the year to all our readers, especially to all technicians, servicemen, engineers and experimenters. Tell your radio friends about it!

By the Editor

A COMPLETE Tube Chart for all types of tubes for receiving and transmitting purposes is printed in the following pages. This is probably the most important and useful contribution that will appear in any radio magazine during the year 1937. When you want operating data on a tube, you usually have to scramble around through 15 or 20 catalogs of tube charts from various manufacturers and often you cannot find the exact data needed. For transmitting there is very little data published. Here in one methodically arranged unit the readers of RADIO NEWS have all this data at their finger tips.

The tube charts were prepared through the collaboration of our Technical Editor and Fred Seid, both with many years of experience in tube work, who spent the better part of a month collecting the needed special data from manufacturers and laboriously arranging it in usable form. The editors feel that this great contribution for design and operation purposes makes this issue of RADIO NEWS an outstanding one that should be kept throughout the year for ready consultation.

Tubes Grouped

The receiving tubes have been arranged in groups, each group of one common filament voltage. Tubes in each group are arranged numerically and alphabetically. In cases where a tube has characteristics equivalent to another tube in the same group, the data is given once and reference is made to the equivalent. When the equivalent tube is in another group the characteristics are given twice for added convenience.

In all cases of push-pull service where the notice "(2 tubes)" appears under applications, plate current, screen current and power output shown is the total for two tubes and the load impedance given is "plate to plate."

The characteristics given by the manufacturer show conditions as amplifiers where there is no appreciable voltage drop across the plate load. Therefore, tubes like the 6R7, 55, 85, 56, etc., have additional information for application as resistance-coupled amplifiers. In this case the "output" columns give the output in *volts*. This information is given for one set of conditions only—the one which is most generally used. Other conditions were shown in the articles on resistance-coupled amplifiers in the June and July issue.

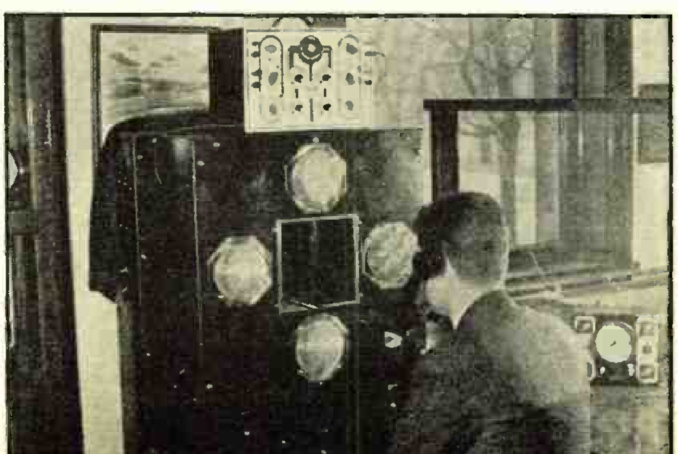
All tubes with octal bases reserve pin Number 1 for connections to the shell. When the tube is a G tube, this pin has no connection. In order to save space no extra base diagrams have been made of equivalent metal and G tubes. The 25A7G is the only exception—its pin Number 1 connects to a cathode.

Rectifier Data

The last two columns of the rectifier chart shows the maximum voltage obtained at the input of the filter for an 80 ma. drain. Where the tube has a maximum rating less than 80 ma. output voltage for maximum current is shown. In all cases, this voltage is obtained with the maximum allowable a.c. voltage per plate as shown on the same line in the chart.

TUBES ARE THE "HEART" OF RADIO

All radio receivers, transmitters, testing equipment, measuring apparatus, facsimile and even television set-ups utilize from one to fifty tubes of various kinds for proper functioning. Photo shows U. A. Sanabria of the De Paul University Laboratories with his new wire-line television transmitter. It uses many different kinds of tubes and for checking purposes Mr. Sanabria employs an oscillograph-wobbulator, shown above transmitter, of the Triumph Manufacturing Company that also uses a number of tubes for the indicator and the oscillator.



WHAT'S NEW in RADIO

***By* The Associate Editor**

AND NOW, A TWO-INCH, HIGH-VACUUM, CATHODE-RAY TUBE

The popularity of the recent one-inch cathode-ray tube has acquainted many experimenters with the advantages that can be gained by using a cathode-ray oscilloscope in radio service work. This new two-inch cathode-ray tube, just announced by the Allen B. DuMont Laboratories, will produce bigger images providing as it does four times the screen area of its predecessor.

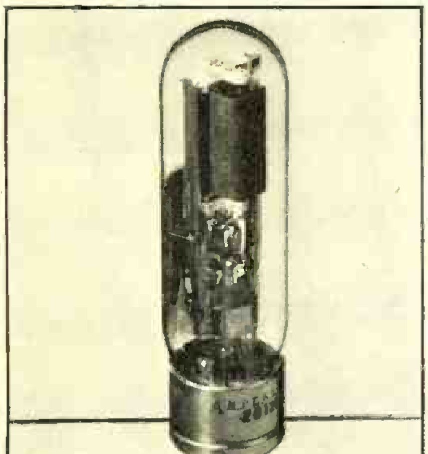
Unique Zero-Bias Tube

While the new Amperex ZB120 type transmitting tube, recently made available for the amateur, is a general purpose tube adaptable to various classes of r.f. and a.f. operation it was engineered with specific design constants to make it particularly desirable for use in zero-bias class B audio-amplifying circuits.

General Characteristics

Amplification factor	90
Grid to plate transconductance at 100 ma.	5,000
Filament voltage	10 volts
Filament current	2 amps.
Maximum allowable plate dissipation	75 watts

The manufacturer points out that the amplification constant of 90 is sufficiently high to allow practical zero-bias operation, that the magnitude of transconductance serves to reduce the plate distortion inherent in conventional hi-mu tubes and to keep the power output at a high level. Further, the high power-output is obtained with relatively low voltages and the high input resistance together with the constancy of this characteristic make possible practically distortionless operation, at exceptionally low driving power. Operating characteristics for this tube for all classes of services are contained in the Transmitting Tube Chart given elsewhere in this issue.



866 Jr.

The Taylor Tube Company announces the 866 Jr. half-wave mercury-vapor rectifier. This new tube fills a real need for a low-cost tube to meet intermediate power requirements. It is intended for use in power units delivering from 600 to 1000 volts d.c., where the standard type rectifier designed for receiver use will not stand the gaff and where the power capabilities of the heavy duty 866 are not required. A constructional feature of this rectifier is in the use of the multi-strand filament said to have twice the emitting surface of the nickel alloy ribbon type filament.

General Characteristics

Fil. volts	2.5 v.
Fil. current	2.5 a.
Max. RMS a.c. volts	1250
Max. d.c. per pair with choke input	250 ma.

Physical Characteristics

Max. length, inches	5¼
Max. dia., inches	2¼

UX ceramic base

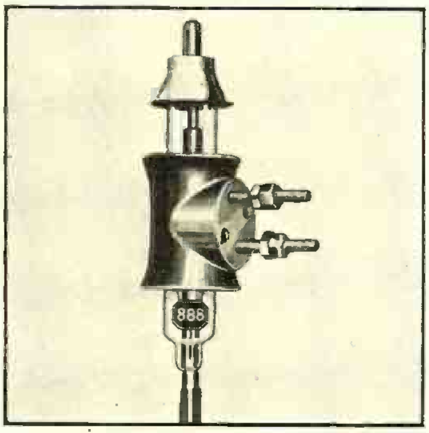
New Tubes

New York, N. Y.—Two new tubes were recently announced by Sylvania; these are designated as 6ZY5G and 6Z7G. The 6ZY5G is a full-wave, high-vacuum rectifier of the heater type. The filament requires 6.3 volts at 0.3 amps. The maximum a.c. potential per plate is 350 volts r.m.s.; maximum output current 35 ma; peak inverse voltage, 1000 volts; peak plate current 150 ma. per plate; maximum potential between heater and cathode, 400 volts. It employs an octal 6-pin base; connections are shown in circuit 6M on the tube-base chart in this issue.

The 6Y7G is a double triode, intended for Class B service. It can deliver a maximum of 4.2 watts output with a 180-volt plate supply. The filament requires 6.3 volts at 0.3 ampere.

RCA 887 and 888 Water-Cooled Triodes

Two of the latest transmitting tubes to be introduced by the RCA Manufacturing Company, are the types 887 and 888, water cooled transmitting triodes. They are designed to provide high power at ultra-high frequencies. Alike in fundamental design these new tubes feature low inter-electrode capacitances, low lead inductance, attached water jacket, high output capability and no internal insulating material. The type 887 is a low-mu tube, amplification factor 10, whereas the 888 is a high-mu, amp. factor 30. The latter type is shown in the illustration. When used as oscillators, these new tubes can be operated with the maximum power input of 1200 watts at frequencies as high as 240 megacycles (wavelengths down to 1.25 meters). In r.f. amplifier service, either type can be used with maximum input at frequencies as high as 300 megacycles.



Tentative Characteristics

	888	887
Filament voltage (a.c. or d.c.)	11 v.	11 v.
Filament current	24 amp.	24 amp.
Direct interelectrode capacitances (approx.)		
With Grid Shield and Water Jacket		
Grid plate	7.8 mmfd.	6.9 mmfd.
Grid filament	2.8 mmfd.	2.5 mmfd.
Plate filament	2.5 mmfd.	2.7 mmfd.
Type of cooling	Water and forced air	

Maximum Ratings and Typical Operating Conditions

As r.f. power amplifier—Class B telephony
Carrier conditions per tube for use with a max. modulation factor of 1.0

	888	887
D.C. plate voltage	3000	3000 max. v.
D.C. plate current	200	200 max. ma.
Plate input	600	600 max. w.
Plate dissipation	600	600 max. w.
Typical operation:		
D.C. plate voltage	2500-3000 v.	2500-3000 r.

(*Turn to page* 124)

RECEIVING TUBE CHART

1.1 VOLT DETECTOR AND AMPLIFIER TUBES

Type No.	Description: Type	Glass or Metal	Fil or Htr	Base (see socket connection chart)	Fil Current Amps	Capacitances MMFD: Grid Plate	In Put	Out Put	Typical Operating Conditions: Application	Plate Sup. Volts	Scr Grid Volts	Control Grid Volts	Cut Off Bias Volts	Plate Current MA	Scr Current MA	μ	Rp Ohms	Gm Micro Mhos	Max Undistorted Output Watts	Load Resistance Ohms
WD11 / WX12	TRIODE	G	F	SPECIAL 4 PIN 4F	0.25	3.3	2.5	2.5	GRID LEAK DETECTOR	45		+A								
				MED. 4 PIN 4G					AMPLIFIER	90		-4.5		2.5		6.6	15500	425	0.007	15000
										135		-10.5		3.0		6.6	15000	440	0.040	15000
864	TRIODE	G	F	SM. 4 PIN 4G	0.25				NON.-MICROPHONIC AMPLIFIER	90		-4.5		2.9		8.2	13500	610		15000
										135		-9.0				8.2	12700	645		15000

1.5 VOLT DETECTOR AND AMPLIFIER TUBES

Type No.	Type	Glass or Metal	Fil or Htr	Base	Fil Current Amps	Grid Plate	In Put	Out Put	Application	Plate Sup. Volts	Scr Grid Volts	Control Grid Volts	Cut Off Bias Volts	Plate Current MA	Scr Current MA	μ	Rp Ohms	Gm Micro Mhos	Max Undistorted Output Watts	Load Resistance Ohms
26	TRIODE	G	F	MED. 4 PIN 4G	1.05				AMPLIFIER	90		-7		2.9		8.3	8900	935		
										180		-14.5		6.2		8.3	7300	1150		

2.0 VOLT DETECTOR AND AMPLIFIER TUBES

Type No.	Type	Glass or Metal	Fil or Htr	Base	Fil Current Amps	Grid Plate	In Put	Out Put	Application	Plate Sup. Volts	Scr Grid Volts	Control Grid Volts	Cut Off Bias Volts	Plate Current MA	Scr Current MA	μ	Rp Ohms	Gm Micro Mhos	Max Undistorted Output Watts	Load Resistance Ohms
1A4	VARIABLE MU PENTODE	G	F	SM 4 PIN 4J	0.060	0.007	4.6	1.1	R.F. AMPLIFIER	180	67.5	-3	-15	2.3	0.8	750	1.0 MEG	750		
										90	67.5	-3	-15	2.2	0.9	425	0.6 MEG	720		
									MIXER	67.5-180	67.5	-5	OSCILLATOR PEAK 4 VOLTS							
1A6	PENTA GRID CONVERTER	G	F	SM. 6 PIN 6A	0.060	0.8	5	6	CONVERTER: OSCILLATOR SECTION	135	RG1 = 5000 OHMS			2.3	0.2	IG1				
						0.25	10.5	9	CONVERTER: MIXER SECTION	180	67.5	-3	-22.5	1.3	2.4		0.5 MEG	300	CONVERSION	Ic =
										135	67.5	-3	-22.5	1.2	2.4		0.4 MEG	275	CONDUCTANCE	62 MA
1B4	PENTODE	G	F	SM. 4 PIN 4J	0.060	0.007	5	11	R.F. AMPLIFIER	180	67.5	-3	-8	1.7	0.6	1000	1.5 MEG	650		
										90	67.5	-3	-8	1.6	0.7	550	1.0 MEG	600		
									BIASED DETECTOR	135	45	-6								
									GRID LEAK DETECTOR	135	45	GRID CONDENSER 0.00025; RG: 1-3 MEG.								0.1 MEG
1B5 / 25S	DUO-DIODE TRIODE	G	F	SM. 6 PIN 6B	0.060	3.6	1.6	1.9	TRIODE SECTION CLASS A AMP.	135		-3		0.8		20	35000	575		
1C6	PENTAGRID CONVERTER	G	F	SM. 6 PIN 6A	0.120	1.5	6	6	CONVERTER: OSCILLATOR SECTION	135	50000 OHMS		2.6	0.2	} IG, ANODE SUPPLY THROUGH 20000 OHMS BY PASSED BY 0.1 MFD					
						0.3	10	9		180	GRID LEAK		3.3	0.2						
									CONVERTER: MIXER SECTION	135	67.5	-3	-14	1.3	2		550,000	300	CONVERSION	Ic = 6.5
										180	67.5	-3	-14	1.5	2		150,000	325	CONDUCTANCE	Ic = 7
1C7G	PENTAGRID CONVERTER	G	F	OCT. 8 PIN 8A	SAME AS 1C6															
1D5G	VARIABLE-MU PENTODE	G	F	OCT. 7 PIN 7G	SAME AS 1A4															
1D7G	PENTAGRID CONVERTER	G	F	OCT. 8 PIN 8A	SAME AS 1A6															
1E5G	PENTODE	G	F	OCT. 7 PIN 7G	SAME AS 1B4															
1E7G	DOUBLE PENTODE	G	F	OCT. 8 PIN 8B	0.240				CLASS A PUSH-PULL AMP.	135	135	-7.5		6.5 TOTAL	2.0 SECT				0.65	24000 P-TO-P
									CLASS A (ONE SECTION)	135	135	-4.5		7.5	2.1	350	0.22 MEG	1600		
1F4	PENTODE	G	F	SM. 5 PIN 5B	0.120				CLASS A AMPLIFIER	135	135	-4.5		8	2.6	340	0.2 MEG	1700	0.34	16000
										90	90	-3		4	1.3	340	0.24 MEG	1400	0.12	20000
1F5G	PENTODE	G	F	OCT. 7 PIN 7H	SAME AS 1F4															
1F6	DUO-DIODE PENTODE	G	F	SM. 6 PIN 6D	0.060	0.007	4	9	PENTODE UNIT: R.F. AMPLIFIER	180	67.5	-1.5	-12	2.0	0.6	650	1.0 MEG	650		
									PENTODE UNIT: A.F. RESISTANCE COUPLED AMPLIFIER	135	135	-1.0	R PLATE 0.25 MEG.	0.42	RG2 1 MEG.	GAIN 48	PEAK INPUT VOLTS 0.64		30.8V	R NEXT GRID: 1.0 MEG.
																43			28V	R NEXT GRID: 0.5 MEG
										135	135	-2.0	0.25 MEG	0.42	0.8 MEG.	46	0.62		28V	R NEXT GRID: 1.0 MEG
																41			25.2V	R NEXT GRID: 0.5 MEG
1F7G	DUO-DIODE PENTODE	G	F	OCT. 8 PIN	SAME AS 1F6															
1G5G	PENTODE	G	F	OCT. 7 PIN 7H	0.120				AMPLIFIER, CLASS A	90	90	-6		8.5	2.7	200	135000	1500	0.3	8500
1H4G	TRIODE	G	F	OCT. 7 PIN 7J	SAME AS 30															
1H6G	DUO-DIODE TRIODE	G	F	OCT. 8 PIN	SAME AS 1B5/25S															
1J6G	DOUBLE TRIODE	G	F	OCT. 8 PIN	SAME AS 19															
15	PENTODE	G	H	SM. 5 PIN 5D	0.220	0.01	2.35	7.80	R.F. AMPLIFIER	135	67.5	-1.5		1.85	0.3	600	0.8 MEG.	750		
										67.5	67.5	-1.5		1.85	0.3	450	0.63 MEG.	710		
19	DOUBLE TRIODE	G	F	SM. 6 PIN 6C	0.260				CLASS B AMPLIFIER (TWO SECTIONS)	135		0		5-13.5		PER TUBE	INPUT POWER MW. 170		2.1	10000 P to P
										135		-3		2-12.5			130		1.9	10000 P to P
										135		-6		0.5-11			95		1.6	10000 P to P
30	TRIODE	G	F	SM. 4 PIN 4G	0.060	6.0	3.0	2.1	CLASS A AMP.	180		-13.5		3.1		9.3	10300	900		
										135		-9		3.0		9.3	10300	900		
										90		-4.5		2.5		9.3	11000	850		
									CLASS A DRIVER (FOR 2 TYPE 30 CLASS B)	157.5		-11.3								18000
									CLASS B AMP. (2 TUBES)	157.5		-15		20 (STATIC)	DRIVING POWER 60MW				2.1	8000 P to P
									BIASED DETECTOR	180		-18								
									GRID CIRCUIT DETECTOR	45-MAX.	GRID CONDENSER 0.00015 MFD. LEAK 1-5 MEG.									
31	TRIODE	G	F	SM. 4 PIN 4G	0.130	5.7	3.5	2.7	CLASS A AMPLIFIER	180		-30		12.3		3.8	3600	1050	0.375	5700
										135		-22.5		8.0		3.8	4100	925	0.185	7000
32	TETRODE	G	F	SM. 4 PIN 4H	0.060	0.015	5.3	10.5	R.F. AMP.	180	67.5	-3		1.7	0.4	780	1.2 MEG.	650		
										135	67.5	-3		1.7	0.4	610	0.95 MEG.	640		
									BIASED DET.	135	67.5	-6								0.1 MEG.
33	PENTODE	G	F	SM. 5 PIN 5B	0.260				CLASS A AMPLIFIER	180	180	-18		22	5	90	55000	1700	1.4	6000
										135	135	-13.5		14.5	3	70	50000	1450	0.7	7000
34	PENTODE	G	F	SM. 4 PIN 4J	0.060	0.015	6.0	11.5	R.F. AMPLIFIER	180	67.5	-3	-22.5	2.8	1.0	620	1.0 MEG.	620		
										135	67.5	-3	-22.5	2.8	1.0	360	0.6 MEG.	600		
										67.5	67.5	-3	-22.5	2.7	1.1	224	0.4 MEG.	560		
									MIXER	67.5-180	67.5	-5	OSCILLATOR PEAK: 4 VOLTS							
49	TETRODE	G	F	SM. 5 PIN 5C	0.120				CLASS B AMP. (2 TUBES) G1 AND G2 CONNECTED TOGETHER	180		0		4	} ZERO SIGNAL (2 TUBES)				3.5	12000 P to P
										135		0		2.6					2.3	8000 P to P
									CLASS A AMP. G2 CONNECTED TO PLATE	135		-20		6.0		4.7	4175	1125	0.17	11000 / 22000 (AS DRIVER)

3.3 VOLT DETECTOR AND AMPLIFIER TUBES

Type No.	Type	Glass or Metal	Fil or Htr	Base	Fil Current Amps	Grid Plate	In Put	Out Put	Application	Plate Sup. Volts	Scr Grid Volts	Control Grid Volts	Cut Off Bias Volts	Plate Current MA	Scr Current MA	μ	Rp Ohms	Gm Micro Mhos	Max Undistorted Output Watts	Load Resistance Ohms
20	TRIODE	G	F	MED. 4 PIN 4G	.132	3.7	2.4	2.3	AMPLIFIER	135		-22.5		6.5		3.3	6300	525	.110	6500
22	TETRODE	G	F	MED. 4 PIN 4H	.132	.02	4	12	AMPLIFIER	135	67.5	-1.5	-7.5	3.7	1.3	125	25 MEG	500		
									RES. COUP. AMPLIFIER	180	22.5	-.75		.3		350	2 MEG	175		.25 MEG.
V-99 / X-99	TRIODE	G	F	SPEC. 4 PIN / MED. 4 PIN	.063	3.6	2.5	2.2	GRID LEAK DETECTOR	45		+A		1.5		6.6	17000	370		
									AMPLIFIER	90		-4.5		2.5		6.6	15500	425	.007	15500

RECEIVING TU E CHART

2.5 VOLT DETECTOR AND AMPLIFIER TUBES

DESCRIPTION: TYPE		GLASS OR METAL	FIL OR HTR	BASE (SEE SOCKET CONNECTION CHART)	FIL CURRENT AMPS	CAPACITANCES MMFD: GRID PLATES	IN PUT	OUT PUT	TYPICAL OPERATING CONDITIONS: APPLICATION	PLATE SUP. VOLTS	SCR GRID VOLTS	CONTROL GRID VOLTS	CUT OFF BIAS VOLTS	PLATE CURRENT MA	SCR CURRENT MA	μ	Rp OHMS	Gm MICROMHOS	MAX UNDISTORTED OUTPUT WATTS	LOAD RESISTANCE OHMS
2A3 / 2A3H	TRIODE	G	F / H	4G MED 4 PIN / 4K	2.5 / 2.8	13	9	4	CLASS A (ONE TUBE)	250		-45		60		4.2	800	5250	3.5	2500
									CLASS AB1 (2 TUBES) FIXED BIAS	300		-62		80-100					15	3000
									CLASS AB1 (2 TUBES) SELF-BIAS	300	Rc = 780 OHMS			80-150					10	5000
2A5	PENTODE	G	H	MED SIX-PIN 6E	1.75				CLASS A PENTODE	250	250	-16.5		34	6.5	190	0.8	2350	3.0	7000
									CLASS A PENTODE	315	315	-22		42	8	260	1.0	2600	5.0	7000
									CLASS A TRIODE (ONE TUBE)	250		-20		31		6.2	1700	2300	0.65	3000
									CLASS AB2 PENTODE (TWO TUBES) FIXED BIAS	375	250	-26		34	5				19	10000
									CLASS AB2 PENTODE (TWO TUBES) SELF-BIAS	375	250	Rc = 340 OHMS		54					19	10000
									CLASS AB2 TRIODES (TWO TUBES) FIXED BIAS	350		-38		45					18	6000
									CLASS AB2 TRIODES (TWO TUBES) SELF BIAS	350	Rc = 730 OHMS			50					14	10000
2A6	DUO DIODE TRIODE	G	H	SM. 6 PIN 6F	0.8	1.7	2	4	TRIODE AMPLIFIER	250		-2		0.8		100	91000	1100		
									TRIODE AMP. (RES. COUPLED)	300	Rc = 3900 OHMS					GAIN = 53			51 [illegible]	R PLATE 0.25 MEG R NEXT GRID 0.5 [illegible]
2A7	PENTAGRID CONVERTER	G	H	SM. 7 PIN 7A	.8	1.0	7	5.5	OSC. SECTION	250	RG1 = .05 MEG.			4	RG2 = .02 MEG.					
									OSC. SECTION	100	RG1 = .01 "			3.3						
						.3	8.5	9	MIXER SECTION	250	100	-3	-45	3.5	2.2		.36 MEG.	520	CONVERSION CONDUCTANCE	
									MIXER SECTION	100	50	-1.5	-20	1.3	2.5		.6 MEG.	350	"	"
2B6	DIRECT COUPLED DUAL TRIODE	G	H	MED. 7 PIN 7X	2.25				INPUT SECTION	250		-24		4		7.2		600		8000
									OUTPUT SECTION	250		+2.5		40		18		3500	4	5000
2B7	DUO DIODE PENTODE	G	H	SM. 7 PIN 7B	0.8	.007	3.5	9.5	AMPLIFIER (PENTODE SECTION)	250	125	-3	-21	9	2.3	730	.65 MEG	1125		
									AMPLIFIER (PENTODE SECTION)	100	100	-3	-17	5.8	1.7	265	.3 MEG	950		
									AMP. (RES. COUPLED)	300	Rs = 1.2 MEG	RC = 1600 OHMS		GAIN = 79					100V	R PLATE .25 MEG R NEXT GRID .5 [illegible]
24A	TETRODE	G	H	MED. 5 PIN 5J	1.75	.007	5.3	10.5	AMPLIFIER	250	90	-3	-15	4	1.7	630	0.6 MEG	1050		
									AMPLIFIER	180	90	-3	-15	4	1.7	400	0.4 MEG	1000		
27	TRIODE	G	H	MED. 5 PIN 5A	1.75	3.3	2.1	2.3	AMPLIFIER	250		-21		5.2		9	9250	975		
									AMPLIFIER	180		-13.5		5		9	9000	1000		
									AMPLIFIER	90		-6		2.7		9	11000	820		
									BIAS DETECTOR	250		-30		0.2						
35	VARIABLE MU TETRODE	G	H	MED. 5 PIN 5J	1.75	.007	5.3	10.5	AMPLIFIER	250	90	-3	-40	6.5	2.5	420	.4 MEG.	1050		
									AMPLIFIER	180	90	-3	-40	6.3	2.5	305	.3 MEG.	1020		
45	TRIODE	G	H	4G MED 4 PIN	1.5	7	4	3	CLASS A AMPLIFIER (1 TUBE)	275		-56		36		3.5	1700	2050	2.0	4600
									CLASS A AMPLIFIER (1 TUBE)	250		-50		34		3.5	1610	2175	1.6	3900
									CLASS AB2 (TWO TUBES) SELF-BIAS	275	Rc = 775 OHMS			72 TO 90					12	5060
									CLASS AB2 (TWO TUBES) FIXED BIAS	275		-68		[illegible]					18	3200
46	TETRODE	G	F	5C MED. 5 PIN	1.75				CLASS A AMPLIFIER	250		-33		22		5.6	2380	2350	1.25	6400
									CLASS B AMPLIFIER (2 TUBES)	400		0		12 TO 75					20	5800
									CLASS B AMPLIFIER (2 TUBES)	300		0		8 TO 70					16	5200
47	PENTODE	G	F	5G MED. 5 PIN	1.75				CLASS A AMPLIFIER	250	250	-16.5		31	6	150	60000	2500	2.7	7000
53	DOUBLE TRIODE	G	H	7C MED. 7 PIN (LARGE PIN CIRCLE)	2.0				CLASS A DRIVER (2 SECTIONS IN PARALLEL)	294		-6		7		35	11000	3200	0.37	20000 TO 40000
									CLASS A DRIVER (2 SECTIONS IN PARALLEL)	250		-5		6		35	11300	3100		
									CLASS B AMP (2 SECTIONS IN PUSH PULL)	300		0		35-65					10	10000 P TO P
									CLASS B AMP (2 SECTIONS IN PUSH PULL)	250		0		28-50					8	8000 P TO P
55	DUO-DIODE TRIODE	G	H	6F SM 6 PIN	1.0	1.5	1.5	4.3	TRIODE UNIT AMP.	250		-20		8		8.3	7500	1100		
									TRIODE UNIT RES. COUP. AMP.	300	Rc = 8300 OHMS					GAIN = 5.7			82V.	R PLATE 0.1 MEG R NEXT 0.25 [illegible]
56	TRIODE	G	H	5A SM. 5 PIN	1.0	3.2	3.2	2.2	AMPLIFIER	250		-13.5		5		13.8	9500	1450		
									AMPLIFIER	100		-5		2.5		13.8	12000	1150		
									RES. COUP. AMPLIFIER	300	Rc = 6400 OHMS					GAIN = 10			95V	R PLATE .25 MEG R NEXT GRID .5 MEG.
									BIASED DETECTOR	250	Rc = 30000 TO 150000 OHMS									
57	PENTODE	G	H	6J SM. 6 PIN	1.0	.007	5.0	6.5	AMPLIFIER	250	100	-3		2	.5	1500	1.5 MEG.	1500		
									AMPLIFIER	100	100	-3		2	.5	1185	1 MEG	1185		
									RES. COUP. AMPLIFIER	300	300	Rc = 1200 OHMS	RG2 = 1.18 MEG	GAIN = 140					97V.	R PLATE .25 MEG. R NEXT GRID .5 MEG.
									BIASED DETECTOR	250	100	-4.3 (OR Rc = 10,000)								
									BIASED DETECTOR	100	30	-1.83 (OR Rc = 10,000)								
58	PENTODE	G	H	6J SM. 6 PIN	1.0	.007	4.7	6.3	AMPLIFIER	250	100	-3	-50	8.2	2	1280	.8 MEG	1600		
									AMPLIFIER	100	100	-3	-50	8	2.2	375	.25 MEG	1600		
									MIXER	250	100	-10	OSCILLATOR PEAK 7 VOLTS							
59	TRIPLE GRID TUBE	G	H	7T MED. 7 PIN (LARGE PIN CIRCLE)	2.0				CLASS A TRIODE [illegible]	250		-28		26		6	2300	2600	1.25	5000
									CLASS A PENTODE	250	250	-18		35	9	100	40000	2500	3	6000
									CLASS B TRIODES (2 TUBES) G1 TO G2, G3 TO P	400		0		26 TO 78					20	6000 P TO P
									CLASS B TRIODES (2 TUBES) G1 TO G2, G3 TO P	300		0		20					15	4600 P TO P

5.0 VOLT DETECTOR AND AMPLIFIER TUBES

TYPE		GLASS OR METAL	FIL OR HTR	BASE	FIL CURRENT AMPS	GRID PLATES	IN PUT	OUT PUT	APPLICATION	PLATE SUP. VOLTS	SCR GRID VOLTS	CONTROL GRID VOLTS	CUT OFF BIAS VOLTS	PLATE CURRENT MA	SCR CURRENT MA	μ	Rp OHMS	Gm MICROMHOS	MAX UNDISTORTED OUTPUT WATTS	LOAD RESISTANCE OHMS
00A	CS VAPOR TRIODE	G	F	4G MED. 4 PIN	.25	8.5	3.2	2.0	GRID LEAK DETECTOR	45		0		1.5		20	30000	666		
01-A	TRIODE	G	F	4G MED. 4 PIN	.25	8.8	3.1	2.2	AMPLIFIER	135		-9		3.0		8	10000	800		
12A	TRIODE	G	F	4G MED. 4 PIN	.25	8	4	2	AMPLIFIER	135		-9		6.2		8.5	5100	1650	.13	9000
									AMPLIFIER	180		-13.5		7.7		8.5	4700	1800	.85	10 700
71A	TRIODE	G	F	4G MED. 4 PIN	.25	9.5	3.02	2.9	AMPLIFIER	135		-27		17.3		3	1820	1650	.4	3000
									AMPLIFIER	180		-40.5		20		3	1750	1700	.79	4800
40	TRIODE	G	F	4G MED. 4 PIN	.25	8.8	3.4	1.5	BIASED DETECTOR	180		-4.5		.1						.25 MEG.
									RES. COUP. AMPLIFIER	180		-3		.2		30	.15 MEG.	200		.25 MEG.

6.3 VOLT DETECTOR AND AMPLIFIER TUBES

TYPE		GLASS OR METAL	FIL OR HTR	BASE	FIL CURRENT AMPS	GRID PLATES	IN PUT	OUT PUT	APPLICATION	PLATE SUP. VOLTS	SCR GRID VOLTS	CONTROL GRID VOLTS	CUT OFF BIAS VOLTS	PLATE CURRENT MA	SCR CURRENT MA	μ	Rp OHMS	Gm MICROMHOS	MAX UNDISTORTED OUTPUT WATTS	LOAD RESISTANCE OHMS
6A3	TRIODE	G	F	MED. 4 PIN 4G	1.0	16	7	3.5	CLASS A AMP.	250		-45		60		4.2	800	5250	3.2	2500
									CLASS AB1 TWO TUBES FIXED BIAS	325		-68		80-100						3000
									CLASS AB1 TWO TUBES SELF BIAS	325	Rc = 750 OHMS			80-150					10	5000
6A4 LA	PENTODE	G	F	MED. 5 PIN 5G	0.3				PENTODE AMPLIFIER	180	180	-12		22	4.5	150	0.6 MEG.	2500	1.5	8000
									PENTODE AMPLIFIER	100	100	-6.5			1.6	150	83250	1700	0.3	11000
6A5G	TRIODE	G	H	OCT. 8 PIN 8F	1.0	16	7	5	SAME AS 6A3 EXCEPT POWER OUTPUT SINGLE TUBE										3.75	
6A6	DOUBLE TRIODE	G	H	MED. 7 PIN 7C	0.8				CLASS A DRIVER (2 SECTIONS IN PARALLEL)	294		-6		7		35	11000	3200	0.37	20000 TO 40000
									CLASS A DRIVER (2 SECTIONS IN PARALLEL)	250		-5		6		35	11300	3100		
									CLASS B AMPLIFIER (SECTIONS IN PUSH-PULL)	300		0		35-65					10	10000 P TO P
									CLASS B AMPLIFIER (SECTIONS IN PUSH-PULL)	250		0		28-50					8	8000 P TO P
6A7	PENTAGRID CONVERTER	G	H	SM. 7 PIN 7A	0.3	1.0	7.0	5.5	CONVERTER OSCILLATOR SECTION	250	RG1 = 0.05 MEG.			4.0	RG2 = 0.02 MEG.					
									CONVERTER OSCILLATOR SECTION	100	RG1 = 0.01 MEG.			3.3						
						0.3	8.5	9.0	CONVERTER MIXER SECTION	250	100	-3	-45	3.5	2.2			520	CONVERSION CONDUCTANCE	
									CONVERTER MIXER SECTION	100	50	-1.5	-20	1.3	2.5			350		
6A8	PENTAGRID CONVERTER	G	H	OCT. 8 PIN 8G	0.3	0.8	6.5	5	CONVERTER OSCILLATOR SECTION	250	RG1 = 0.05 MEG.			4.0	RG2 = 0.02 MEG					
									CONVERTER OSCILLATOR SECTION	100	RG1 = 0.05 MEG			1.6						
						0.3	8.5	9.0	CONVERTER MIXER SECTION	250	100	-3	-45	3.3	3.2		0.36 MEG.	500	CONVERSION CONDUCTANCE	
									CONVERTER MIXER SECTION	100	50	-1.5	-20	1.2	1.5		0.6 MEG.	350		

RECEIVING TUBE CHART

6.3 VOLT TUBES (CONT.)

DESCRIPTION: TYPE	GLASS OR METAL	FIL OR HTR	BASE (SEE SOCKET CONNECTION CHART)	FIL CURRENT AMPS	CAPACITANCES MMFD: GRID PLATE	IN PUT	OUT PUT	TYPICAL OPERATING CONDITIONS: APPLICATION	PLATE SUP. VOLTS	SCR. GRID VOLTS	CONTROL GRID VOLTS	CUT OFF BIAS VOLTS	PLATE CURRENT MA	SCR. CURRENT MA	μ	Rp OHMS	Gm MICROMHOS	MAX UNDISTORTED OUTPUT WATTS	LOAD RESISTANCE OHMS
6B4G	TRIODE	G	F	OCT. 8PIN 8H	1.0	16	7	5	SAME AS 6A3										
										INPUT PLATE	GRID VOLTS RMS			INPUT PLATE					
6B5	DYNAMIC COUPLED DUAL TRIODES	G	H	MED. 6 PIN 6G	0.8			DYNAMIC COUPLED AMP. SINGLE	300	300	0	15	42	8	58	24000	2400	4.0	7000
								PUSH-PULL (2 TUBES)	325	325	0	42	102	18				13.5	10000
6B6	DUO-DIODE TRIODE	G	H	OCT. 7PIN 7K	0.3	1.7	2	4	SAME AS 75.2A6										
6B7	DUO-DIODE PENTODE	G	H	SM. 7PIN 7B	0.3	0.007	3.5	9.5	PENTODE UNIT R.F. AMPLIFIER	250	125	-3	-21	9.0	2.3	730	[illegible]	1125		
									100	100	-3	-17	5.8	1.7	285	[illegible]	950		
								PENTODE UNIT RES. COUPLED A.F. AMP.	300	RGL = 1.2 MEG.		Rc = 1600 OHMS GAIN = 79						100V.	RPLATE 0.25 MEG. R NEXT GRID 0.5 MEG.
6B8	DUO-DIODE PENTODE	M	H	OCT. 8 PIN 8J	0.3	0.005	6	9	PENTODE UNIT R.F. AMPLIFIER	250	125	-3	-21	10.0	2.3	800	[illegible]	1325		
								FOR OTHER APPLICATIONS SEE 6B7											
6C5	TRIODE	M	H	OCT. 6 PIN 6H	0.3	1.8	4	13	AMPLIFIER	250		-8		8		20	10000	2000		
								RES. COUPLED AMPLIFIER	300	Rc = 12300 OHMS; Rg (NEXT STAGE) = 0.5 MEG. GAIN = 14								85V	RPLATE [illegible] MEG.
6C6	PENTODE	G	H	SM. 6PIN 6J	0.3	0.010	5.0	6.5	BIASED DETECTOR	250	100	-4.3	Rc = 10000 OHMS							RPLATE = 0.25 MEG.
									100	30	-1.83	Rc = 10000 OHMS							
								R.F. AMPLIFIER	250	100	-3	-7	2	0.5	1500	[illegible]	1225		
									100	100	-3	-7	2	0.5	1185	[illegible]	1185		
								RES. COUPLED A.F. AMP.	300	RGL = 1.2 MEG. Rc = 1200 OHMS GAIN = 140								104 VOLTS	RPLATE 0.25 MEG. R NEXT GRID [illegible] MEG.
								TRIODE AMPLIFIER	250		-8		6.5		20	10000	1900		
6C8G	DOUBLE TRIODE (SEPARATE CATHODES)	G	H	OCT 8 PIN 8K	0.3	TRIODE WITH GRID CAP 2.4	2.5	3.9	CLASS A AMP. (ONE TRIODE)	250		-4.5		3.1		38	26000	1450		
						OTHER TRIODE 2.5	3.4	3.5	PHASE INVERTER	250		-3	PER SECT	Rc (COMMON) 1500 OHMS GAIN 46					80 VOLTS	[illegible]
									250		-3	PER SECT	Rc (COMMON) 900 OHMS GAIN 45						60 VOLTS	[illegible]
6D6	VARIABLE MU PENTODE	G	H	SM 6PIN 6J	0.3	0.010	4.7	6.5	R.F. AMPLIFIER	250	100	-3	-50	8.2	2.0	1280	[illegible]	1600		
									100	100	-3	-50	8.0	2.2	375	[illegible]	1500		
								MIXER	250	100	10	OSCILLATOR PEAK 7 VOLTS							
6D8G	PENTAGRID CONVERTER	G	H	OCT 8PIN 8G	0.15	1.0	6.0	5.5	CONVERTER OSCILLATOR SECTION	250	Rg = 0.05 MEG.			4.5	RGL = 0.02 MEG.					
									100	Rg = 0.05 MEG.			1.8						
						0.3	8.0	11.0	CONVERTER MIXER SECTION	250	100	-3	-40	3.0	3.5		[illegible]	500	CONVERSION	
									100	50	-1.5	-20	1.0	1.7		[illegible]	300	CONDUCTANCE	
6E6	DOUBLE TRIODE	G	H	MED 7PIN 7C	0.6				CLASS A AMP. (ONE SECTION)	250		-27.5		18		6	3500	1700	0.8	7000
									CLASS A PUSH-PULL AMP. TWO SECTIONS	250		-27.5							2.0	10000
										180		-20							0.95	15000
6F5	TRIODE	M	H	OCT 5PIN 5H	0.3	2	6	12	AMPLIFIER	250		-2		0.3		100	66000	1500		
								RES. COUPLED AMPLIFIER	300	Rc = 3200 OHMS GAIN = 63 Rg NEXT = 0.5 MEG.								5.4 VOLTS	RPLATE 0.25
6F6	PENTODE	M	H	OCT 7PIN 7L	0.7				SINGLE CLASS A PENTODE	250	250	-16.5		34	6.5	200	80000	2500	3.0	7000
									315	315	-22		42	8	200	75000	2650	5.0	7000
								SINGLE CLASS A TRIODE	250		-20		31		7	2600	2700	0.85	4000
								CLASS AB1 PENTODES (2 TUBES) FIXED BIAS	375	250	-26		34	5	PK. INPUT G TO G 82V			19	10000 P TO P
								CLASS AB1 PENTODES (2 TUBES) SELF BIAS	375	250	Rc 340 OHMS		54	8	94V			19	10000 P TO P
								CLASS AB1 TRIODES (2 TUBES) FIXED BIAS	350		-38		45		123V			18	6000 P TO P
								CLASS AB1 TRIODES (2 TUBES) SELF BIAS	350		Rc = 730 OHMS		50		132V			14	10000 P TO P
6F7	TRIODE PENTODE	G	H	SM. 7PIN 7D	0.3	TRIODE 2.0	2.5	3.0	AMPLIFIER TRIODE UNIT	100		-3		3.5		8	16000	500		
									AMPLIFIER PENTODE UNIT	250	100	-3	-35	6.5	1.5	900	[illegible]	1100		
						PENTODE				100	100	-3	-35	6.3	1.6	300	[illegible]	1050		
						0.008	3.2	12.5	CONVERTER TRIODE OSC.	100	Rg = 0.1 MEG.			2.4	0.15	GRID CURRENT				
									CONVERTER PENTODE MIXER	250	100	-10		2.8	0.6		[illegible]	300	CONVERSION CONDUCTANCE	
6H6	DUO-DIODE	M	H	OCT. 7PIN 7M	0.3	P1 TO P2		0.7	DIODE DETECTOR	MAX. A.C. PER PLATE 1000 VOLTS R.M.S.										
						P TO C		2.0		MAX PLATE CURRENT 4.0 MA.										
6J5G	TRIODE	G	H	OCT 7PIN 7N	0.3	3.4	3.8	3.3	CLASS A AMPLIFIER	250		-8		9.0		20	7700	2600		
6J7	PENTODE	M	H	OCT. 7PIN 7O	0.3	0.005	7.0	12.0	SAME AS 6C6											
6K6G	PENTODE	G	H	OCT. 7PIN 7L	0.4				CLASS A AMPLIFIER	250	250	-18		32	5.5	150	68000	2200	3.4	7000
										100	100	-7		9	1.6	150	103500	1450	0.33	12000
6K7	VARIABLE MU PENTODE	M	H	OCT 7PIN 7O	0.3	0.005	7.0	12.0	R.F. AMPLIFIER	250	125	-3	-52.5	10.5	2.6	990	[illegible]	1650		
									250	100	-3	-42.5	7.0	1.7	1160	[illegible]	1450		
									90	90	-3	-38.5	5.4	1.3	400	[illegible]	1275		
6L5G	TRIODE	G	H	OCT. 6PIN 6H	0.15	2.7	3	5	CLASS A AMPLIFIER	250		-9	-20	8		17	9000	1900		
									135		-5	-11	5.5		17	11300	1500		
6L6	BEAM TYPE TETRODE	M	H	OCT. 7PIN 7P	.9				CLASS A AMP.	250	250	-14		72	5	135	22500	6000		
									CLASS A AMP (SINGLE TUBE) SELF BIAS	300	200	Rc = 220 OHMS		51	3				6.5	4500
									CLASS A AMP (SINGLE TUBE) FIXED BIAS	375	250	-17.5		57	2.5				11.5	4000
									PUSH PULL CLASS A1 SELF BIAS	250	250	Rc = 125 OHMS		120	10				13.8	5000
									PUSH PULL CLASS A1 FIXED BIAS	250	250	-16		120	10				14.5	5000
									PUSH PULL CLASS AB1 SELF BIAS	400	300	Rc = 200 OHMS		112	7				32	6600
									PUSH PULL CLASS AB1 FIXED BIAS	400	300	-25		102	6				34	6600
									PUSH PULL CLASS AB2 FIXED BIAS (2 TUBES)	400	250	-20		80 TO 168	4 TO [illegible]		INPUT POWER [illegible] W		40	6000
									PUSH PULL CLASS AB2 FIXED BIAS (2 TUBES)	400	300	-25		102 TO 230	6 TO [illegible]		.35W		60	3800
6L7	PENTAGRID MIXER	M	H	OCT. 7PIN 7F	.3	G1-G3 = .12; G1-P = .0005; G3-P = .025; G1 IN = 11.5; G3 IN = 8.5 OUTPUT 12.5			MIXER			-6 G1	G1							
										250	150	-15 G3	-45	3.3	8.3		1 MEG.	350	OSC PEAK 18V MIN	
												-3 G1	-15 G1							
									AMPLIFIER	250	100	-3 G3	-15 G3	5.3	5.5	880	.8 MEG.	1100		
6N6G	DYN.-CPLD. DUAL TRIODES	G	H	OCT. 7PIN 7E	.8				DYNAMIC COUPLED AMP (1 TUBE)	300	INPUT P 300	0		45	INPUT P [illegible]	58	24000	2400	4	7000
									" " PUSH PULL (2 TUBES)	325	325	0		102	18	INPUT SIGNAL 43V RMS G TO G			13.5	10000
6N7	DOUBLE TRIODE	M	H	OCT 8PIN 8L	8	SAME AS 6A6														
6P7	TRIODE PENTODE	M	H	OCT 8PIN 8M	.3	2 / .01	2.5 / 3.3	3 / 10	TRIODE PENTODE SAME AS 6F7											
6Q6G	SINGLE DIODE TRIODE	G	H	OCT. 6PIN 6L	.15	1.8	2.5	5.2	TRIODE UNIT AMPLIFIER	250		-3		1.2		65		1050		
										135		-1.5		.9		65		1000		
6Q7	DUO DIODE TRIODE	M	H	OCT. 7PIN 7Q	.3	1.3	2.7	5.7	TRIODE UNIT AMPLIFIER	250		-3		1.1		70	58000	1200		
										100		-1.5		.35		70	87500	800		
									RES. COUPLED AMPLIFIER	300	Rc = 3000 OHMS				GAIN = 45				52V.	R PLATE [illegible] MEG. R NEXT 0.5 MEG.
6R7	DUO DIODE TRIODE	M	H	OCT. 7PIN 7Q	.3	2.3	2.5	4.5	TRIODE UNIT-AMPLIFIER	250		-9		9.5		16	8500	1900		
									RES. COUPLED AMPLIFIER	300	Rc = 3800 OHMS				GAIN = 10				68V.	[illegible]
6S7G	VAR. MU PENTODE	G	H	OCT. 7PIN 7O	.15	.007	4.6	7.8	AMPLIFIER	250	100	-3	-38.5	8.5	2	1100	.63 MEG.	1750		
										135	67.5	-3	-25	3.7	.9	850	.68 MEG.	1250		
6T7G	DUO DIODE TRIODE	G	H	OCT 7PIN 7Q	.15	1.7	1.8	3.1	TRIODE UNIT-AMPLIFIER	250		-3		.9		65	.65 MEG.	1000		
										100		-1.5		.3		65	.95 MEG.	680		
									RES. COUPLED AMPLIFIER	SEE 6Q7										
6U7G	VARIABLE MU PENTODE	G	H	OCT 7PIN 7O	.3	SAME AS 6D6														

RECEIVING TUBE CHART

6.3 VOLT DETECTOR AND AMPLIFIER TUBES (CONT.)

	DESCRIPTION: TYPE	GLASS OR METAL	FIL. OR HTR.	BASE [SEE SOCKET CONNECTION CHART]	FIL. CURRENT AMPS.	CAPACITANCES MMFD.: GRID PLATE	IN-PUT	OUT-PUT	TYPICAL OPERATING CONDITIONS: APPLICATION	PLATE SUP. VOLTS	SCR. GRID VOLTS	CONTROL GRID VOLTS	CUT OFF BIAS VOLTS	PLATE CURRENT MA	SCR. CURRENT MA	μ	Rp OHMS	Gm MICROMHOS	MAX. UNDISTORTED OUTPUT WATTS	LOAD RESISTANCE OHMS
6V6	BEAM TYPE TETRODE	M	H	OCT. 7 PIN 7P	.45				CLASS A AMPLIFIER (SINGLE)	250	250	-12.5		45	4.5	218	52000	4100	4.25	5000
									CLASS AB1 (2 TUBES)	300	300	-20		78 TO 90	5 TO 13.5				13.5	8000 (P TO P)
										250	250	-15		70 TO 79	5 TO 12				8.5	10000 (P TO P)
6V7G	DUO-DIODE TRIODE	G	H	OCT. 7 PIN 7Q	.3	1.5	1.5	4.3	SAME AS 85											
6Y7G	DOUBLE TRIODE	G	H	OCT. 8 PIN 8L	.6				SAME AS 79											
36	TETRODE	G	H	SM. 5 PIN 5J	.3	.007	3.7	9.2	AMPLIFIER	250	90	-3		3.2	1.7	595	.55 MEG	1080		
										180	90	-3		3.1		525	.5 MEG	1050		
										100	55	-1.5		1.8		470	.55 MEG	850		
									BIASED DETECTOR	180	67.5	-6		.1						.25 MEG.
37	TRIODE	G	H	SM. 5 PIN 5A	.3	2	3.5	2.9	AMPLIFIER	250		-18		7.5		9.2	8400	1100		
										180		-13.5		4.3		9.2	10200	900		
										90		-6		2.5		9.2	11500	800		
									BIASED DETECTOR	250		-28		.2						
38	PENTODE	G	H	SM. 5 PIN 5D	.3	.3	3.5	7.5	CLASS A AMPLIFIER	250	250	-25		22	3.8	120	1 MEG.	1200	2.5	10000
										100	100	-9		7	1.2	120	.14 MEG	1100	.27	15000
39/44	PENTODE	G	H	SM. 5 PIN 5D	.3	.007	3.5	10	AMPLIFIER	250	90	-3	-42.5	5.8	1.4	1050	1 MEG.	1050		
										180	90	-3	-42.5	5.8	1.4	750	.75 MEG.	1000		
										90	90	-3	-42.5	5.6	1.6	360	.375"	960		
									MIXER	250	90	-7	OSCILLATOR PEAK 6 VOLTS							
41	PENTODE	G	H	MED. 6 PIN 6E	.4				CLASS A AMPLIFIER	250	250	-18		32	5.5	150	68000	2200	3.4	7600
										100	100	-7		9	1.6	150	103500	1450	.33	12000
42	PENTODE	G	H	MED. 6 PIN 6E	.7				CLASS A PENTODE	315	315	-22		42	8	260	1 MEG.	2600	5	7000
										250	250	-16.5		34	6.5	190	80000	2350	3	7000
									CLASS A TRIODE	250		-20		31		6.2	2700	2300	.65	3000
									FOR PUSH PULL SERVICE SEE 6F6											
75	DUO DIODE TRIODE	G	H	MED. 6 PIN 6F	.3	1.7	1.7	3.8	TRIODE UNIT AMP.	250		-2		.8			91000	1100		
									TRIODE UNIT RES COUP.	300	Rc=3900				GAIN=53				51V	R PLATE=.1 MEG R NEXT GRID=.25
76	TRIODE	G	H	MED. 5 PIN 5A	.3	2.8	3.5	2.5	AMPLIFIER	250		-13.5		5		13.8	9500	1450		
										100		-5		2.5		13.8	12000	1150		
									RES. COUP. AMP.	300	Rc=6400 OHMS			GAIN=10					95 V	R PLATE=.1 MEG R NEXT GRID=.25
									BIASED DETECTOR	250	Rc= 30000 – 150,000 OHMS									
77	PENTODE	G	H	SM. 6 PIN 6J	.3	.007	4.7	11	AMPLIFIER	250	100	-3		2.3	.5	1500	1.5 MEG	1250		
										100	60	-1.5		1.7	.4	715	.65 MEG	1100		
									BIASED DETECTOR	250	100	-4.3 (OR Rc=10000)								.5 MEG.
										250	50	-2 (OR Rc=3000)								.25 MEG.
										100	36	-2 (OR Rc=12500)								.25 MEG.
78	VAR. MU PENTODE	G	H	SM. 6 PIN 6J	.3	.007	4.5	11	SAME AS 6K7											
79	DOUBLE TRIODE	G	H	SM. 6 PIN 6N	.6				CLASS B (2 SECTIONS)	250		0		10.6 TO 50					8	14000 (P TO P)
										180		0		7.6 TO 40					5.5	7000 (P TO P)
85	DUO-DIODE TRIODE	G	H	SM. 6 PIN 6F	.3	1.5	1.5	4.3	TRIODE UNIT AMP.	250		-20		8		8.3	7500	1100	.35	20000
										135		-10.5		3.7		8.3	11000	750	.075	25000
									TRIODE UNIT RES COUP.	300	Rc = 8300 OHMS			GAIN=5.75					82V	R PLATE=.1 MEG. R NEXT GRID=.25

7.5 VOLT DETECTOR AND AMPLIFIER TUBES

	TYPE	GLASS OR METAL	FIL. OR HTR.	BASE	FIL. CURRENT AMPS.	GRID PLATE	INPUT	OUTPUT	APPLICATION	PLATE SUP. VOLTS	SCR. GRID VOLTS	CONTROL GRID VOLTS	CUT OFF BIAS VOLTS	PLATE CURRENT MA	SCR. CURRENT MA	μ	Rp OHMS	Gm MICROMHOS	MAX. UNDISTORTED OUTPUT WATTS	LOAD RESISTANCE OHMS
10	TRIODE	G	F	4G MED. 4 PIN	1.25	7	4	3	AMPLIFIER	350		-31		16		8	5150	1550	.9	11000
										425		-39		18		8	5000	1600	1.6	10000
50	TRIODE	G	F	4G MED. 4 PIN	1.25	8.4	44	27	AMPLIFIER	350		-63		45		3.8	1900	2000	2.4	4100
										450		-84		55		3.8	1800	2100	4.6	4350
1602	LOW MICROPHONIC TRIODE	G	F	4G MED 4 PIN	1.25	7	4	3	AMPLIFIER	350		-32		16		8	5150	1550	.9	11000
					(FORMERLY TERMED 10 SPECIAL)					425		-40		18		8	5000	1600	1.6	10200

SERIES FILAMENT POWER OUTPUT TUBES

	TYPE	GLASS OR METAL	FIL. OR HTR.	BASE	FIL. CURRENT AMPS.	GRID PLATE	INPUT	OUTPUT	APPLICATION	PLATE SUP. VOLTS	SCR. GRID VOLTS	CONTROL GRID VOLTS	CUT OFF BIAS VOLTS	PLATE CURRENT MA	SCR. CURRENT MA	μ	Rp OHMS	Gm MICROMHOS	MAX. UNDISTORTED OUTPUT WATTS	LOAD RESISTANCE OHMS
12A5	PENTODE	G	H	7S SM. 7 PIN	.3A/12.6V .6A/6.3V				CLASS A PENTODE AMP	100	100	-15		17	3	70	35000	1900		
										180	27	-27		36	6	80	32000	2500		
12A7	PENTODE DIODE	G	H	7R SM. 7 PIN	.3A/12.6V				AMPLIFIER	135	135	-13.5		9		100	100000	975	.55	13500
									RECTIFIER	125		30 (MAX)								
18	PENTODE	G	H	6G MED. 6 PIN	.3A/14V				AMPLIFIER	250	250	-16.5		34	7.5	185	79000	2350	3	7000-9000
25A6	PENTODE	M	H	7L OCT. 7 PIN	.3A/25V				SAME AS TYPE 43											
25A7G	PENTODE DIODE	G	H	8N OCT. 8 PIN	.3A/25V				AMPLIFIER	SAME AS TYPE 43										
									RECTIFIER	125		75 (MAX)								
25B5	DIRECT CPLD DUAL TRIODE	G	H	6G MED 6 PIN	.3A/25V				DYNAMIC COUPLED AMPLIFIER	110		0		45		25	11400	2200	2	2000
										180	100+	0	21	46	5.8	35	15200	2300	3.8	4000
25B6G	PENTODE	G	H	7L OCT. 7 PIN	.3A/25V				CLASS A AMPLIFIER	95	95	-15		45	4 TO 12			4000	1.75	2000
25L6	TETRODE	M	H	7S OCT. 7 PIN	.3A/25V				CLASS A AMPLIFIER	110	110	-8		45	3.5	80	10000	8000	2.2	1500
25N6G				7S OCT. 7 PIN	SAME AS 25B5															
43	PENTODE	G	H	6E MED. 6 PIN	.3A/25V				AMPLIFIER	95	95	-15		20	4	90	45000	2000	.9	4500
										135	135	-20		37	8	85	35000	2450	2	4000
48	TETRODE	G	H	MED. 6 PIN 4Q	.4A/30V				AMPLIFIER	96	96	-19		52	9			3800	2	1500
										125	100	-20		56	9.5			3900	2.5	1500

RECTIFIERS

TYPE NO	DESCRIPTION: HALF- OR FULL WAVE	HIGH VACUUM OR MERCURY VAPOR	GLASS OR METAL	CATHODE	BASE (SEE SOCKET LAYOUT CHART)	FILAMENT: V.	AMP.	MAX. VOLTS RMS PER ANODE	MAX. PEAK INVERSE VOLTS	MAX. OUTPUT CURRENT MA	MAX PEAK PLATE CURRENT	MIN. CHOKE BEFORE FILTER HENRIES	MAX VOLTS HEATER CATHODE	MAX D.C. VOLTS AT INPUT OF FILTER AT 80 MA. DRAIN: CONDENSER INPUT 8 MFD.	CHOKE INPUT
1-V	HALF	V	G	H	SM. 4 PIN 4D	6.3	0.3	350	1000	50			500	400 AT 50 MA. DRAIN	
5T4	FULL	V	M	F	OCT. 5 PIN 5E	5.0	2.0	450	1250	250				570	
								550	1550	250		10			480
5U4G	FULL	V	G	F	OCT. 8 PIN 8C OCT. 5 PIN 5E	5.0	3.0	500	1400	250				580	410
5V4G	FULL	V	G	H	OCT. 8 PIN 8D	5.0	2.0	400	1100	200	700			490	325
5W4	FULL	V	M	F	OCT. 5 PIN 5E	5.0	1.5	350	1000	110				390	
5X4G	FULL	V	G	F	OCT. 8 PIN 8E	5.0	3.0	SAME AS 5U4G AND 5Z3 EXCEPT FOR BASE							
5Y3G	FULL	V	G	F	OCT. 5 PIN 5E	5.0	2.0	SAME AS 80							

RECEIVING TUBE CHART

TYPE NO.	DESCRIPTION: HALF OR FULL-WAVE	HIGH-VACUUM OR MERCURY VAPOR	GLASS OR METAL	CATHODE	BASE (SEE SOCKET LAYOUT CHART)	FILAMENT V.	FILAMENT AMP.	MAX. VOLTS RMS PER ANODE	MAX. PEAK INVERSE VOLTS	MAX. OUTPUT CURRENT MA.	MAX. PEAK PLATE CURRENT	MIN. CHOKE BEFORE FILTER HENRIES	MAX. VOLTS HEATER CATHODE	MAX. D.C. VOLTS AT INPUT OF FILTER AT 80 MA. DRAIN: CONDENSER INPUT 8 MFD.	CHOKE INPUT
RECTIFIERS															
5Y4G	FULL	V	G	F	OCT.8-PIN 8E	5.0	SAME AS 80								
5Z3	FULL	V	G	F	MED.4-PIN 4B	5.0	3.0	500	1400	250				580	410
5Z4	FULL	V	M	H	OCT.5-PIN 5F	5.0	2.0	400	1100	125				500	330
6W5G	FULL	V	G	H	OCT.6-PIN 6M	6.3	0.9	350		100			500		
6X5	FULL	V	M	H	OCT.6-PIN 6M	6.3	0.6	350	1250	75	325		400	400	290
6Z4/84	FULL	V	G	H	SM.5 PIN 5M	6.3	0.3	350	1000	60	200		500	410	290
12Z3	HALF	V	G	H	SM.4-PIN 4D	12.6	0.3	250	700	60			350	280	
25Z5	DOUBLER	V	G	H	SM.6 PIN. 6R	25.0	0.3	125		100	500			192 (16 MFD.)	
	HALF (2 SECT.)							125		85	500			85	
25Z6	DOUBLER	V	M	H	OCT.7 PIN 7W	25.0	0.3	125		85	500				
	HALF (2 SECT.)							125		85	500				
80	FULL	V	G	F	MED.4 PIN 4B	5.0	2.0	350		125				400	
								400		110				445	
								550		135		20			440
81	HALF	V	G	F	MED.4 PIN 4A	7.5	1.25	700		85				700	550
82	FULL	MV	G	F	MED.4 PIN 4B	2.5	3.0	500	1400	125	400			620 (4 MFD.)	440
83	FULL	MV	G	F	MED.4 PIN 4B	5.0	3.0	500	1400	250	800				
83V	FULL	V	G	H	MED.4 PIN 4C	5.0	2.0	400	1100	200	700			500	330
878	HALF	V	G	F	MED.4 PIN 4M	5.0	2.5	7100	20000	5					
879	HALF	V	G	F	MED.4 PIN 4M	2.5	1.75	2650	7500	7.5	100				
0Z3	FULL	GAS	G	COLD	SM.5 PIN 5K			350	1250	75 MAX. 30 MIN.	200			425	300
0Z4	FULL	GAS	M	COLD	OCT.5 PIN 5L										
0Z4G	FULL	GAS	G	COLD	OCT.5 PIN 5L										
BA	FULL	GAS	G	COLD	MED.4 PIN 4F			350	1000	350	1000				300
BH	FULL	GAS	G	COLD	MED.4 PIN 4F			350	1000	125	400				300
BR	HALF	GAS	G	COLD	MED.4 PIN 4E			300	850	50	200				

6.3 VOLT CATHODE-RAY TUNING INDICATORS

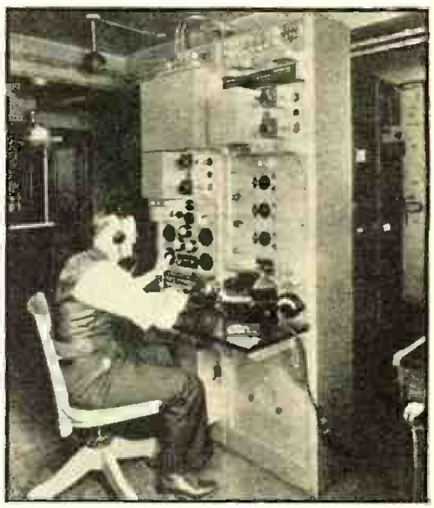
TYPE NO	DESCRIPTION		BASE (SEE SOCKET CONNECTION CHART)	FILAMENT CURRENT AMPS.	PLATE SUPPLY VOLTS	TARGET VOLTS	GRID BIAS FOR 0 SHADOW	GRID BIAS FOR 90° SHADOW	PLATE CURRENT MA. (ZERO BIAS)	TARGET CURRENT MA.	PLATE RESISTOR MEGS.
6AB5	SHADED SECTOR		SM. 6 PIN 6K	0.15	135	135	-7.5	0	0.5	4.5	0.25
6E5	SHADED SECTOR		SM. 6 PIN 6K	0.3	250	250	-8.0	0	0.24	4.5	1.0
					100	100	-3.3	0	0.19	4.5	0.5
6G5	SHADED SECTOR	REMOTE CUT-OFF	SM. 6 PIN 6K	0.3	250	250	-22	0	0.24	4.5	1.0
					100	100	-8	0	0.19	4.5	0.5
6H5	ONE FIXED 90% SHADED SECTOR, ONE VARIABLE	REMOTE CUT-OFF CURRENT LIMITING GRID	SM. 6 PIN 6K	0.3	250	250	-22	0		4.5	1.0
					100	100	-8.0	0		1.5	
6N5	SHADED SECTOR	REMOTE CUT-OFF	SM. 6 PIN 6K	0.15	135	135	-12	0	0.5	4.5	0.25
6T5	ANNULAR SHADOW	REMOTE CUT-OFF	SM. 6 PIN 6K	0.3	250	250	-22	0	0.24	3.0	1.0
6U5	SAME AS 6G5 EXCEPT FOR BULB SIZE										

Automatic, Ship-to-Shore

RADIO Telephone

Saves Lives

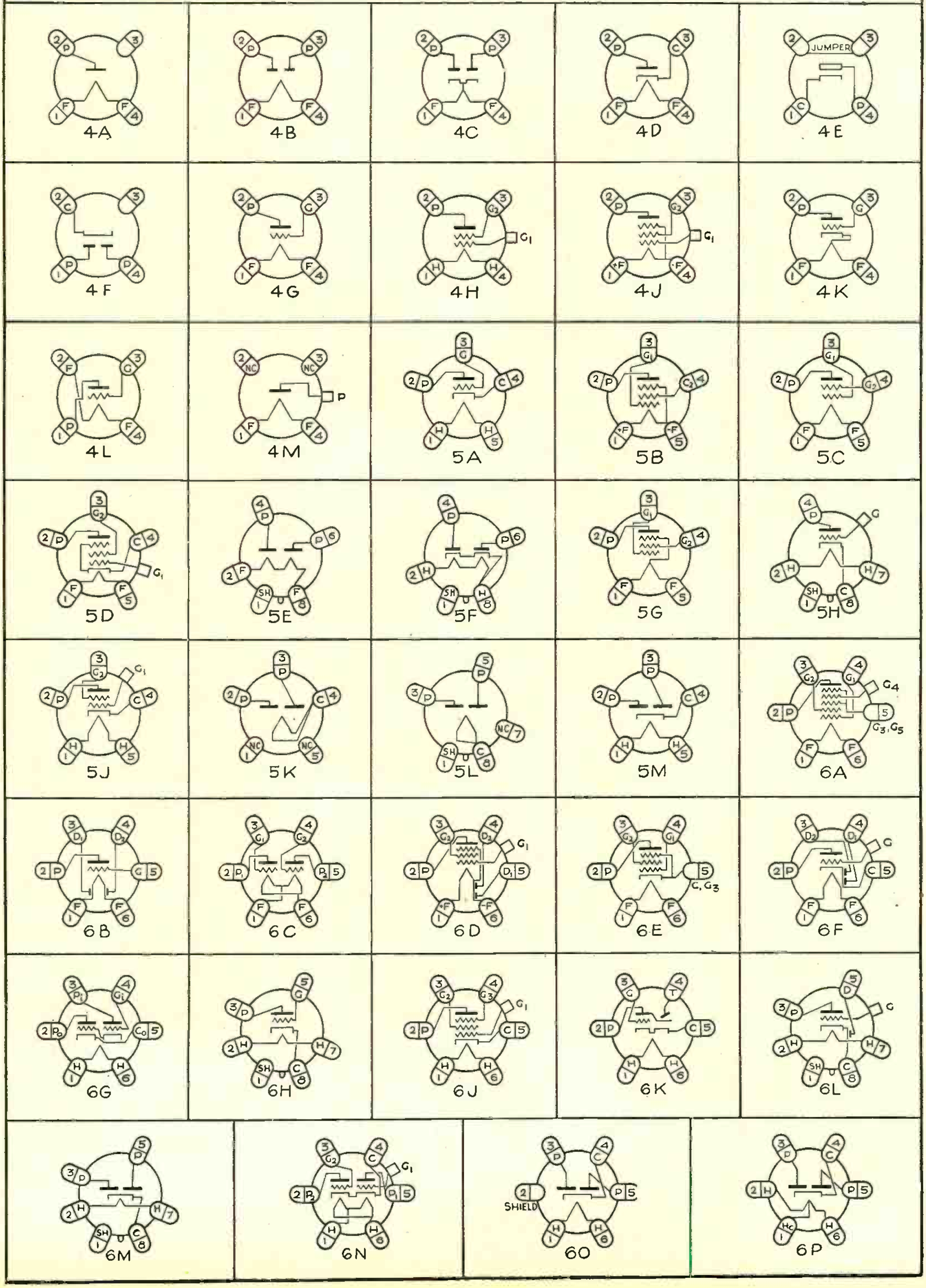
By John Strong



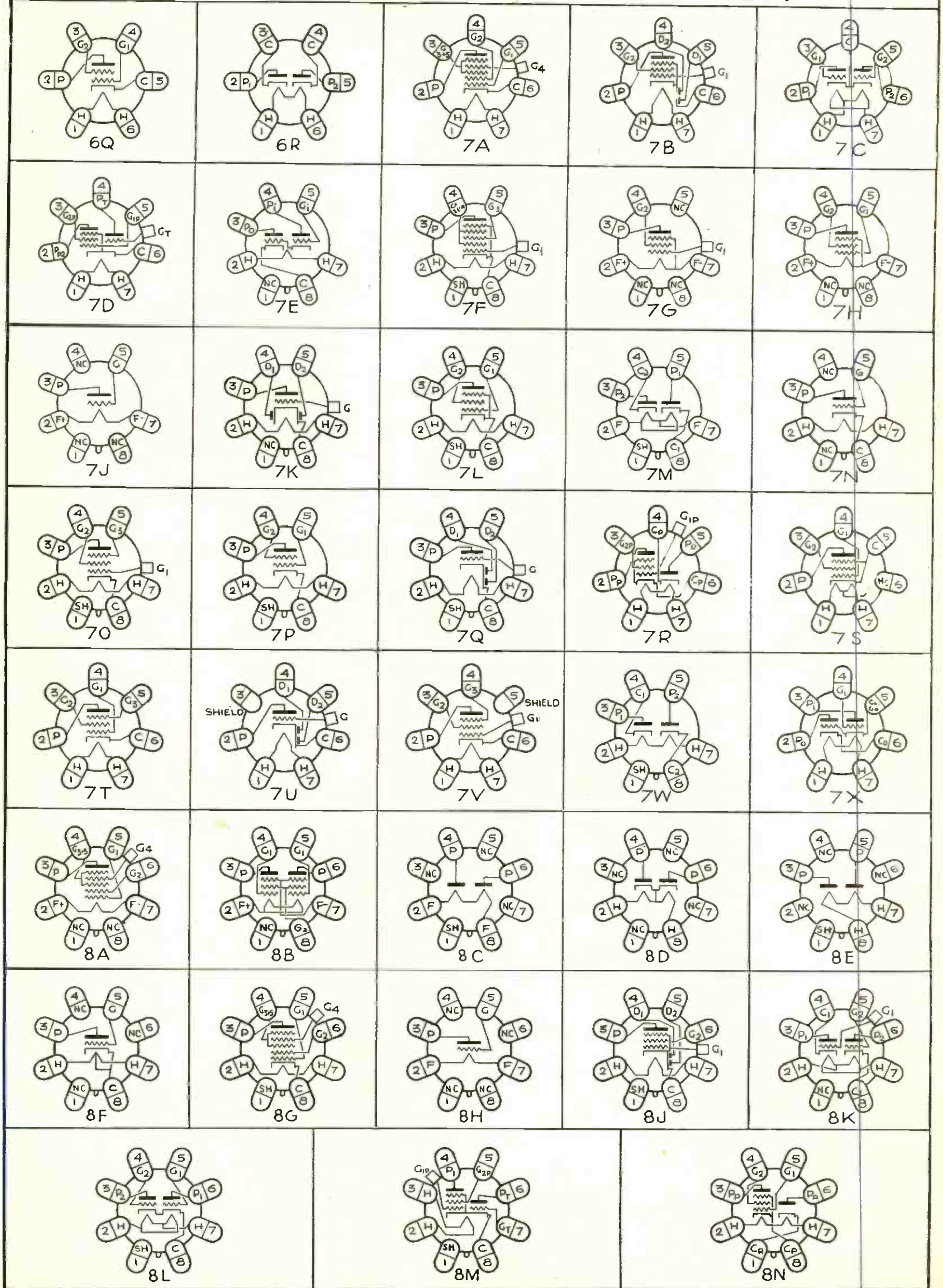
AN unforeseen contribution to the saving of life and the mitigation of suffering is being made by the ship-to-shore radio telephone system established by The Atlantic Communications Corporation to enable the parent refining company or other subscribers to direct from their home office buildings in Philadelphia the operations of their tugs plying on the Delaware and Schuylkill rivers.

A typical example of this unexpected development is provided by the events following the receipt by the operator of the system of a radiogram from the captain of the M.S. *Point Breeze* calling for help for one of the ship's engineers who had been taken suddenly ill. The message was flashed from the vessel at 4:15 in the morning as it approached its anchorage in the Delaware, inbound from Providence. The Atlantic Refining Company's tug *Atlantic*, off Paulsboro, New Jersey, was reached by the radio phone and instructed to meet the *Point Breeze* at its anchorage. The tug arrived alongside within less than an hour, took the desperately ill man aboard, sped three miles up the river, transferred him to an ambulance waiting at the dock, and enabled him to reach the hospital at 7 a.m. (*Turn to page* 107)

SOCKET CONNECTIONS BOTTOM VIEW



SOCKET CONNECTIONS BOTTOM VIEW



TRANSMITTING TUBE CHART

TYPE NO.	DESCRIPTION CATH	DESCRIPTION BASE	FILAMENT VOLTS	FILAMENT AMPS	CAPACITANCES (MICRO-MICRO FARADS) C_{GP}	C_{GF}	C_{PF}	APPLICATION	RATED VOLTAGES E_P	E_G	SC. GRID	SUP GRID	RATED MA. I_P	I_G	SC. GRID	POWER PL. DIS.	POWER OUT PUT	DRIVER POWER WATTS	GRID LEAK OHMS
TRIODES																			
10	THOR. FIL.	MED. 4 PIN	7.5	1.25	7.0	4.0	3.0	CLASS C AMP.-OSC.	450	-100			60	10		15	12	4.0	10,000
								CLASS B MOD. ⊗	425	-50	TWO TUBES		8				35		
UNITED HV12	THOR. FIL.	JUMBO 4 PIN	10.0	4.0	13.0	7.0	5.0	CLASS C AMP.-OSC.	2000				250	60		200	300		
								CLASS C MOD.-AMP.	1750				200	60		125	250		
RK18	THOR. FIL.	MED. 4 PIN	7.5	1.25	5.0	3.8	2.0	CLASS C AMPLIFIER	1000	-150			85	15		40	50	3.0	15,000
T20*	THOR. FIL.	MED. 4 PIN	7.5	1.75	4.0			CLASS C AMP.-OSC.	750	-100			75	17		20	42	5.0	6,000
								CL. B MOD. 2 TUBES⊗	800	-40			20				70		
RK24	OXIDE FIL.	SMALL 4 PIN	2.0	0.12	5.5	3.5	3.0	5 METER PORT. OSC.	180	-45			20			1.5	1.2		
HV27	THOR. FIL.	JUMBO 4 PIN	10.0	4.0	14.0	7.0	4.5	CLASS C AMP.-OSC.	2000				250	60		200	300		
								CLASS C MOD.-AMP.	1750				200	60		125	250		
								CLASS B MOD. ⊗	2000										
RK30	THOR. FIL.	MED. 4 PIN	7.5	3.25	2.5	2.7	1.0	CLASS C AMPLIFIER	1250	-175			70	15		35	65	4.0	10,000
								CLASS C MOD.-AMP.	1000	-200			70	15		35	50	4.0	10,000
								CL. B LINEAR AMP.	1000	-55			42			35	14		
RK31	THOR. FIL.	MED. 4 PIN	7.5	3.0				CLASS C AMPLIFIER	1000	-50			85	15		35	50	5.0	3,000
								CLASS B MOD. ⊗	1250	0	TWO TUBES		30				140		
RK32*	THOR. FIL.	MED. 4 PIN	7.5	3.25	3.0	2.0	1.0	CLASS C AMPLIFIER	1250	-250			100	25		50	75	7.5	10,000
								CLASS C MOD. AMP.	1000	-185			100	25		50	50	7.5	7500
RK34*	OXIDE CATH.	MED. 7 PIN	6.3	0.8	2.7	4.2	2.1	CLASS C AMP.-OSC.	300	-36			80	18		10	14		2000
								CLASS B MOD. ⊗	300	-15			15				12		
RK35*	THOR. FIL.	MED. 4 PIN	7.5	3.25	2.7	3.5	0.4	TELEPHONY CLASS C AMP. OSC.	1000	-320			100	20		35	65	7.0	20,000
								TELEGRAPHY CLASS C AMP. OSC.	1500	-400			100	20		35	115	7.0	20,000
35T*	THOR. FIL.	MED. 4 PIN	5.0	4.0	1.9	2.5	0.3	TELEPHONY CLASS C AMP.-OSC.	1500	-180			100	20		35	120	4.0	5000
								TELEGRAPHY CLASS C AMP.-OSC.	1500	-180			135	20		35	170	4.0	5000
	A MAXIMUM OF 2000 VOLTS CAN BE APPLIED TO THE 35T. PLATE DISSIPATION SHOULD NOT EXCEED 70 WATTS, 150 MA PLATE CURRENT FOR CW, 125 FOR PHONE							CLASS B MOD. ⊗	1500				155				235		
RK36*	THOR FIL.	MED 4 PIN	5.0	8.0	5.0	4.5	1.0	CLASS C AMP.-OSC.	3000	-360			165	35		100	370	15	
								CLASS C AMPLIFIER TELEPHONY	2000	-360			150	30		100	200	15	15,000
RK37*	THOR FIL.	MED 4 PIN	7.5	3.25	3.2	3.5	0.2	CLASS C AMP.-OSC.	1250	-90			90	20		35	78	3.2	5000
								CLASS B MOD ⊗	1250	-32	TWO TUBES		32	29			125	2.8	
								CL. B LINEAR AMP	1250	-45			43			35	19	1.8	
								CL. B LINEAR AMP	PEAK OUTPUT 76 WATTS										
RK38*	THOR FIL.	MED 4 PIN	5.0	8.0	4.3	4.6	0.9	CLASS C AMP.-OSC.	2000	-200			150	30		100	225	11.0	15,000
								CLASS B MOD ⊗	2000	-52	TWO TUBES		36	39			330	5.8	
								CL. B LINEAR AMP	2000	-100			75			115	55	7.0	
								CL. B LINEAR AMP	PEAK OUTPUT 220 WATTS										
T55*	THOR FIL	MED 4 PIN	7.5	2.75	3.75	4.0	1.5	CLASS C AMPLIFIER	1500	-200	40		150	25		55	168	15	8000
								OSCILLATOR	1250	-200	40		125			55	66		8000
F100	TUNGS FIL	SPECIAL	11.0	25.0	10.0	4.0	2.0	CLASS C AMPLIFIER	2000	-300			500			500	600		10,000
F108A	TUNGS FIL	JUMBO 4 PIN	10.0	11.0	7.0	3.0	2.0	CLASS C AMPLIFIER	3000	-350			200			175	400		15,000
HF100*	THOR FIL	MED 4 PIN	10.0	2.0	4.5	3.5	1.4	OSCILLATOR	1200	-225			130	30		60	96		7500
								CL. B LINEAR AMP	1500	-55			75	1.5		80	42	PEAK 3	
								CLASS C AMPLIFIER	1500	-200			150	18		55	170	6.0	10,000
								CL. C AMP. TELEPHONY	1250	-250			110	21		33	105	8.0	10,000
								CLASS B MOD ⊗	1500	-52	TWO TUBES		50				260	2.0	
100TL*	THOR FIL	MED 4 PIN	5.0	6.5	2.3	2.0	0.4	CLASS C AMPLIFIER	3000	-600			135	30		105	300		20,000
								TELEPHONY OR	2000	-400			150	30		75	225		15,000
								TELEGRAPHY	1000	-200			200	30		80	120		7000
100TH*	THOR FIL	MED 4 PIN	5.0	6.5	2.0	2.2	0.3	CLASS B MOD ⊗	1250	0							260		
								CLASS C AMPLIFIER	3000	-210			135	45		105	300		5,000
								TELEPHONY OR	2000	-140			150	45		75	225		3000
								TELEGRAPHY	1000	-70			200	45		80	120		1500
ZB120		JUMBO 4 PIN	10.0	2.0	5.2	5.3	3.2	CLASS B MOD ⊗	1250	0	TWO TUBES		95				245	4.0	
								CLASS B MOD ⊗	1500	-9	TWO TUBES		60				300	5.0	
								CL. B LINEAR AMP	1250	0	TELEGRAPHY		150	21		187	120	1.2	
	A SELF BIAS RESISTOR OF 750 OHMS SHOULD BE INCLUDED IN THE FIXED BIAS FOR THE CLASS C MOD-AMP							CL. B LINEAR AMP	1250	0	TELEPHONY		95	8		74	45	1.5	
								CLASS C AMPLIFIER	1250	-135	TELEGRAPHY		160	23		55	145	5.5	6000
								CLASS C AMPLIFIER	1000	-400			120	21		25	95	5.0	7000
								CL. C GRID MOD AMP	1250	-75			90	7		70	42	1.6	750
HK154*	THOR FIL	MED 4 PIN	5.0	6.5	5.9	4.3	1.1	CLASS C AMPLIFIER	1000	-380			175	20		48	127	10.0	20,000
								CL. C AMPLIFIER -1-	1250	-460			170	20		50	162	12.0	23,000
								CL. C AMPLIFIER -2-	1500	-590			167	20		50	200	15.0	30,000
					1-MAXIMUM FOR TELEPHONY 2-MAXIMUN FOR TELEGRAPHY			CL. B LINEAR AMP	1500	-265			52			50	28	5.0	
								CLASS B MOD ⊗	1500	-265	TWO TUBES		40			95	250	10.0	
								CLASS B MOD ⊗	1000	-155	TWO TUBES		60			100	200	10.0	
T155*	THOR. TUNGS FIL	JUMBO 4 PIN	10.0	4.0	3.0	2.5	1.0	CLASS C AMP.-OSC.	3000	-250			200	60		155	450		4200
T200*	THOR FIL	JUMBO 4 PIN	10-11	4.0	7.0	5.0	3.0	CLASS C AMP.-OSC.	2500	-300			350	80		200	500		3750
								CLASS C MOD AMP	2000	-300			350	80		200	500		3750
C200* HF200	THOR FIL	JUMBO 4 PIN	10.5	3.4	5.8	5.2	1.2	CLASS C AMPLIFIER	2500	-300	TELEGRAPHY		200	18		120	380	8.0	17,000
								CLASS C AMP *	1750	-300	TELEPHONY		200	30		80	270	14.0	10,000
								CLASS B MOD ⊗	2500	-130	TWO TUBES		60				600	8.0	
C201	THOR FIL	JUMBO 4 PIN	10.0	3.25	9.0	6.0	1.8	CLASS B MOD	1250	-45	TWO TUBES		160			75	250		
								CL B. LINEAR	1250	-45			110			92	46		
								CLASS C AMPLIFIER	1250	-200	TELEPHONY		165	50		71	135		4000
								CLASS C AMPLIFIER	1250	-125	TELEGRAPHY		165	25		71	135		5000

*RECOMMENDED VALUES UP TO 56-60 MEGACYCLES—HIGH EFFICIENCY OBTAINED FROM THESE TUBES. AT 56-60 MEGACYCLES.

⊗ STATIC PLATE CURRENT IS GIVEN UNDER "IP" FOR TWO TUBES.

TRANSMITTING TUBE CHART

TYPE NO.	DESCRIPTION CATH	DESCRIPTION BASE	FILAMENT VOLTS	FILAMENT AMPS	CAPACITANCES MICRO-MICRO FARADS C_{GP}	C_{GF}	C_{PF}	APPLICATION	RATED VOLTAGES E_P	E_G	SG	SUP	RATED MA I_P	I_G	SG	POWER PLATE DISS	POWER OUTPUT	DRIVER POWER WATTS	GRID LEAK OHMS
TRIODES																			
C202	THOR FIL	JUMBO 4 PIN	10.0	3.25	8.0	5.5	2.0	CLASS B MOD	1250	- 100	TWO TUBES		160			75	250		
								CL. B LINEAR AMP	1250	- 100			110			92	46		
								CLASS C AMPLIFIER	1000	- 260	TELEPHONY		165	50		55	110		5000
								CLASS C AMPLIFIER	1250	- 260	TELEGRAPHY		165	25		71	135		10.400
203B	THOR-TUNGS	JUMBO 4 PIN	10.0	3.85	14.0	6.0	5.0	CLASS B MOD ⊗	1000	- 35	TWO TUBES		40				200		
HD203A	THOR TUNGS	JUMBO 4 PIN	10.0	4.0	12.0	7.0	5.0	CLASS C AMP-OSC.	2000		TELEGRAPHY		250	60		150	300		3000
								CLASS C AMP-OSC.	1750	- 180			250	60		150	300		3000
								CLASS B MOD ⊗	1750	- 67.5	TWO TUBES		36				500		
203A 303A C203A	THOR TUNGS	JUMBO 4 PIN	10.0	3.25	14.5	6.5	5.5	CLASS C AMPLIFIER	1250	- 125	TELEGRAPHY		150	25		100	130	7.0	5000
								CLASS C AMPLIFIER	1000	- 135	TELEPHONY		150	50		100	100	14.0	3000
								CL. B LINEAR AMP	1250	- 45			106			100	425		
HD203C	THOR TUNGS	JUMBO 4 PIN	10.0	4.0	9.0	6.0	4.0	CLASS C AMP-OSC.	2000	- 200	TELEGRAPHY		250	60			250		3333
HD211C					9.0	5.0	4.0	CLASS C AMP-OSC.	1750	- 200			250	60			250		3333
204A 304A 504A	THOR TUNGS	SPECIAL	11.0	3.85	15.0	12.5	2.3	CLASS C AMPLIFIER	2000	- 175			250	50		250	350		5000
304B *	THOR TUNGS	MED 4 PIN	7.5	3.25	2.5	2.0	0.7	CLASS B MOD ⊗	1250	- 110	TWO TUBES		40				140	10.0	
								CLASS C AMPLIFIER	1250	- 180	TELEGRAPHY		100				85		
								CLASS C AMPLIFIER	1000	- 180	TELEPHONY		100	25			65		7500
211 311	THOR TUNGS	JUMBO 4 PIN	10.0	3.25	14.5	6.0	5.5	CLASS C AMPLIFIER	1250	- 225	TELEGRAPHY		150	18		100	130	7.0	10,000
								CLASS C AMPLIFIER	1000	- 260			150	35		100	100	14.0	5000
								CL. B LINEAR AMP	1250	- 100			106			100	425		
211C 311C	THOR TUNGS	JUMBO 4 PIN	10.0	3.10	9.0	6.0	5.0	SAME AS 311											
316A*#	THOR TUNGS	NO BASE	2.0	3.65	1.6	1.2	0.8	CLASS C AMPLIFIER	450		TELEGRAPHY		80	12			7.5	SPECIAL ULTRA	
								CLASS C AMPLIFIER	400		TELEPHONY		80	12			6.5	HIGH FREQ TUBE	
242C	THOR TUNGS	JUMBO 4 PIN	10.0	3.25	13.0	6.1	4.7	CLASS B MOD ⊗	1250	- 80	TWO TUBES		50			100	200	25	
								CL. B LINEAR AMP	1250	- 90			120				50		
								CLASS C MOD AMP	1000	-160			150	50			100		3200
250TL *	THOR FIL	JUMBO 4 PIN	5.0	10.5	3.5	3.0	0.5	CLASS C AMPLIFIER	3000	-600			330	45		240	750		13,500
								CLASS C AMPLIFIER	2000	-400			350	45		200	500		9000
								CLASS C AMPLIFIER	1000	-200			300	45		100	200		4500
250TH *	THOR FIL	JUMBO 4 PIN	5.0	10.5	3.3	3.5	0.3	CLASS C AMPLIFIER	3000	-210			330	55		240	750		3800
								CLASS C AMPLIFIER	2000	-140			350	55		200	500		2550
								CLASS C AMPLIFIER	1000	- 70			300	55		100	200		1300
								CLASS B MOD ⊗	1400	0	TWO TUBES						575	APPROX.	
261A 361A	SEE 211C-311C																		
276A 376A	THOR FIL	JUMBO 4 PIN	10.0	3.0				SEE 211C-311C											
C300 HF300 *	THOR FIL	JUMBO 4 PIN	11.5	4.0	6.5	6.0	1.4	CLASS C AMP OSC	3000	-400	TELEGRAPHY		250	28		150	600	16.0	14.300
								CLASS C AMPLIFIER	2000	-300	TELEPHONY		250	36		115	385	17.0	8300
								CL. B LINEAR AMP	2500	-100			120	0.5		195	105	6.0	
								CLASS B MOD ⊗	2000	- 72	TWO TUBES		60				650	14.0	
300T*	THOR TUNGS	JUMBO 4 PIN	7.5	12.0	4.0	4.0	0.6	CLASS C AMPLIFIER	2500	-400			300	60		190	560	60.0	6700
								CL. B LINEAR AMP	2500	-150			200			300	200		
HK3540* HK354	THOR TUNGS	JUMBO 4 PIN	5.0	10.0	3.8	4.5	1.1	CLASS C AMPLIFIER	3000	- 275			150	27		150	300		10000
								CLASS B AMPLIFIER	3000	- 275	TWO TUBES		390				665	36.0	
500T *	THOR TUNGS	SPECIAL	7.5	20.0	4.5	6.0	0.8	CLASS C AMPLIFIER	2000	-400			450	100		250	650		4,000
								CLASS C AMPLIFIER	3000	-600			450	100		350	1000		6000
								CLASS C AMPLIFIER	4000	-800			450	100		450	1350		8000
756	THOR TUNGS	MED 4 PIN	7.5	2.0	8.0	3.5	2.7	CLASS C AMP-OSC.	850	- 75	TELEGRAPHY		110	20		34	60		3750
								CLASS C AMP-OSC	750	- 75	TELEPHONY		110	20		34	48		3750
								CLASS B AMPLIFIER	850	- 30	TWO TUBES		20				100		
800 *	THOR-TUNGS	MED 4 PIN	7.5	3.25	2.5	2.75	1.0	SEE RK30											
801	THOR TUNGS	MED 4 PIN	7.5	1.25	6.0	4.5	1.5	CLASS C AMP-OSC.	600	- 150			65	15		20	25	4.0	10,000
								CLASS C AMP-OSC.	500	-190			55	15		20	18	4.5	10800
								CL. B LINEAR AMP.	600	- 75			45			20	7.5		
								GRID BIAS MOD-AMP	600				50	2.0		20	10	2.0	
805 905	THOR TUNGS	JUMBO 4 PIN	10.0	3.25	6.5	8.5	10.5	CLASS C AMP OSC.	1500	-105			200	40		85	215	8.5	2625
								CLASS C AMPLIFIER	1250	-160			160	60		60	140	16.0	2650
								CL. B LINEAR AMP	1500	- 10			115	15		115	57.5	7.5	
								CL B AMPLIFIER ⊗	1250	0	TWO TUBES		148				300	7.0	
806	THOR TUNGS	JUMBO 4 PIN	5.0	10.0	3.4	6.1	1.1	CLASS C AMP-OSC.	3000	-600			195	25		135	450	20.0	24,000
								CLASS C AMPLIFIER	2500	-600			195	40		97	390	32.0	15,000
								CL. B LINEAR AMP.	3000	-240			70	0		140	70	5.0	
								CLASS B MOD. ⊗	3000	-240	TWO TUBES		20				660	10.0	
808 *	THOR TUNGS	MED 4 PIN	7.5	4.0	3.0	5.0	0.2	CLASS C AMP-OSC.	1500	-200			125	30		47.5	140	9.5	6,700
								CLASS C AMPLIFIER	1250	- 225			100	32		20	105	10.5	7,000
								CL. B LINEAR AMP.	1500	-35			45	1.0			22	2	
								CLASS B MOD. ⊗	1250	-15	TWO TUBES		40				190	7.8	
814	THOR TUNGS	JUMBO 4 PIN	10.0	4.0	13.0	7.0	5.5	CLASS C AMP-OSC	2000	-400			300	75		200	400	300	5200
822	THOR TUNGS	JUMBO 4 PIN	10.0	4.0	14.0	8.0	6.0	CLASS C AMP-OSC	2000	-220			300	60		200	400		3700
								CLASS B MOD	2000	- 90	TWO TUBES		50				500	300	
825	THOR TUNGS	MED 4 PIN	7.5	2.0	7.0	3.0	2.7	CLASS C AMP-OSC	750	- 180			110	25		40	50		7200
								CLASS B AMPLIFIER	850	- 67.5	TWO TUBES		50				82		
830 930	THOR TUNGS	MED 4 PIN	10.0	2.15	9.9	4.9	2.2	CLASS C AMPLIFIER	750	- 180			110	18		40	55	7.0	10000
								GRID BIAS MOD AMP	1000	- 200			50	20		40	15	3.0	
830B 930B	THOR TUNGS	MED 4 PIN	10.0	2.0	11.0	5.0	1.8	CLASS C AMP. OSC	1000	- 110	TELEGRAPHY		140	30		50	90	7.0	3670
								CLASS C AMP. OSC	800	- 150	TELEPHONY		95	20		26	50	5.0	7500
								CL. B LINEAR AMP	1000	- 35			85	6.0			26	6.0	
								CL B AMPLIFIER ⊗	1000	- 35	TWO TUBES		20				175	6.0	
834 *	SEE RK32																		
841 941	THOR TUNGS	MED 4 PIN	7.5	1.25	7.0	4.0	3.0	CLASS C AMP OSC.	450	- 32			50	12.5		85	14	1.25	2560
								CLASS C AMPLIFIER	350	- 36			50	18		60	11.5	1.75	2000
								CL. B AMPLIFIER ⊗	425	- 5	TWO TUBES		13				28		
841A	THOR TUNGS	MED 4 PIN	10.0	2.0	9.0	3.5	2.5	CLASS C AMP-OSC.	1250	-180			150	30			85		6000
								CLASS C AMPLIFIER	1000	-180			150	30					6000
838	THOR TUNGS	JUMBO 4 PIN	10.0	3.25	8.0	6.5	5.0	CLASS C AMP.-OSC	1250	- 80			150	30		100	130	6.0	3000
								CLASS C AMPLIFIER	1000	- 35			150	60		100	100	16.0	3000
								CLASS B MOD. ⊗	1250	0	TWO TUBES		74			100	130		

*RECOMMENDED VALUES UP TO 56-60 MEGACYCLES—HIGH EFFICIENCY OBTAINED FROM THESE TUBES AT 56-60 MEGACYCLES.
⊗ STATIC PLATE CURRENT IS GIVEN UNDER "IP" FOR TWO TUBES.

TRANSMITTING TUBE CHART

TYPE NO	DESCRIPTION CATH.	BASE	FILAMENT VOLTS	AMPS	CAPACITANCES MICRO-MICRO FARADS Cgp	Cgf	Cpf	APPLICATION	RATED VOLTAGES Ep	Eg	SG	SUP	RATED MA Ip	Ig	SG	POWER PL DISS.	OUTPUT	DRIVER POWER WATTS	GRID LEAK OHMS
TRIODES																			
849 949	THOR TUNGS	SPECIAL	11.0	5.0	33.5	17.0	3.0	CLASS C. AMPLIFIER	2000	-200			300	40		400	450		5000
								CLASS B. MOD ⊗	2500	-130	TWO TUBES		20			400	500	7	
852 952	THOR TUNGS	MED 4 PIN	10.0	3.25	2.6	1.9	1.0	CLASS C. AMP-OSC.	3000	-600			85	15		100	165	12	10,000
								CLASS C AMPLIFIER	2000	-500			67	30		100	75	23	10,000
								CL. B LINEAR AMP	3000	-250			43			100	40		
831	THOR-TUNG	SPECIAL	11.0	10.0	4.0	3.8	1.4	CLASS C AMPLIFIER	3500	-400			275	40		400	590	30	10,000
TETRODES PENTODES																			
RK20 RK20A	THOR TUNGS	MED 5 PIN	7.5	3.0 3.25	.012	11.0	10.0	CLASS C AMPLIFIER	1250	-100	300	0	80	7-10	37	40	64	1.0	15,000
								CLASS C AMPLIFIER	1250	-100	300	+45	92	7-10	32	40	80	1.0	15,000
								SUPP. MOD. AMP.	1250	-100	300	-45	43	7-10	36	40	18	1.0	15,000
RK23 RK25 RK25B	OXIDE CATH	MED 7 PIN	2.5 6.3	2.0 0.8	.02	10.0	10.0	CLASS C AMP-OSC.	500	-90	200	0	50	6-8	40	10	18	0.8	15,000
								CLASS C AMP-OSC.	500	-90	200	+45	55	6-8	35	10	24	0.8	15,000
								SUPP MOD. AMP.	500	-90	200	-45	32	6-8	40	10	5.5	0.8	15,000
RK28	THOR TUNGS	JUMBO 5 PIN	10.0	5.0	.02	15.5	5.5	CLASS C AMPLIFIER	2000	-100	400	0	120	10-12	75	125	160	1.8	10,000
								CLASS C AMPLIFIER	2000	-100	400	+45	140	10-12	60	125	200	1.8	10,000
								SUPP. MOD. AMP	2000	-100	400	-45	80	10-12	85	125	60	2.7	10,000
RK39 RK41	OXIDE CATH.	MED 5 PIN	6.3 2.5	0.9 2.4	0.2	13.0	10.5	CLASS C AMP-OSC	500	-60	250		95	3.0	12	42	35	0.26	10,000
								CLASS C AMPLIFIER	400	-50	250		95	2.5	8	33	25	0.18	10,000
								CLASS B R.F. AMP	500	-30	250		75	0.3	3		11		
305A*	THOR TUNGS	MED 4 PIN	10.0	3.1	0.14	10.5	5.4	CLASS C AMP-OSC.	1000	-270	200		125				85		
								CLASS C AMPLIFIER	800	-270	200		125				70		
								CLASS B RF AMP.	1000	-135	200		90			60	30		
306A	THOR TUNGS	MED 5 PIN	2.75	2.0	0.35	13.0	13.0	CLASS C AMPLIFIER PLATE & SCREEN MODULATED	300	-50	180		36	3.0	15		7		10,000
307A	THOR TUNGS	MED 5 PIN	5.5	1.0	0.55	15.0	12.0	SUPP MOD. CL.C AMP	500	-35	200	-50	40	1.5	20		6		
								CLASS C AMP-OSC.	500	-35	250	0	60	1.4	13		20		
802	OXIDE CATH	MED 7 PIN	6.3	0.95	0.15	12.0	8.5	CLASS C AMPLIFIER	500	-100	250	+40	45	2.0	12	10	16	0.25	15,000
								SUPP. MOD. AMP.	500	-90	200	-45	22	4.5	28	10	3.5	0.5	15,000
								CL. B LINEAR AMP	500	-28	200	0	25	0	7	10	3.5	0.18	
803	THOR TUNGS	JUMBO 5 PIN	10.0	3.25	0.15	15.5	28.5	CLASS C AMPLIFIER	2000		500	-30	160	16	42	125	210	1.6	5000
								SUPP MOD AMP.	2000		500	-50	80	1.5	55	125	53	1.6	5000
								CL. B LINEAR AMP	2000		500	-40	80	3.0	15	125	54	1.5	
804	THOR TUNGS	MED 5 PIN	7.5	3.0	0.01	16.0	14.5	CLASS C AMPLIFIER	1250	-100	300	0	80	7.0	33	40	64	0.9	15,000
								CLASS C AMPLIFIER	1250	-100	300	+45	92	7.0	27	40	80	0.9	15,000
								SUPP MOD AMP	1250	-100	300	-50	48	7.0	35.5	40	21	0.85	15,000
807	THOR TUNGS	MED 5 PIN	6.3	0.9	0.2	11.6	5.6	CLASS C AMP-OSC	400	-50	250		95	2.5	9		25	0.18	20,000
								CLASS C MOD-AMP	325	-75	270		80	1.5	9		17	0.15	50,000
								CL. B LINEAR AMP	400	-25	250		75	0	4		9	0.25	
						TWO TUBES		CL. AB MOD ⊗	400	-25	300		102	20			60	0.35	
850	THOR TUNGS	JUMBO 4 PIN	10.0	3.25	0.2	17.0	26.0	CLASS C MOD-AMP	1000	-100	140		125	45		60	65	10	5000
								CLASS C AMP-OSC.	1250	-150	175		160	35		70	130	10	4300
860	THOR TUNGS	MED 4 PIN	10.0	3.25	0.08	7.75	7.5	CLASS C AMPLIFIER	3000	-150	300		85	15		100	165	7.0	10,000
								CLASS C MOD-AMP	2000	-225	300		67	30		69	75	15.0	10,000
								CL. B LINEAR AMP.	3500	-150	300		43			100	40		
861	THOR-TUNGS	SPECIAL	11.0	10.0	0.10	17.0	13.0	CLASS C AMPLIFIER	3500	-250	600		275	30		400	590	25	8000
865		MED 4 PIN	7.5	2.0	0.10	8.5	8.5	CLASS C AMP-OSC.	750	-80	125		40	5.5		14	16	1.0	14,000
								CLASS B MOD-AMP.	500	-120	125		40	9.0			10	2.5	13,500
								CL. B LINEAR AMP.	750	-30	125		22				4.5		

*RECOMMENDED VALUES UP TO 56-60 MEGACYCLES—HIGH EFFICIENCY OBTAINED FROM THESE TUBES AT 56-60 MEGACYCLES

⊗STATIC PLATE CURRENT IS GIVEN UNDER "IP" FOR TWO TUBES.

RECEIVING TUBES USED IN TRANSMITTERS

TYPE NO	CATH.	BASE	VOLTS	AMPS	Cgp	Cgf	Cpf	APPLICATION	Ep	Eg	SG	SUP	Ip	Ig	SG	PL DISS.	OUTPUT	DRIVER POWER WATTS	GRID LEAK OHMS
TRIODES																			
2A3	OXIDE	MED. 4 PIN	2.5	2.5	13.0	9.0	4.0	CLASS AB-PP-MOD	300	-62	TWO TUBES		80				15		750
								CLASS C AMP-OSC.	400	-180			100	10		15	25	3.0	50,000
6A3	OXIDE	MED. 4PIN	6.3	1.0	16.0	7.0	3.5	SAME AS 2A3											
6A6	OXIDE	MED. 7PIN	6.3	0.8				SEE RK34	PUSH PULL TRIODE										
6E6 #	OXIDE	MED. 7PIN	6.3	0.6				SEE RK34	PUSH PULL TRIODE										
6N7G 6N7	OXIDE	SMALL OCTAL 8 PIN	6.3	0.8				SEE RK34	PUSH PULL TRIODE										
12A	THOR FIL	MED 4PIN	5.0	0.25	8.0	3.5	2.5	CLASS C AMP.-OSC.	250	-90			80			9	11		20,000
19 #	THOR FIL	SMALL 6 PIN	2.0	0.26	PUSH PULL TRIODE			CLASS C AMP.-OSC.	135	-50			27	10		1.6	2.0		5000
								CLASS B MOD.	135				100	MAX.			2.1		
45 #	OXIDE	MED 4PIN	2.5	1.5	6.5	3.6	3.0	CLASS C AMP-OSC	400	-200			40			10	10	3.0	50,000
53	OXIDE	MED 7PIN	2.5	2.0	PUSH PULL TRIODE			SEE RK34											
71A #	THOR. FIL	MED 4PIN	5.0	0.25	6.6	3.2	2.9	SEE 12A											
46	OXIDE	MED 5 PIN	2.5	1.75	AS A TRIODE			CLASS C AMPLIFIER	400	-50			40	3.0		10	10	3.0	20,000
								CLASS B MOD	400	0	TWO TUBES		200	MAX.		20	20		
955 ⊗	OXIDE	SPECIAL	6.3	0.15	ACORN-FOR ULTRA HIGH FREQ.			CLASS C AMP-OSC.	180	-35			7.0	1.5			0.5		20,000

SATISFACTORY OPERATION AS MODULATED OSCILLATOR CAN BE HAD ON 56-60 MC. BAND
TYPES 19 AND 6E6 IDEAL FOR PORTABLE AND PORTABLE MOBILE USE RESPECTIVELY ON 56-60 MC.
⊗ WILL OSCILLATE AT THE VALUES DOWN TO 1 METER - BELOW THIS POINT REDUCE RATINGS

TETRODE-PENTODE TYPES

TYPE NO	CATH.	BASE	VOLTS	AMPS	Cgp	Cgf	Cpf	APPLICATION	Ep	Eg	SG	SUP	Ip	Ig	SG	PL DISS.	OUTPUT	DRIVER POWER WATTS	GRID LEAK OHMS
2A5	OXIDE	MED 6PIN	2.5	1.75				CLASS C AMP-OSC.	400	-50	100		30	10		5.0	7.0		5000
6F6 6F6G	OXIDE	SMALL OCTAL 7 PIN	6.3	0.7				SAME AS 2A5											
6L6 # 6L6G	OXIDE	SMALL OCTAL 7 PIN	6.3	0.9				CLASS C AMP-OSC	450	-120	300		100	4.0	80	10	25		50,000
						TWO TUBES		CLASS AB MOD ⊗	400	-25	300		100				60		
42	OXIDE	MED 6PIN	6.3	0.7				SAME AS 2A5											
47	OXIDE	MED 5PIN	2.5	1.75	1.2	8.6	13.0	OSC. DOUBLER	350		100	50	40	3.0		7.0	7.0		50,000
59	OXIDE	MED 7 PIN	2.5	2.0				OSC. DOUBLER	SAME AS 47										
								CLASS B MOD	400	0	TWO TUBES		200	MAX	SG	20	20		

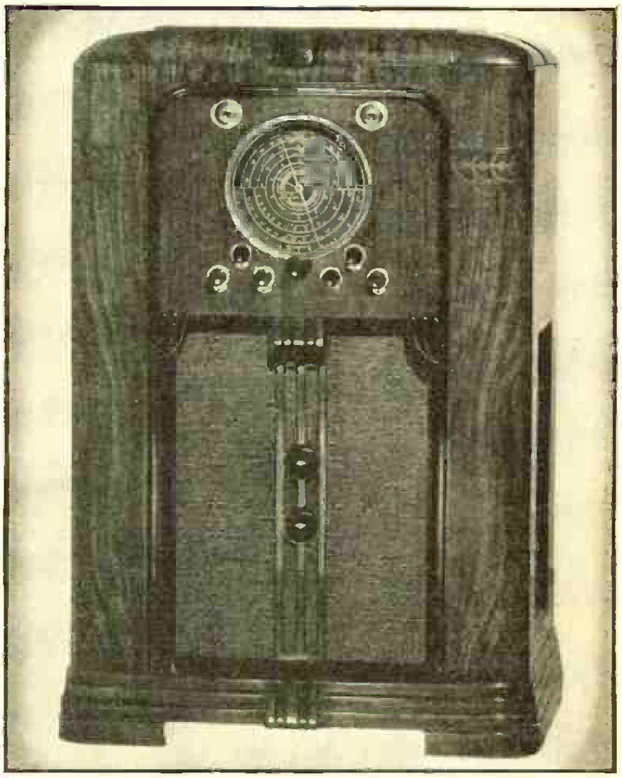
⊗ STATIC PLATE CURRENT GIVEN

New "Philharmonic" 30-TUBE Receiver

(Latest Scott Custom-Built Set)

By Laurence M. Cockaday *and* S. Gordon Taylor

(Part One)

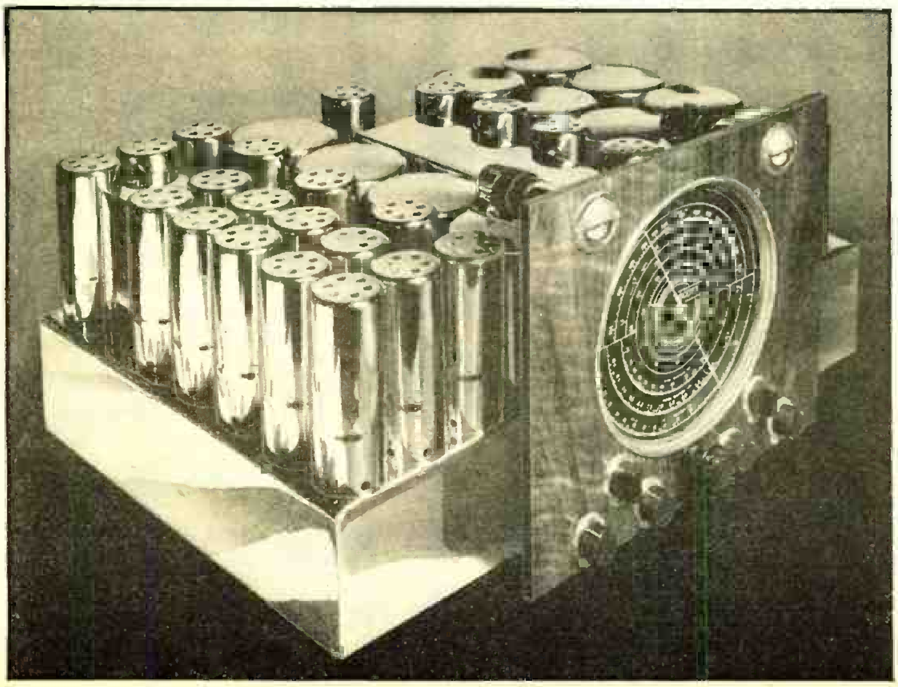


THE NEW 3.75 TO 2000-METER RECEIVER
Thirty tubes are employed in a circuit which includes dual a.v.c., volume expansion, continuously variable selectivity, true high fidelity and numerous other features.

PRELIMINARY to a description of some of the technical features which make the new Scott "Philharmonic" receiver so definitely outstanding, it will be of interest to many readers to know something of the inside story of Scott receivers, as observed by a RADIO NEWS staff member when he visited the Scott Laboratories in Chicago during a recent midwestern trip.

OUR visit to the home of the Scott receivers started with a leisurely walk through the entire premises, then the ground was again gone over in more detail, starting from the "inner laboratory" where research and development work is carried on constantly. This particular laboratory, incidently, is about as "hard-to-get-into" as the vaults of the Bank of England, the reason being that, incidental to the development of receivers, much original work is done here which first sees the light of day when patent applications are filed in Washington.

From here we proceeded to the "components testing laboratory" where every part going into the receivers is tested in an unusually thorough manner. Naturally, where such a variety of parts is used, a great many have to be purchased from manufacturers who specialize in their production. When these parts from other manufacturers are received they go to the components test laboratory and there each individual one—not just a sample from each lot—is put through a series of critical tests. Mica condensers, for instance, are tested for leakage at three times the maximum voltage to which they will be subjected in the receiver, using test equipment capable of measuring leakage currents as minute as .001 microampere (a billionth part of 1 ampere). Then they are tested for capacity, in some cases tolerance of only 1 micro-microfarad being allowed. Finally they are tested for power factor with a tolerance of ½ of 1 percent.



THE CHASSIS
Chromium plated throughout, this unit is one to please the most critical eye. But more important, of course, is its electrical and mechanical excellence.

Exacting Tests

Paper condensers are checked for voltage breakdown at several times the voltage values to which they are subjected in the receiver, also for capacity and leakage. They are likewise "sample tested" for power factor. Electrolytics are tested for capacity and leakage, at voltages 25 percent in excess of their ratings. All air dielectric condensers, including those used for r.f. tuning, i.f. tuning, trimmers, etc., are put through a variety of tests so rigid that many of these condensers must be specially made to meet the close tolerance specified. In the case of the main gang-tuning condensers, for instance, not only must they be a close approach to electrical perfection, but the mechanical bearing tension must be such that a certain specified amount of effort is required to turn the shaft. To insure the accuracy of this test, these condensers are supplied by the manufacturer without wiping contacts. These contacts are later installed and adjusted precisely for a degree (*Turn to page* 121)

Automatic RADIO Balloons

Report Weather Facts

By W. G. Many

CHECKING THE U.H.F. BALLOON TRANSMITTER
Experts of the Weather Station at Blue Hill Observatory making a final check on the ultra-short-wave equipment for the crewless balloon.

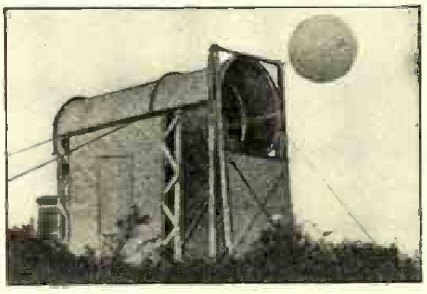
MORE and better guesses as to tomorrow's weather may soon be chalked up to the credit of the weather man, thanks to tiny automatic 1¼ and 2½-meter radio transmitters carried aloft by crewless balloons. Experiments at Blue Hill Observatory near Boston, as well as demonstrations at New York and elsewhere. have disclosed the gathering of meteorological facts of great value in prognosticating weather. The tiny automatic radio transmitter can flash back reports from a height of 50,000 feet, and twice that altitude is the ultimate aim.

Tiny Transmitter Used

Of course there is nothing new in the use of gas-filled balloons for weather forecasting. As far back as 1918, during wartime days, balloons have been sent aloft and observed through telescopes and surveying instruments in order to gauge prevalent winds high above the earth. But the weather man needs more information for a really good guess as to tomorrow's weather. He would like to know the temperature, barometric pressure and humidity readings taken at different altitudes and that requires someone up there to take readings and flash them back to earth. In various parts of the country airplanes are sent up daily with capable observers for the purpose of gathering just such data. Such flights, however, are costly and in bad weather they are not always feasible.

So along comes a daring and really clever idea from Harvard University's Blue Hill Meteorological Observatory. A tiny short-wave, 2-tube transmitter, weighing less than a pound, with another pound or so of special dry batteries supplying the current, is sent aloft by means of special rubber balloons filled with gas. Of selected size for given gas capacity, the balloons are intended to ascend at a speed of about 750 feet per minute, which has been found the most desirable rate for satisfactory observations. Within an hour the tiny radio transmitter, sending its reports all the while, has attained a height of 50,000 feet. Messages are handled at the rate of eight per minute, being picked up by a short-wave receiver at the observatory.

START OF ASCENSION
Here is the balloon seen leaving its hangar in a 20-mile breeze.



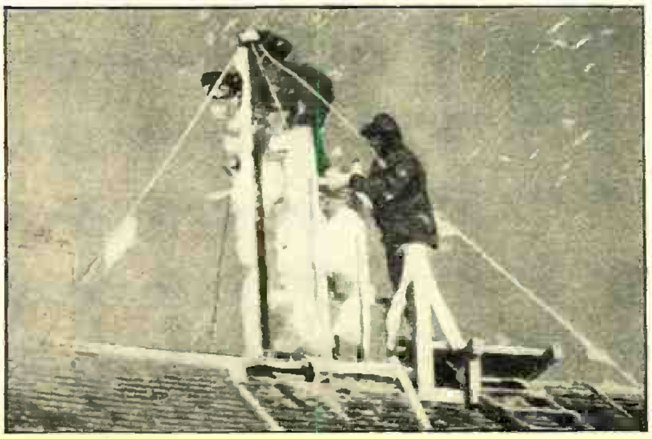
To secure the data so vital to the weather man below, the balloons carry aloft several pieces of equipment in addition to the automatic radio transmitter. There is an aneroid barometer to measure pressure; a precise temperature indicator employing delicate bi-metallic strips; and a single human hair to measure relative humidity.

Signals Flashed Back

The respective readings of these devices are picked up in rotation by a revolving contact arm, and turned over to the tiny transmitter which flashes them to the waiting station below. The receiving operator at the observatory jots down these signals and, with the aid of a converting device, translates them eventually into curves of pressure, temperature and humidity. The wind velocity at different altitudes can be determined by observers on the ground, following the drift of the ballons by means of a theodolite or other instrument. (*Turn to page* 105)

LISTENING FOR SIGNALS
An operator at the Weather Station picks up and records the balloon's signal on its upward journey.

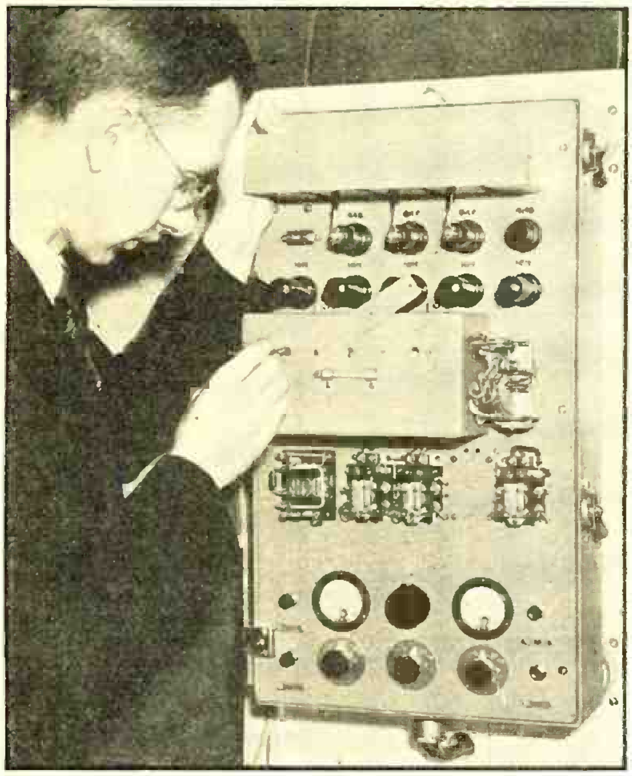
DEFROSTING THE ANTENNA
Some idea of the terrific winds encountered at the Weather Station can be gotten from this picture.



New "ROBOT" Receiver *for* Cargo Vessels

(Tunes for SOS Signals)

***By* Merle S. Cummings**



THE AUTOMATIC RADIO ALARM UNIT
Engineer adjusting one of the sensitive electrical relays of the automatic "listener".

A SUCCESSION of marine disasters in recent years brought about a hue and cry for new standards in means for safety of life at sea. The radio telegraph has, perhaps, done more for the preservation of passengers' and crews' lives than any other scientific device. And now radio again comes forward with an invention that may prove a boon to the crews of cargo vessels.

This newest contribution is an automatic radio alarm that "listens, thinks and acts" without constant human attention. In effect, the instrument serves as a robot operator when the human operator is off duty. By law, the device cannot be recognized on American passenger ships as a substitute for radio operators, but is restricted to cargo vessels of 5,500 gross tons or over, employing but one radio operator so that a sort of continuous watch may be kept.

Two-Month Test

Developed by the Radiomarine Corporation of America, the alarm has already been approved by the Federal Communications Commission and ships will begin to be equipped as soon as changes specified by the FCC have been made. Government approval followed a two-month test in the Bureau of Standards Laboratories and in the Sandy Hook stations of the Coast Guard.

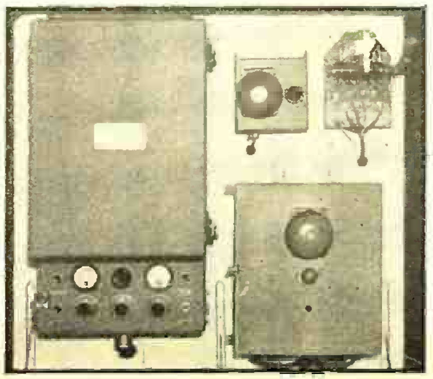
As explained by Charles J. Pannill, president of Radiomarine Corporation, this is the way the device is used: The operator, upon completion of his watch, turns on the automatic alarm and leaves the cabin; thereupon the robot begins its work of listening for the telegraphic characters of the international emergency signal from other ships. Besides the 600-meter distress call channel, the alarm receives a small band on either side so that it may hear any ship slightly off the usual wave. The device is pre-set to recognize a series of dashes, each of four seconds' duration and separated by an interval of one second; but the unit also has the power of recognizing a dash which may be a bit more or less than four seconds long.

It might be said that the alarm has an "intelligence" that will retain such dashes in sequence, after which it will turn on signal lights and ring bells on the bridge and in the radio operator's quarters.

An important added feature of the unit is that it sends out an alarm when anything is wrong with the robot itself. If a tube burns out or a battery fails, the alarm will sound its own distress call, hastening the human operator to correct the ailment.

The general form of the automatic alarm signal was specified at both the 1927 International Radio Telegraph Convention held in Washington and the 1932 International Telecommunication Convention held in Madrid. The four-dash signal supplements but does not supersede the usual SOS, but is transmitted by the vessel in distress just prior to the standard call for help.

THE COMPLETE SYSTEM
At left: Automatic radio receiver. Lower right: Bell and light unit for operator's cabin. Top center: Bell and light unit for the bridge. Upper right: Switch for turning on the alarm.



The robot's voice (bells and lights) can call the ship's officers for receipt of the automatic alarm signal; receipt of a false signal caused by combined static and interference; the loss of line voltage; tube heater burn outs, and other important things calling for more aid than the robot itself can offer.

The United States Senate and the President ratified the Convention of Safety of Life at Sea in June, 1936. It became applicable to American flag ships last November except as to the continuous-wave requirement. Under the Convention's terms, a nation may grant its ships an exception from the continuous watch requirement for a period not exceeding one year from the effective date of the Convention. But the FCC has extended this exemption to August 6, 1937.

Radio Telephone on Ships

New York, N. Y.—Telephone service between ships at sea and the Bell system is to be provided jointly by the RCA and the A.T.&T. The Radiomarine Corp. plans to install the required equipment aboard American ships while the shore equipment is to be operated and built by the Bell system. The Radiomarine Corp. has contracted with the Matson Navigation Company of San Francisco for the installation of telephone apparatus on their S.S. Lurline, S.S. Malolo, S.S. Mariposa, and S.S. Monterey. These vessels will be in communication with other vessels, the American Mainland, the Hawaiian Islands, and Australia.

New York, N. Y.—RCA Communications and The Mackay Radio and Telegraph Co. have filed with the F.C.C. a schedule which will drastically reduce the rates of domestic night letters. This new schedule, it is claimed, will permit the transmission of medium-length letters by radio telegraph at low rates. The reduction in rates is approximately 25 to 50 percent.

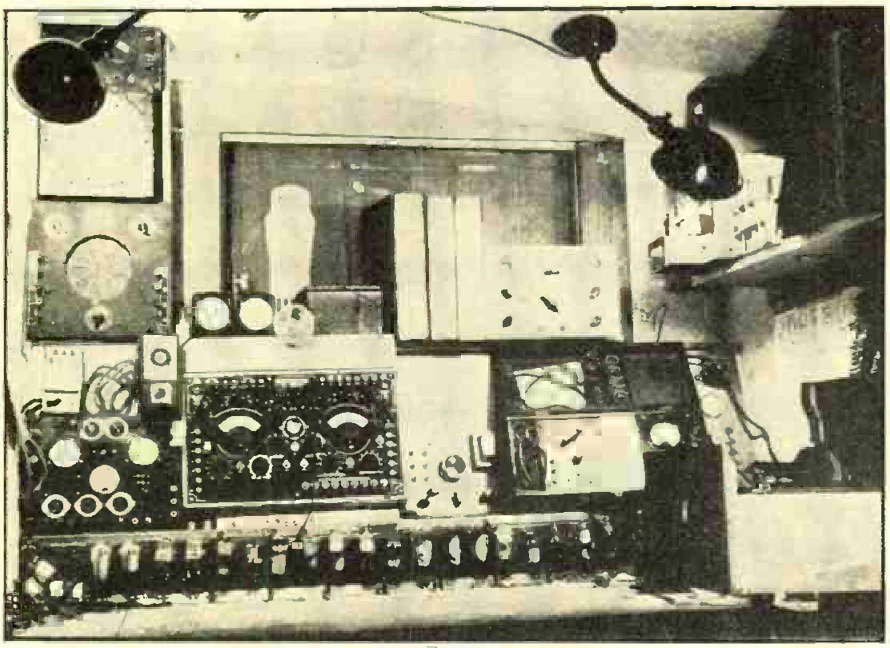


FIGURE 1
From a hobby to a business. And, by the way, nothing makes a more substantial Service Bench than a second-hand flat-top desk, with convenient storage for tools and parts.

THE SERVICE BENCH

Sloppy Service . . . Service Shops . . . Universal Test Panel . . . Noise . . . Servicing Vacuum Cleaners . . . Service Sidelines . . . Checking Tuning Condenser Shorts . . . Service Kinks . . . Selling Sound . . . SERVICING: Crosley . . . Packard Bell . . .

Conducted by Zeh Bouck, *Service Editor*

AGAINST SLOPPY SERVICING

DURING the last four months your service editor has visited many service shops on the east coast of the U. S. A. He has been royally welcomed from New York to Florida, and has seen many stimulatingly efficient layouts. And in those same shops he has seen some lamentably sloppy servicing. Oscilloscopes to the right and oscillators to the left, the minor details omitted by many servicemen would make any efficient gas station attendant weep. We've seen chassis, with two hours justifiable labor charge, replaced in the cabinet as dusty as when it was removed—not to mention the inside of the dial glass, which could be cleaned only with the chassis on the bench! We've seen a serviceman making a final cabinet-mounted test on a receiver. He had the hands of the village blacksmith and so paid no attention to the fact that the controls were partially jammed. We've seen receivers ready for return with the knobs sticking out various distances from the panel, as if they had been deliberately staggered. Not to mention finger prints enough to furnish exhibit A's for every murder since Cain killed Abel!

We're not mentioning any names, but some of you lads may recognize yourself in the above. Take a tip from your favorite gas station—that gas station where, driving up for only five gallons, an attendant cleans your windshield and checks your water without being asked, and then asks you if you'd like your oil and air checked.

The cures to the above conditions are so obvious we need say little more. Tighten all dial lights before returning the chassis to the cabinet. Remember, the customer should both *see* and hear the difference in his receiver. It should glisten inside and out. Let him *feel* the difference too—with velvet operating controls. Two rags should be in every service kit—one mildly saturated with a good furniture oil and the other clean and dry. Polish the cabinet thoroughly in the shop—and once again when located in the customer's home, to remove the final finger prints incurred during transportation, and for the psychological effect.

THIS MONTH'S SERVICE SHOP

Starting in as a hobby, R. S. Pemberton, of Pemberton's Radio Service (Wholesale and Retail), Shelby, Ohio, has built up a profitable radio trade, and the shop shown in the photograph of Figure 1. Describing the layout, Mr. Pemberton says—"The room is about 14 feet square, besides the alcove photographed which just fits the Work Bench. The bench itself is an old flat-top desk—mighty substantial—2 by 5 feet. The instruments include a 385 Supreme tester, a Radiart vibrator tester, a vacuum-tube voltmeter, 6E5 output indicator, a pocket Triplett tester, a Triplett 1200, a combination Solar-Sprayberry-Tobe condenser tester which makes about all the tests of which I have ever heard, a portable tube tester (not shown) and all-wave signal generator, a turntable and pick-up, with an associated amplifier and a complete complement of power supplies. There is a 913 oscilloscope under construction at present. The walls are pretty well papered with tube and vibrator charts, so placed as to be readable from the Bench. The bound volumes above the bench contain back numbers of RADIO NEWS. I picked up a flock of second-hand filing cases which are distributed about the shop, giving me some 100 drawers for small tools and parts. I have a power drill and grinder which help a lot in heavy work."

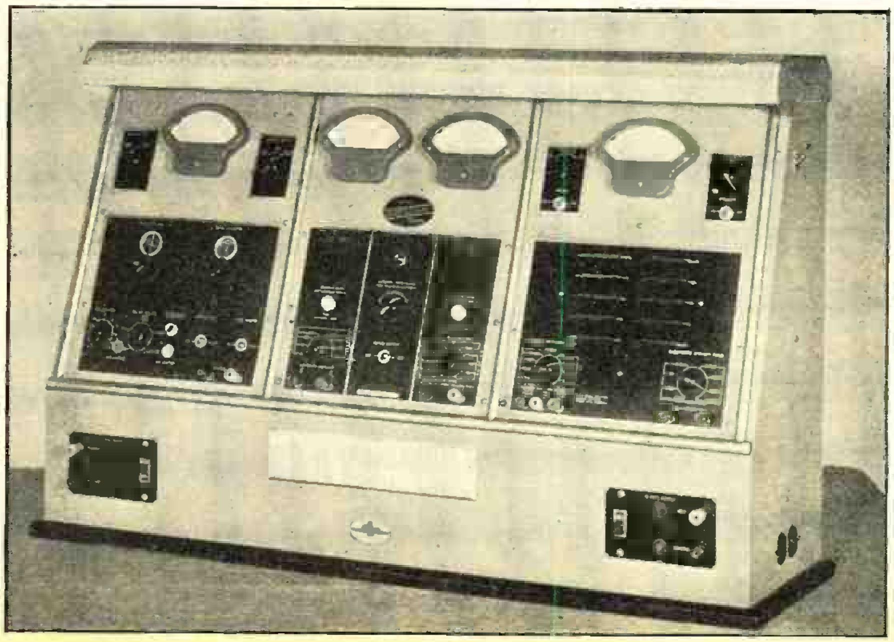
Mr. Pemberton sent us two pictures of his shop—one in which he himself is a prominent bit of decoration. However, we have published the one shown, despite the fact that Mr. Pemberton is reading RADIO NEWS in the other, because more of the equipment is to be seen.

UNIVERSAL RADIO TEST PANEL

Simplification of Service Bench design and construction has been considerably effected by United Motors in their "Universal Radio Test Panel" which includes the major part of the equipment essential to any modern shop mounted in one impressive and handsome unit. The complete set-up is shown in Figure 2. The

(*Turn to page* 104)

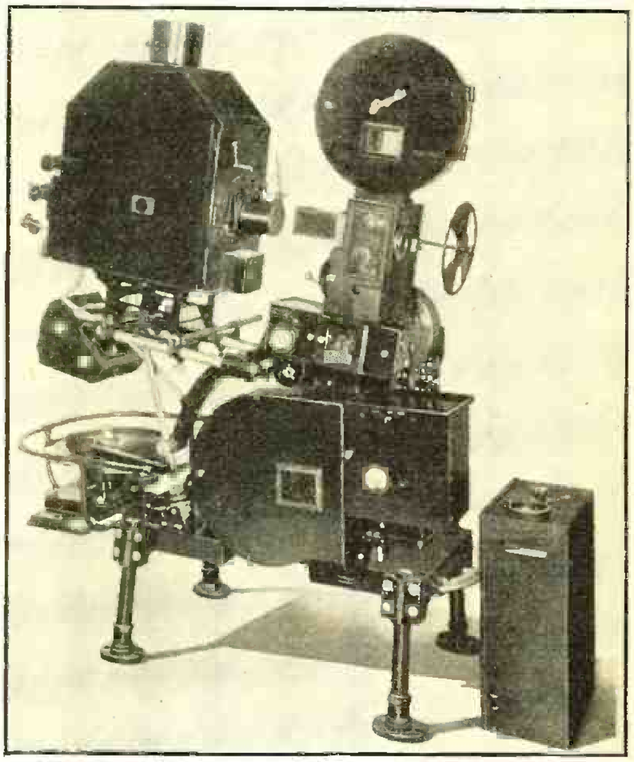
FIGURE 2
A combination job that supplies most of the permanent equipment required in a modern service shop.



Practical Pointers For Servicemen On

Servicing MOVIE SOUND

By W. W. Waltz



A WESTERN ELECTRIC PROJECTOR

A complicated looking device—and it is complicated. However, the sound serviceman is interested only in the electrical equipment. Mechanical troubles are the worry of the projectionist.

NEW problems confront the radio serviceman who contemplates the expansion of his activities to include the servicing of motion picture sound equipment. Fundamentally, his knowledge of radio and audio circuits is the same as that required of the sound equipment technician; there the similarity ends. New ideas, not only of circuits and equipment, but also of the meaning of the word "service," must be absorbed. The creed of the theatres, *the show must go on*, will of necessity be adopted and honored by the man who would succeed in this field.

BEFORE any attempt can be made intelligently to service theatre equipment, its essential features must be understood. And, at this point the brutal truth must be told—no two installations are alike. Regardless of the fact that the installation engineer followed standardized blue-prints, and that the equipment itself was probably manufactured with inter-changeability of parts in mind, it still remains that in the assembly and inter-connection of the components in the theatre as much individuality exists as in "ham" radio. Consequently, each theatre presents a different problem to be studied. When, and how, to make this study is something that must be left to the ingenuity of the serviceman. One cannot expect the theatre owner willingly to provide the opportunity for this study. In such cases—and these will be remote indeed—where the serviceman can sell a routine inspection service to the theatre, the difficulty solves itself. For the man who is called only in emergencies, the only safe rule is to become so familiar with the basic principles of the equipment that a brief, intelligent "once over" will show how and where that particular installation differs from others. Then follows the task of locating and clearing the trouble; work that must be done with one eye on the clock. There are no opportunities in theatre work to "take the thing to the shop." If the trouble is to be cleared, it must be done on the job, and in a matter of minutes. Intelligent work in cases such as these requires system—for which reason the serviceman will have, mentally catalogued, a series of questions to fire at the projectionists—"when did it start?"; "how did it sound?"; "what did the meters do, kick down or up?"; "are the batteries—if any—charged, or fresh?".

This line of questioning—and the above questions are far from being comprehensive enough for actual use—must be supplemented by a check of every reply, that is, in an emergency take no one's word as final. Check!

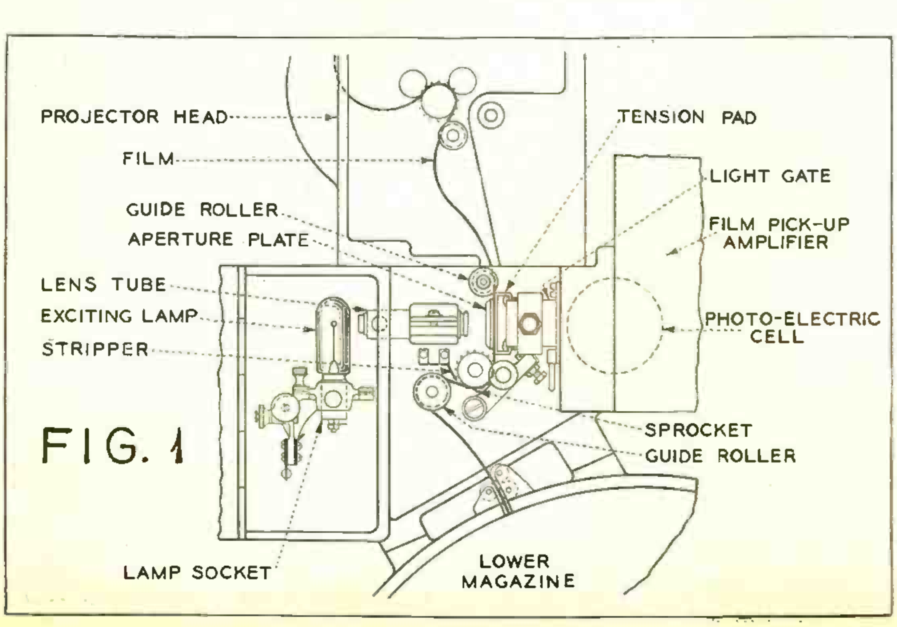


FIG. 1

Types of Troubles

A recent investigation of the opinions of sound equipment maintenance men revealed that no two of them agreed on the point of "most common troubles." No decision could be arrived at as to whether mechanical or electrical troubles were in the majority. On that basis it will be best to assume a 50-50 break and to discuss briefly the more common troubles of both kinds.

Mechanism failures can be traced usually to the following: Improper lubrication, over-loading, and normal wear. Generally, a mechanical failure means a replacement of the part. In this case the serviceman, unless he has a source of supply, should retire in favor of the projectionist. If the part is not immediately available, it probably will mean finishing the show on one machine or closing down. If the replacement part is available, the projectionist is the man to do the job—for one reason, many state and city (*Turn to Page* 127)

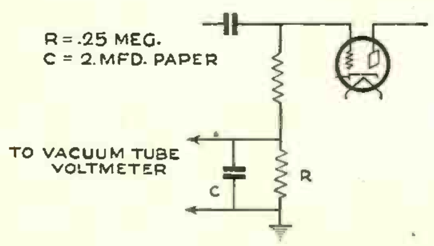


FIGURE 5

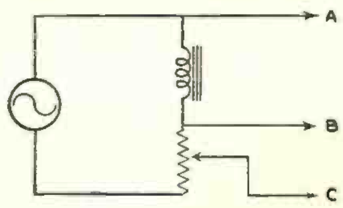


FIGURE 6

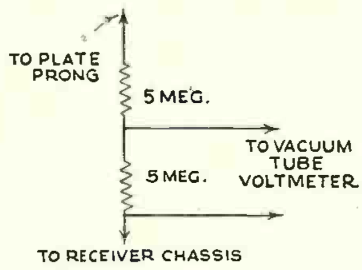


FIGURE 7

How to Build and Use a

V. T. VOLTMETER

Undoubtedly a much larger number of servicemen, technicians and experimenters would employ the vacuum tube voltmeter in their work if its wide utility and specific applications were better understood. The technique to be followed in locating and correcting trouble in many representative cases is explained in this article. Constructional details of the v.t. voltmeter were given, with complete operating data, in a comprehensive article printed last month.

By **R. M. Ellis**

(*Part Two*)

IN superheterodyne receivers it is essential that the r.f. input from the oscillator be less than the bias of the first detector. If it is equal or greater, grid current will flow in the first detector grid circuit and trouble will be experienced with broad tuning, cross modulation and "birdies." On the other hand, if the oscillator output is inadequate, the receiver will lack sensitivity and have excessive hiss. (The above applies particularly to mixers not of the pentagrid type. For 6A7 tubes, uniformity, rather than amplitude, of oscillation is the primary consideration. For the 6L7, the oscillator voltage applied should be 12 volts or more. Again, wide variations in oscillator voltage over the tuning range are undesirable.—*Ed. Note.*)

The solution of some cases of non-uniform sensitivity over the band can be traced to variable oscillator output.

This v.t. voltmeter will accurately measure the bias of the tube and the oscillator output so that the conditions mentioned above can be speedily located and corrected.

Aligning Receivers Having A.V.C.

There are a number of ways of aligning a receiver using a.v.c. The usual method is to employ a modulated oscillator and output meter, the output of the modulated oscillator being sufficiently attenuated to prevent the a.v.c. from acting. With many receivers, there is no delay in the a.v.c. action, so that this circuit becomes operative whenever a modulated signal of sufficient intensity to give an audible output is fed into the receiver. Whenever this condition occurs, a false impression of broadness in the individual trimmer will be noted, since when an individual circuit is slightly detuned, the a.v.c. action will hold up the output. To align a receiver with the v.t. voltmeter, feed an unmodulated signal into the receiver with sufficient intensity to develop a small amount of a.v.c. action. Connect the v.t. voltmeter to the receiver chassis and to the a.v.c. lead connection to the grid returns. With this connection, the v.t. voltmeter will read the actual a.v.c. voltage. When a trimmer is now adjusted, a very sharp resonance point will be indicated by the sudden increase in a.v.c. voltage.

Balancing Phase-Inverter Circuits

In the old days when every push-pull stage had an input transformer, a simple resistance test on this transformer usually indicated whether or not this unit was functioning satisfactorily. The modern trend is to employ some form of resistance-coupled phase inversion, since this form of coupling presents a number of important advantages, such as freedom from hum, extended frequency response and economy. But, unfortunately for the serviceman, parts which may vary are substituted for the transformer. Proper values of resistances are essential if the full quality of tone and power output of the receiver are to be realized, and in some designs the tube characteristics are important.

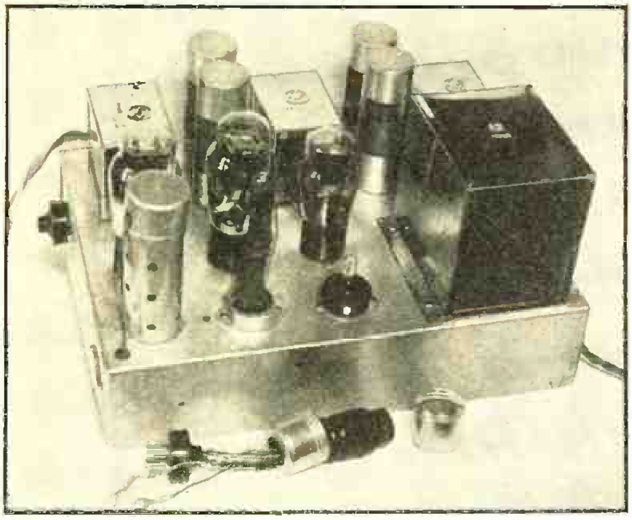
In any case, the signal voltage delivered to the individual output tubes must be equal. This audio-frequency voltage is difficult to read with an ordinary voltmeter, not only because of the inaccuracy of the voltmeter at the reference frequency employed, but also because of the loading effect of the usual a.c. voltmeter on the circuit. The v.t. voltmeter adds no appreciable load to the circuit at any audio frequency and grid voltage can be read with close accuracy. By juggling inverter resistor values and measuring with the v.t. voltmeter, the serviceman will have no difficulty in adjusting a push-pull stage for correct balance.

Measuring Surge Voltages

When installing filter condensers, it is desirable to know the maximum surge voltage, since it is necessary for the filter condensers to withstand this momentary surge potential each time the set is turned on. The maximum surge voltage is frequently much higher than would be expected from the working voltage, owing to poor regulation in the power transformer, or to the action of line voltage regulating resistors. To check this surge with the v.t. voltmeter, simply remove the rectifier tube from its socket and measure the voltage between the chassis and one plate prong of the rectifier tube socket. The voltage indicated will be the highest that can be developed in the normal operation of the receiver. If the maximum range of the instrument, 500 volts, is not adequate to measure the voltage encountered in the application, the range can (*Turn to page* 111)

A Practical, Push-Pull D. C. Amplifier That is Excellent

By Gerard J. Kelley



THE COMPLETED AMPLIFIER CHASSIS
Illustrating the ship-shape layout for the new direct-current, push-pull amplifier. Note the small "lamp-fuse" at the front of the chassis which gives ample protection.

IN the May issue of RADIO NEWS, a single-ended, direct-coupled amplifier was described employing a 2A3 as output tube. Present-day requirements often call for more power and in such cases the use of a push-pull amplifier is more desirable than a larger single tube.

IF the advantages of direct coupling are to be retained it is necessary to employ some form of direct coupling to the second output tube. One possible solution to this problem is the use of two single-ended amplifiers connected back to back. Such an arrangement requires a push-pull detector when a tuner is employed while a transformer with center tapped secondary must be used with a phonograph. It is preferable to eliminate the input transformer with direct coupled amplifiers, since they are especially sensitive to hum due to their excellent low-frequency response. If it is necessary to use an input transformer the secondary must be of low impedance and carefully placed for minimum hum pickup.

The circuit for the push-pull direct coupled amplifier is shown in Figure 1. A portion of the output of the first output tube, *Tube A*, is applied to the second output, *Tube B*. Besides employing a potentiometer so as to make the output of tube B equal to that of tube A, care must be taken to obtain the right grid bias at the same time. All these requirements are met by the use of two carbon resistors, R7 and R8, which apply ¼ of the output of tube A to the grid of tube B. This places the grid of tube B at approximately the same potential as the grid of tube A. Then the filament of tube B must also be "up in the air." It might at first glance seem that a common bias resistor can be used for both tubes but this is not practical.

Maintaining "Balance"

The automatic compensation circuit, which maintains the balance between the two tubes requires separate bias resistors. Without this form of compensation the plate current of the two output tubes will be unstable: one tube will be completely blocked while the other carries all the plate current.

Since the two tubes have individual bias resistors, these two resistors will be in series with the load unless there is a low impedance a.c. path between the two cathodes, hence the need for condenser C3.

As in the single-ended amplifier, the compensating circuit consists of an arrangement whereby the screen voltage on the input tube is controlled by the plate current in tube A. When plate current increases in tube A, the screen voltage rises, makes the plate voltage of the input tube increase and drops the bias on tube A, thus compensating for the change. This circuit is slow acting and does not interfere with the signal.

Bringing Up "Highs"

The high frequencies may be brought up somewhat by the addition of the padder condenser C9 of 150 mfd. maximum. This is connected between the plate of tube B and the grid of tube A, causing regeneration at the higher frequencies. The condenser is set at about 40 mfd. but the adjustment will vary with layout and wiring. When making the adjustment, the effect on the response characteristic should be observed. Constructors who have no facility for measurements can proceed by first increasing C9 until the amplifier oscillates, then decrease until the oscillation stops and then further decrease the capacity by half a turn more for safety.

Volume Control

The diagram does not show a volume control since the writer controls his volume in the input device. However, the resistor R1 can be replaced by a 250,000 ohm potentiometer.

Construction

The transformer should have three different filament windings, all of them center tapped. (*Turn to page 128*)

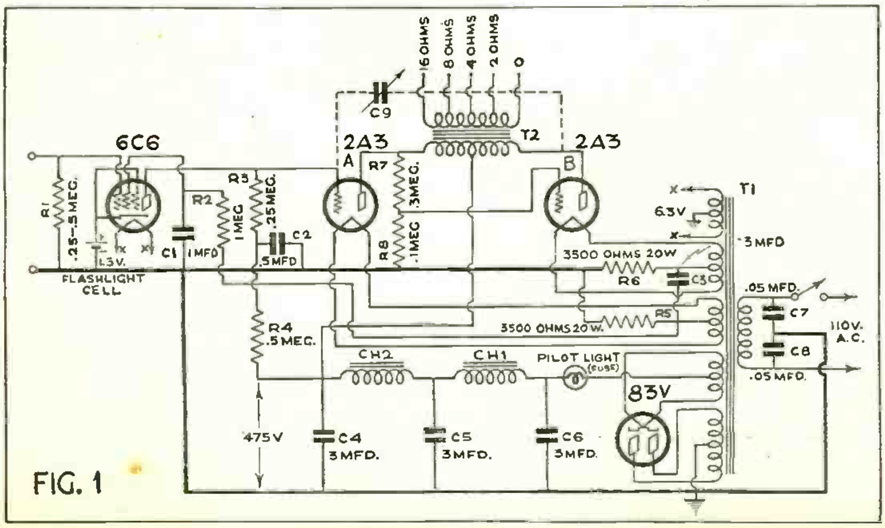
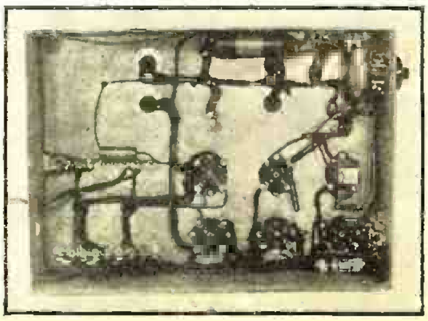


FIG. 1

UNDER THE CHASSIS
The neat and simple wiring for the amplifier is shown in this bottom view.



The "HAM" Shack

Conducted by
Everett M. Walker
Editor for Amateur Activities

RADIO F3LG
Charles Guilbert, F3LG of Deauville, France, sends cordial greetings to RADIO NEWS *readers.*

Using Antenna RELAYS

EVERY amateur knows good reception is essential to the successful operation of a station. But too frequently a great deal of time and effort, as well as money, are expended on providing a good transmitting antenna, but any old short piece of wire strung in the attic or around the picture moulding is used for a receiving aerial. Why not use the transmitting antenna for reception as well as transmitting? It is idle, when the transmitter is not in use and, for reception, will give far better results than a "piece of wire." The performance will soon more than compensate for the cost of installing the switching apparatus.

THE writer recently made a series of tests using both 20- and 75-meter antennas for reception as well as transmission, as against a 30-foot antenna strung in the attic. The difference was amazing. By switching over from one to the other, a given signal increased from one to three "Rs" (as measured on an "R" meter in a receiver). Furthermore signals not audible with the "piece of wire" were picked up with sufficient strength for a "QSA4" report.

Tests also were conducted at several other stations, and the same results obtained. At one station which operates almost exclusively on 10 meters and where an elaborate array was employed, the array antenna far out-performed all other types of aerials used. Furthermore, the advantage of using a directional or semi-directional antenna for reception as well as transmission is obvious. Such an antenna will be just as directional for reception as well as transmission. Signals in an unwanted direction will not be received with anything like the volume they would be if the array was pointed toward them, with the consequent result of less interference and more satisfactory "QSOs."

This feature alone in cases where a directional antenna is available is a strong argument for using the same antenna for both transmission and reception. But there are still other advantages. First, it is necessary to have only one antenna strung up in the back yard and other wires (aerials) which might have some effect on the radiation pattern of the radiator will be eliminated. Second, a good transmitting antenna usually is fed by a good feeder system, and the radiator itself is located as far away as possible from surrounding objects. This naturally will eliminate a lot of man-made interference such as oil burners and other electrical appliances, thus resulting in a better signal-to-noise ratio.

Tests with Doublets

The tests on 20 and 75 meters were made with half-wave, doublet antennas using twisted pair (EO-1) feeder lines. The receiver was a standard make superheterodyne, equipped with a sensitive "R" meter. On 75 meters the signals of a Cuban amateur (CO8YB) were picked up. He was operating on approximately 3996 kilocycles. There were several strong signals on adjacent channels. Using the "piece of wire" aerial, the voice of this station was audible but not understandable. His signal pushed the "R" meter to R2. The 75-meter doublet was switched in. The signal ratio to the interference was increased tremendously and the signal became readily understandable. The "R" meter swung to R6.

This same test was repeated on about 50 stations and the results were equally gratifying in practically all cases. Only in a very few instances was the interference problem increased by the use of the larger antenna and in each of these cases the interference came from local stations with strong ground waves. But, by-in-large reception was much improved from the standpoint of readability, audibility, interference and signal-to-noise ratio.

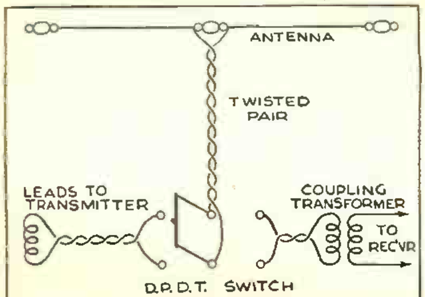
Virtually the same results were obtained when the tests were repeated on 20 meters. Furthermore, on 20 meters the "piece of wire" aerial and the "transmitting" antenna were at right angles. This often is the case. It was found that stations that could be worked could not be heard on the "piece of wire" but came through with good signal strength on the transmitting antenna. A typical case was that of a station in Honolulu (K6MVV). This station was barely an R5 with the "wire" aerial and drove the "R" meter beyond the R9 point when the transmitting antenna was switched in.

5-Meter Tests

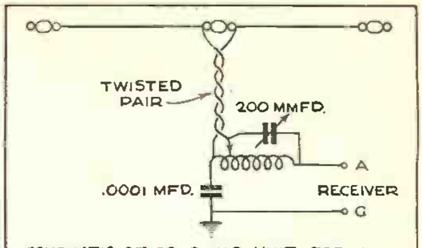
Similar tests also were conducted on 5 meters. On this band some amateurs still like to operate "duplex" and therefore the use of the same antenna for both transmitting and receiving may not be desirable. But, on the other hand, a 5-meter antenna for transmitting usually is a simple affair and it is not difficult to put up a duplicate one for reception and then enjoy duplex operation. Also on 5 meters a large number of stations are using directive arrays, and, like on 20 and 10 meters, are using simple antennas for reception. But on 5 meters the advantages of using the directive antenna, for reception to dodge interference, are even greater than on the other bands,

(*Turn to page* 122)

FAMOUS SWISS AMATEUR
Herr Lips of Zurich, Switzerland, First Prize winner in a European competition, is well-known to American "Hams" for his early work on trans-ocean communication on ten meters. His call letters, shown in photo, are known the world over.



SWITCH CHANGE-OVER ARRANGEMENT



SCHEMATIC OF COUPLING UNIT FOR A RECEIVER HAVING ONLY "A" AND "G" POSTS. A COMMERCIAL COUPLING TRANSFORMER ALSO MAY BE USED. THOSE WITH STATIC SHIELDS ARE BEST.

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

Wins Amateur Award

TO Walter Stiles, Jr., radio amateur of Coudersport, Pa., whose call is W8DPY, goes the distinction of being the winner of the William S. Paley Amateur Radio Award, donated by the president of the Columbia Broadcasting System. The award to Stiles was based on his brave performance during the March, 1936, flood emergency when he supplied the sole direct means of communication for 130 hours for the 4,000 isolated citizens of Renovo, Pa., and transmitted more than 1,000 messages on behalf of official agencies operating in the flooded Allegheny River area.

The Presentation

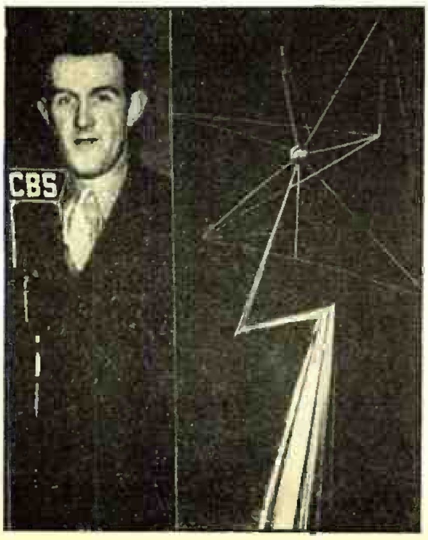
Mr. Stiles received his award in a fitting atmosphere of distinction. The presentation was made at a luncheon at the Waldorf-Astoria Hotel, New York, the ceremonies being broadcast over the nationwide CBS network. He received tributes from Anning S. Prall, chairman of the Federal Communications Commission, Mr. Paley and numerous amateurs who sent their congratulations direct into the hotel via an amateur station erected right in the dining room.

The Awards Board which selected Stiles as the 1936 winner of the handsome trophy designed by Alexander Calder, internationally known sculptor, included: Rear Admiral Cary T. Grayson, chairman of the American Red Cross, C. P. Edwards, director of radio for the Canadian Department of Marine, Dr. J. H. Dellinger, chief of the radio section of the United States Bureau of Standards; Professor A. E. Kennelly, professor emeritus of electrical engineering at Harvard University, and Mr. Prall.

The American Radio Relay League was

(*Turn to page* 123)

TWO WELL-KNOWN AMATEURS
Walter Stiles, Jr., W8DPY, won the amateur radio award for his flood emergency work. Lower right: Another RADIO NEWS *reader and follower, A. S Mather, VK2JZ of New South Wales, Australia, in his radio shack.*



Ship-Shape "CAR" Transmitter

by Robert Ames

THE advantage of remote control for portable mobile work is graphically illustrated in the accompanying two photographs of the latest Harvey model UHX-10 low-power mobile transmitter. Figure 1 shows the operator working phone through the remote control mounted on the dashboard of his car. If desired, the control can be fastened to the steering post or some other convenient point. The control is connected by cable to the transmitter, conveniently installed out of the way in the trunk compartment of the car.

An inspection of Figure 2 will show that the transmitter is mounted on shock-proof rubber mounts so as to eliminate vibration and retain transmission stability. The transmitter is powered from a dynamotor operated from a 6-volt battery. The dynamotor is shown to the left of the transmitter and to the right is the special tuning-meter panel-board. Once the correct positions are found the tuning controls are locked in position.

Amateurs will show more than passing interest in this new transmitter. They will be quick to realize and appreciate the fact that this unit must have involved considerable detail work in design and installation problems. The transmitter is of course not confined to "Ham" use, it is an all-purpose unit with many possible applications for commercial and experimental services.

The transmitter is equipped for c.w., modulated c.w. and phone types of emission, which can be selected by a 3-position, 4-gang switch. By means of plug-in coils it has an unusually wide frequency coverage from 1500 to 60,000 kilocycles.

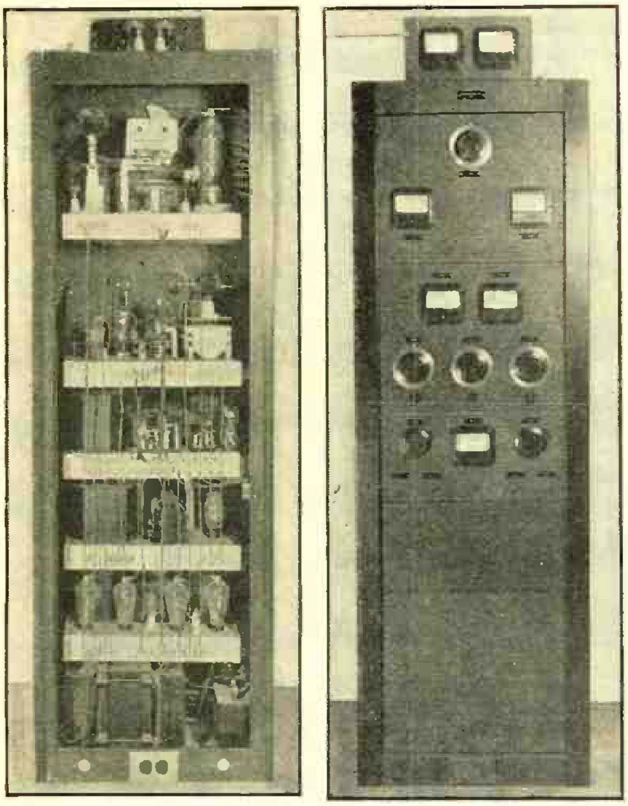
The oscillator employs the type 6L6 tube which may be run either pentode-connected, for operating straight through on the crystal frequency, Tri-Tet connected, for frequency multiplying as high as the 4th harmonic of the crystal, and electron-coupled control when crystal control is not desired. Operation in the 5-meter range is limited to this latter form of control.

The output of the oscillator drives a second 6L6 as power amplifier. This latter tube always runs as a straight amplifier. For 100 per cent modulation, a 6N7 furnishes 10 watts of audio power to the plate and screen of the power amplifier. A second 6N7 acts as a Class-B driver and the microphone input is fed directly to the grid of this tube.

The cathode circuit of the final amplifier tube is keyed for straight c.w. and the cathode circuit of the audio driver tube for modulated c.w., this latter method interrupts the tone modulation of the carrier.

Each final amplifier plate-coil carries its own antenna pick-up coil correct for the frequency it covers. An antenna condenser is connected in parallel with this coil for tuning any moderately high-impedance antenna or feeder circuit. For feeding quarter-wave antennas or low-impedance feeders, the condenser may easily be changed to a series connection.

Additional specifications show: power input 20 watts throughout the frequency range of the transmitter, power output 12 watts on 1500 kc., 7 watts on 60,000 kc. The dimensions of the transmitter are 12 by 6½ by 7 inches.



Rear—THE R.F. CABINET—*Front*

Design and Construction

X'tal-Control 10—20

(Power: Up

A one kilowatt phone transmitter! does this phrase conjure in the minds emotions do these thoughts arouse? amateur depends, chiefly, on the size as well as his financial status in might be considering in the

By **Willard Bohlen, Chester**

(Part

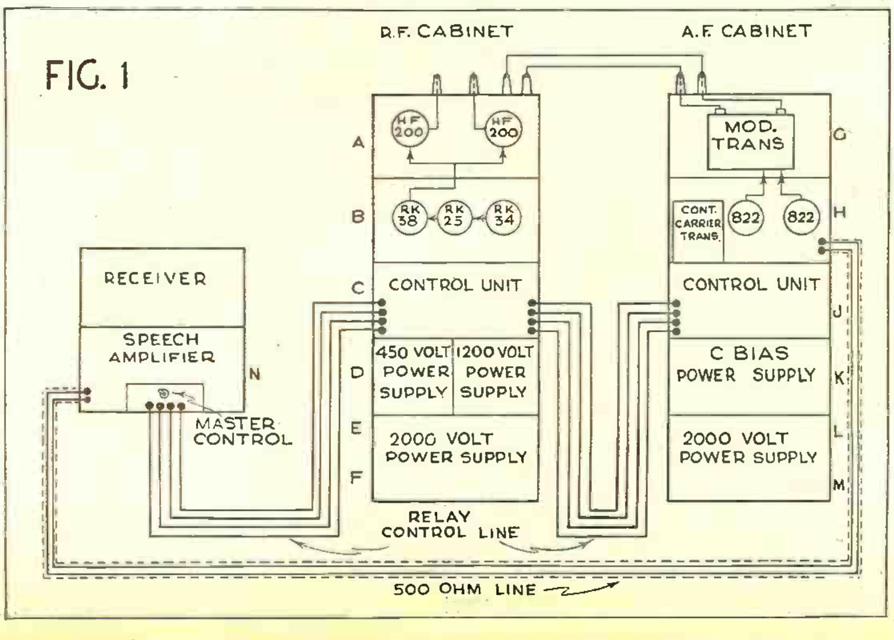
FOR the ham now running a half kw. or so input the increase to a full kw. may only mean the purchase and installation of a new plate transformer, a bigger bottle or two in the final and a few other odds and ends. To the ham with an input of only a hundred watts or so, however, the jump to one kw. input involves not only an expenditure running into a good many hundreds of dollars but a long and arduous rebuilding program.

Starting from Scratch

For those amateurs who can afford the increase to a full kilowatt of transmitter power, and who prefer to do the work themselves, the methods of accomplishing this result are as varied as the individual equipment now owned by these amateurs, as well as their personal preferences in regard to circuits, construction and appearance of the finished transmitter. A chap with a breadboard layout and plenty of room for expansion can most easily and quickly have his kilowatt in operating condition. A ham with a present transmitter of frame or rack construction. and plenty of room for expansion, can also accomplish his desired result with the construction of an additional unit containing a high-power final stage. kilowatt power supply and also appropriate modulator with its necessary power supply.

The best method of building a 1-kw transmitter, however, is to forget the present transmitter and the parts it contains and start from scratch with the design of a completely new job. For those amateurs with this idea in mind, as well as the oh-so-necessary cash in hand, this transmitter has been designed. Not only that, but it has been made as compact as possible so that the builder can place it in even the smallest of shacks or the corner or some room dedicated to more important (to them) purposes in life by other members of the household who are still sane enough to realize that a new car is a much more sensible investment than a new transmitter.

The design and construction of a new and complete 1-kilowatt transmitter, especially if it is to be a phone job, is a complex and long drawn-out process. There is nothing very difficult about any particular phase of this process that cannot be successfully handled by the amateur with a record of one or more medium-powered transmitters behind him. It is, rather, the coordination of all these varied phases of design and construction that constitute the major difficulty besetting the ambitious ham. There is more to the design of such a transmitter than merely the necessary number of r.f. and a.f. stages and their appropriate power supplies. The r.f. stages must be properly coupled together with leads that are short, but not so short that the stages crowd each other to the extent that undesirable interaction takes place. The a.f. circuits must, in addition to these precautions, be well separated and shielded from the r.f. circuits to prevent unwanted coupling



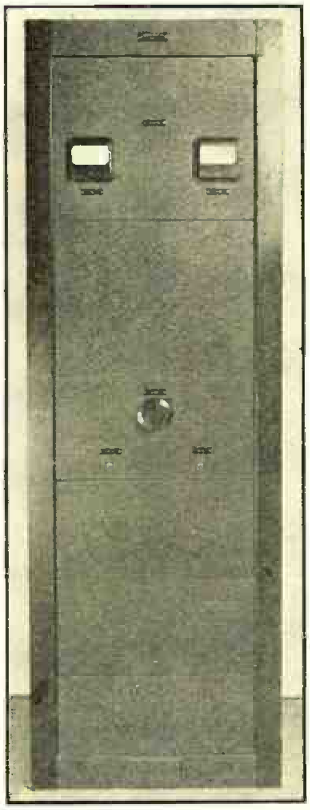
Data on a Modern Transmitter METER

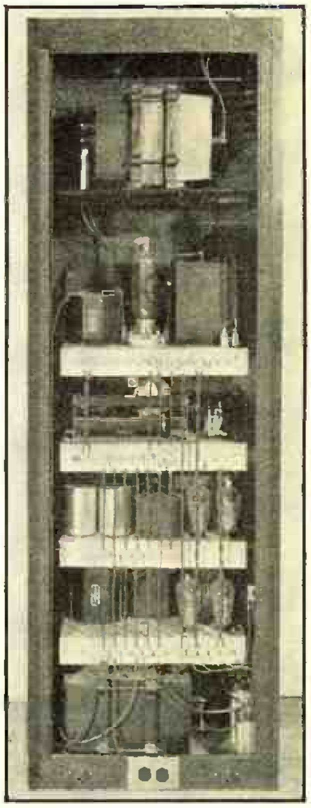
to 1 Kw.)

What thoughts and mental visions of the "Ham" fraternity? What The effect of this phrase on the and power of his present transmitter, regard to power increases that he not too very distant future

Watzel *and* L. M. Cockaday

One)

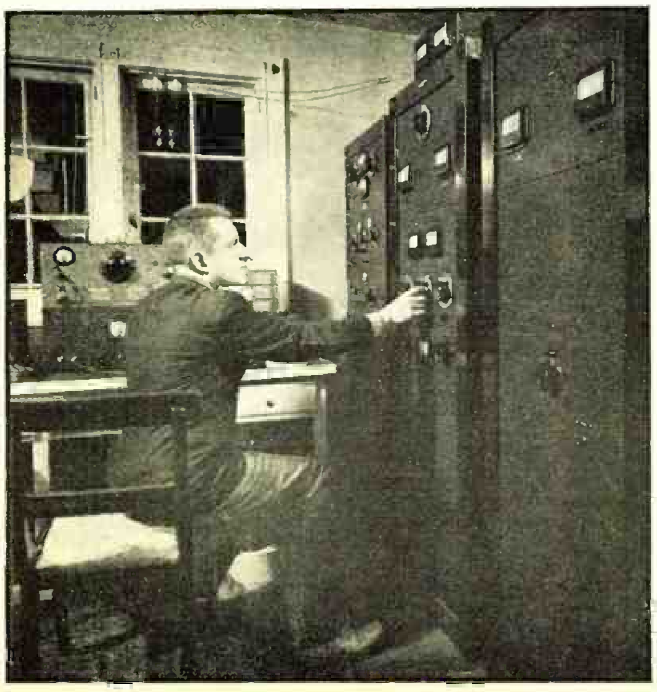




Front—THE MODULATOR—*Rear*

and resulting disastrous feedback.

The power supplies of this transmitter-to-be require more than a bunch of switches to turn them "on or off." All control of the transmitter must be centered in a single, easy-working switch, located right at the operating position, even though the transmitter power is somewhat remotely located from this position. Not only that, the control of the 110 volt a.c. circuits of a transmitter of this power must be handled through a group of relays of adequate current-handling capacity. The keying of the r.f. stages for c.w. operation must also be handled remotely by means of a keying relay. In addition, other relays of protective design, such as over-load and under-load types, must be tied into the complete relay system. In this compact-kilowatt transmitter, for instance, a total of nine relays (of four different types) are utilized for this purpose. When the final r.f. stage of a high-power transmitter arcs over, or breaks down from some other cause, the resulting fireworks puts a Fourth-of-July display to shame; not to mention the damage to equipment that will probably result. Over-load relays take care of this, shutting all plate power off instantly! Another type of protective relay is the under-load relay. One should always be used on a high-power phone transmitter to shut the modulator plate supply off when the final r.f. amplifier does not present a heavy enough load on the modulator; a condition that may result, for instance, with failure of excitation to the final. An unloaded modulator produces damagingly high peak voltages.



IN OPERATION

The new transmitter is now in operation at W2JCY, North Pelham, N. Y., on 10-meter phone. In the first 48 hours all districts in the United States had been contacted on this band with R8 to R9 plus average reports. Also, contacts were made with lower South America, Hawaii, Mexico, San Domingo and the Canal Zone. This was accomplished in spite of the fact that the 10-meter band was considered "closed." The photo above shows the editor making final adjustments on the rig.

Efficient Mechanical Design

The electrical design of a transmitter is only half the job. The mechanical design of a high-power transmitter is a considerable problem owing to the greater number of components necessary, larger physical size of these components and the necessity for an adequate system of relays and controls. When all these various parts are to be contained in a compact cabinet or two the problem is greatly intensified for the amateur who has never built a really large transmitter before. It is actually necessary to have all the parts on hand and to arrange them in various units before any idea may be had of the physical size and layout of the completed transmitter.

Another headache in the design of such a transmitter comes in choosing the actual transformers, tubes, cabinets and other items of the large variety of components necessary for construction of the transmitter. It requires the poring-over of several dozen different catalogs to even get a good idea of the choices to be made. In order to save the constructor as much time and brainwork as possible we have designed and built the RADIO NEWS "Compact Kilowatt" transmitter. (*Turn to page* 114)

The RADIO WORKSHOP

Items of interest for beginners, experimenters and radio constructors.

Conducted by William C. Dorf

Rewinding Old Transformers for 6-Volt Tubes

Present day radio apparatus more and more favors the use of 6.3 volt tubes and many amateurs and experimenters find themselves with surplus filament and power transformers useful only with the 2.5 volt tubes. These transformers can be easily revamped for use with 6.3 volt tubes. Here is how I rewind one of these units; first I take the transformer laminations apart, then I take the insulation off the coil uncovering the filament windings, they are usually the top windings. Knowing the voltage of one of these filament secondaries, then counting the turns on this same winding, you can find the turns-per-volt relation by dividing the turns by the voltage. Now then all you must do to find the turns for the 6.3 volt winding is to multiply the turns per volt value by 6.3. Since the 2.5 volt tubes require from three to six times as much current as the 6.3 volt tube, you can readily see that you can easily put the extra turns in the same winding space because the wire can be much smaller.

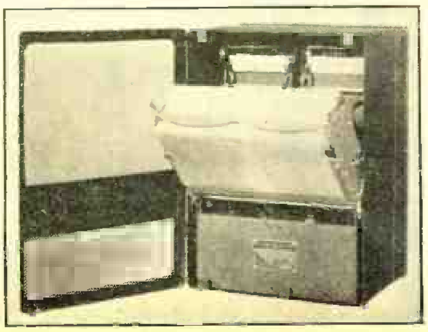
If you are going to draw a total filament current of 1 to 1½ amperes use No. 18 wire; for 2 to 2½ amperes use No. 16 wire, and for 4 amperes use No. 14 B and S wire. Another suggestion: One could take all the secondaries off one of these power transformers and rewind enough secondaries to make a universal filament power supply for use in a tube checker.

MATTHEW MASTERS,
North Tonawanda, N. Y.

Double Photo-Electric Recorder

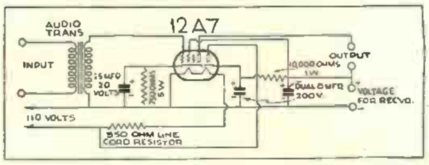
This is the new General Electric double photo-electric instrument designed to record simultaneously on one chart, two electrical quantities as low as one microampere, full scale, and representing a power consumption of but one billionth part of a watt from the measured circuit. The double photo-electric recorder can be applied wherever simultaneous readings are desired. In some cases this immediately cuts testing time in half and in others it aids materially in discovering unusual relations between two variable electrical quantities.

The device can be applied in temperature recording, for the recording of high-resistance voltmeter-ammeter measurements, illumination measurements, and others, requiring galvanometers or other types of measuring elements.



Combination Power Supply and Audio Amplifier

This piece of equipment should be useful in any experimenter's workshop. It may be used with small r.f. tuners, for

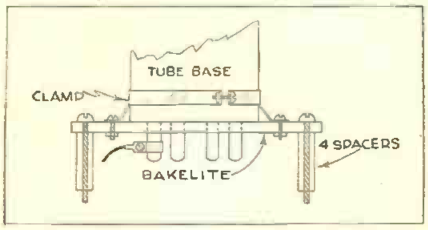


testing and other similar purposes. This combination unit is made possible by the dual purpose 12A7 tube operating as a rectifier and a screen-grid amplifier. The speaker is connected to the terminals marked "output".

BARNETT MITCHELL,
Selma, Ala.

Tube Mounting Kink

Here is a neat socket arrangement for amateur power transmitting tubes, easily



made from parts generally available in every experimenter's junk box. With this arrangement the tube is held securely and low-contact resistance is made possible by the sure-grip connections to the prongs.

Use a square piece of bakelite or other composition for the base. This is drilled to accommodate the tube prongs, the supporting bolt and the mounting screws for the clamp, as illustrated. The clamping ring is the type furnished with the upright mounted, wet electrolytic type condensers. Tubular variable resistor taps are used for connection to each prong.

EDITOR'S NOTE: It is suggested that a single large cut-out be made in the bakelite base instead of drilling holes for the individual prongs. This will reduce the drilling operations and provide more perfect insulation.

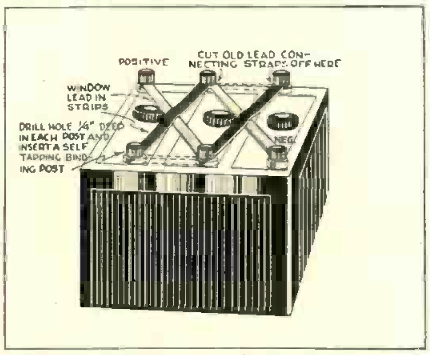
HOWARD ECKER,
St. Paul, Minn.

Good Tools for Good Work

A well equipped radio experimenter's work bench is provided with an assortment of different size screw drivers, both plain and ratchet, well constructed hand drills, a good swivel type vise, and other well made tools that are both labor saving and necessary to good work. The North Bros. Mfg. Co., makers of the well known "Yankee" tools, are specialists in tools of this type. They make small powerful hand drills, especially suitable for radio work, ratchet screw drivers, bench drills, vises of many types and sizes and other special tools.

A Combination 2 and 6-Volt Battery

The owners of 2-volt storage battery receivers frequently have trouble in getting a low-voltage battery charged due to the fact that most charging sources are of the 6-volt type. The diagram below shows a method for utilizing a standard 6-volt automobile or radio battery and charging it in the standard manner, that is, from a regular 6-volt charger and then changing it back to a 2-volt supply with the three cells connected in parallel and providing three times the ampere-hour capacity of the original unit. The connecting lead strips can be cut off with a hacksaw or a metal-cutting handsaw. The new connectors are window lead-in insulated copper

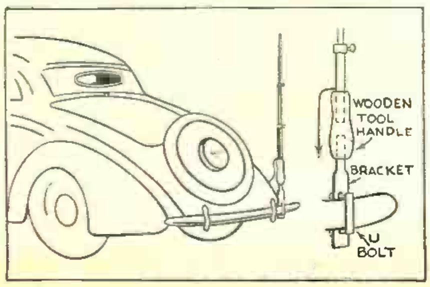


strips, ¾ inch wide. The binding posts are of the self-tapping variety.

H. D. HOOTON,
Beech Hill, W. Va.

Car Aerial Made From on Old Music Stand

The trend of aerials for motor radio seems to be for the upright type, generally consisting of a telescopic rod insulated and mounted on the bumper rod. This little kink shows how to make a motor car antenna of this type from the metal upright support of an old music stand. It can be adjusted to its



Cash for Kinks

EVERY experimenter, from time to time, works out some simple idea or kink that could be profitably passed along to his fellow experimenters through the "Radio Workshop", a department which caters especially to the exchange of such ideas. Send your ideas to the Workshop Editor, and whenever possible include a simple but clear drawing or a photograph. All ideas published will be paid for at regular space-rates.

full length easily and quickly, and in tests has proven very satisfactory.

The drawing shows that a long wooden tool handle is the insulated sleeve between the antenna rod and iron bracket. Do not drill the holes in this handle over-size; they should be a snug fit to prevent undue vibration. The iron bracket of the stand fastens to the car bumper by means of a U-bolt, as shown.

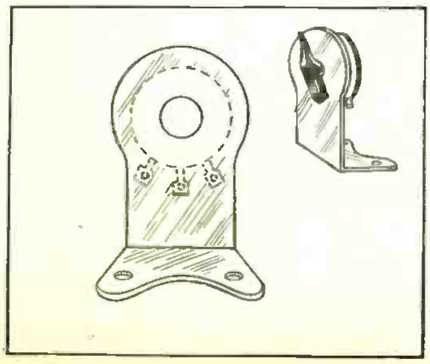
Special Pick-up for Heartbeats

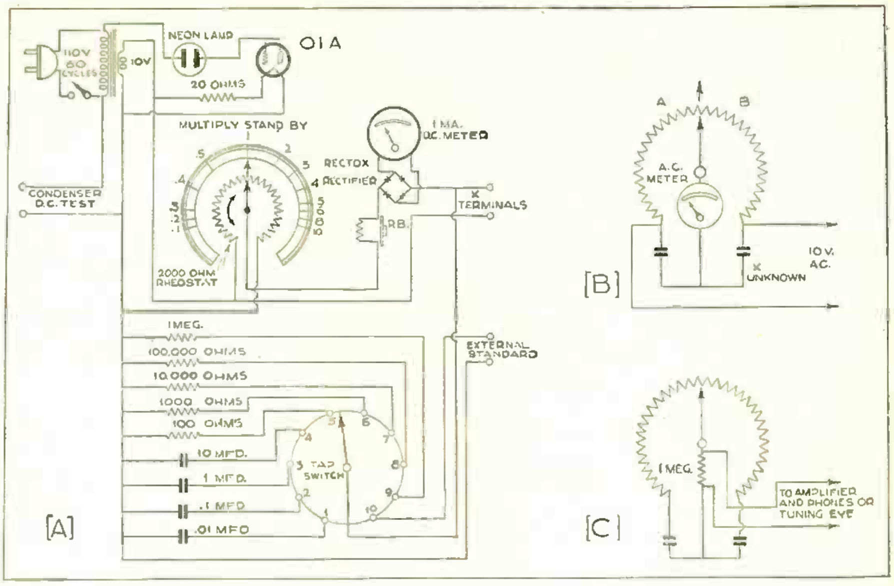
The new non-acoustic, piezo-electric (crystal) "Stethophone," announced by

Shure Brothers is a special pick-up device designed to be used in conjunction with a suitable high-gain amplifier for reproducing and recording heartbeats and chest sounds. The manufacturer advises that extremely faint sounds difficult or impossible to detect with the ordinary stethoscope can be heard clearly with the Stethophone. An outstanding feature of this new model is the anti-feedback design which permits the device to be used near loud speakers without the usual acoustic feedback.

Mounting Volume Controls

Here is a little kink for experimenters who are always building experimental bread-board setups. It is an improvised mounting for volume controls, made from an ordinary shade-roller bracket. The type I use, about 3 inches high by 1½ inches wide, is the kind generally employed with large office shades. The smaller shade-bracket used in the home will do the trick, with the exception that they are not as high and therefore will only take the small-size controls. It is only necessary to drill out the center hole of the bracket to an oversize one-quarter inch, then the shaft





Homemade Bridge Analyzer

This item concerns a handy testing and measuring device, useful to the experimenter as well as the serviceman. It is easily constructed and its operation is extremely simple. It can be employed for checking condensers, for finding the value of fixed resistors, volume control, etc., for reactance measurements and other applications.

The operation of the instrument is based on the Wheatstone bridge balance principle, using a rectifier and sensitive meter. Ten volts a.c. is applied to the bridge circuit, and a balance is obtained by a continuous and uniformly variable A-B ratio as shown on the sketch. For this purpose a 2000-ohm wire-wound rheostat is used. To the rheostat knob a pointer is attached which indicates on a scale the A-B ratio multiplier. This ratio scale is marked in by connecting various known values in the X arm of the bridge (at terminals marked X on the sketch) and balancing the bridge by turning the rheostat until the galvanometer shows zero deflection. Once the scale is marked any unknown value of capacity or resistance can be read quite accurately by connecting at X, setting tap switch for lowest reading on the meter and finally balancing the meter to zero by adjusting the rheostat. The value of X then is the product of the scale reading and the standard used. Unusual values may be obtained by connecting a special standard at the terminals provided and using in the same way, setting tap switch in Position 10. Choke coil or transformer impedance may readily be compared in the same way.

A d.c. condenser test is provided with the usual neon lamp and rectifier. This is so familiar that it does not need an explanation. This instrument can be used as an output meter, as a continuity tester for locating defective parts, etc. A tuning eye, type 6G5 or headphones could be used instead of the meter for the balance indicator. In this case a one-stage amplifier would be necessary and connected at the points in drawing "C".

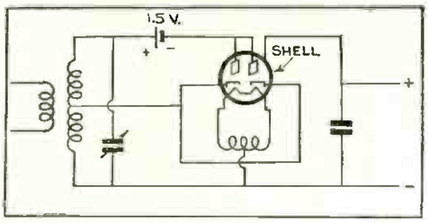
JOHN R. WEEKS,
Mansfield, Ohio.

of the control is slipped through this hole and fastened by its lock nut.

W. CHALMERS,
Peoria, Ill.

New Job For the 6H6 Tube

Recently while working with several 6H6 type tubes in a laboratory setup where the metal shell of the tube was floating, that is



not grounded, it was noticed that there was current flow to the shell. Of course in a standard application of this type tube the shield is grounded and this effect would not occur.

The above conditions suggested that the tube might be used as a triode by tying the diodes together, also the cathodes and applying a potential to the shell. This was tried and it was found that, with 250 volts applied between the cathode and the shell the current measured was 1 milliampere. The amplification factor was from 4 to 7 with a plate resistance of .1 to 1 megohm. I thought this was quite a novel connection arrangement for this tiny tube and I am passing it on to my fellow experimenters for other applications that they may improvise for it.

Using the tube in this way it was found that it would oscillate at either radio or audio frequencies, depending upon the constants of the LC circuit employed. The circuit is shown herewith.

GERARD KELLEY,
New York, N. Y.

Dielectric Measuring Instrument

The unusual looking instruments shown below are the new Boonton "Q" meter and dielectric testing unit. The two instruments combined can be used for measuring the highest grade dielectrics, even up to quartz, with precise accuracy. The dielectric testing unit greatly extends the usefulness of the "Q" meter multiplying the scale reading four times.

The DX *for the*

Conducted by

Laurence

PRETTY YOUNG FOR DX'ING

Listening Post Observer Robert Muguet of Meudon, France, sends in a picture of his 9-months-old YL who seems to be enjoying whatever she hears.

THE fifty-third 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 allwave set pay big dividends!

Credit Where It Is Due

We wish to commend the following Listening Post Observers for their outstanding reports this month: Alfred, Bittner, de Ruadhal, Hartzell, Jaime, McCartin, Partner, Ralat and Smith. Again we are glad to acknowledge new credit to these new names on the extra credit list. We are also able to welcome as a new Citizen of the United States, Warner Howard, although he has always been an excellent and experienced Listening Post Observer. We are also glad to know that H. S. Bradley, 66 Main Street, Hamilton, N. Y., is to handle all QSP'ing of cards for short-wave listeners in the U. S. A. Listeners should furnish him with a self-addressed stamped envelope, size eight, for mailing cards to listeners. A complete list of S. W. Listening Post Observers will be found in the following pages.

Another Interesting Job for Observers

All of our observers who are equipped to listen on the 5-meter band are requested to listen for the DX Editor's station, W2JCY, operating crystal-control, 250 watts input, on 58.246 mc., near the middle of the 5-meter band. When heard, observers should make a record of the conversation, calls mentioned, etc. This will be part of a new research in finding out how far these 5-meter waves travel during the summer. Already reception has been reported in Europe as well as other countries outside of the United States. This same station also operates on 10 meters on 28.38, 28.40 and 28.42 mc. Reports on these transmissions are also requested.

A PENNSYLVANIA LISTENER

Meet Steve Gorgkowski of Ellwood City, Pa., shown in his DX Corner, with a fine exhibit of "veries".

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

CSW, Lisbon, Portugal, 11,040 kc., 12-6 p.m., 9940 kc., 6-8 p.m., (from veri.), (Alfred, Smith, Goetz, Eder, Robinson), signed 7 p.m., (Schrock, Beck, Boussy, Westman, de Ruadhal, Atherton, Dressler, Scala, Howald, Blakebrough, Ralat, Coover), Saturday and Monday 7:15 p.m., (Lindner), Slogan: "Emisora Nacional", Address: Emisora Nacional de Radiofusao, Rue do Queldas.

CT1AA, Lisbon, Portugal, 9665 kc., Tuesday, Thursday and Saturday until 7 p.m., 4-7 p.m. on above days, interval signal three cuckoo calls (from veri.), (Alfred, Smith), 9680 kc., (McCartin, Randle, Goetz, de Ruadhal, Hare, Herzog, Ralat), Slogan: "Radio Coloniale." Address: Antonio Augusto d'Aguiar, 144.

CT1GO, Parede, Portugal, 48.4 meters, daily 5:15-6:30 p.m., except Thursday, 24.19 meters, Tuesday, Thursday and Friday, 2-3:15 p.m., (Randle). 12,396 kc., (Gossett).

CT1CT, Parede, Portugal, 31 meters, Thursday also 24.83 meters, (Blakebrough).

I2RO4, Rome, Italy, 11,805 kc., 8:30-10:30 a.m., (from veri.), (Sporn).

I2RO, Rome, Italy, 9630 kc., 6 p.m., (Myers, Becker, Eder, Wollenschlager), Monday 7-8 p.m., (Kidd), 9:20 a.m.-1:30 p.m., 2-5:30 p.m., (de Ruad-

CT1AA's VERIFICATION

Below: A comprehensive picturization of "Radio Colonial" is given on this card which is sent to listeners reporting on their signals from Portugal.

Corner SHORT WAVES

M. Cockaday

hal), 25.400 kc. (from veri.). (Forrester, Patrick), 11,810 kc., (Fallon, Robinson, Sesma, Hendry, Ralat, Coover), 15,790 kc., (Marshall, Beck).

I2RO3, Rome, Italy, 9635 kc., daily 6-7:30 p.m., (Bittner, Dressler, Sprague).

HVJ, Vatican City, Italy, 15,120 kc., daily from 10:30-10:45 a.m., daily from 2 p.m., (Smith, McCartin, Smith, Hendry, de Ruadhal, Sporn).

Radio Libertad, Milan, Italy, 7400 kc., 7-8:10 p.m., Communist station, (Fallon), 6950 kc., (Rodriguez, Beck, Shamleffer), Slogan: "Al Servicis de la Libertad Del Pueblo Italiano."

IQA, Rome, Italy, 14,730 kc., 9:30 a.m., (Howald).

IRY, Rome, Italy, 16,120 kc., (Jordan, Fallon).

TPA3, Pontoise, France, 11,880 kc., 9 a.m. and on, (Howald), 5:15-11 p.m., (de Ruadhal, Blakebrough, Herzog), 11,895 kc., (Ralat, Lindner), "Radio Coloniale", Address: 98 bis Blvd. Haussmann 98 bis.

TPA4, Pontoise, France, 11,710 kc., 9 p.m. and on, (Howald), 5-10 a.m., (de Ruadhal, Hendry, Blakebrough, Sesma, Eder), 11,720 kc., 6:30-8:30 p.m., 10 p.m.-1 a.m., (Dressler, Beck, Hendry, Black), Slogan: "Radio Coloniale".

TPA2, Pontoise, France, 15,240 kc., 8:15-8:30 a.m., (McCartin). Sunday 9:15 a.m., (Ralat), 3-4 a.m., 10:15 a.m.-5 p.m., (de Ruadhal, Sporn, Blakebrough, Sesma, Emerson), Slogan: "Radio Colonial".

TYA1, Paris, France, 18,090 kc., (Birnie).

TYA2, Pontoise, France, 9040 kc., 12-1:30 a.m., 2-3 a.m., (Sporn, Stabler, Hartzell).

FNSK, S.S. "Normandie", 13,210 kc., (Hartzell).

"Stazione del Partito Communista Italiano", 10,620 kc., daily 4-5:45 p.m., 9520 kc., 7-8 p.m., daily, no call or location given, (Scala), Address: 25 Rue de Ausoca, Paris, France.

HBL, Geneva, Switzerland, 9595 kc., sign Saturday 8:25 p.m., (Alfred), Saturday 5:30-5:45 p.m., (from veri.), (Smith, Ralat, Schrock), 9345 kc., 5:30-8 p.m., (from veri.), (Westman, Hendry, Blanchard, Robinson).

HBO, Geneva, Switzerland, 11,402 kc., sign Saturday 8:25 p.m., (Alfred), Monday 2:30-3 a.m., (from veri.), (Smith), Saturday 6:45-8 p.m., (Shamleffer, Schrock). Monday and Saturday, 3:15 a.m.-8 p.m., (from veri.), (Sporn, Howald).

HBP, Geneva, Switzerland, 7797 kc., Saturdays 5:15-6:30 p.m., (from veri.), (Smith, Shamleffer, Robinson, Schrock, de Ruadhal, Sporn, Jaime).

HB9BG, Switzerland, 41.1 meters, Friday 4-5 p.m., announces in English, German, French, Italian, (Smith, Skinner).

HBJ, Geneva, Switzerland, 14,535 kc., Saturday 6:45-8 p.m., (Shamleffer, Schrock), 20 meters, (Patrick, Howald). Saturday 7:15-8:30 p.m., (Gossett, Beck), Address: Quai de la Poste 12.

HBA, Geneva, Switzerland, 8345 kc., Saturday 9:10 p.m., (Robinson).

GBTT, S.S. "Queen Mary", 13,000 kc., 1 p.m., (Hare), 13,220 kc., 5:45 p.m., (Hartzell, Dressler).

GSP, Daventry, England, 15,310 kc., daily 6:20-8:30 p.m., (from ann.), (Bittner, Law, Marshall, deRuadhal, Patrick), daily 9-11 p.m., (Stabler, Jordan, Partner, Howard, Eder, Emerson).

GSC, Daventry, England, 9580 kc., daily 9-11 p.m., (Bittner, Eder, Law, de Ruadhal, Partner), 12 p.m. and on, (Howard).

GSD, Daventry, England, 11,750 kc., (Eder, Law, Ralat, Marshall), daily 6-8, 9-11 p.m., (Kidd), 1-3:15 a.m., 12:20-2:45 p.m., (de Ruadhal, Patrick, Partner, Howard, Hendry, Cooven, Goetz, daily 12-2 a.m., (Dressler, Wacker).

GSI, Daventry, England, 15,260 kc., 9-11 p.m., (Howard, Bittner, Eder), 12:20-2:45 a.m., (de Ruadhal), 2:30-

(Turn to page 100)

THE "RADIOCLUB PARTUGUES"

This is the studio building of the Portuguese short-wave station, CT1GO. The two masts are shown at the right.

CARD WORTH RECEIVING

Observer Hugo Richter, of Zurich, Switzerland, sends in for publication this card from 3LR, Lyndhurst, Victoria. Have you got one?

REAL RADIO PRIEST

The Rev. F. R. Vollmer, O.P., of Raleigh, N. C., pictured below with his Radio News "Ocean Hopper", scans the short waves between services.

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

HOURS OF TRANSMISSION

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
												Wave-length Meters	Call Letters	Frequency Kc.	City Country												
											D	13.93	W8XK	21540	Pittsburgh, Pa.	D											
									D	D	D	13.93	GSJ	21530	Daventry, England	D	D	D	D								
									D	D	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								
												15.77	HS8PJ	19020	Bangkok, Siam	D	D										
			D	D	D				D	D	D	16.86	GSG	17790	Daventry, England	D	D	D	D	D	D	D	D	D	D		
										XS	D	16.87	W3XAL	17780	Bound Brook, N. J.	D	D	D	D	D	D	D	D	D	D	D	
											S	16.88	PHI	17770	Huizen, Holland	XW	XW										
												16.89	W2XE	17760	New York, N. Y.				D								
				D	D	D	D	D	D	D	D	16.89	DJE	17760	Zeesen, Germany	D	D	D	S	S							
D	D	D										19.56	DJR	15340	Zeesen, Germany	D								D	D	D	D
												19.57	W2XAD	15330	Schenectady, N. Y.			D	D	D	D	D	D	D	D	D	D
D												19.60	GSP	15310	Daventry, England											D	D
											D	19.62	LRU	15290	Buenos Aires	D											
D	D	D		D	D	D	D	D	D	D	D	19.63	DJQ	15280	Zeesen, Germany	D	D	D	S	S				D	D	D	D
												19.65	W2XE	15270	New York, N. Y.					D	D	D	D	D			
	D	D										19.66	GSI	15260	Daventry, England					D	D	D	D				
										D	D	19.68	TPA2	15243	Pontoise, France	D	D	D									
												19.70	OLR5A	15230	Podebrady, Czech.	D	D					D					
								T	T			19.71	PCJ	15220	Huizen, Holland	W	W	W									
												19.72	W8XK	15210	Pittsburgh, Pa.		D	D	D	D	D	D	D	D	D	D	
D	D	D		D	D	D	D	D	D	D	D	19.74	DJB	15200	Zeesen, Germany	D	D	D	S	S				D	D	D	D
	S	S	D	D	D		AM	D	D	D	D	19.75	ZBW4	15190	Hong Kong, China	D	D	Sa									
D			D	D	D				D	D	D	19.76	GSO	15180	Daventry, England	D	D	D	D					D	D	D	D
	D	D										19.82	GSF	15140	Daventry, England		D	D	D					D	D		
									XS			19.84	HVJ	15121	Vatican City			I									
				D	D					S	S	19.85	DJL	15110	Zeesen, Germany	D			D	D	D	D	D	D			
				S	S	S	S	S	D	D	S	20.04	LZA	14970	Sofia, Bulgaria			S	S	S	U	U	S	S			
				D							D	20.55	JVH	14600	Nazaki, Japan												
S	S	S										22.16	SPW	13653	Warsaw, Poland				C	C	C				S	S	S
												24.52	TFJ	12235	Reykjavik, Iceland						S	S					
										V		25.00	RV59 (RNE)	12000	Moscow, U.S.S.R.			S									
								D				25.24	TPA3	11885	Pontoise, France					D	D	D	D	D	D		
D	D											25.27	W8XK	11870	Pittsburgh, Pa.												D
Z	Z	Z										25.34	OLR4A	11840	Podebrady, Czech.							D	D	I			
D												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
										D	D	25.40	I2RO4	11810	Rome, Italy	D	D	D	D	D	I	I	I	I	I	I	I
												25.42	JZJ	11800	Nazaki, Japan									AM			
												25.45	W1XAL	11790	Boston, Mass.		M	I	M				S	D	D	S	
D	D	D										25.49	DJD	11770	Zeesen, Germany				D	D	D	D	D	D	D	D	D
D	D	D	D	D	D							25.53	GSD	11750	Daventry, England					D	D	D	D			D	D
D	D	D	D									25.58	CJRX	11730	Winnipeg, Canada											D	D
D	D	D	D	D								25.60	TPA4	11720	Pontoise, France											D	D
D	D	D										25.62	HJ4ABA	11710	Medellin, Colombia				D	D					I	D	D
S	S											26.24	COCX	11435	Havana, Cuba	D	D	D	D	XS						S	S
												26.60	HIN	11280	Trujillo, D. R										XS		
								D	D	D	D	27.93	JVM	10740	Nazaki, Japan							D	D				
				D	D	D		I				28.14	JVN	10660	Nazaki, Japan									D			
												29.04	ORK	10330	Ruysselede, Belgium						D	D	I	I			
D	D	D	D									30.43	EAQ	9860	Madrid, Spain						S	S				D	D
D	D	D	D									30.75	COCQ	9750	Havana, Cuba	D	D	D	D	D	D	D	D	D	D	D	D
							K	K			K	31.00	CQN	9677	Macao, Asia	K											
D	D	D	D									31.06	LRX	9660	Buenos Aires, Argentina		D	D	D	D	D	D	D	D	D	D	D
D												31.09	YNLF	9650	Managua, Nicaragua						D						D
												31.09	CT1AA	9650	Lisbon, Portugal									G	G	G	I
D					I							31.10	HH3W	9645	Port-au-Prince, Haiti					D							D
												31.14	I2RO3	9635	Rome, Italy					I	I	I	I	I	I	I	I
D	D											31.25	RAN	9600	Moscow, U.S.S.R.												D
D	D	D	D	Sa								31.25	HJ1ABP	9600	Cartagena, Colombia				D	D	D				D	D	D
				M								31.27	HBL	9595	Geneva, Switzerland										Sa	Sa	
										XS	XS	31.28	VK6ME	9590	Perth, Australia												
												31.28	W3XAU	9590	Philadelphia, Pa.				D	D	D	D	D	D	D	D	
					S	S			S	S	S	31.28	VK2ME	9590	Sydney, Australia	S	S	S	S								
W	W											31.28	PCJ	9590	Huizen, Holland						T	AG					V
D	D	D										31.28	HP5J	9590	Panama City, Pana.			S	S	D	S						D
			I	I	D	I	XS	XS	XS	XS	XS	31.32	VK3LR	9580	Lyndhurst, Australia	XS											
	D	D										31.32	GSC	9580	Daventry, England												
D	D	I										31.33	HJ2ABC	9575	Cucuta, Colombia				D					D		D	D
D	D	D	D	D						XS	XS	31.35	W1XK	9570	Millis, Mass.	D	D	D	D	D	D	D	D	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	D								D	31.40	TIPG	9559	San Jose, C. R.	D	D			D	D					D	D
D	D	D		D	D	D	D	D	D	D	D	31.45	DJN	9540	Zeesen, Germany	D	D	D						D	D	D	D
D	D	D	D									31.48	W2XAF	9530	Schenectady, N. Y									D	D	D	D
									D	D	D	31.48	LKJ1	9530	Jeloy, Norway												
	S	S	D	D	D		AM	D	D	D	D	31.49	ZBW3	9525	Hong Kong, China	D	D	Sa									
D			D	D	D							31.55	GSB	9510	Daventry, England					D	D	D	D	D	D	D	D
C	C	C										31.55	HJU	9510	Buenaventura, Colom.					C	C						
								XS	XS	XS		31.55	VK3ME	9510	Melbourne, Australia												
D	D	D	D									31.56	XEFT	9505	Veracruz, Mex.				D	D	D	D	D				D
												31.58	PRF5	9500	Rio de Janeiro, Brazil						D	D		XS	XS		
XA	XA	M	M									31.58	HJ1ABE	9500	Cartagena, Colombia		D		X	X		S	S	S	D	XS	XS
D	D	D	D							D	D	31.82	COCH	9428	Havana, Cuba	D	D	D	D	D	D	D	D	D	D	D	D
												32.88	HAT4	9125	Budapest, Hungary											S	
I	I					I	I					33.53	HCJB	8948	Quito, Ecuador						I	I				I	I
X	X	X										34.62	CO9JQ	8665	Camaguey, Cuba												
												38.48	HBP	7797	Geneva, Switzerland										Sa	Sa	
						D						39.95	JVP	7510	Nazaki, Japan							D		I			
D	D											43.48	HI3C	6900	La Romana, D. R.					D	D						D
										XS	XS	43.99	XGOX	6820	Nanking, China	D	D	XS									
AC							D					44.14	HIH	6796	San Pedro, D. R.					AC	AC			S			AC
D	D	I	I									44.71	TIEP	6710	San Jose, Costa Rica										I	D	D
	T	T	T									45.22	HC2RL	6635	Guayaquil, Ecuador										S	S	S
			Sa	Sa								45.25	HIT	6630	Trujillo, D. R.					XS	XS					D	D

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				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											
	Th	Th	Th									45.34	PRADO	6618	Riobamba, Ecuador		T	T									
												45.80	HI4D	6550	Trujillo, D. R.				XS	XS	XS			XS	XS	XS	XS
D	D											46.01	YV4RA	6520	Valencia, Venezuela				D	D	D				D	D	D
D	I											46.08	HIL	6510	Trujillo, D. R.											D	D
												46.66	HI1S	6430	Puerto Plata, D. R.					D	D					D	D
D	D	D	I	I	I							46.85	YV5RH	6400	Caracas, Venezuela										D	D	D
												46.91	HI8Q	6395	Trujillo, D. R.				D	D	D				D	D	D
D	D	D	D									47.12	YV1RH	6360	Maracaibo, Ven.												D
D	D										D	47.24	HRP1	6350	San Pedro Sula, Honduras					D	D					D	D
I	I	Sa	Sa									47.54	HIZ	6310	Trujillo, D. R.					S	S	S		I	I	I	I
I	I	I										47.62	YV4RD	6300	Maracay, Venezuela												
XS	XS											47.77	HIG	6280	Trujillo, D. R.												XS
	D	D										47.77	COHB	6280	Sancti Spiritus, Cuba		D			D				D	D		
D	D											48.05	HIN	6243	Trujillo, D. R.					D	D						D
XS	XS	XS										48.11	HRD	6235	La Ceiba, Honduras									S	S		
L	L	L										48.15	OAX4G	6230	Lima, Peru												L
AM												48.19	HJ1ABH	6225	Cienaga, Colombia												AM
D	XS	XS		S								48.39	COKG	6200	Santiago, Cuba										D		
D	D	I	I	I								48.50	HI1A	6185	Santiago, D. R				D	D	D						D
D	D	D		D								48.62	OAX1A	6170	Chiclayo, Peru												
D	D	D										48.70	XEXA	6160	Mexico, D. F., Mexico												D
										XS	XS	48.70	VPB	6160	Colombo, Ceylon	XS	XC	V	V	Sa							
D	D	D	D									48.70	CJRO	6160	Winnipeg, Canada											D	D
D	D	D										48.72	YV5RD	6158	Caracas, Venzuela				D	D	D			D	D	D	D
			Sa	Sa								48.78	VE9CL	6150	Winnipeg, Canada												
D	D											48.78	HJ2ABA	6150	Tunja, Colombia						D						D
	D	D	D									48.78	HJ5ABC	6150	Cali, Colombia				D	S	S						
		D	D	D								48.86	W8XK	6140	Pittsburgh, Pa.												
								D	D	D		48.88	CR7AA	6137	Lourenzo Marques, A					D	D	D	D				
												48.94	LKJ1	6130	Jeloy, Norway				D	D	D	D	D	D			
D	D	D									X	48.94	VE9HX	6130	Halifax, N. S.	X	X	X	X	X	F	F	SF	D	D	D	D
D	D	D	D	D	D							48.94	COCD	6130	Havana, Cuba												D
D	D	D	XS									48.96	HJ3ABX	6122	Bogota, Colombia			XS	XS	D	D				XS	D	D
D	D	D										49.00	HJ1ABB	6120	Barranquilla, Colom.				D	D					D	D	D
	D											49.02	W2XE	6120	New York, N. Y												
					D	D		S	S	S	D	49.18	YTC	6100	Belgrade, Yugoslavia	XS					D	D	D	D	D		
D	D											49.18	W3XAL	6100	Bound Brook, N. J												D
			XSa	XS								49.18	W9XF	6100	Chicago, Ill.												
D			XS	XS			XS	D	XS	XS	S	49.20	ZTJ (JB)	6098	Johannesburg, Africa	S	D	D	XS	D	D	D	D				
D	D	D	D									49.20	HJ4ABE	6097	Medellin, Colombia		D	D	D	D					D	D	D
	S	S	D	D	D		AM	D	D	D	D	49.26	ZBW2	6090	Hong Kong, China	D	D	Sa									
			Sa									49.26	CRCX	6090	Toronto, Canada				S	D	D	D	D	D	D	D	D
XS	XS	XS										49.30	HJ5ABD	6085	Cali, Colombia												N
XS	XS	D										49.31	HJ3ABF	6084	Bogota, Colombia				D								XS
									X	X		49.32	VQ7LO	6083	Nairobi, Kenya, Afr	E	E		U	U	U	XC			XS	XS	
D	D	XS	XS									49.34	HP5F	6080	Colon, Panama					S	D	XS		S	S		D
D	D	D	D							D	D	49.34	W9XAA	6080	Chicago, Ill.	D	D	D	D	D	D	D	D	D	D	D	D
											XS	49.34	ZHJ	6080	Penang, S. S.	XS											
												49.40	OER2	6073	Vienna, Austria		XS	XS	XS	XS	XS	XS	XS	XS	Sa	Sa	
D	D											49.42	YV1RE	6070	Maracaibo, Venez				D	D					D	D	D
			D	D	D					XS	XS	49.50	W8XAL	6060	Cincinnati, Ohio	D	C	C	D	D	D	D	D	D	D	D	D
D	D											49.50	W3XAU	6060	Philadelphia, Pa.												D
												49.50	OXY	6060	Skamlebaek, Denmark				S	S	D	D	D	D	D	D	
												49.59	HJ3ABD	6050	Bogota, Colombia												
D	D	D										49.59	HI9B	6050	Trujillo, D. R.					D						D	D
	D											49.63	HJ3ABI	6045	Bogota, Colombia												
XS	XS	XS		Sa								49.65	HJ1ABG	6042	Barranquilla, Colom.					XS	XS	S				XS	XS
							D	D	D	D		49.67	YDA	6040	Tandjong Priok, Java												
												49.67	W1XAL	6040	Boston, Mass.											Q	Q
D	D	D										49.75	HP5B	6030	Panama City, Panama					D				I			D
D	D	D	D		I							49.79	HJ1ABJ	6025	Santa Marta, Colombia					D							D
												49.83	DJC	6020	Zeesen, Germany				D	D	D	D	D	D			
D	D	D	D	D								49.83	XEUW	6020	Veracruz, Mexico	D	D	D	D	D	D	D	D	D	D	D	D
E	XS	XS	XS									49.88	XEWI	6015	Mexico, D. F., Mexico								C		I		E
D	D	D	I									49.90	HJ3ABH	6012	Bogota, Colombia				D	D	D	D		S	S	D	D
			Sa	Sa								49.92	COCO	6010	Havana, Cuba		D	D	D	D				D	D	D	
												49.96	CFCX	6005	Montreal, Can.	D	D	D	D	D	D				Sa		
D											D	49.96	HP5K	6005	Colon, Panama	D				D						D	D
				Sa								49.96	VE9DN	6005	Montreal, Canada							D					
D	D	D	D	D								50.00	XEBT	6000	Mexico, D. F., Mexico			D	D	D	D	D	D	D	D	D	D
												50.00	RV59	6000	Moscow, U.S.S.R									H			
Z	Z	Z									S	50.17	HIX	5980	Trujillo, D. R.	S	S	S		D	D			D	D		
D	D	D										50.25	HJN	5970	Bogota, Colombia				D								
									S			50.26	HVJ	5969	Vatican City							D					
XSa	D	Sa	Sa									50.50	TG2X	5940	Guatemala City												
XS	XS											50.72	HH2S	5915	Port-au-Prince, Haiti						D						
D	D	S	S									50.76	HRN	5910	Tegucigalpa, Hond.					D		S	S	S	D	D	D
D	D											50.85	YV3RA	5900	Barquisimeto, Venez.					D						D	D
D	D											51.15	HI1J	5865	San Pedro D. R.					D	D	D				D	D
D	D											51.46	TIGPH	5830	Alma Tica, Costa Rica					D	D					D	D
D	D	XS										51.72	YV5RC	5800	Caracas, Venezuela		S	S	D	D	S	S	S	D	D	D	D
	AH	AH	AH									51.90	OAX4D	5780	Lima, Peru		AN	AN	AN								

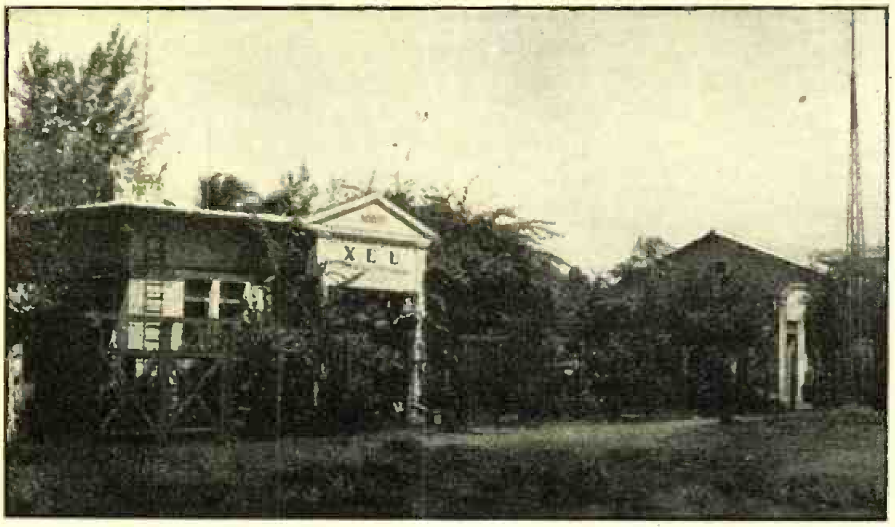
List of Symbols

A—Thursday, Sunday
B—Saturday, 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
Q—Sunday, Monday, Tuesday
R—Sunday, Monday, Friday
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
X—Except Saturday, Sunday
XB—Except Tuesday, Thursday
XC—Except Tuesday, Thursday, Sunday
XM—Except Monday
XS—Except Sunday
XW—Except Wednesday
XY—Except Tuesday, Sunday
XSa—Except Saturday



FROM SUNNY MEXICO

The card sent out by XEUW, 6020 kc., whose slogan is: "El Eco de Sotavento desde Veracruz".

The DX Corner (Short Waves)

(*Continued from page 97*)

5:45 a.m.. (from veri.), (Sporn, Partner, Dressler, Howard, Atherton).

GSF, Daventry, England, 15,140 kc., daily off 6 p.m.. 8-11 p.m., (from ann.), (Bittner, Eder, Ralat, Robinson). 4-8 p.m., (de Ruadhal). 15,180 kc. (Stabler, Black, Patrick), 6-8:55 a.m., (Partner, Dressler, Howard, Hendry, Black, Coover).

GSO, Daventry, England, 15,180 kc., 6-8 p.m., (Bittner, Law, Robinson, Wollenschlager). 1-8:55 a.m.. 4-8 p.m., (de Ruadhal, Patrick, Partner, Dressler, Howard. Black). 11,750 kc. (Beck, Emerson).

GSA, Daventry, England, 15,180 kc., (Marshall).

GSK, Daventry. England, 26.100 kc., (Robinson), 6-8:55 a.m., daily starting in June. (Partner).

GSH, Daventry, England, 21,470 kc., 7 a.m.-12 noon. (de Ruadhal, Blakebrough), 6-8:55 a.m., daily. (Partner), 9:15-11:30 a.m., (Dressler, Croston).

GSJ, Daventry England. 21,530 kc., 7-12 a.m., (de Ruadhal, Blakebrough), new schedule 6-8:55 a.m., 9:15-noon, (Dressler, Partner).

GSG, Daventry, England. 17.790 kc., (Eder, Law). Wednesday. Thursday 2-4 p.m.. (Shamleffer), 1 a.m.-6 p.m.. (de Ruadhal, Blakebrough), 5:45-7 p.m. daily, (Patrick), 12-2:15 a.m., 9:15-12 a.m., 12:20-3:45 p.m., (Partner, Dressler, Howard, Goetz, Ralat).

GSB, Daventry. England, 9510 kc.. (Eder, Law, Ralat. Marshall), 1-3:15 a.m.. (de Ruadhal, Patrick), 3:15-5 a.m, (Sporn, Jaime, Blakebrough), 5:45-7:07 p.m. daily, (Patrick), daily 12-2:15 a.m., 12:20-6 p.m., 6:30-8:30 p.m., (Partner, Sprague, Coover, Dressler).

GST, Daventry, England, 21,550 kc., new station. (Skinner, White), daily 4:15-9:30 a.m., (Dressler), Coronation station. (Fallon), 9:15 a.m.-noon, (Kemp).

GBP, Rugby, England, 10,770 kc., 7:30 p.m.. (Herzog, Harley).

GBU, Rugby. England, 12,290 kc., (Herzog. Ralat), 7-8 p.m., (Goetz).

GBS, Rugby, England, 12,150 kc., (Herzog, Ralat), 7-8 p.m., (Goetz), 5 p.m., (Chambers).

GBA, Rugby, England, 16,140 kc., for Coronation, (Beck).

GSN, Daventry, England, 11.820 kc., used for Coronation. (Partner).

GSE, Daventry, England. 11,860 kc., irreg. 9:15-12 a.m., Coronation special, (Partner).

GAS, Rugby, England, 18,310 kc., 11:15 a.m.. (Herzog).

DJD, Zeesen, Germany, 11,770 kc., (Eder, Ralat), daily 4:50 p.m., (Marshall), daily 4-10 p.m., (Kidd, Sesma. de Ruadhal), 11:35 a.m.-4:30 p.m., (Partner, Dressler, Howard, Hendry, Emerson, Sprague, Coover, Goetz, Harley).

DJN, Zeesen, Germany, 9540 kc., (Eder, Ralat). 5:55 a.m.-4:20 p.m., (de Ruadhal), 4:50-10:45 p.m. daily, (Dressler, Sesma, Howard).

DZB, Zeesen, Germany, 10,040 kc., 4:30-6:30 p.m.. (Stabler),

DJT, Zeesen, Germany, 15,360 kc., until 11 p.m.. (Howard, Eder).

DZH, Zeesen, Germany, 14,460 kc., 6-7 p.m., (Bittner, Hartzell), 5 p.m., (Herzog), 9:50-11:05 p.m., (Brown).

DJC, Zeesen, Germany, 6020 kc.. news 2-2:15 p.m., 5-5:15 p.m., (McCartin, Chokan), 1:10 a.m.-4:20 p.m., (de Ruadhal. Partner, Goetz).

DJA, Zeesen, Germany, 9560 kc., (Eder, Ralat). irreg. (de Ruadhal), 12:05-5:15 a.m., 4:50-11 p.m., (Partner, Dressler, Sesma, Howard).

DJL, Zeesen, Germany, 15,110 kc.. Sunday only, (Alfred), daily 12 p.m. and on, (Bittner). 1:10 a.m.-4:20 p.m., (de Ruadhal). 12-2 a.m., 11:35 a.m.-4:30 p.m., (Partner, Sesma. Eder, Howard).

DJO, Zeesen. Germany, 11,795 kc.. 2 p.m.. 15,280 kc.. Sunday until 12:20 p.m., (Alfred. Sporn. Unger, Eder). 11,800 kc.. (Birnie, Robinson, Coover, Goetz).

DZC, DXC, Zeesen, Germany, 10,290 kc., Saturday 4:50 p.m., (Alfred, Ralat).

DJE, Zeesen, Germany, 17,760 kc., 5:55-11 a.m., (de Ruadhal), 12:05-5:15 a.m., (Partner).

DIP, Nauen. Germany, 14,410 kc., daily 4:50-10:45 p.m., (Alfred).

DJB, Zeesen, Germany, 15.200 kc., daily 4:50-10:45 p.m., 8-9 a.m., (Alfred), daily 6-11 p.m., (Bittner, Eder. Dressler, Marshall, Wollenschlager. de Ruadhal), 12:05-5:15 a.m., Sunday 11:10 a.m.-12:30 p.m., (Partner, Sesma. Howard, Harlen).

DJZ, Berlin. Germany, 15,280 kc., daily 4:50-10:45 p.m., (Alfred), daily 7-10:45 p.m., (Bittner. Eder, de Ruadhal, Sporn, Jordan). daily 12:05-5:15 a.m., 6-8 a.m., (Partner, Sesma. Howard).

DJR, Zeesen, Germany, 15,340 kc., 12:05-5:15 a.m., 8-9 a.m., 4:50-11 a.m., (Partner. Eder).

DFL, Nauen, Germany, 10,850 kc., 7:30 p.m., (Herzog).

DJP, Zeesen, Germany, 11,850 kc., (Beck).

EAQ1, Madrid. Spain, 9860 kc., daily 5-7:30 p.m., requests reports. (Alfred), daily 6-9 p.m., (Bittner, Becker, Law.

(*Turn to page 103*)

TWO FINE CENTRAL AMERICAN CARDS

Below: Sr. Jose Lopez of Cuba sends the card from Ecuador, and Jerome Roberts, the card from Costa Rica.

THE WORLD'S ORIGINAL ORGANIZATION OF SHORT-WAVE LISTENING POST OBSERVERS

S.W. PIONEERS

Official RADIO NEWS Listening Post Observers

LISTED below by states are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner.

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Illinois: Evert Anderson, Grace M. Beck, Larry Eisler, Arthur Evans, George B. Flint, Leo Herz, Bruce Holmgren, Robert Irving, Heinie Johnson. Walter Lorvig, Charles A. Morrison. Floyd M. Murphy, William Ross, Harold E. Schrock, William J. Vette. Floyd Waters. Robert L. Weber, J. Ira Young, Eddie C. Zarn; **Indiana**: Freeman C. Balph. Arthur B. Coover, Virgil Lewis Gossett, Delmar Hert. Karl W. Miles. Howard W. Oliver, M. E. Packman, Jr., Earl R. Roberts, Henry Spearing, Zane Sprague; **Iowa**: Earle Drew, Vincent M. Poll. Edwin P. Webb; **Kansas**: William Schumacher, Ralph E. Weikal; **Kentucky**: Elmer Duncan. W. W. Gaunt. Jr., Milton Horstman, William A. McAlister, Charles Miller. James T. Spalding, J. E. Wilson, Walter R. Yeary; **Louisiana**: Irving G. Couvillion, Roy W. Peyton; **Maine**: Danford L. Adams. Linwood R. Delano, M. Keith Libby, R. C. Messere. Clayton D. Sands, H. Francis Shea. Charles R. Wilson. Vincent M. Wood; **Maryland**: Howard Adams, Jr., Lyman F. Barry, William L. Bauer, Forest W. Dodge, J. F. Fritsch. August J. Walker. William Homer Wesley. Lee Meade Williams.

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Pennsylvania: Harold W. Bower, J. B. Canfield, Roy L. Christoph, S. G. De Marco. F. C. Foltz, Herman H. Forester, R. H. Graham, Clarence Hartzell, Thomas P. Jordan. Fred Karpen, R. O. Lamb. George R. Lang, George Lilley, Edward C. Lips. Charles B. Marshall, Jr., R. T. Merkel, Albert Michaels. William T. Murray. Charles Nick. R. B. Oxreider, Hen. F. Polm, C. T. Sheaks, Stephen G. Spicer, K. A. Staats. Leon Stabler, F. L. Stitzinger, Joseph Stokes, T. Burnell Unger, Thomas Walczak, C. H. Williams, Walter W. Winand; **Rhode Island**: Norman Gertz, Spencer E. Lawton, Gustave A. Magnuson, Carl Schradieck. Joseph V. Trzuskowski; **South Carolina**: H. M. Hallman, Abraham Sutker; **Tennessee**: James M. Alexander. Jr., M. C. Bostick, Robert Howard, Dick Stevenson.

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Official RADIO NEWS Listening Post Observers in Other Countries

LISTED below by countries are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner.

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Belgium: Rene Arickx.
Bermuda: Ralph Clarke.
Brazil: W. W. Enete, Louis Rogers Gray, Flavio Mascarenhas.
British Guiana: E. S. Christiana. Jr.
British West Indies: D. G. Derrick. Aubrey H. Forbes. Daniel N. Hood, Edela Rosa.
Canada: Fred W. Alfred. J. T. Atkinson, A. Belanger. William Buchanan, Li Chi Chiang. Fred Cox, Warren D'Orsay. Claude A. Dulmage, Robert Edkins. Robert B. Hammersley, Charles Hesterman, Fred C. Hickson. C. Holmes. W. Harman Kidd, Ernest W. Law. George L. Loke, Arthur E. MacLean. A. E. Milley, John E. Moore. Ian C. Morgan. Joseph A. Ryan. James Walsh. Jr.
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Canary Islands: Manual Davin.
Chile: Jorge Izquierdo.
China: P. J. Cawseey.
Colombia: Italo Amore, J. D. Lowe.
Cuba: Augusto Anca, Rafael Penalyer y Ballina, Oscar Jaime, Jr.. Frank H. Kydd, Jose L. Lopez, Juan Manuel Salazar. Dr. Evelio Villar.
Czechoslovakia: Ferry Friedl, Joe Klar.
Denmark: Hilhert Jensen.
Dominican Republic: Jose Perez.
Egypt: Aram Ishkanian.
El Salvador: Jose R. Rodriguez.
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Germany: Herbert Lennartz. Theodor B. Stark.
Greece: Peter D. Masganas. S. E. Stefanou.
Guatemala: Luis Diez A.
Holland: R. Groeneveld, L. Huntzbergen.
Iceland: Arni Sigurdsson.
India: Terry A. Adams, A. H. Dalal. Harry J. Dent, H. W. Kamen, D. R. D. Wadia.
Iraq: Hagop Kouyoumdjian.
Irish Free State: Earard de Ruadhal, Harry Dumpleton, Philip Fitzsimmons, W. J. Humphries, Thomas Randle.
Italy: Renato Brossa. A. Passini. Dr. Guglielmo Tixy.
Japan: Tomonobu Masuda. Masall Satow, Shokichi Yoshimura.
Malaya: D. A. Seneviratne.
Malta: Edgar J. Vassallo.
Manchukuo: Anatol Kabatoff.
Mexico: E. Geneve. Manuel Gomez Ortiz. Felipe L. Saldana.
Morocco: T. E. Gootee.
Netherlands East Indies: A. den Breems. E. M. O. Godee, J. H. A. Hardeman.
Netherlands West Indies: V. V. Labega. Rein J| G. van Ommeren, P. E.
New Zealand: W. J. Lander. B. A. Peachey. John C. Sibbin. Eric W. Watson.
Newfoundland: Frank Nosworthy.
Northern Rhodesia: J. C. Innes.
Norway: Per Torp.
Palestine: W. E. Frost. Reuven Sokolovsky.
Peru: Ramon Masias. Enrique A. O. Ziegler.
Philippine Islands: George Illenberger, Victorino Leonen. E. R. Rances, J. Ruiz. Johnny Torres.
Poland: P. Piorko.
Portugal: Alvaro Azevedo. Ruben Marques Granja Garcia. Jose Fernandes Patrae, Jr.
Portuguese East Africa: Denver Edward Whyte.
Puerto Rico: Manuel E. Betances. Jose D. Caro Costas. Jr., A. N. Lightbourn. Jorge Ralat.
Reunion Island: Prince Vinh San.
Scotland: T. Duncan Donaldson. Jack Holden. D. Summers Smith.
South Africa: Eric Gertenbach. Allan B. E. Goetsch. Edward R. Greaves. Mike Kruger. C. McCormick, H. Westman, Norman E. Westman. Oscar Westman, L. E. Williams.
South West Africa: H. Mallet-Veale.
Straits Settlements: C. R. Devaraj, S. P. Shotam.
Sweden: Olaf Liljegren, B. Scheierman.
Switzerland: Dr. Max Hausdorff, Hugo Richter.
Syria: L. R. Fritsch.
Turkey: Hermann Freiss, A. K. Onder, M. Seyfeddin.
Uruguay: H. Acosta y Lara.
Venezuela: Francisco Fossa Anderson.

SHORT-WAVE STATION LIST

(Africa, Asia and Oceania)

Arranged by Countries and Cities

AFRICA

Location	Call	Kc.	Meters	Class
Algeria				
Algiers	FVA	8960	33.48	P
Angola				
Lobita	CR6AA	7177	41.80	B. P
Belgian Congo				
Leopoldville	OPL	20040	14.97	P
Leopoldville	OPM	10140	29.59	P
Canary Islands				
Santa Cruz, Tenerife	EAJ43	10380	28.90	B
Egypt				
Abu Zabal	SUV	10055	29.84	P
Abu Zabal	SUX	7860	38.12	P
Abu Zabal	SUY	19660	15.26	P
Abu Zabal	SUZ	13820	21.70	P
Abu Zabal	SUZ1	13811	21.72	P
Cairo	SU1CH	13820	21.70	A, B
Ethiopia				
Addis Ababa	IUA	5880	51.02	P
Addis Ababa	IUB	7620	39.32	P
Addis Ababa	IUC	11955	25.09	P
Addis Ababa	IUD	18270	16.42	P
Addis Ababa	IUG	15450	19.42	P
Kenya				
Nairobi	VQ7LO	6083	49.32	B
Madagascar				
Tananarive	FIQA	6000	50.00	B
Mozambique				
Lourenzo Marques	CR7AA	6137	48.88	B
Lourenzo Marques	CR7BH	11718	25.60	B
Morocco				
Rabat	CNR	12830	23.38	P
Rabat	CNR	8035	37.34	P, B
Spanish Morocco				
Tetuan	EA9AH	7000	42.86	B
Tetuan	. . .	6545	45.84	B
So. Rhodesia				
Bulawayo	ZEB	6148	48.80	B
Salisbury	ZEA	5882	51.00	B
Tunisia				
Tunis	FT4AJ	6150	48.78	E
Union of So. Africa				
Johannesburg	ZTJ	6098	49.20	B
Klipheuvel	ZSS	18890	15.88	P
Pretoria	ZUD	5000	60.00	E

ASIA

Location	Call	Kc.	Meters	Class
China				
Hong Kong	ZBW2	6090	49.26	B
Hong Kong	ZBW3	9525	31.49	B
Hong Kong	ZBW4	15190	19.75	B
Hong Kong	ZBW5	17755	16.90	B
Macao	CQN	9600	31.28	B
Macao	CQN	6073	49.37	B
Nanking	XGOX	6848	43.81	B
Shanghai	XGR	11540	26.00	P
Shanghai	XGW	10420	28.79	P
Dutch East Indies				
Bandjermasin, Borneo	YDV2	3330	92.88	B
Makassar, Celebes	PNI	8775	34.18	P, B
Bandoeng, Java	PLE	18830	15.93	P
Bandoeng, Java	PLG	15950	18.81	P
Bandoeng, Java	PLP	11000	27.27	P, B
Bandoeng, Java	PLV	9415	31.86	P. B
Bandoeng, Java	PMA	19345	15.51	P. B
Bandoeng, Java	PMC	18135	16.55	P. B
Bandoeng, Java	PMN	10260	29.24	P. B
Bandoeng, Java	PMY	5415	55.40	P. B
Bandoeng, Java	PMY	5140	58.37	B
Bandoeng, Java	YDA5	6120	49.02	B
Bandoeng, Java	YDC	15150	19.80	B
Soerabaja, Java	YDB	11860	25.29	B
Soerabaja, Java	YDB	9610	31.22	B
Tandjongpriok, Java	YDA	6040	49.67	B
Tandjongpriok, Java	YDA	3040	98.68	B
Medan, Sumatra	YBG	10430	28.76	P, B
Formosa				
Tyureki	JIA	15750	19.05	P
Tyureki	JIB	10535	28.48	P
India				
Bombay	VUB	9565	31.36	B
Calcutta	VUC	6109	49.10	B
Kirkee	VWY	9045	33.17	P
Kirkee	VWY2	17480	17.16	P
Colombo, Ceylon	VPB	6067	49.45	B
French Indo-China				
Saigon	FZS	18310	16.38	P
Japan				
Kemikawa-Cho	JYK	13610	22.04	E. B
Kemikawa-Cho	JYR	7880	38.07	B
Kemikawa-Cho	JYS	9840	30.49	B, E
Nazaki	JVA	18910	15.86	P, B
Nazaki	JVB	18190	16.49	P, B
Nazaki	JVC	19050	15.75	P, B
Nazaki	JVD	15860	18.90	P
Nazaki	JVE	15660	19.16	P, B
Nazaki	JVF	15620	19.21	P, B
Nazaki	JVG	14910	20.12	P,B
Nazaki	JVH	14600	20.55	P, B
Nazaki	JVI	13560	22.12	P, B
Nazaki	JVL	11660	25.73	P, B
Nazaki	JVM	10740	27.93	P. B
Nazaki	JVN	10660	28.14	B, P
Nazaki	JVO	10375	28.92	P, B
Nazaki	JVP	7510	39.95	B, P
Nazaki	JVQ	7470	40.16	P, B
Nazaki	JVT	6750	44.44	P, B
Nazaki	JVU	5790	51.81	P, B
Nazaki	JVV	5730	52.36	P, B
Nazaki	JZE	13020	23.04	P
Nazaki	JZG	6330	47.39	P
Nazaki	JZI	9535	31.46	B
Nazaki	JZJ	11800	25.42	B
Nazaki	JZK	15160	19.79	B
Nazaki	JZL	17785	16.87	B
Nazaki	JZM	21520	13.94	E
Manchukuo				
Kanjoshi	JZA	15680	19.13	P
Kanjoshi	TDE	10065	29.81	P
Shinkio	TDD	5830	51.46	P
Siam				
Bangkok	HSG2	10955	27.38	P, B
Bangkok	HSP	17740	16.91	P
Bangkok	HS8PJ	19020	15.77	B
Bangkok	HS8PJ	9350	32.09	B
Straits Settlements				
Penang	ZHJ	6080	49.34	B
U. S. S. R. (Siberia)				
Khabarovsk	RV15	4273	70.21	B
Sverdlovsk	ROI	5490	54.64	P
Tashkent	RPT	5995	50.04	P

OCEANIA

Location	Call	Kc.	Meters	Class
Australia				
Adelaide	VK5DI	7288	41.14	E
Fiskville	VIZ-3	11495	26.10	P
Lyndhurst	VK3LR	9580	31.31	B
Melbourne	VIY-VK3ME	12020	24.96	E
Melbourne	VK3ME	9510	31.58	B
Perth	VK6ME	9597	31.26	E
Port Hedland	VK8SC	6960	43.10	B
Sydney	VK2ME	9590	31.28	B
Fiji Islands				
Suva	VPD2	13980	21.46	E
Suva	VPD2	8719	34.40	B
Hawaiian Islands				
Kahuku	KEQ	7370	40.71	P
Kahuku	KIO	11680	25.68	P
Kahuku	KKH	7520	39.87	P
Kahuku	KKP	16030	18.71	P
Kahuku	KQH	15985	18.77	P
Kahuku	KRO	5845	51.32	P
New Zealand				
Wellington	ZLT4	11000	27.27	P
Philippine Islands				
Manila	KAX	19980	15.02	P
Manila	KAY	14980	20.03	P
Manila	KAZ	9990	30.03	P
Manila	KAZ	8120	36.95	P
Manila	KBB	8710	34.44	P
Manila	KBI	21140	14.19	P
Manila	KBJ	13240	22.66	P
Manila	KBK	6718	44.66	P
Manila	KTO	16240	18.47	P
Manila	KZGF	5800	51.72	P. B
Tahiti				
Papeete	FO8AA	7100	42.25	B

Abbreviations for Class Column

- **A**—*Amateur*
- **B**—*Broadcast*
- **E**—*Experimental*
- **F**—*Frequency*
- **P**—*Phone*
- **T**—*Time Signals*

WISCONSIN HEARD FROM

Greetings from L.P.O. Joe Rudolph of Wisconsin, shown at Listening Post.

Boussy, Wollenschlager, Kidd, de Ruadhal, Blakebrough, Sporn. Patrick, Unger, Partner, Lopez, Beck, Ralat, Coover).

EAQ2, EAR, Madrid, Spain. 9480 kc., 7:30-9 p.m., requests reports. (Alfred, Howard, Myers, Bittner, Abbott, Smith, Moss, Eder, Rodriguez, Sakely, Robinson, Duncan, Lindner, Hartzell, Staley, Westman), Friday 9-10 p.m., (Kidd, de Ruadhal). call changed to EAR, (Turner, Blanchard, Michaels) daily except Monday 2:30-6:30 p.m., Skipworth, Hartman, Ruppert, Scala, Messer, Hendry, Blakebrough, Gresham, Partner, Shamleffer, Birnie, Lopez, Beck, Black, Ralat, Dressler, Kemp, Coover, Fallon). Slogan: "Voice of Spain", Address: P. O. Box 951.

Radio San Sabastian, San Sebastian, Spain, 7205 kc., a rebel station "at the Service of Spain and France", 1:40 p.m., (Abbott), 7:30 p.m., (Rodriguez).

EAX, Spain, (Skinner).

EA?, Madrid, Spain, 14,300 kc., "the voice of the trenches", (Stabler).

"Radio Requete", San Sebastian, Spain, Guipuzcoa, 7250 kc., 7:15 p.m., (Ralat).

RWS9, Moscow, U.S.S.R., 50 meters, Sunday, Monday, Wednesday, Friday, 4-5 p.m., (de Ruadhal).

RK1, Moscow, U.S.R.R., 15,050 kc., Sunday 2 p.m., (Hartzell), signed 3 p.m., (Herzog), 15,040 kc., 4-6 p.m., (Schrock).

RNE, Moscow, U.S.S.R., 12.000 kc., 4-5 p.m., Sunday 11-12 p.m., (Alfred, Eder), daily 10-10:45 p.m., (Stabler), Sunday 6-7 a.m., 10-11 a.m., Wednesday 6-7 a.m., (de Ruadhal, Sporn, Ralat, Hare).

RAN, Moscow, U.S.S.R., 9595 kc., (Alfred), Saturday 9 p.m. or later, (Howard), Friday 9 p.m., (Myers) daily 7-8:15 p.m., (from veri.). (Bittner), 9600 kc., (Eder, Ralat, Partner, Wollenschlager, de Ruadhal). 9520 kc., 7-9 p.m., (Sporn, Randle, Scala, Unger, Dressler, Beck, Emerson), Address: Miss Iuna Mar, Salyanka.

RIM, Tashkent, U.S.S.R., 19.68 meters, daily 4:30 a.m., (de Ruadhal).

OLR, Prague, Czechoslovakia, 11,840 kc., 6010 kc., 8:55-11:55 a.m., (McCartin), Sunday, Monday, Wednesday, Thursday, Saturday, 8-9:45 p.m., 2:30-4:30 a.m., (from veri.), (Tate, Stabler, Randle). 9550 kc., (Croston, Coover).

OLR2A, Prague, Czechoslovakia, 6010 kc., (Skipworth), Monday, Wednesday, Friday), 4:05-4:40 p.m., (de Ruadhal, Birnie).

OLR3A, Prague, Czechoslovakia,

(*Turn to page* 116)

THE SERVICE BENCH

(*Continued from page 86*)

design considers the requirement for auto as well as home radio servicing, and provision is made for testing tubes and vibrators in the receivers being serviced—rather than by exterior methods. The left-hand panel consists of a signal generator, with associated controls and the output meter. The center section provides for a.c. and d.c. testing, resistance, capacity, etc. The right-hand unit contains a universal speaker of the permanent-magnet, dynamic type with a variable-impedance, output-matching transformer and a variable, substitute-speaker field. The eyes are shielded from the diffused lighting which is cast directly on the meters.

In effect, the Universal Radio Test Panel is a modern service shop three-quarters finished!

THE DAY'S WORK

Eugene C. Dobeck sends in the following notes. He services from Los Angeles, California.

Crosley 148

"The complaint was a noisy volume control—and the cure will apply to many similar complaints on other receivers. Try working a few drops of carbon tetrachloride into the control. Often this can be done by pouring a small amount on the shaft.

Packard Bell

"This receiver developed a short-circuit from B-plus rectifier to chassis. You guessed it—a broken-down condenser—.1 mfd., 400 volts."

Mr. Drobeck also points out the possibilities of—

Servicing Vacuum Cleaners As a Sideline

"This is a logical job for the radio serviceman, and it is worth-while establishing himself as being capable of doing such work by an added line on his business card and advertising and by asking for such work at the completion of a radio service call exactly as he might inquire concerning 'How do your lights work?—electric iron?—fan? . . . etc.'

"The complaint usually is that the vacuum cleaner either doesn't run—or runs but does not clean. In cases of non-operation of the motor, the trouble will generally be found in the cord, with a break probably at the switch or motor or at one of the sharp bends in winding. The tests and repairs are obvious. Where the motor itself is at fault, the difficulty will usually be an open circuit caused by a worn brush not firmly touching the commutator, an extremely dirty commutator, or a clogged brush—dirt, grease and grit impeding the spring action which holds the brush against the commutator. The field, armature and ensemble can be tested for continuity with your radio test equipment. An open winding is usually a job for a motor expert. That is—send the motor to the factory, or order a new field or armature, as the case may be.

"If the motor hums when the switch is turned 'on,' this is an indication of a mechanical rather than an electrical fault (though not necessarily, as the same symptoms may be present with a partially short-circuited field or armature). The fan may be clogged—or the sweeping brush when directly driven by the motor.

"If the motor runs, but the cleaner is not effective, the trouble will usually be

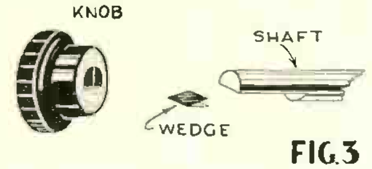


FIG.3

FIGURE 3
Improvised spring wedges will often save the cost of a new set of knobs.

plain unadulterated dirt—a dirty and clogged bag, or a clogged cleaning brush turned by the wheels rather than the motor. If the cleaning brush is belt driven, the belt may have stretched permitting slippage. Sometimes the bristles of the brush are so worn that the sweeping action is nil."

Short-Circuited Tuning Condensers

Al. R. Dayes, radio serviceman and amateur operator W2DTD of Brooklyn, N. Y., sends along an excellent idea for locating those elusive spots where tuning condensers short-circuit. The complaint in his particular case was of a—

Majestic Series 90

"This is an old set, but so well constructed that thousands are in use today. I have fixed several complaints of noise—a loud scratching noise when turning—and occasionally complete cut-out over a wide portion of the dial. This is always caused by the cast-lead, alloy rotor on the steel shaft, expanding in both directions short-circuiting to the stators. A similar trouble is sometimes encountered with other receivers and the location of the points of short-circuit is often difficult by mere visual inspection. I employ a very effective method of sleuthing.

"Put an ohmmeter on its lowest scale and connect it across the plates of an unshort-circuited tuning section. It will of course read 'zero' due to the low resistance of the coil. Now turn the zero adjustment rheostat on the ohmmeter until you obtain a small deflection, at which point you are ready for the test. When the ohmmeter is connected across a defective condenser, and the condenser tuned, a slight movement of the needle will be noted at every short-circuited position. With a screw driver shift the stator plates and bend the rotor plates until no deflection is noticed as the condenser is tuned. Realign and the job is done."

Improvised Knob Wedges

When knob wedges are lost, or lose their tension, they can be replaced by small lengths of clock spring bent as shown in Figure 3—according to Ambrose Dennek, St. Cloud, Mich. Where the spring is very difficult to bend, or it breaks, the short length should be heated red-hot and permitted to cool slowly in air. When cool it can be readily bent into the "V" shape. It should then be reheated and tempered by immersing in cold oil or water. This will restore its spring qualities.

SELLING SOUND

Allan F. Seaver of New Bedford, Mass., sends us the cards illustrated in Figures 4 and 5. These cards were designed by him, and are employed in selling and systematizing his sound rental business. Figure 4 is an advertisement, and is large-

Use the *Modern Method* in your productions; the

SOUND SYSTEM

for amplified effects, music and speech

SOUND EFFECTS *and dance music for off-stage or radio effects.*

PROGRAM MUSIC *for between the acts.*

MUSICAL BACKGROUNDS *and sequences for lectures.*

CONTINUOUS MUSIC *and effects for silent movies.*

—o—

Call ALLAN SEAVER - - Tel. 6829

(See reverse side)

FIGURE 4

An advertisement that sells sound and sound effects for a New England serviceman.

ly circulated among dramatic clubs, schools, etc. The reverse side carries suggestions of plays in which sound effects can be effectively employed, among which are listed—"Offstage dance music and between the acts," "Music between the acts," "Radio effects," "Radio, airplane and siren effects," "Boat whistle and offstage music," and "Train effect."

Complete Record

A complete record of each job is kept on the form of Figure 5. The reverse of this card is blank, and program notices

Date. Hours
Hall Address
Purpose:
Stage? Balcony? Mike? Speakers?
RECORDINGS EFFECTS

Customer:
Address: Tel: Price:
REMARKS:

FIGURE 5

A record of sound installations is just as important as a record of each service job.

and press comments, when of suitable size, are pasted on the back to make the record complete.

Photograph Each Job

We can only add our suggestion that at least one photograph be made of each P.A. set-up. There is nothing like a pictorial presentation to sell the prospect on the next job. Next to deeds, pictures speak louder than words. We know of one serviceman who has photographs of some 50 public address installations which he has made, and they are the best answer to the prospect's question of—"Can I rely on you?", "Have you done much of this work before?", "Are you sure this job isn't too big for you?" Etc?, etc.?

Serviceman's Diary

(*Continued from page* 68)

I considered. The flanks were not those of a race-horse. They were of the beautifully modeled and rounded Mae-Western type. It was definitely a mare.

"The Sweetheart of Phi Beta Kappa?" I hazarded.

"Try again," he urged.

I looked again. The tail was slightly raised, as if it were about to take a healthy swat at a fly. Perhaps it had something to do with modern educational methods. Perhaps it was supposed to represent a Trojan horse, with graduates emerging to battle the business world. Then, again, maybe it was only a nightmare! I gave up. My job, after all, was to work the volume control, follow orders and not to acquire a headache over such puzzles.

I went back to our amplifiers and turntables. I felt more at ease there. But I like those professors.

Radio Balloons

(*Continued from page* 84)

The balloons have been made in limited quantities at Harvard University, at a cost of $30.00, which price compares favorably with a single airplane trip to a height of 17,000 feet. For the same cost, when mass-produced, larger balloons capable of soaring to 100,000 feet altitude may soon be available.

Recent developments permit sending up the radio meteorograph, as the automatic radio stratosphere reporter is named, in darkness, which is an advantage to the weather man. Sufficient lifting power is obtained with the balloons, even without sunlight to warm up the gas and provide greater buoyancy. Meanwhile, fog, rain, snow or high winds which deter airplane observation flights, do not stop the tiny balloons from going aloft.

Perhaps the most serious problem facing Dr. Karl O. Lange of the Blue Hill Meteorological Observatory and his co-workers, is in the extreme cold encountered at high altitudes. At 50,000 feet the temperature recorded in several recent tests has been well below 70 degrees Zero, Fahrenheit. The radio and other equipment is therefor subjected to the most trying conditions. Components have had to be selected with such extreme temperature in mind. Condensers, as well as dry cells, must be capable of operating at temperatures quite unheard of in the usual run of radio work. The equipment is mounted in a balsa wood frame, and enclosed in a light insulated bag.

Reaching out into the upper regions or stratosphere in this ingenious manner, the weather man is at last coming into his own in a really big way. The data flashed back by tiny transmitters carried aloft by dozens and even hundreds of balloons in many parts of the country, may soon provide a safer basis for long-range weather forecasting. For it is far above the earth's surface that the elements are concocting not only tomorrow's weather, but that for the following day and many days thereafter.

HOW TO GET STARTED IN SERVICE

Next month Mr. Zeh Bouck will outline the fundamentals of service for beginners.

RADIO PHYSICS COURSE

ALFRED A. GHIRARDI

Lesson 64. Filters

By inverting the band-pass filter, the filters shown at (A) and (B) of Figure 1 are obtained. This is called a *band-suppression filter*. The characteristic of this type is shown at (C). Filters of this type are commonly used to suppress electrical disturbances lying within some particular band of frequencies.

The *"wavetrap"* sometimes used in the antenna circuits of radio receivers is a form of band-suppression filter. As shown at (A) of Figure 2, a series wavetrap consisting of a coil and a variable condenser connected in parallel with each other, are connected in series with the antenna circuit of a radio receiver. When the filter is tuned to resonance for a given frequency, signals of that frequency cannot enter the receiving set since the parallel resonance filter circuit presents a very high impedance to the flow of current of the frequency to which it is tuned. It can be designed to suppress a band of frequencies about 10 kc wide, depending upon the width of its resonance curve. It is a "rejector" wave trap.

If the filter is shunted across the antenna and ground connections as shown at (B), the signals to which the filter is tuned will go through the receiver while the other signals will be shunted across through the filter since it offers a very high impedance to signals of its resonant frequency and a low impedance to all others. A band of frequencies about 10 kc wide (depending on the resonance curve of the filter) will pass through the receiver coil for any setting of the filter condenser. This is an *acceptor wave trap*. The filter tunes more sharply if it is inductively coupled to the antenna circuit by winding a 5-turn coil over the coil of the filter and connecting it in series with the coil in the antenna circuit.

Electrical filters are used extensively in studying the characteristics of communication equipment and in the transmission of electrical impulses of multiple frequency as exemplified by speech or music. Such filters consist of capacitance and inductance networks so designed that they allow certain frequencies to pass readily through them while at the same time they attenuate other frequencies strongly. By the use of filters for instance, a composite sound may be divided into several parts, or a fault in telephone apparatus may be remedied by attenuating or placing emphasis on certain ranges of the frequency spectrum.

By means of band filters, it becomes possible to separate in accordance with the frequency. We are thus enabled to transmit a number of messages simultaneously over the same telephone circuit, or through the air, and to separate these messages at the the receiving station.

For example, in the multiplex telegraph system, known as the carrier current system, there are transmitted over the same pair of wires simultaneously, 10 telegraph messages which are carried by currents of ten different frequencies, all somewhat above those of the voice range; two ordinary telegraph messages, carried by direct currents, i.e., zero frequency currents, and an ordinary telephone conversation. This multiplex telegraph system is in operation between many of the important cities of the country. In every case, the separation of the different messages is accomplished by means of electrical filters which select a single band of frequencies for transmission to the apparatus to which they are connected and fail completely to transmit all the other messages which may be simultaneously received.

Filters are being used more and more in

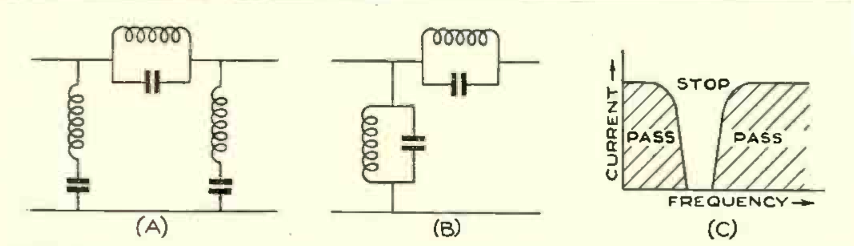


FIG. 1

Figure 1. Two forms of band-suppression filters and the transmission characteristic produced

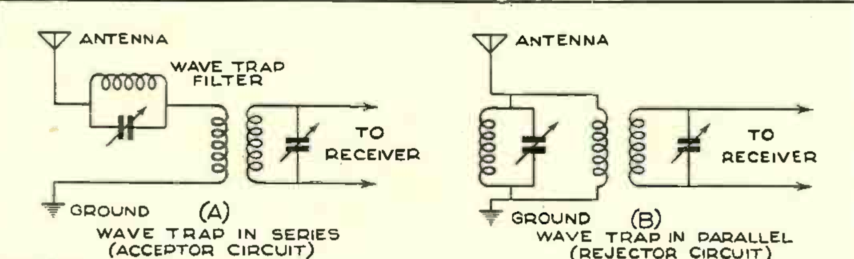


FIG. 2

Figure 2. Band-suppression wave traps or filters connected to the antenna circuit of a radio receiver to eliminate interference from unwanted stations. (A) Series wave trap. (B) Shunt or parallel wave trap.

radio receivers in order to obtain certain desired characteristics which are either otherwise unobtainable, or else would be very much more expensive if arrived at by other methods.

Resistance-capacity type filters consisting merely of a resistor in series with one side of the line, and one or more condensers across the line, are used extensively in audio amplifiers. They have one great advantage in this type of work in that they are cheap and do not have any bothersome resonant frequency points which might be objectionable if the ordinary inductance-capacity filters were used.

Band-pass filters are being used extensively in radio receivers of both the tuned-radio-frequency (T.R.F.) and the superheterodyne type. They are arranged to pass a band of frequencies approximately 10 kilocycles wide.

Radio Telephone

(*Continued from page 77*)

Even quicker action was recorded in responding to an emergency phone call from the tug *Atlantic* itself. At 8:27 a.m. the captain of the *Atlantic* phoned that one of the firemen had been taken very ill and was suffering from intense pain in the abdomen. At the time the tug was just entering the Horseshoe Range in the Delaware, above the Philadelphia Navy Yard. The captain was instructed to proceed immediately to Girard Point and wait the arrival of an ambulance. St. Agnes Hospital was communicated with and an ambulance was rushed to meet the tug. The fireman was admitted to the hospital 63 minutes after the call for help was received. The life of this man was undoubtedly saved by the radio telephone, for upon admission to the hospital it was found that he was suffering from a ruptured gastric ulcer. Any delay would almost certainly have been fatal.

This new marine radio telephone system is operated in conjunction with the Bell Telephone Company of Pennsylvania. The shore equipment consists of two unattended radio receivers which pick up the calls from the tugs: an unattended radio transmitter which transmits calls to the tugs, and an attended control terminal. One of the radio receivers is at Girard Point, the other at Point Breeze. The transmitter is on the roof of the home office building. All of the shore equipment is connected by wire telephone circuits with the toll telephone switchboard.

The control terminal, which unlike the receivers and the transmitter requires the constant presence of a skilled operator, has two chief functions. The first is to effect a satisfactory connection between the radio circuits and the wire circuit to the telephone switchboard where the calls are switched to land telephone lines. The second is to attain the best possible ratio of useful signal to the noise which is inevitably introduced by radio transmission.

The control terminal operates on direct current furnished by a motor generator capable of delivering approximately 6 amperes at 24 volts and .2 ampere at 130 volts. The transmitter is a high-frequency, crystal-controlled, 50-watt radio transmitter operated by remote power control over the telephone circuit, and by voice control of the carrier. The carrier can be adjusted to any frequency from 30 to 60 megacycles. The radio receivers are of the a.c.-operated, crystal-controlled superheterodyne type, designed for unattended operation on fixed-frequency communication in the 30- to 42-megacycle band.

THE TECHNICAL REVIEW

CONDUCTED BY THE TECHNICAL EDITOR

Fundamentals of Vacuum Tubes, by A. V. Eastman; McGraw-Hill Book Co., 1937. Quoting from the preface: "It has been the author's intent . . . to combine in a single text the basic theory underlying the operation of all types of modern vacuum tubes, both radio and industrial, together with their more common applications. In so doing an effort has been made to avoid either writing a text that is almost purely descriptive or presenting such a wealth of mathematical material as to make the work unattractive to a large group of potential readers who desire only a basic working knowledge of vacuum tubes." The text deals with the operation of the tube itself and its associated circuit but is not in any way a collection of multiple tube circuits. A general knowledge of a.c. laws is assumed and mathematical knowledge including calculus. Since mathematics has not been used to excess, readers with lesser accomplishments in this direction can still benefit from its study.

The author discusses the phenomena of electron emission in some detail, giving the characteristics of different types of cathodes, the required temperatures, etc. The treatment of tube circuits, such as amplifiers, rectifiers, detectors, relays, have been explained at length so that the reader should be able to design the most efficient circuit for a given tube. The text is clearly written and appears to be up to date except for some minor subjects such as direct coupled amplifiers. It is also refreshing to see that the author has used the customary technical terms and engineering symbols instead of inventing a language of his own—this is rare in tube literature. Although the title of the book refers to vacuum tubes, industrial gas-filled tubes are also included; the reader can learn all about Phanotrons, Ignitrons, Thyratrons and other members of the gas-filled family. A table of characteristics of the most popular types is included.

Man in a Chemical World, by A. Cressy Morrison; Charles Scribner's Sons; 1937. This volume was published as a result of the great success of the celebration of the Three Hundredth Anniversary of the founding of the Chemical industry in the United States of America, in 1635, by John Winthrop, the younger, then Governor of Connecticut. It is a book, intended for the general reader, which describes all the myriads of ways all of us depend on the Chemical industry. Practically any kind of industry nowadays employs chemists for the preparation of their materials. The radio industry is no exception, metal tubes, bakelite and other insulators, condensers, etc., are as much the product of chemists as of radio engineers.

Manual of Lathe Operation and Machinists' Tables, by the Engineering Department, Atlas Press Co. Although it has no direct connection with radio, this book has been listed here since many workers in radio have occasion to use a lathe. It is a guide to the operation of the lathe for all sorts of purposes and in addition gives numerous tables with respect to drill sizes for different classes of fit. Mechanically inclined readers will find in it much valuable information. Chapter Headings are: 1. Lathe Care and Construction; 2. Theory of Metal Cutting; 3. Cutting Tools; 4. The Machining of Various Materials; 5. Holding the Work; 6. Drilling and Boring; 7. Thread Cutting; 8. Lathe Attachments and their Uses; 9: Woodturning on the Metal Lathe; 10. Machinists' Tables; 11. Index; 12. Pages for your Shop Notes.

Review of the Proceedings of the Institute of Radio Engineers for May, 1937

A Simplified Circuit for Frequency Substandards Employing a New Type of Low-Frequency Zero-Temperature-Coefficient Quartz Crystal, by S. C. Hight and G. W. Willard. This paper presents a new type of stabilized quartz controlled oscillator and a new type of low-temperature-coefficient piezo-electric quartz circuit element which, in their combination, are particularly suitable for portable substandards of frequency. The oscillator circuit is simple and may be easily stabilized by two reactance adjustments so that the frequency is unaffected by change of tubes or by small changes in the circuit reactances, the plate voltage, and the ambient temperature.

The Harmonic Mode of Oscillation in Barkhausen-Kurz Tubes, by W. D. Hershberger. The phenomenon of harmonic operation of Barkhausen-Kurz tubes employing a resonating helical grid is investigated by the use of tubes with the plate cut transversely into three sections. It is shown that the fundamental or Barkhausen frequency may be elicited by exciting the grid at its central portion, but that if the grid is excited at its ends either symmetrically or unsymmetrically the oscillations occur at double the Barkhausen frequency. This doubled frequency is that usually generated by tubes of this type. It is also shown that it is essential to tune the filament circuit of the oscillator if maximum power output is desired.

Application of the Auto-synchronized Oscillator to Frequency Demodulation, by J. R. Woodyard. A new frequency-operated demodulator is described which does not respond to amplitude modulation. These results are achieved by making use of a controlled oscillator at the receiver which automatically synchronizes with the transmitter frequency. If desired, this method can be made to give a large response with extremely small amounts of frequency shift. On the other hand, it can also be used when the maximum frequency shift is many times as great as the signal band width. Other advantages are its linear response and its simplicity which requires the addition of only one tube to existing receivers.

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.

Noise in Frequency Modulation, by Hans Roder, Electronics, May 1937. A mathematical demonstration of the validity of the noise-suppression effect in wide-band frequency modulation, which shows the necessity of a wide-band and a limiter.

Tone Fidelity Switch, by A. G. Manke, Electronics, May 1937. Description of a multiple switch which varies bass-compensation and tone-control circuits simultaneously with the coupling of the i.f. transformers. Six different positions are provided.

The General Radio Co. has issued a new catalog, "Catalog J", containing data on several new instruments manufactured by that company, in addition to the regular line of equipment for the laboratory.

A Noise Reducer for Radio-Telephone Circuits, by N. C. Norman, Bell Laboratories Record, May 1937. Description of a noise reducing circuit consisting of the expander section of the "compandor." The circuit is so adjusted that signal levels of —30 db are passed without change while levels above this are amplified progressively. Levels below —30 db are attenuated progressively and are lost along with the noise.

Frank Talk about this Business of Transmitting Tube Ratings, by E. C. Hughes, Jr., QST, June 1937. This article explains the reasons for the maximum ratings of transmitting tubes and should prove handy for amateurs who do not take these ratings seriously.

Type 726-A Vacuum-Tube Voltmeter; The General Radio Experimenter, May 1937. Description of a v.t. voltmeter employing a diode rectifier and an amplifier with cathode-loading. The instrument measures peak voltages with small errors (less than 3 percent) up to 100 mc. Five ranges are provided with maximum readings of 1.5-5-15-50-150 volts (r.m.s.). The rectifier is a 955 and mounted in a probe so as to eliminate leads.

Inverse Feedback, Its Benefits and Its Limitations; The Aerovox Research Worker, April 1937. A review of the subject and an explanation of what can and what cannot be done.

R. F. Transmission Lines, by E. L. Dillard. The Radio Engineer Vol. 1. No. 3. A practical discussion of the two-wire open type and concentric tube non-resonant r.f. transmission lines with useful tables and graphs.

FREE BULLETINS

Free Broadside on Super-Pro

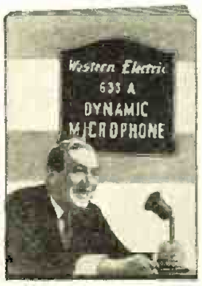
Any RADIO NEWS reader, interested in the new Hammarlund "Super-Pro" receiver will be pleased to know that he can obtain a free booklet which provides detailed descriptive information on this new set, complete with curves and illustrations. Requests should be addressed to RADIO NEWS, 461 Eighth Avenue, New York City.

Special "Ham" Guide

The Wholesale Radio Service Company announces a new Amateur and Short-Wave catalog No. 66, containing information on transmitters, receivers, tubes, and other apparatus. Copies are free to call amateurs. Write to RADIO NEWS, 461 Eighth Avenue, New York City.

New Dynamic Microphone

The book shown in the accompanying illustration on the new Western Electric 633A dynamic microphone is free to all RADIO NEWS readers for the asking. The manual outlines the features of this new "mike" and the reader will find it highly illustrated and interestingly written. Write to RADIO NEWS, 461 Eighth Avenue, New York City.



New Instruction Book for Potential Amateurs

The "Radio Amateur Newcomer" by Frank C. Jones is an excellent book for anyone desiring to become an amateur. It tells how to get started in amateur radio, gives practical instructions for learning the code and obtaining an amateur's license. It is complete with information and circuit diagrams for building modern amateur receivers and transmitters. The price of the book in this country is 25 cents; foreign cost, 30 cents. Address requests to RADIO NEWS, 461 Eighth Avenue, New York City.

Free Tube Folder Classifies Over 400 Tubes

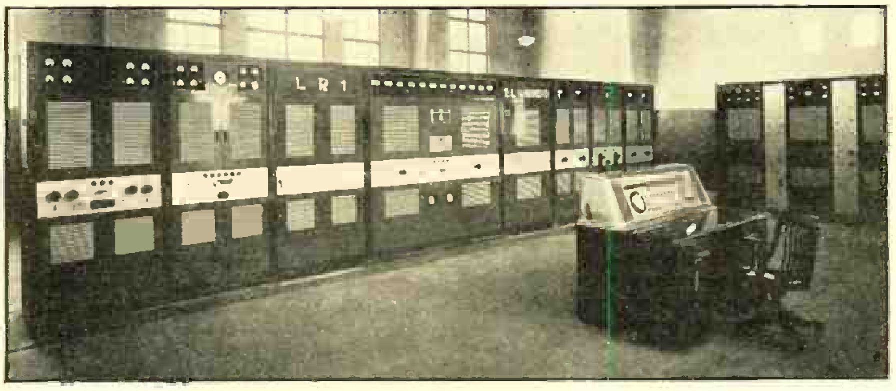
A newly revised folder classifying more than 400 makes and types of vacuum tubes according to their base connections has just been issued by the Weston Electrical Instrument Corporation. The tube base connection diagrams in this latest folder show 85 different prong arrangements and base connections. The diagrams have been specially prepared to facilitate the Weston methods of selective analysis. The leaflet is available to servicemen without charge, simply address your request to RADIO NEWS, 461 Eighth Avenue, New York City.

Special P.A. Catalog

The Webster Company's latest catalog on sound equipment describes in detail their complete line of low and high-power public address systems, their new inter-office call systems, speakers, microphones, and other accessories. Copies are obtainable free of charge from RADIO NEWS, 461 Eighth Avenue, New York City.

Electrical Wiring Accessories

The Harvey Hubbell Co., Inc., have offered to supply a free copy of their 1937 (*Turn to page* 115)



QRD? QRD? QRD?

CONDUCTED BY GY

NOW that the Wagner Act has been upheld by the U. S. Supreme Court, radiops have the strongest weapon with which to fight for better working conditions and wages. The NRA was the first impetus that radio organizations ever received in their uphill fight for recognition and which produced the present standard of wages won at hard cost. But NRA's short-lived usefulness caused shipowners and employers of radio technicians to snicker at further attempts to better the operator's working conditions, in spite of the admitted splendid progress.

TO the rescue came this Wagner Act backed by a fighter, by a Supreme Court decision, and by the forcefulness of a man of action who intends to make it his personal grievance if the law is not abided by, the President of the USA. Now also comes the momentous and fearful question. Can radiop organizations, like individuals, stand prosperity? Will they *"kill the goose that lays the golden eggs"* by *too much pressure,* or as they say in New York, try to get as much "as the traffic will bear," by striking continually? We hope not but that remains to be seen.

Radiops are continuing to receive indirect assistance in their battle for recognition by the frequency with which SOS signals have been transmitted by distressed vessels on both coasts. Not that radiops pray for this type of publicity to further their demands, but stormy weather conditions and newspaper accounts have unconsciously worked toward this end. Recently, the German tramp freighter Borkum, bound for Houston from Hamburg, sent out SOS msgs when it suffered a broken stearing gear in a violent storm. It was almost in the middle of the Atlantic Ocean when this mishap occurred and but for the timely arrival of the SS Tamaroa and the SS Colombie, another ship might now be crossed off the lists of Lloyd's Register. Terror was added to the crew's discomfort when the radio receiver went out of commission. One of the msgs received stated that "receiver is damaged." Just another case to prove the necessity for auxiliary equipment.

Radio operators in South America certainly have some fine station equipment to adjust and supervise. The photo in our heading this month shows the 50-kw transmitter and control desk at Radio "El Mundo," San Fernando, Argentine.

In a recent issue we described the experience of Skipper Walter Robertson in the Vasca De Gama blow-up and his assurance that "I'll never go to sea again unless a radiop and proper apparatus are included in the vessel's equipment." Well, he's going back to sea again after a year's layoff on the Tunaclipper Westgate, a 110-footer just recently launched. And this time there will be installed complete radio equipment of the latest type used on fishing boats. Also, his radiop in charge will be no less a personage than Brother R. Cunningham who has been receiving excellent reports on his papers from various skippers for the past fifteen years. Nothing but the best, says Robertson, *which should be the motto for all ships!* And say we, "Bon Voyage and pleasant weather, and may your tuna catches be large and often."

The old sleuth pins another medal on the chest with the ferreting out of William Leipert for his old pal, who is now sojourning in that far away country, Bangkok, Siam. Remember this Siamese letter was published in this space requesting the former's whereabouts? And we find he is on the SS Pan American and have transmitted Friend Bassett's letter from Siam to Leipert. We wish to thank Brother Cozier of the SS E. J. Bullock for aiding us in locating Brother Leipert. Therefore, me hearties, anything goes after this bit of Sherlock Holming. Only don't ask us to find lost teeth in the Black Sea or scratched radio tubes in New York.

Among the fan mail a unique request comes from a radioman. Here is one radiop who isn't particularly happy about trying to get employment within the confines of these coasts but prefers something "either in South America or Rumania." Why these two spots should be picked out is a mystery as Greece or Africa could just as easily denote desire for foreign service. Although we are asked and occasionally answer numerous strange questions, some of which involve "encyclopedic" research and some the aid of Consul Generals; this one stumps us. He has a ticket and is eligible for duty on any of the usual ship or shore stations here in the States, but whether this qualifies him for foreign duty, is another thought. If any of our readers know the answer to this one, how's to drop us a line which will be relayed to "anxiously waiting."

And another Indian bites the dust! Yeah, brethren, Brother Cosmos, one of ARTA'S original members, has resigned. His reason stated in terse language can be outlined in brief. "I resign in protest against the recent action of Mervyn R. Rathborn and Hoyt S. Haddock in seeking affiliation with the CIO and . . . our National officers' utter disregard of the mandate of the membership calling for affiliation with the CTU." This column has known of the good hard work that Brother Cosmas has performed in bringing the

ARTA to its present strength and it regards with regret and fear this, another, resignation by one of its outstanding members. Of course, the reasons quoted are only part of his argument of differences with ARTA, but in the main the above are symbols to explain his withdrawal from an organization which he has seen grow from "diapers to short pants and up to the thrill of longies." Whatever Cosmas does and wherever he may go, ye Ed and all of us sincerely wish him the best of luck.

On the heels of this comes the announcement of the formation of a new organization for radiops and this one is organized under the banner of the CTU, an A.F.L. affiliate. In a letter received from Brother L. J. Kleinklaus, its acting general Sec-Treas., he briefly gives a synopsis of its aims which are: "Former members of the New York local of the ARTA in order to correct a situation which we deemed detrimental to radiomen, applied to the CTU for a charter. This was gained a few months ago. This has set up a Marine division of the CTU with our own autonomy in this field but, of course, working within the confines of the International constitution. Work has been proceeding admirably and we are at present engaged in building up our membership. Our aim is to set up a radio organization comprising a jurisdiction over only Marine operators and Marine Shore Station men, which will allow the men to be employed at naturally the best conditions obtainable and without the entangling and obnoxious ties of other groups" In this manner the Marine Division of the CTU has been set up to embrace all Marine Radio officers and Coastal Station Radiomen, with full autonomy in the marine field, working of course within the scope of the constitution of the CTU.

Various groups in most organizations have certain ideas which they believe are for the best interests of the total membership. This new offspring honestly and truthfully believes it is in the right. As long as each association is honestly working for the good of the radiop, then nothing more can be said. But when such organization is found to be using its membership for the private gain of subversive groups and undesirable elements in the organization and in the operating profession, then it is the duty of all interested persons and mediums to bring such matters to light for the benefit of all radiops.

It is with pleasure we note the great strides being made in the shipping industry. This will bear directly on the employment situation for radiops, which is now notably easing up on both coasts. Still further improvement must be made so that the few who cannot find a billet (even during good times) will be able to ship out from the beach, if for no other reason than to get their tickets signed by a benevolent skipper. So with a cheerio and 73 . . . . ge . . . .GY.

V. T. Voltmeter

(*Continued from page* 88)

be doubled by using two 5-megohm resistors connected as shown in Figure 7.

Measuring Amplifier Power Output

The power output of a receiver or an audio amplifier can easily be measured with the v.t. voltmeter. The procedure is as follows: Disconnect the voice coil from the output transformer and connect in its place a vitreous resistor having a d.c. resistance equal to the a.c. impedance of the voice coil. Operate the amplifier at the desired level and measure the voltage developed across the resistor. By using the formula

$$\frac{(E \text{ peak} \times .707)^2}{R}$$

the power output can be calculated.

If it is desired to know the maximum undistorted output of a Class A amplifier, this can be obtained by measuring when the amplifier is operated with sufficient input so that grid current just begins to flow on signal peaks. This operating point can be determined by the method given in the following paragraph.

Checking Class "A" Audio Stages for Overload

A Class A audio stage will overload and distort at the point where grid current starts to flow. In the case of resistance-coupled amplifiers with high-mu tubes and high-value grid leaks, the grid current may be too small to measure with a common milliammeter. However, with the circuit given in Figure 5, this measurement may be made with precision. Condenser (C) bypasses the audio signal, so it will not actuate the tube voltmeter. However, any d.c. flowing in the grid circuit will charge this condenser and the resulting voltage will be indicated by the v.t. voltmeter.

Measuring Impedance

The following procedure will permit the measurement of a wide range of impedances, from voice coils to audio transformers: With reference to Figure 6, connect the unknown impedance in series with a potentiometer having a resistance greater than the unknown impedance. Then connect the pair to an a.c. source of the frequency at which the measurement is desired. Measure the voltage developed across the inductance (points "A" and "B") and note its value. Then re-connect the v.t. voltmeter to the junction of the inductance and potentiometer and to the moving arm of the potentiometer, (points "B" and "C"); adjust the potentiometer until the voltmeter reading is the same as the first reading noted. The impedance of the unknown inductance will then be equal to the d.c. resistance of the portion of the resistance element that is in the meter circuit ("B" to "C"). This d.c. resistance can then be measured with a common ohmmeter.

Measurement of R.F. and I.F. Potentials

This versatile v.t. voltmeter provides an easy and accurate method of measuring r.f. and i.f. potentials which renders it invaluable for investigation of r.f. gain, detector efficiency, etc. These voltages are measured in exactly the same manner as low frequency voltages, except that the goose neck adapter is employed.

After making the necessary connections, the tuned circuit to which the v.t. voltmeter is attached should be readjusted for resonance as the small input capacity of the meter tube will slightly detune the circuit. If the frequency is very high, also connect a 1/10 mfd. paper bypass condenser between the cathode of the 75 tube and the low potential point of the circuit to be measured to bypass r.f. from the v.t. voltmeter, so that the meter and its associated components will not become part of the r.f. circuit. This connection can be made without disturbing the tube socket by using one of the little wafer type adapters commonly used for phonograph connections.

Many other applications will suggest themselves based on the technique described in this article.

DX'ING IN BED—JUST AN OLD ENGLISH CUSTOM

Observer Coales, Southsea, England, shows how he can DX while catching up on his rest. The cabinet at the right houses a 12-2000 meter regenerative receiver and the smaller cabinet a 1-tube, 4.8-200 meter converter. This is his "bedside" equipment. A large, modern superhet is used in his more ambitious moments.

THE DX CORNER

(*For Broadcast Waves*)

S. GORDON TAYLOR

Verification Insurance

OBSERVER PARFITT (Cleveland, Ohio) sends in an interesting resume of his activity as a DX'er from 1932 to date. He has a total of 652 verifications out of 662 stations logged. The ten so far unverified have all been logged and reported during the present season. In other words, prior to the 1936-7 season a verification was received from every station to which a report was sent. This is certainly an excellent record and would seem to indicate that all stations will verify reports if the reports contain information useful to the station. This conclusion is based on the fact that Observer Parfitt's reports are unusually thorough. A few other observers who likewise try to make their reports helpful to the stations find this is uniformly successful in obtaining verifications.

DX AND WEATHER

OBSERVER HESTERMAN of Saskatchewan submits the following observations, concerning relationship of weather and DX, which will be of interest to other DX'ers:

"The weather here right now is definitely against good DX. It is mild in the daytime and quite cold at night. The change seems to be detrimental to reception, inasmuch as the QRM is prevalent nightly. I personally much prefer an even temperature, with plenty of humidity.

"My personal observations seem to work out contrary to those of the majority. I have kept records ever since I started to DX, records of practically everything that possibly could have a bearing on reception, and these appear to show that reception is definitely better and more consistent when low barometric pressure is universal over the transmission path. I have found that a region of high, or relatively high when compared with the low, is a barrier to the signals, causing them to show decided flutter and weakness in general at such times. This I have found to be true in practically every case. Surely so many, so very many, consistent observations should show something definite!"

RADIO NEWS Specials

Observer Wilbur T. Golson, Chief Engineer of WJBO, writes as follows:

"I am still dedicating our frequency checks to RADIO NEWS Listening Post Observers and I am planning for next season a series of special broadcasts for the DX Corner. As you know we are building a complete new station here which we hope to have in operation before next DX season. Our new transmitter is to be farther out of town and the studios moved to the new newspaper building now under construction uptown. The DX series will be put on from the transmitter building and from the remote points for special events. The new station will operate on 1120 kc. with 500 watts. Shunt feed grounded tower 485 feet in height is being erected now. This is to be of the ½ wave type. The tower is 20 feet square at base and uniform 20 feet up to a 90-foot point, then it is to taper to 2 feet at top. Has 1000-watt flashing airways beacon mounted on top as tower is in direct line with new lighted airways now under construction in the south."

Addresses of Brazilian Stations

Rio de Janeiro

The following list was submitted by s.w. L.P.O. Mascarenhas:

PRA3—Radio Club do Brasil, 21 Bethencourt da Silva.

PRB7—Soc. Radio Educadora do Brasil, 44 Marquez de Valenca.

PRH8—Radio Ipanema, 1080 Avenida Atlantica.
PRC8—Radio Sociedade Guanabara, 123 rua 1° de Marco.
PRA9—Radio Soc. Mayrinck Veiga, 17/21 rua Mayrinck Veiga.
PRA2—Radio Soc. do Rio de Janeiro, 45 rua da Carioca.
PRG3—Radio Tupy, 33/35 rua 13 de Maio.
PRD2—Soc. Radio Cruzeiro do Sul, 270 rua Mariz e Barros.
PRC6—Soc. Radio Philips do Brasil, 41 rua Saccadura Cabral.
PRE3—Soc. Radio Transmissora Brasileira, 300 rua Piauhy.
PRE8—Sociedade Radio Nacional —Rio de Janeiro.
PRD5—Departamento de Educacao da Prefeitura—Rio de Janeiro.
PRE2—Radio Sociedade Cajuti, 37 rua 13 de Maio.
PRF4—Radio Jornal do Brasil, 110 Avenida Rio Branco.

Other Brazilian Stations

PRD6—Radio Club de Piracicaba—Piracicaba (Sao Paulo).
PRH2—Sociedade Radio Farroupilha—Porto Alegre (Rio Grande do Sul).
PRB4—Radio Club de Santos—Santos (Sao Paulo).
PRD8—Radio Club Flumineuse-Nictheroy (Estado do Rio).
PRB9—Radio Sociedade Record—Sao Paulo (Sao Paulo).
PRA6—Soc. Radio Educadora Paulista-Sao Paulo.
PRG2—Radio Tuby—Sao Paulo (Sao Paulo).
PRA8—Radio Club de Pernambuco, Av. Cruz Cabuga Recife (Pernambuco).
PRF3—Radio Diffusora Sao Paulo —Sao Paulo (Sao Paulo).
PRC2—Radio Sociedade Gaucha——Porto Alegre (R. G. do Sul).
PRA5—Radio Club de Sao Paulo—Sao Paulo (Sao Paulo).

NOTES FROM READERS

Observer Woytan (Syracuse, N. Y.): "CMQ can be heard 12:30-1 a.m. Sunday mornings. My log is now up to 420 and have logged 44 states."

Observer Birnie (Newark, N. J.): "WJBO has moved to 1120 kc. from 1420 kc.; WMBG, 1210 to 1350 kc.; WOL, 1310 to 1230 kc. The call of XFA has been changed to XEXA; KTER to KROP; KGFG to KTOK and JOIG to JOLG. The following are new stations:

KOKO	1370 kc.	La Junta, Calif.
KPFA	1210 kc.	Helena, Mont.
KTMS	1220 kc.	Santa Barbara, Colo.
KWNO	1200 kc.	Winona, Minn.
KYCA	1500 kc.	Prescott, Ariz.
WICA	940 kc.	Ashtabula, Ohio.
WSNJ	1210 kc.	Bridgeton, N. J.
WOLS	1200 kc.	Florence, S. C."

Observer Black (Pittston, Pa.): "Our local station, WGBI, 880 kc., has joined the Columbia system and has increased power to 1 kw. while the local, WQAN, has been closed down and hereafter these two stations will use the same transmitter. From 12:30-1 p.m. and 4:30-5 p.m. transmissions will be under the call of WQAN while the call, WGBI, will be used the rest of the time. XET, 690 kc., now uses 5 kw. with a 1 kw. transmitter operating on 11760 kc. A beautiful diploma of verification has just been received from LR5. Also a nice card and a picture of the city of Sao Paulo from PRF-3. Why do broadcast-band stations verify BCB reports with their short-wave cards? CMCD, CMCF, CHNS, CJRC and YV5RA have all done this. KSOO, WAAT, CMBS, CMBY, CMCG, CMCO, CMCW, CMK and CMBN have all failed to verify my reports even after reminders from me. In general, reception conditions this spring have been the worst in my experience of three years.

I am using a 7-tube Brunswick model 15 TRF receiver which is now seven years old but I have verified all continents except Africa with it. I would enjoy corresponding with any other listeners who may be using this receiver." (His address is 103 Carroll St.).

Observer Routzahn (York, Pa.): "The week-end of April 10 was one of the best I have experienced this year. Otherwise, reception has been dropping off. Newest additions to the United States station list are: WEAU, 1050 kc.; WBLK, 1370 kc. and WAIR, 1250 kc. The daily schedule of the latter station is 8 a.m.-6:15 p.m."

Observer Rebensdorf (Harvard, Illinois): "Boosted my verifications to 580 by adding 50 this season. Next season I hope to run this up to 700. I had some SWL cards printed recently and will be glad to exchange photos and cards with any DX'er or short-wave listener." (His initials are H. E. and the address is complete at the head of this paragraph.)

Observer Truax (Aurora, Ill.): "The Mexicans are being juggled around and almost anything may be expected in the way of changes. The Mexican government is attempting legislation which may eliminate XERA, XENT, XEAW and some of the other border stations. Some DX'er with a financial surplus ought to send orchids to LS2 for their beautiful verification card. CRCB, the British Columbia regional station using 5 kw., can be heard at about 1-1:45 a.m., E.S.T., daily. This station is the beginning of what will probably be a 'new deal' in broadcasting for Canada."

Observer Kruse (Dubuque, Iowa): "For some unknown reason I succeeded in logging five 100-watters in Washington and Oregon on April 10—all stations which I had never heard previously. Can any one help identify a station on 1160 kc. playing American recordings from 4 to 5 a.m., E.S.T.? This station has been heard several times. Can any one tell me more about BU4 on 1584 kc.?" Any one desiring to communicate with Observer Kruse (and he promises to answer all letters) may address him as follows: C. D. Kruse, 1316 Gar-

(Turn to page 123)

ANOTHER "BEDSIDE" LISTENING POST

Observer Golson, Baton Rouge, La., combines his DX equipment and amateur transmitter in one convenient set-up.

A SWISS LISTENING POST

Broadcast-band DX is only one of the radio interests of Dr. Max Hausdorff. The cabinet in the foreground is his television receiver, and on the desk his all-wave receiving equipment.

10-20 Meter Transmitter

(*Continued from page 93*)

After studying this series of articles it will be possible for the amateur to know quite definitely what is required in the line of parts, finances and work. It is not necessary to make a Chinese copy of this transmitter to benefit by its design, either. The data in these articles may serve in the design of a quite different high-power transmitter. For instance, the r.f. cabinet of the transmitter contains a complete 1 kilowatt c.w. transmitter which requires no other auxiliary equipment to go on the air. By the same token, the a.f. cabinet may be used independently to modulate any other transmitter having a power input of 1 kw. or less (also more, if you live in "Kalifornia"). The speech amplifier, with its Varimatch output transformer, may be used to either drive any other high-power modulator through a 500-ohm line, or to modulate a low-power transmitter with proper impedance match to it.

The RADIO NEWS "Compact Kilowatt" is, as has just been intimated, divided into three major units, or cabinets. The first, and most important, is the r.f. cabinet. This is a complete 1 kilowatt c.w. transmitter. The second is the a.f. cabinet which is a complete 500-watt modulator. The third is the combined speech amplifier, voice-level indicator, and master-control unit. The cabinet for this latter unit is "dual" so that a receiver may be included. In this particular station (W2JCY) the receiver used is a National HRO. This combination places a complete station in but three cabinets. Compare this to other 1-kilowatt phone stations which require a great deal more space to accommodate the equipment.

Figure 1 is a block diagram of the entire transmitter. It was thought best to put the diagram in this form so as to show the reader more quickly not only the electrical layout of the transmitter but also its mechanical layout. The arrangement of the actual cabinets correspond to the arrangement shown on the diagrams. Each cabinet, as may be noticed from the photos, contains six panels. Each panel holds a separate unit which corresponds to the diagram. This divides the a.f. and r.f. cabinets into twelve distinct, mechanically-separate, units.

The r.f. stage lineup begins in unit B. Three crystals are used, these having frequencies of 7095, 7100 and 7105 kc. A switch, controlled from the lower-right knob on panel B, selects either of these three crystals. This provides an instant selection of three frequencies 10 kc. apart on the 20-meter phone band and 20 kc. apart on 10-meters.

The first tube in the r.f. lineup is an RK-34. This is a dual-triode tube designed expressly for high-frequency transmitter use. One section of the RK-34 is used as a 40-meter oscillator stage. This stage is tuned by means of a Hammarlund midget APC trimmer condenser mounted directly in the oscillator plate coil. As this condenser needs but a single initial adjustment this type of tuning is quite permissible. The other section of the RK-34 is used as a 20-meter doubler stage. This stage is tuned by the right-hand dial of unit B. No meter is used on either of the RK-34 stages, as the result of their tuning may be observed by the reading of the RK-25 plate meter.

An RK-25 screen-grid pentode is used in the third stage. This is tuned by the center dial, has its plate meter at the right of panel B and is turned "off and on" by means of a toggle switch controlled by the lower-center knob. The lower-left knob controls the bias on the RK-25. When operating on 20 meters the RK-25 operates as a straight amplifier. For 10-meter operation of the transmitter the RK-25 is a doubler to 10 meters.

The driver stage employs an RK-38. This is a high-mu, low-C triode having a plate dissipation of 100 watts. While the tube is rated at over 2000 plate volts, it is run at but 1200 volts, this being quite sufficient for adequate drive to the final amplifier, as the RK-38 works "straight through" for both 10 and 20-meter operation. Originally an RK-28 giant pentode was employed in this position. It did not, however, work out well in this particular layout. As no link coupling is used, it is necessary to use a split-tank circuit on the driver plate so as to be able to drive a push-pull final stage. Due to its relatively high plate impedance, an RK-28 does not work very efficiently into a split 10-meter tank. The higher interelectrode capacities of the tube further reduced its efficiency on 10 meters.

The plate meter for the RK-38 is at the left of panel B, while its tuning is controlled by the left-hand dial. No separate switch is needed to turn this stage "off" during tuning-up operations, as this stage has a separate 1200-volt plate supply, with an independent switch.

Unit A comprises the final r.f. stage. A pair of Amperex HF-200's are used in push-pull. Coupling from the RK-38 driver stage is direct, the excitation leads being clipped right on the RK-38 plate coil. By clipping to different turns a correct impedance match may be obtained between the two stages without resort to link coupling. As a matter of fact, no link coupling is used between any of the r.f. stages.

No antenna tuning system is used or required. Two Johnson Q antennas, one for 10 meters and one for 20, are employed. These antennas merely require untuned link coupling to the HF-200's plate tank. This link is built into each of the plate coils, greatly simplifying the tuning procedure. A pair of r.f. thermocouple ammeters are mounted on a hard rubber panel atop the r.f. cabinet so that there will be no leakage loss to the metal cabinet from this source.

Four other units, C, D, E, and F are contained in the r.f. cabinet. E and F, together, make up a kilowatt power supply for the final amplifier on unit A. The 450-volt supply for the RK-34 and RK-25, and the 1200 volt supply for the RK-38 are mounted on unit D. Unit C is the control unit for the r.f. cabinet, and also the a.f. cabinet, as far as the relay-control circuit is concerned. All power and control circuits of the entire r.f. cabinet enter this unit, C, and are properly controlled and distributed.

The general layout of the a.f. cabinet is similar to that of the r.f. cabinet. Units G and H together comprise the modulator stage proper. Unit G contains only the plate and filament meters and the output transformer, but this is quite sufficient, as may be seen from the rear view photo, showing this transformer. The transformer is only slightly less in size and weight than the big kilowatt power transformers.

Unit H mounts the pair of Taylor 822 modulator tubes, as well as the 500-ohm line-to-grid, input transformer. This line does not go through the audio-control unit, J, but runs directly to the speech-amplifier output, as shown in the sketch. The controlled-carrier Variactor is also on the chassis of unit H. This Variactor transformer, in company with an auto transformer mounted in unit C, provide controlled-carrier operation which may be switched out, when desired, by a control on the unit C panel.

The control unit, J, is similar in function control unit C in the other cabinet, but considerably simpler in layout. This is natural, since the a.f. cabinet has but one stage, while the r.f. cabinet contains four stages. Unit K holds a heavy-duty C-bias supply, while units L and M together take care of a power supply for the 822 modulators that is identical to the large supply in the r.f. cabinet.

The speech amplifier, master-control unit N handles four separate functions. The first is the speech amplification, proper. The amplifier takes a crystal microphone directly, without necessity for preamplification, and has sufficient gain to place 30 to 40 watts of audio into its 500-ohm output. The power supply for the speech-amplifier section of this unit is self-contained, further simplifying the transmitter layout as a whole.

The second function of Unit N is audio mixing, on a somewhat simplified scale. The input transformer to the third audio stage is a heavy-duty type that will carry the plate current of the output tube of any receiver. An extra jack on the panel permits any receiver to be plugged in for mixing operations.

The third function of this unit is indication of the volume level. A decibel meter is mounted on the front panel which reads from minus—10 to plus-6 decibels. A knob on the front panel permits an extended range to plus-42 decibels in 4 decibel steps. This meter is connected across the 500-ohm line output and not only reads the output level of the amplifier but, indirectly, indicates the percentage of modulation. This is done by first checking the reading on the meter against an oscillograph for various modulation percentages. The step switch may be adjusted so that the 100-percent point comes at or near the end of the scale. This method provides a convenient meter check of modulation level directly before the operator's eyes.

The fourth function of unit N is simple but important. The relay-control line from the r.f. cabinet is plugged into the back of the chassis of unit N. A toggle switch at the bottom center of the panel; a relay on the chassis, and two pairs of binding posts on the back edge complete the master-control system. One pair of binding posts takes the connections from the key, making it possible to key the transmitter for c.w. operation, without running an extra line all the way over to the r.f. cabinet. The other pair of binding posts connect to the high-voltage line of the receiver. When the master-control toggle switch "on" the panel is thrown to the "transmit" position the receiver is turned "off" through its h.v. line, by means of the relay on the chassis of unit N. At the same time the relay system of both the r.f. and a.f. cabinets is set into operation, throwing the complete transmitter "on." Throwing the master control switch back to the "receive" position reverses the procedure, shutting "off" the transmitter and placing the receiver back into operation. This master control of the complete station by means of a single toggle switch is practically instantaneous, being completed in a tiny fraction of a second. This permits of fast break-in operation. The control circuit from the master-control unit to the r.f. cabinet, and from this cabinet to the a.f. cabinet, carries but 6 volts, a.c., at low currents.

This unit-by-unit description of the various transmitter functions, in conjunction with Figure 1, should provide the reader with a good overall idea of both the electrical and mechanical layout of the transmitter; or should we say station? The inclusion of the receiver into the same cabinet as the versatile unit N makes the station complete for 10 and 20-meter operation. As will be noted from Figure 1, this type of complete-station layout eliminates a multiplicity of individual units with their attendant complex system of interconnecting wires and cables. Only two flexible cables are required to connect the receiver and unit N to both of the transmitter cabinets. Two very short lines take care of all interconnections between these two cabinets. The only additional connections to the entire station layout necessary for operation is to plug the 110-volt, a.c.-line into each of the cabinets and connect to the receiving and transmitting antennas. With the exception of the antenna and audio output leads all connections and cables are "plug-in." All external connections to the three cabinets may be removed in a few minutes and replaced in the same length of time. This is a great deal simpler than with many low-power stations we have seen.

Interconnections between the various units also follow a simple and systematic plan. This will be fully described in the following articles, although a study of the rear-view photos of the transmitter will provide an inkling as to how this unit interconnection method is accomplished.

Next month the r.f. cabinet, with full constructional and operating instructions, will be covered. The a.f. cabinet will be taken care of in the third of this series, with the fourth and final installment reserved for unit N and a review of operating results with this station.

The manufacturers cooperating in the design and construction of this transmitter are:

Hammarlund—tuning condensers, sockets. RF chokes, coil forms; United Transformer Corp—all transformers and chokes; Triplett—meters; General Radio—dials, coil forms and knobs; Johnson—Antennas, insulators, sockets; Raytheon—tubes, RK38, RK25, RK34, eight 866A's; Taylor Tubes—two 822 modulators; Amperex—two HF200's for final stage; Parmetal Products—cabinets, panels and chassis; Birnbach—feed-through and standoff insulators; National—neutralizing condensers and final tank condenser; Cornell-Dubilier—all by-pass and filter condensers; Ward Leonard—all resistors and relays and rheostats; Leeds—three mounted crystals (Leeds type LD-5); Brush Development Company—microphone.

The transmitter is installed at the Westchester Listening Post. The actual construction work was done by Bohlen and Watzel.

The Technical Review

(*Continued from page* 109)

catalog to all bona-fide servicemen, dealers, and engineers. It is a large 56 page book listing their complete line of electrical wiring devices, comprising receptacles, plugs, switches, sockets, and many new special products. Send your request 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, FREE technical booklets and manufacturers' catalog offers, which were described in detail in the March, April, May, June and July 1937 issues. The majority of these booklets are still available to all readers. Simply ask for them by their code designations and send your request to RADIO NEWS, 461 Eighth Avenue, New York, N. Y. The literature marked with an asterisk is available only to bonafide servicemen, dealers, and engineers. In applying for these folders it is necessary to send in your request on your card or letterhead. If you are an amateur give call letters. The list follows:

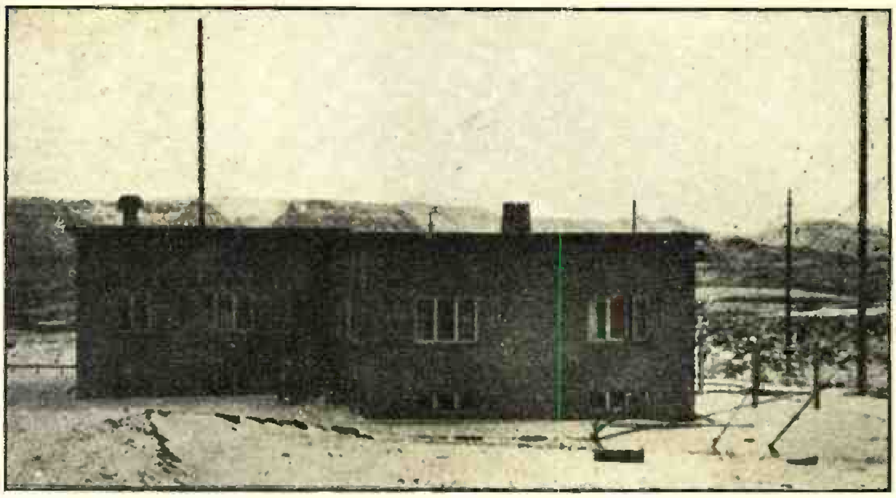
Mh2—Test Equipment Catalog. Clough-Brengle Co.

A11—56 page Catalog. Montgomery Ward & Co.

A12—Parts Catalog. Hammarlund Mfg. Co.

A13—McGraw-Hill Publishing Co., General catalog listing radio text books.

(*Turn to page* 125)



ICELANDIC BROADCASTING

A picture of radio station TFJ, Reykjavik, Iceland, who transmits on 24.52 meters, 12235 kc.

The DX Corner (Short Waves)

(*Continued from page* 103)

9550 kc., Monday and Thursday, 8-11 p.m., (Alfred, Eder), Sunday 5 a.m., (Hartzell). Saturday, Sunday, Tuesday, Thursday 4:05-4:40, (de Ruadhal, Skipworth. Dressler, Howard. Hendry), wants reports, (Unter, Coover).

OLR4A, Prague, Czechoslovakia, 11,840 kc., Monday, Thursday 8-11 p.m., (Alfred, Myers), 5:10-5:30 p.m., (Randle), 11,840 kc., 2:30-3:30 p.m., (Hodgkyns. Schrock. Birnie, Eder, Beard, de Ruadhal, Ralat, Skipworth. Dressler, Howard. Willmott, Hendry), desires reports. (Blanchard, Partner, Robinson. Hartman, Kristof. Unger, Emerson, Sprague, Rosa, McCartin, Goetz. Fallon. Stabler).

OLR5A, Prague, Czechoslovakia, 15,230 kc., Sunday until 11 a.m., (Alfred), 7:55-9:50 a.m., (Randle, Hodgkyns. Eder). daily 8-10 p.m., (Schrock, Birnie, Poll), daily 2-2:15 p. m., (Beard, de Ruadhal. Ralat, Skipworth. Dressler, Willmott, Partner, Rosa). daily 2:55-4:50 a.m., (McCartin).

OLR4C, Prague. Czechoslovakia, 11,875 kc., (Jordan, Birnie. Skipworth).

OLR6A, Prague, Czechoslovakia. 21,450 kc., (Birnie, Skipworth).

OLR5B, Prague, Czechoslovakia, 15,320 kc., (Birnie, Skipworth).

OLR5C, Prague, Czechoslovakia, 15,160 kc.. (Skipworth. Birnie).

OLR4D, Prague, Czechoslovakia. 25.21 meters, (Skipworth).

OLR4B, Prague. Czechoslovakia. 11,760 kc., (Skipworth. Birnie).

OLR3B, Prague. Czechoslovakia, 31.57 meters. (Skipworth).

OLR2C, Prague. Czechoslovakia, 6115 kc.. (Birnie. Skipworth).

OLR2B, Prague, Czechoslovakia. 11,760 kc., 6-10:15 a.m., (from veri.), (Sporn). 6030 kc., (Birnie. Skipworth).

OXY, Skamlebaek. Denmark. 6060 kc., 10:30-12 p.m., (Falon, de Ruadhal). 9490 kc., (Skinner).

PHI, Huizen, Holland, 17,775 kc., Sunday 9 a.m., (Ralat), Monday Tuesday, Thursday, Friday 8-9:35 a.m., (de Ruadhal, Blanchard). 11730 kc.. (Fallon. Rosa), Sunday 8:30-10:30 a.m.. (Dressler).

PCJ, Huizen, Holland, 15,220 kc., Tuesday 4:30-6 a.m., Wednesday, 8-11 a.m., 9590 kc., Tuesday 11:30 a.m.-3 p.m., (from veri), (Smith, Frederick, Goetz, Beck, Stabler, Fallon, Shamleffer, Hendry. Alfred. Sakely. Hartzell, Eder, de Ruadhal, Henry, Blanchard. Unger. Black. Dressler. Coover, Rosa. Randle. Gossett). Slogan: "The Happy Station," new address: Hilversum. Address: Phohi Studios. Hilversum.

LKJ1, Jeloy, Norway, 6120 kc., 11 a.m.-5:15 p.m., (McCartin), 5-8 a.m., (de Ruadhal), 9535 kc., Sunday and Wednesday, 11-12 p.m., 4 a.m., (Partner). 6130 kc., (Robinson).

SBG, Motala. Sweden. replacing temporarily SM5SX. 25.6 meters until 1:30 p. m.. 49 meters after 1:30 p.m., (Hodgkyns. Smith, de Ruadhal. Skipworth. Blakebrough. Skinner).

SM5SX, Stockholm. Sweden, 11,705 kc., daily 9 a.m., (Howard), closed down and replaced by SBG. (Hodgkyns, Skinner), 20 meters. (Skipworth), daily 1-4 p.m.. (Westman, Willmott, de Ruadhal. Blakebrough), daily 11 a.m.-5-10 p.m.. (Partner).

HAS3, Budapest, Hungary, 15,370 kc., Sunday 9-10 a.m., (Alfred. Eder, Skinner), Wednesday, Saturday. Sunday, 9-10 a.m.. 6-7 p.m.. (Boussy. de Ruadhal. Blakebrough. Blanchard, Partner. Emerson, Croston).

HAT4, Budapest, Hungary, 9125 kc., Sunday 10-11 a.m.. (Alfred. Eder), Sunday and Wednesday. 7-8 p.m.. Saturday 6-7 p.m.. (Skinner, Fallon. Kidd, de Ruadhal. Hendry, Blakebrough. Partner, Kristof, Sprague, Dressler. Ralat, Schrock. Blanchard).

TFJ, Reykjavik, Iceland. 12,235 kc., Sunday 1:40-2:30 p.m., (Alfred. Smith, Eder, Hartzell, de Ruadhal. Poll, Jordan. Kentzel, Noyes).

Radio Belgrade, Belgrade. Yugoslavia, various times. (Abbott). Monday 12:30-1 p.m.. (Smith), Friday 7-8:30 p.m.. (Blanchard), Slogan: "Radio Beograd."

YTC, Belgrade, Yugoslavia, 6550 kc., daily around 5 p.m., 9600 kc., 8 p.m. daily no call or location, (Scala), 11,700 kc.. daily 2:30-5 p.m.. 9610 kc. 7-9:30 p.m.. (Kemp), 6000 kc.. 6:30-8:30 p.m.. (Croston).

ORK, Ruysselede, Belgium, 10,330 kc., daily 12:30-2 p.m., (from veri.). (Smith). daily 1:30-3 p.m., (Hartzell. de Ruadhal).

OER2, Vienna, Austria, 11,800 kc., Monday-Friday 11 a.m.-5 p.m., Saturday 11 a.m-6 p.m., (from veri), (Smith, Herzog, Robinson, de Ruadhal, Sporn), daily 8 a.m.-4 p.m., (Partner), from veri., (Schrock), Address: Wien 1. Johannesgasse 4B.

SPW, Warsaw, Poland, 13,635 kc., Monday, Wednesday, Friday, 12:30-p.m., (from veri), (Smith, Hartzell). 13.620 kc., (Boussy, Kemp, de Ruadhal).

SPF, Gdynia, Poland, 12.322 kc., 2-3 p.m., (Kemp).

LZA, Sofia, Bulgaria, 14,920 kc., signed 4:30 p.m., (Hartzell), 2 p.m., (de Ruadhal, Eder), 14,945 kc., Slogan: "Radio Sofia."

Asia

JVT, Nazaki, Japan, 6750 kc., 4-5 p.m. for U.S.A. all day for Manchukuo. (Alfred). 6 a.m., (Ralat, Randle).

JZJ, Nazaki, Japan, 11.800 kc., all day for Europe 4-5 p.m., 12-1 a.m. for U.S.A., (Alfred, Abbott, Smith), 2:30-3:30 p.m., (Schrock). daily 7-8 a.m., (Robinson, Brown). 8-9 a.m., (Howard, Hendry, Scala, Lopez, Partner, Gossett, Emerson, Randle, Kashimoto, Blanchard, Willmott, Ralat, Hare, Blakebrough). Address: Broadcasting Corp. of Japan, Atagoyama.

JVM, Nazaki, Japan, 10.740 kc., all day for Europe, (Alfred, Abbott), daily 2:30-3:30 p.m., (Smith, McCartin, Schrock, Brown, de Ruadhal). 12:30-1:30 a.m. for U.S.A., (Willmott, Hare, Blakebrough, Hendry, Scala, Lopez, Partner, Sesmo, Beck). Address: same as JZJ.

JVN, Nazaki, Japan, 10,660 kc., 4-5 p.m. for U.S.A. all day for Manchukuo. (Alfred, Abbott). 4-7:40 a.m., (Law, Skinner, Schrock, Brown, de Ruadhal, Stabler, Ralat, Blakebrough). 12:30-1:30 a.m. for U.S.A., (Scala, Lopez, Partner, Sesma, Gallagher, Dressler, Randle).

JVH, Nazaki, Japan, 14.640 kc., 4-5 p.m. for U.S.A., all day for Manchukuo. (Alfred, Law, Brown, Lopez). 14,580 kc., (Sesma). 14.600 kc., (Black, Randle).

JVP, Nazaki, Japan, 7510 kc., 4-5 p.m. for U.S.A., all day for Manchukuo. (Alfred). daily 2:30-3:30 p.m., (Robinson, Brown, Lopez, Robinson, Randle).

JVE, Nazaki, Japan, 15.660 kc., 9-11:30 a.m., (Sporn, Gallagher), 3-5 a.m., (Black).

JVL, Nazaki, Japan, 11.660 kc., 9-11:30 a.m., (from veri.). (Sporn).

JVJ, Nazaki, Japan, 11.800 kc., (Kashimoto).

JZI, Nazaki, Japan, 9535 kc., daily 8-9 a.m., (Alfred, Abbott), daily 7-8 a.m., (Schrock, Robinson, Brown). 9-10 a.m., (Hartzell, Hare, Blakebrough, Scala, Lopez, Partner, Robinson, Randle).

JZK, Nazaki, Japan, 15.160 kc., 9-10 a.m., irreg., (Howarld, Hartzell), 12,020 kc., (Gallagher).

JZU, Nazaki, Japan, 25.42 meters, 3 p.m., (de Ruadhal).

TDE, Manchukuo, Japan, 10,060 kc., daily 1-3:10 a.m., (Croston) 4:30-6 a.m., 9 a.m.-3 p.m., Sunday 2:15-6 a.m., 8 a.m.-2:30 p.m., (from veri.), (Lorvig), will verify only experimental transmissions, (Atherton).

PLP, Bandoeng, Java, 11.000 kc., daily 6-7:30 a.m., (Alfred, Stabler, Hartzell, de Ruadhal, Lorvig), daily to 10 a.m., (Howard, Chambers, Hendry). daily 6 p.m., (Blanchard).

PMN, Bandoeng, Java, 10.260 kc., 6-7:30 a.m., (Alfred, McCartin, Hartzell, de Ruadhal, Blakebrough). daily to 10 a.m., (Howard), 5:30-11 a.m., (Black).

PLH, Bandoeng, Java, 6720 kc., daily to 11 a.m., (Howard).

PLO, Bandoeng, Java, 10.680 kc., Sunday 5 a.m., (Hartzell).

PLV, Bandoeng, Java, 9410 kc., Sunday 5:30 a.m., (Hartzell).

YDC, Bandoeng, Java, 15,150 kc., commences 5 a.m., (Hartzell). Sunday 10 a.m., (de Ruadhal).

YDB, Soerabaja, Java, 9545 kc., daily to 11 a.m., (Howald), 9650 kc., (Eder), 11,860, 9610 kc., (Birnie, de Ruadhal).

YDA, Batavia, Java, 98.68 meters, (Blakebrough).

YBG, Medan, Sumatra, 10.430 kc., daily 7:30-8:30 a.m., rarely announce., (Poll).

ZBW3, Hong Kong, China, 9525 kc., daily 5-10 a.m., Saturday and Tuesday, 5-11 a.m., (Partner, Black). Monday, Thursday, 7 a.m., will not verify, (Sprague).

ZBW, Hong Kong, China, 9520 kc., (Eder), daily 5 a.m., (Rodriguez), 15.190 kc., (Michaels). 7:30-10 a.m., (Sporn, Hartzell). daily weekdays.

ZBW4, Hong Kong, China, 15,195 kc., 8-8:30 (Sporn, Blakebrough).

ZBW5, Hong Kong, China, 17.760 kc., 6-11:30 a.m., (from veri), (Sporn), Saturday 11:30 p.m.-1:30 a.m., (Robinson).

XGN, Shanghai, China, 17,635 kc., 9:45-10:15 a.m., (Sporn, Gallagher).

XTC, Shanghai, China, 9300 kc., 9-9:30 a.m., (Sporn).

XOJ, Shanghai, China, 15,800 kc., (Chambers). 15,865 kc., 7-9 p.m., (Sporn, Birnie).

ZHI, Singapore, Straits Settlements, 49 meters, closed down, (Smith), replaced by ZHL, (de Ruadhal).

XGOX, Nanking, China, 6850 kc., 5:30-8:30 a.m., (Hartzell).

Radio Philco, Saigon, Indo-China, 11.710 kc., 2:10 a.m., (Sporn).

XTV, Canton, China, 9500 kc., 5 and 10 p.m., (Gallagher).

XGW, China, 10.420 kc., 10 a.m., (Black).

VPD, Colombo, Ceylon, 6110 kc., daily 7-11 a.m., (Croston).

VPB, Colombo, Ceylon, 6160 kc., 8-10:15 a.m., (McCartin), Saturday 11-11:45 a.m., (from veri.), (Smith, Robinson, de Ruadhal), temporarily suspended, (Blakebrough). Address: Chief Telecommunication Engineer, Broadcasting Office, Torrington Square.

VUB, Bombay, India, (Randle).

ZGE, Federated Malay States, 6200 kc., Sunday, Tuesday, Friday, 6:40-8:40 a.m., (Croston).

RVI5, Khabarovsk, Siberia, U.S.S.R., 4250 kc., best at 5 a.m., (Hartzell).

HS8PJ, Bangkok, Siam, 9350 kc., Monday and Thursday 8-10 a.m., (Smith, McCartin, de Ruadhal, Howard, Randle). 19.020 kc. at times. (Scala, Gallagher, Black), Address: Lt. Col. Phra Aramronajit, Supt. of Radio Section, Post and Telegraph Dept., Bangkok.

YAK, Kaboul, Afghanistan, 18,640 kc., 9650 kc., to open in July, (Wilson).

YAM, Yan, Yao, Yat, Afganistan, 4150 kc., to open in July, (Wilson).

Africa

FIQA, Tananarive, Madagascar, 31.5 and 49.96 meters, weekdays 1:30-2:30 p.m., reports requested, (Hendry); 9515 kc., 9-11 a.m. and 6-7 p.m. (Partner). Address: Direction des P.T.T., Hotel des Postes, Place Colbert, Tananarive.

FIU, Tananarive, Madagascar, 31.2 meters, daily 10 a.m.-11 p.m. (Westman).

ZNB, Mafeking, Union of South Africa, 5900 kc. (Birnie).

ZTJ, Johannesburg, Union of South Africa, 6097 kc., (Robinson).

FVA, Alger, Algeria, 8960 kc., 12-3 a.m. (Partner); 12120 kc. (Hendry). Slogan: "Radio Algiers".

TYA, Algeria, (Blakebrough).

CR7AA, Lourenco Marques, Mozambique, 6137 ks. (Abreu).

CR7BA, CR7BH, Lourenco Marques, Mozambique, 11718 kc., 9:30 a.m. and on. (Howard); daily 9:30-11 a.m. (Sakely); 7:30-8:30 a.m. (Poll, Partner, Abreu).

CR6AA, Lobito, Angola, 41.8 meters, Wednesday 2 p.m. (de Ruadhal, Blakebrough).

Guardia Civil, Tetuan, Spanish Morocco, 6550 kc., Sunday 7:45 p.m. (Ralat).

EA9AH, Tetuan, Spanish Morocco, 7000 kc., 10:15 p.m. (Rodriguez, Ralat); 32360 kc. (from veri). (Sporn); 7030 kc., 4-4:25 p.m., 12-12:30 a.m. irregularly. (Wilson); 14200 kc., daily except Sunday 2:15-5 p.m., 7-10 p.m. (Gossett)

VQ7LO, Nairobi, Kenya, 49.32 meters, 2:15 p.m. (Smith); daily except Sunday 6-6:30 a.m. (Stevens, de Ruadhal, Blakebrough). Address: P. O. Box No. 777.

JUC, Addis Ababa, Ethiopia, 11955 kc. (Robinson); 11:37 p.m. (Chambers).

IUG, Addis Ababa, Ethiopia, 15450 kc., daily 9 a.m., (Howard).

SUV, Cairo, Egypt, 10055 kc., 6:47-6:35 p.m. (Alfred).

SUZ, Cairo, Egypt, 13820 kc., 5:47-6:35 p.m. (Alfred, Hartzell).

EAJ43, Tenerife, Canary Islands, 10360 kc., Monday through Saturday 7:20-10 p.m., or later, Sunday irregularly. (Alfred); daily 2-4 p.m., 5:45-7 p.m. (Smith, Rodriguez, Stabler, Skinner, Michaels, Sargent, Randle); 10380 kc. (Wilson, Chambers, Ralat); 10370 kc. (Kentzel). Address: P. O. Box No. 225.

EA8AB, Tenerife, Canary Islands, 7210 kc., 2-7 p.m. (de Ruadhal); 7210 kc. (Birnie); 8:30 p.m. (Rakat).

EA8HB, Tenerife, Canary Islands, 7000 kc., 8 p.m. (Boussy).

YBG, Medan, Sumatra, 28.76 meters, daily 11:30 a.m.-12:30 p.m. (Westman).

North America

VE9HX, Halifax, N.S., Canada, 6130 kc., schedule: 10 a.m.-1 p.m., 6-12 p.m., daily except Saturday and Sunday, Friday 2-4 p.m., 3-12 a.m. on Saturday and Sunday, relays CHNS on 9300 kc. (Alfred, Fallon, Goetz). Address: Maritime Broadcasting Co., Ltd.

GGA3, 15580 kc., 6:30 p.m. (Beck).

CFCX, Montreal, Quebec, Canada, 6000 kc., 6-11:30 p.m. (McCartin, Kidd).

CFRX, Toronto, Ontario, Canada, 6070 kc., (Goetz); 6090 kc., weekdays 7:45 a.m.-5 p.m., Saturday 11 a.m.-12 p.m., Sunday 11 a.m.-5 p.m. (from veri.). (Fallon, Wittig, Schrock); relays CFRB.(Hartzell, Kidd, de Ruadhal, Pinkerton, Jaime, Unger, Goetz). Slogan: "Roberts Radio". Address: Roger's S.W. Station.

CJRX, Winnipeg, Manitoba, Canada, 11720 kc. (Kidd, de Ruadhal); 11:30 p.m. (Paime, Sesma, Emerson).

CRCX, Bowmanville, Canada, 6090 kc., 3:45-4 p.m. (Goetz).

CGA, Drummondville, Canada (Hare).

VE9DN, Montreal, Quebec, Canada, 6005 kc., 4:55-6 a.m. (Lopez).

CJRO, Vancouver, B.C., Canada, 6150 kc. (Sesma); 11:45 p.m. (Emerson).

W4XB, Miami, Florida, 11950 kc., testing at 11:30 a.m., (Beck).

W9XG, West Lafayette, Ind., 2050 kc., schedule: Tuesday 8:30 p.m. and Thursday 9 p.m. (from veri.) (Sprague).

WHA, Virginia, 11200 kc., irregularly (Schrock).

W5XAU, 31600 kc., 12-1 p.m. (Murphy).

W9XF, Chicago, Ill., 6100 kc., schedule: daily except Saturday 10:05 p.m.-1 a.m., Saturday 12:05-1 a.m. (Duncan).

W3XKA, Pittsburgh, Pa., 31600 kc., 8:30 a.m. (Murphy).

W2XAF, Schenectady, N. Y., 9530 kc., 5-11 p.m. (Kidd, de Ruadhal, Hartzell, Duncan); 4:20-4:30 p.m. (Goetz); daily 4-12 p.m. (Marshall). Slogan: "The Voice of Electricity".

W2XDV, New York, N. Y., 31600 kc., 35600 kc., 38600 kc. and 41000 kc. (from veri.) (Ruppert); 5-9 p.m. (Croston).

W8XK, Pittsburgh, Pa., 17700 kc., 10 a.m. (de Ruadhal, Hendry, Duncan); 11870 kc., 6:34-6:45 p.m. (Goetz).

W2XE, New York, N. Y., 15200 kc. (de Ruadhal); 5 p.m. (Jaime); 15220 kc. (Randle); 11830 kc. (Duncan); 21520 kc., 6:30-9 a.m., 17760 kc., 12-1 p.m., 15270 kc., 2-5 p.m. (Fallon, Kemp, Goetz).

W2XAD, Schenectady, N. Y., 15330 kc. (de Ruadhal, Hare, Hendry); daily 10 a.m.-6 p.m. (Marshall, Duncan).

WLK, Lawrenceville, N. J., 11 a.m. (deRuadhal).

W1XK, Boston, Mass., 9570 kc., 12 p.m. (Jaime); 6:30 a.m.-1 p.m., Sunday 8 a.m.-1 p.m. (Fallon, Goetz).

W1OXGY, 25 meters, (Jordan).

W1XKB, 31600 kc., changed from W1XKA (Birnie).

W9XAA, Chicago, Ill., 6080 kc., 11830 kc., 17780 kc. (Unger). Slogan: "Voice of Labor and Farmer". Address: 666 Lake Shore Drive.

W6XKG, Los Angeles, Calif., 25950 kc., daily 24 hours. (Hartzell, Gertz); relays KGFJ. (Croston).

W8XAL, Cincinnati, Ohio, 6060 kc., 1:30 p.m. (Duncan, Kidd, Sprague).

KKQ, Bolinas, Calif., 11950 kc., 10:30-11 p.m. (Kidd); 9-9:45 p.m. (Herzog, Dressler, Unger, Hendry).

W1XAL, Boston, Mass., 15250 kc., 6010 kc., latter frequency Sunday 8:30-10:15 p.m. (Bittner); 6040 kc., 7-9 p.m., 11790 kc., 5-6:30 p.m. (Wittig, Shamleffer, Kidd, de Ruadhal); fiive-note chime. (Hare, Randle, Duncan, Fallon, Sprague, Foetz).

W3XAL, Bound Brook, N. J., 6100 kc. daily 6-11 p.m. (from announcement) (Bittner); 17310 kc. (Law, Duncan, de Ruadhal); 17760 kc., 3:45 p.m. (Jaime, Randle, Fallon, Goetz).

W3XAU, Philadelphia, Pa., 6060 kc., daily 8-11 p.m., 9590 kc., daily except Sunday and Wednesday 12-8 p.m., Sunday and Wednesday 12-7 p.m. (Fallon, Kidd, de Ruadhal, Duncan, Goetz).

KWU, Dixon, Calif., 15350 kc. (Shamleffer); 9:45 a.m. (Unger).

XEWV, Guadalajara, Mexico, 11330 kc. (Schrock).

XETN, Mexico, D.F. 11520 kc. (Skinner).

XRQ, Guadalajara, Mexico, 9475 kc. daily 9-11:30 p.m. (from announcement.) (Sporn).

XENI, Durango, Mexico, 6700 kc., 10:10-11:30 p.m. on Saturday. (Sporn).

XELI, Mexico, D.F., Mexico, 6710 kc., daily 8:30-10:20 p.m. (Sporn).

XEWW, Mexico, D.F., Mexico, 9500 kc., 11 p.m., wants reports, plans names increase. (Fallon).

XECR, Mexico, D.F., Mexico, 7340 kc., Sunday signing at 8 p.m. (Ralat).

XEPM, Mexico, D.F., Mexico, 6110 kc., relays XEJW. (Beck); 11550 kc., Sunday 9 p.m. (Schrock). Slogan: "La Voz del Aguila Azteca". Address: P. O. Box No. 8403.

XEUW, Vera Cruz, Mexico, 6020 kc., irregularly 8 p.m.-12:30 a.m. (Sesma, Hartzell).

XEWB, Guadalajara, Mexico, no frequency announced, 6:45 p.m. (Jaime).

XEFT, Vera Cruz, Mexico, 9490 kc., relays XEF, three cuckoo calls, calls ½ hour and two chimes three times. (Beck).

XEYU, 9600 kc., Mexico, requests reports and signs at 11:30 p.m. (Sakely). Slogan: "The National University of Mexico".

XBGG, Mexico, D.F. 9500 kc., signs at 11 p.m. (Sakely).

XEDQ, Guadalajara, Mexico, 9480 kc. (Sesma); three cuckoo calls, 9 p.m. (Beck).

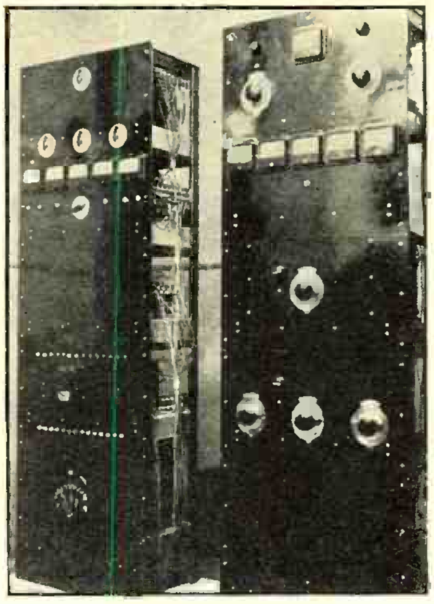
XEBR, Hermosillo, Sonora, Mexico, 11820 kc., daily 1-4 p.m., 9-12 p.m., relays XEBH on 9300 kc. (Alfred, Eder, Robinson, Parsons, Sesma, Schrock). Slogans: "Radio Difusora de Sonora" and "El Heraldo de Sonora". Address: P. O. Box No. 68.

XEBT, Mexico, D.F., Mexico, 6000 kc., 7 p.m.-1:15 a.m. (McCartin, Coover, de Ruadhal, Hartzell)

XEXA, Mexico, D.F., Mexico, 6170 kc. (Eder); Sunday 7-8 p.m. (from veri) Schrock, Kidd); 6130 kc. (Tate, Jaime, Robinson); 6182 kc. (Sesma); 10:30 p.m. (Unger); Tuesday 11:30 p.m. (Ralat). Address: Departmento de Publicidad y Propaganda Correspondencia y Central.

XEWI, Mexico, D.F., Mexico, 11900 kc. (Eder, Hendry); Saturday 9-12 a.m. (Lindner, Robinson); 11370 kc. (Howard); Tuesday and Friday 7:45-9 p.m. (Sesma, Goetz, Wacker).

XEUZ, Mexico, DF., Mexico, 6120 kc. (Hendry); 8 p.m.-2 a.m., relays XEFO. (Partner, Beck). Address: Cadena Radio Nacional, Partido Nacional Revolucianario, Mexico, D.F., Mexico.



XEWI TRANSMITTER

Observer T. W. Walczak of Ellwood City, Pa., sends in this rare photo of XEWI

XEPW, Mexico, D.F., Mexico, 6120 kc., 8-12 p.m. except Sunday. (Partner); daily 7-8:30 p.m. (Sporn).

Central America

HP5I, Aguadulce, Panama, 11895 kc., schedule: daily 7:30-9:30 p.m. (from veri.) (Alfred, Robinson); 11790 kc., 7-8 p.m. irregularly. (Partner, Lindner).

HP5B, Colon, Panama, 6030 kc., daily 7:30-10:30 p.m. (Bittner, McCartin, de Ruadhal, Sporn, Jaime).

HP5J, Panama City, Panama, 9600 kc. (Eder); 6-10:30 p.m. (Goetz, Gossett); 9615 kc. (Ralat). Slogan: "La Voz de Panama". Address: P. O. Box No. 867.

HP5K, Colon, Panama, 6005 kc. (from announcement); Sunday 8:45 p.m. (Ralat); daily 8:30-10 a.m., 7-12 p.m. (Beck). (Slogan: "La Voz de la Victor"). Address: P. O. Box No. 33.

NYLG, Managua, Nicaragua, 8500 kc., daily 8-9 p.m. (Alfred); 8590 kc. (Sesma).

YVNA, Managua, Nicaragua, 8600 kc., Saturday 8 p.m. (Lindner).

YNIPR, Managua, Nicaragua, 8620 kc., 9:18 p.m. (Eder); 8650 kc., 8-10:30 p.m. (from veri.). (Schrock).

TIEP, San Jose, Cota Rica, 6688 kc., daily at late as 11:35 p.m. (Alfred, Eder, Beck); 6710 kc. (Ralat, Wittig); clock chimes used. (Smith); daily 7-10 p.m. (Kidd, Jaime, Sesma, Coover). Slogans: "Lo Voz de los Isthms" and "La Voz del Tropico". Address: P. O. Box No. 257.

TIGPH, San Jose, Cota Rica, 5820 kc., 6-11 p.m. (McCartin, Eder), 6:30 p.m. (Ralat).

TIPG, San Jose, Costa Rica, 6410 kc., 11 a.m.-1 p.m. (McCartin, Eder, Wittig, Hendry); Wednesday and Saturday 9-10 p.m. (from veri) (Lindner); 6-11 p.m. (Ralat, Gossett). Slogan: "La Voz de la Victor" Address: P. O. Box No. 225.

TILS, San Jose, Costa Rica, 5800 kc. (from veri) (Goetz); 9 p.m. (Ralat); 7-10:30 p.m. (Schrock); sign with "Good Night Song". (Skinner); 5903 kc. (Staley, Sakely, Roberts). Slogan: "Emisora Para Ti". Address: P. O. Box No. 3.

TIMS, Costa Rica, 5900 kc. (Eder).

TI2RS, San Jose, Costa Rica, 6880 kc., 10-11:30 p.m. (Schrock, Skinner).

TI4NRH, Heredia, Costa Rica, 30.5 meters, 12:50-1:15 a.m. (de Ruadhal, Lopez).

TIVL, San Jose, Costa Rica, 6720 kc., irregularly, (Sakely); 1:15 a.m. (Beck).

TIX, Costa Rica, 54 meters, 11:31 p.m. (Jaime).

TIOW, Puerto Limon, Costa Rica, 6500 kc., daily 12-1:30 p.m. (Gossett). Slogan: "Ondas del Caribe".

HRN, Tegucigalpa, Honduras, 5870 kc. (Eder).

HRD, La Ceiba, Honduras, 6230 kc. (Eder); signed at 11:05 p.m. (Fallon, Goetz, Lindner). Slogan: "La Voz de Atlantida".

TG2X, Guatemala City, Guatemala, 5940 kc. (Eder); Saturday 11 p.m. (Ralat, Hendry, Jaime, Beck, Lindner). Slogan: "De la Policia Nacional".

TG1, TG2, Guatemala City, Guatemala, 6303 kc., 11:45 p.m. (Hartzell); 6310 kc. (from announcement). (Devil's Like DX'er): 8-12 p.m. (Partner); 11 p.m.-1 a.m. (Howard,

Chiang, Gallagher). Address: Director General of Electrical Communications.
TGWA, Guatemala City, Guatemala. 9450 kc., Thursday 8-10 p.m. (Stabler); daily 12-2 p.m. and 8 p.m.-12 midnight. (Ralat); Saturday 11-12 p.m.. Sunday 12-4 a.m. (from veri). (Fallon, Jaime, Hendry, Eder, Dressler).

South America

LRX, LR1, LRA, Buenos Aires, Argentina. 9660 kc., daily 6-10:30 p.m. (Alfred, Bittner, Frederick, Eder, Hendry, Robinson, Sakely, Ralat, de Ruadhal, Kidd), daily 2-11 p.m. (Westman) daily 7:15 a.m.-11 p.m. (Randle, Herzog) 10350 kc., (Beck, Lowig, Hendry, Sesma, Goetz). Slogan: "Radio El Mundo". Address: P. O. Box 555.
LRU, Buenos Aires, Argentina, 15280 kc., discontinued (from veri.) (Frederick, Sakely, Lowig, Sesma).
LSX, Buenos Aires, Argentina, 10335 kc., Monday, Wednesday, Thursday, 6:30-8 p.m. and irregularly (Dressler).
CP12, Cockabamba, Bolivia, 6160 kc., 12-12:30 p.m. and 8:30—10:30 p.m. (Skinner, Michaels, Sakely) 6120 kc., (Skinner). Slogan: "Radio Tunari."
CP1AA, La Paz, Bolivia, 1400 kc., 8-9 p.m. (Skinner).
CP1, Sucre, Bolivia, 6250 kc. Slogan: "Radio Chuquisaca"
CB615, CEB, Santiago, Chile, 12295 kc., daily 7-8 p.m. (Alfred), daily 4-8 p.m. (Hartzell, Schrock, Robinson, Partner) 12380 kc., three chimes and bugle call. (Randle, Sesma, Black). Slogan: "Radio Service." Address: Desinaras and Cia. Ltd., Bandera 176, Casilla 761.
CB960, Santiago, Chile, 12140 kc., heard Saturdays 4-10 p.m. (Westman). Slogan: "Radio Service."
CB740, Santiago, Chile, 7500 kc., heard irregularly near 10 p.m. (Skinner). Slogan: "La Voz del Nagismo."
HJ1AB, Cartagena, Colombia, 9600 kc., signs weekdays 10 p.m., Saturdays, 11 p.m. (Alfred, Myers) 9620 kc., daily 6-10:15 p.m. (Bittner, Eder, Schrock, Robinson, Wittig, DeRuadhal, Kidd, Hendry, Sesma) daily 7:30-11 p.m. (Dressler, Hendry, Coover, Kaskimoto). Slogan: "Radio Cartagena." Address: P. O. Box 37.
HJ1ABE, Cartagena, Colombia, 9500 kc., signed Monday, 11 p.m., rest of week 10 p.m. (Alfred), daily except Sunday, 11:30 a.m.-1 p.m., 6-10:30 p.m. (Frederick, Eder, Schrock, De Ruadhal, Staley, Sargent, Sesma, Coover). Address: P.O. Box 31.
HJ1ABG, Barranquilla, Colombia, 6040 kc., heard 6-10:15 p.m. (McCartin, Jaime, Ralat).
HJ1ABB, Barranquilla, Colombia, 6450 kc., heard 4-10 p.m. (McCartin) 4800 kc., (Schrock, De Ruadhal, Lindner) 4780 kc., 11 p.m. (Murphy) 9555 kc., 4:30-6 p.m. (Gossett, Ralat). Address: P.O. Box 715.
HJ1ABJ, Santa Marta, Colombia, 6020 kc., heard 9:24 p.m. (Jaime) 6030 kc., (Beck, Ralat).
HJ4ABP, Medellin, Colombia, 6030 kc., (Goetz) Saturday 11 p.m.-12 midnight, requests reports, (Hartzell, Hendry, Jaime). Slogan: "Emisora Philco."
HJ4ABN, Armenia, Colombia, 9520 kc., (Eder) daily 6-10 p.m. (Eder, Hendry, Staley) blare of trumpets at start of transmission. (Michaels, Smith) 8-12 a.m. (Robinson, Dressler).
HJ4ABU, Pereira, Colombia, 6145 kc., (Ralat, Eder) heard 7:43 p.m. (Jaime) 6-10 p.m. (Gossett). Slogan: "La Voz de Pereira."
HJ4ABA, Medellin, Colombia, 11710 kc., heard 8-9 a.m. (Alfred).
HJ4ABB, Manizales, Colombia, 6100 kc., heard 5:30-10:30 p.m. (McCartin, DeRuadhal).
HJ4ABL, Manizales, Colombia, 6070 kc., heard 5:30-8:30, (McMartin, Jaime).
HJ2ABC, Cucuta, Colombia, 9575 kc., signed at 10:45 p.m., (Alfred, Unger), 4810 kc., 6-10 p.m. (Schrock, De Ruadhal, Lindner, Coover, Gossett). Slogan: "La Voz de Cucuta."
HJ2ABD, Bucaramanga, Colombia, 9630 kc., heard 7:30-10:30 p.m. (Gossett).
HJ4ABE, Medellin, Colombia, 6097 kc., daily 9:30 a.m.-1 p.m., 5-11:30 p.m. (Ralat, Blakebrough, Duncan). Slogan: "La Voz de Antioquia."
HJ3ABH, Bogota, Colombia, 6010 kc., heard 6 p.m.-1 a.m., (McCartin) daily except Sunday 6-11 p.m., Sunday 4-11 p.m. (Hartzell).
HJ3ABX, Bogota, Colombia, 6120 kc., (Eder), until new station is completed, (from veri.), heard around 5 p.m. (De Ruadhal).
HJU, Buenaventura, Colombia, 9510 kc., Monday, Wednesday, and Friday, 8-11 p.m., (Schrock, Shamleffer, DeRuadhal, Sargent).
HKB, Bogota, Colombia, 9930 kc., heard 9:10-10 a.m. (Sporn).
HKV, Bogota, Colombia, 8800 kc., heard 8:45-9 p.m. (Beck, Howard).
HJN, Bogota, Colombia, 5950 kc., will be off air until new station is completed, (from veri.), (Beck).
HJ5ABD, Cali, Colombia, 6080 kc., heard 6-12 p.m. (McCartin, Ralat), Slogan: "La Voz del Valle".
PRADA, Riobamba, Ecuador, 6618 kc., Thursday 9-11 p.m., (from veri.) (Ralat, Goetz, Eder, Coover, Beck). Address: P. O. Box 98.
HCETC, Quito, Ecuador, 9350 kc., (Beck).
HC1EC, Quito, Ecuador, 8600 kc., (Beck).
HC1RJ, Quito, Ecuador, 7600 kc., (Beck).
HC2JSB, Guayaquil, Ecuador, 7854 kc., heard 7:15 p.m. (Ralat, Hartzell, Beck), daily 11 a.m.-2 p.m., 4-11 p.m. (Walczak).
HC1AY, Quito, Ecuador, 7200 kc., (Beck).
HC2ET, Guayaquil, Ecuador, 4600 kc., (Beck).
HC1PM, Quito, Ecuador, 5720 kc., (Beck).
HCJB, Quito, Ecuador, 8940 kc., heard 8-9 p.m., (DeRuadhal), also 4200 kc., (Beck).
HC1VT, Ambato, Ecuador, 6570 kc., (Beck).
HC1RE, Quito, Ecuador, 6300 kc., (Beck).
HC2RL, Guayaquil, Ecuador, 6670 kc., Tuesday, 9-11 p.m., (Myers), Sunday, 5:45-7:45 p.m., (from veri.), (Goetz, Lindner) 6630 kc., (Jaime, Beck, Ralat).
HC2ODA, HCODA, Guayaquil, Equador, 9440 kc., (Eder), 7-10 p.m., (Schrock, Dressler, Beck).
HC2CW, Guayaquil, Ecuador, 8404 kc., daily except Sunday, 11:30 a.m.—12:30 p.m., 7-11 p.m., 3-5 p.m. (Schrock, Beck). Slogan: "Ondas del Pacifico." Address: P. O. Box 1166.
OAX4G, Lima, Peru, 6230 kc., signs at 10:30 p.m. (Tate) heard 6:52 p.m., (Jaime, Beck).
OAX4P, Huancays, Peru, 6122 kc., (Beck).
OAX6A, Arequipa, Peru, 6122 kc., (Beck).
OAX4I, Lima, Peru, 9340 kc., daily 6-11:30 p.m. (Hartzell, Beck, Robinson).
OAX5C, Ica, Peru, 6000 kc., (Beck).
OAX4T, Ica, Peru, 9562, (from ann.), (Tate, Beck).
OAX5B, Ica, Peru, 11796 kc., 7-12 p.m. daily, (Partner, Sakely, Jaime, Gossett). Slogan: "Radio Universal de Ica."
OAX4D, Lima, Peru, 5780 kc., Wednesday and Saturday, 9-11:30 p.m. (Alfred, Hartzell, Beck). Slogan: "Radio Dusa."
OAX5A, 5B, Ica, 11800 kc., heard 10 p.m. (Eder) relays OAX5B, two horn signals—every 15 minutes, (Beck). Address: P. O. Box 28.
OAX4J, Lima, Peru, 9335 kc., signed at 12 p.m. (Alfred, Eder, De Ruadhal), 9520 kc., reports requested, (Staley), 9370 kc., (Stabler, Beck), 12-3 p.m., 5 p.m.-1 a.m. (from veri.), (Henry, Ralat). Slogan: "Radio Internacional." Address: P.O. Box 1166.
OAX4Z, Lima, Peru, 6090 kc., signed at 11:37 p.m., (Alfred) daily 8:30 p.m.-12:30 a.m., (Rodriguez, Staley, Tata, Birnie, Beck). Slogan: "Radio Nacional."
OAX4K, Lima, Peru, 6425 kc., (Beck).
OAX1A, Chiclayo, Peru, 6150 kc., (Beck).
OAX7A, Cuzco, Peru, 6128 kc., (Beck).
PRF5, Rio de Janeiro, Brazil, 9501 kc., daily 1:45-2:45 p.m., (from veri), (Goetz, Shamleffer, DeRuadhal), daily 4-11 p.m., (Westman, Ralat, Henry, Shamleffer).
PPQ, Sepetiba, Brazil, daily 7:45-8:15 p.m., sign with the "Blue Danube". (Skinner).

PSE, Marapicu, Brazil, 14935 kc., heard Wednesday 6-6:10 p.m., (Shamleffer).
VP3MR, Georgetown, British Guiana, 6002 kc., Sunday, 7:45-10:15 a.m., weekdays 4:45-8:15 p.m., (Skinner).
PZ1AA, Paramaribo, Dutch Guiana, 13980 kc., heard Tuesday and irregularly. (Gossett).
VP3BG, Georgetown, British Guiana, 6130 kc., heard 5 p.m. (Ralat).
YV1RI, Coro, Venezuela, 6210 kc., heard 7:21 p.m. (Jaime, Ralat). Slogan: "Radio Coro."
YV5RJ, Caracas, Venezuela, 6350 kc., heard 8-11 p.m., (Gallagher), 6250 kc., relays YV5RI, (Chiang), 5:30-8 p.m., (Schrock).
YV6RC, Bolivar, Venezuela, 6420 kc., heard 8 p.m. (Ralat). Slogans: "Radio Bolivar", "Emisora Guayanesa."
YV4RB, Valencia, Venezuela, 6520 kc., heard 5:30 p.m., (Ralat).
YV4RG, Maracay, Venezuela, 6300 kc., 8-10:30 p.m., (Hartzell).
YV2RB, San Cristobal, Venezuela, heard 7:30 p.m. (Ralat).
YV1ORSC, San Cristobal, Venezuela, 5720 kc., (from veri.), (Sporn).
YV5RD, Caracas, Venezuela, 6160 kc., heard 8:04 p.m., (Jaime) heard 10 p.m. (Howard, Hendry).
YV5RC, Caracas, Venezuela, 5800 kc., (Eder), 7-10 p.m. (Kidd, Blanchard, Lopez, Emerson, Coover).
YV5RP, YV5RQ, Caracas, Venezuela, 6290 kc., schedule: Friday, 7-11 p.m. (from ann.) (Hartzell, DeRuadhal) 6270 kc., reports requested, (Staley, Jamie) heard 12-2 a.m., (Lopez, Randle, Lindner, Ralat). Slogan: "La Voz de lo Philco." Address: P. O. Box 505.
YV1RG, Valera, Venezuela, 6230 kc., heard Sunday 9 p.m. (Ralat).
YV5RI, YV5RJ, Caracas, Venezuela, 6250 kc., heard 11:30 p.m., (Ralat, Lindner), relays YV5RJ, (Atherton, Ralat). Slogan: "La Voz de La Esfera."
YV6RB, Caracas, Venezuela, 4584 meters, irregularly, (DeRuadhal).
YV5RH, Caracas, Venezuela, 6400 kc., daily at 6 p.m., (De Ruadhal, Ralat).
YV5RF, Caracas, Venezuela, 6375 kc., heard Saturday 9 p.m. (DeRuadhal, Ralat). Slogan: "La Voz del Caribe."
YV1RE, Maracaibo, Venezuela, 6040 kc., heard 6 p.m., (DeRuadhal, Hendry).
YV4RA, Valencia, Venezuela, 6520 kc., schedule, 12-1 p.m., 6-10 p.m., (from veri.), (Alfred, De Ruadhal, Kidd, Jaime, Ralat). Slogan. "La Voz de Carabobo."
YV3RC, Barquisimeto, Venezuela, 5880 kc., (Alfred, Ralat). Slogan: "La Voz de Lara."
YV1RB, Maracaibo, Venezuela, 5850 kc., daily 7:30-10:15 p.m., (Bittner) Sunday, 5 a.m.,

(Hartzell, Sesma, Eder). Slogan: "Ecos Del Zulia."

YV5RMO, Maracaibo, Venezuela, 5850 kc., heard 5-9 p.m., (McCartin.)

YV1RL, Maracaibo, Venezuela, 5930 kc., (Eder), daily 9-12 p.m., (Lopez, Beck, Jaime, Roberts). Slogan: "Radio Popular." Address: P. O. Box 247.

YV1RH, Maracaibo, Venezuela, 6370 kc., (Eder) signed at 10:45 p.m. (Unger), 8:30-11 p.m., (Schrock, Kidd). 6350 kc. (Staley, Patrick, Tate) daily 5-10 p.m., (Stabler, Unger) 11 a.m.-2 p.m., (Tolpin, Coover). Slogan: "Ondas de Lagos". Address: P. O. Box 361.

YV4RD, Caracas, Venezuela, 6300 kc., (Eder) 6270 kc., heard 10:30 p.m. (Howard, Ralat). Slogan: "La Voz de Aragua."

YV1RA, Valencia, Venezuela, 5900 kc., 8:30 p.m. (Stabler).

West Indies

HIL, Trujillo, Dominican Republic, 6500 kc., heard around 6 p.m., (DeRuadhal) heard 8 p.m. (Ralat).

HI5N, Santiago, Dominican Republic, 6135 kc., heard until 12:30 a.m., (Hartzell) 6150 kc., 9:10-10 a.m., (Sporn) heard 5-8 p.m., (Schrock).

HI7P, Trujillo, Dominican Republic, 6782 kc., 7:10-8:40 p.m., (Skinner) 6800 kc. Slogan: "Emisora Diario del Comercio."

HI9B, Trujillo, Dominican Republic, 5885 kc., changed from 6040 kc. (Birnie).

HI3X, Trujillo, Dominican Republic, 15280 kc., heard Sunday 7:30-10:55 a.m., (Sporn) daily except Sunday, 12:10-1:10 p.m., (Lopez).

HI8A, Trujillo, Dominican Republic, 6450 kc., heard 3:30 p.m. (Ralat).

HIG, Trujillo, Dominican Republic, 6280 kc., heard 5 p.m., (Ralat).

HI1S, Santiago, Dominican Republic, 6420 kc., signs at 8:45 p.m., (Alfred, Hartzell). Slogan: "La Voz d'Espanola."

HIN, Trujillo, Dominican Republic, 12450 kc., 66243 kc., daily 7-10 p.m. (Alfred, Eder, DeRuadhal, Kidd) 12480 kc. (Eder, Stabler, Willmott, Blakebrough, Jaime, Howard). Thursday and Friday, 6:30-9:30 p.m., (Blanchard) 12530 kc., (Gresham, Sesma, Chiang, Schrock, Coover).

HIT, HIV, Trujillo, Dominican Republic, 6650 kc., heard 6-8:40 p.m., (McCartin, Kidd, Eder), used call of HIV, (Atherton).

HI1X, Trujillo, Dominican Republic, 6340 kc., Sunday 7:40-10:40 a.m., Tuesday and Friday 12:10-1:10 p.m., and 8:10-10:10 p.m., all other times, 12:10-1:10 p.m., (from veri.) (Goetz, Sakely, Rabat, Brown, Blanchard, Tate, Birnie, Eder). Tuesday and Friday, 8-10-10:10 p.m., (Schrock, Sakely), Sunday 7:40-10:40 a.m., rest of week except Friday and Tuesday, 12:10-1:10 p.m., (Law, Tate, Sekach, McCartin).

HI2X, Trujillo, Dominican Republic, 11960 kc., Tuesday and Friday, 8:10-10:10 p.m., (from veri.) (Schrock, Sakely, Hartzell, Eder, Michaels, Segach, Coover).

HIZ, Trujillo, Dominican Republic, 6316 kc., heard 6:30 p.m. (Ralat).

HI3C, La Domana, Dominican Republic, 6730 kc., heard 7 p.m., (Ralat).

HI1J, San Pedro de Macoris, Dominican Republic, 5865 kc., heard 8 p.m., (Ralat) 5885 kc., heard irregularly, (Rodriguez, De Ruadhal).

HI1A, Santiago, Dominican Republic, 6185, kc., heard 9:15 p.m., (Ralat).

HI3X, Trujillo, Dominican Republic, 15270 kc., (Sakely) heard Sunday 7:30-9:30 p.m., (Michaels), 15290 kc., (Beck).

HI2D, Trujillo, Dominican Republic, 6900 kc., heard 6 p.m., (Ralatt). Slogan: "La Voz de la Accion Catolica."

HI4D, Trujillo, Dominican Republic, 6555 kc., heard Sunday 9:45 a.m. and on, (Ralat).

COCD, Havana, Cuba, 6130 kc., daily 7 to 1 a.m., (from veri.), (Frederick) 6120 kc., (McCartin) heard 2 a.m., (Becker) 11430 kc., (Hendry), Sunday 1-3 a.m., (DeRuadhal, Kidd, Duncan, Sesma, Lindner, Duncan). Slogan: "La Voz del Aire." Address: P. O. Box 2294.

COCX, Havana, Cuba, 11490 kc., clock chimes and child crying, heard 8 p.m., (McCartin, Eder, DeRuadhal) daily 4-12 p.m. on 11600 kc., (Kidd, Eder) heard on 11550 kc., (Herzog, Sesma, Coover, Goetz). Slogan: "Radio Philco."

COCH, Havana, Cuba, 9428 kc., daily 7 a.m.-12 midnight, (Bittner, McCartin, Eder, Wittig, DeRuadhal, Sesma, Wollenschlager, Kidd, Eder, Hendry, Kashimoto), (from veri.) (Goetz). Address: General Broadcasting Company, 2 B Street, Vedado, Havana.

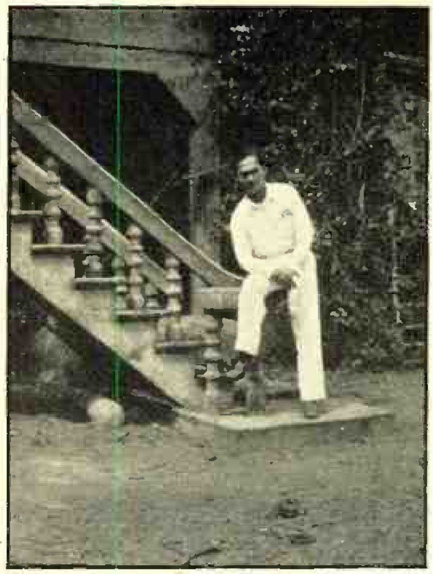
COCO, Havana, Cuba, 6010 kc., daily 6-11 p.m., (Bittner, Sesma, McCartin, Eder, DeRuadhal, Hendry, Ralat).

COCQ, Havana, Cuba, 9740 kc., daily 7 a.m.-12 midnight, (Bittner, Eder) 9750 kc., (Hendry, Law, DeRuadhal, Wollenschlager, Kidd, Eder), signs at 1 a.m., uses sounds of motor car, laugh, baby's cry, and bell and two chimes. (Sargent, Blakebrough, Sesma, Hendry, Kashimoto, Coover, Goetz).

COCA, Havana, Cuba, 11960 kc., signed Tuesday at 12 a.m. (Hartzell).

COCE, Havana, Cuba, 24.5 meters, heard also on 34 meters (Randle).

CO9XX, Tunica, Cuba, 15555 kc., heard 8:32 p.m., requests reports, (Chambers). 14660 kc., (Kentzel, Shamleffer). Address: Frank Jones, Tunica.



PHILIPPINE OBSERVER

Observer E. R. Rances of Gingoog, Oriental Misamis, poses at his door-step for this picture.

COJK, (CO9JQ), Camaguey, Cuba, 8665 kc., heard 5:30 and 8:30 p.m., relayed by CO8RQ on 14 mc., (Howard), heard 8-12 p.m., relays CMJK, requests reports (Gallagher), heard 8:55 p.m., (Chambers, Fallon, Hendry, Alfred, Nutkis), weekdays 7:45-9 p.m., (Hartzell, Schrock, Skinner, Shamleffer) 14122 kc. also. (Patrick, Hartman, Rosa). Slogan: "COJK, the Kenneth Radio Station", "Radio Zenith."

HH2S, Port-au-Prince, Haiti, 5920 kc., heard around 8:30 p.m., (DeRuadhal, Eder), daily 7-9 p.m., (Hartzell) 5.5:30 a.m., (Sporn).

HH3W, Port-au-Prince, Haita, 9640 kc., heard 7:20 p.m., (Jaime), 1-2 p.m. and 7-8 p.m., (Gossett). Address P. O. Box A-117.

HH2T, Port-au-Prince, Haiti, 11570 kc., heard 10:30 p.m., (Beck).

"Radio Suracao" CUROM, Curacao, Dutch West Indies, 5980 kc., schedule daily 6:36-8:36 p.m., (Skinner, Michaels) 9445 kc., 7:30-9:10 p.m. and irregularly. (Partner, Sakely).

FZF (?) Martinique, French West Indies, 9450 kc., no call given, schedule daily 11:30 a.m.-12:30 p.m., 6:15-7:15 a.m., 8-9 p.m., (from ann.), (Robinson, Partner, Croston).

Oceania

VK3LR, Lyndhurst, Victoria, Australia, 9580 kc. Sunday to Friday 3-8:30 a.m., Saturday 10 p.m.-8:30 a.m., (from veri.), (Alfred, Eder, Chokan, Law, Hartzell, de Ruadhal, Hendry), requests reports, (Sporn, Dressler, Sesma).

VK3ME, Melbourne, Australia, 9500 kc., signs 7 a.m. on weekdays, (Myers, Eder), 9510 kc., (Ralat), Monday to Saturday 4-7 a.m., (Immike, Lindner), daily 6-7 a.m., (Dressler, Hendry, Sesma, Sporn). Address: 47 York Street, Sydney.

VK6ME, Perth, Australia, 9590 kc., irreg. schedule, (Smith, Hodgkyns, Eder), testing 6 a.m., (Hartzell), 6-8 a.m., Monday to Saturday, no Sunday transmission, (de Ruadhal, Skipworth, Willmott, Blakebrough, Partner, Schrock). Address: Applecrass, Western Australia).

VK2ME, Sydney, Australia, 9590 kc., 10:30 p.m.-12:30 a.m., (Immicke), 9510 kc., 4:30-5:30 a.m., (de Ruadhal), 10485 kc., 6-7:30 a.m., (Stabler, Randle, Hare).

VK9MI, "Kaminbla", Australia, 49.9 meters, 6:45-7:30 a.m., three times weekly, (Schrock).

ZMBJ, "S.S. Awatea", Australia, 8845 kc., (Poll), will no longer broadcast, (Kemp).

FO8AA, Papeete, Tahiti, 7100 kc., 10:55 p.m.-12:30 p.m., (Rodriguez, Staley), Tuesday 11-12 p.m., (Sporn).

KKP, Kahuku, Hawaii, 16.030 kc., (Robinson), Saturday 9:30-10:30 p.m., also irreg. Sunday 10 p.m., (Schrock, Jordan), Saturday 8-8:30 p.m., (Kentzel, Shamleffer).

KIO, Kahuku, Hawaii, 11,680 kc., (Blanchard, Michaels, Kemp).

KOH, Kahuku, Hawaii, 14,920 kc., (Kemp).

KRO, Kahuku, Hawaii, 5840 kc., (Kemp).

VPD2, Suva, Fiji Islands, 9540 kc., daily 5:30-7 a.m. except Sunday, (Sakely), 8720 kc., (Robinson, Blakebrough), 9520 kc., (Partner).

ZLT, Wellington, New Zealand, 11,055 kc., 12:20-1:15 a.m., (Sporn).

ZLT4, (ZLT?), New Zealand, 11,050 kc., relays VLK, 4:30 a.m., (Croston).

Readers Who Are Awarded "Honorable Mention" For Their Work In Connection With This Month's Short-Wave Report

Lionel White, William Beard, P. L. Patrick.

Carl and Anne Eder, Milton Horstman, J. R. Hodgkyns, Allan B. E. Goetsch, Enrique A. O. Ziegler, W. L. Bauer, William H. Hawkins, M. J. Markuson, R. W. Hendricks, Frank Sakely, Sr., Samuel Tolpin, John W. Blecha, Jack Staley, Elmer R. Fuller, H. Westman, Clarence Hartzell, Dan T. Wollenschlager, Donald Kay Becker, R. J. Abbott, R. T. Coales, Elmer Duncan, Thomas P. Jordan, R. C. Messer, Norman Gertz, George Hare, E. J. Magrie, Walter H. Lorvig, Herman Ruppert, Earard de Ruadhal, Alfred T. Anderson, Shokichi Yoshimura, W. F. Herzog, William W. Oglesby, Jr., Norman Hendry, Wade Chambers, Charles R. Wilson, Elihu Fein, Al Donofri, C. McPherson, Robert Moss, Francis J. R. Burke, C. J. Hurtt, Thomas Randle, Wm Skinner, Robert Pierce, Jr., R. Willmott, Herman H. Forester, Harman Kidd, Oscar Westman, Leon Stabler, Albert Michaels, N. C. Smith, J. Ralat, John Tate, Fred Atherton, J. Sanders, H. Sargent, Kenneth Dressler, V. M. Poll, Fletcher W. Hartman, Irving Sporn, E. W. Turner, Robert Pinkerton, Don Parsons, Burnell Unger, Harold E. Schrock, R. F. Shamleffer, H. E. Wittig, Thomas Fallon, Jr., Ernest Law, Grace M. Beck, Bill Robinson, Harold E. Lindner, Robert L. Blanchard, Orville Brown, Armand A. Boussy, R. F. Stevens, Arthur Immicke, John S. Chokan, Jr., Earl G. Marshall, D. Skipworth, Ernest Law, D. Summers Smith, John Frederick, Simon McCartin, William R. Goetz, Daniel R. Bittner, Fred W. Alfred, Warner Howard, Charles F. Myers, J. Wendell Partner, Jose L. Lopez, Erroll R. Birnie, Yoman Hendry, Wells Gresham, Jose Rodrigues Rivas, Oscar Jaime, Jr., Thomas Randle, A. Blakebrough, E. Scala, Jr., Lester L. Wood, Arthur R. Ruiz, J. L. Mecklum, Jerome Roberts, Li Chi Chiang, Virgil Gossett, Peyton Black, A. S. Nutkis, G. C. Gallagher, Thomas W. Walczak, Thomas Black, B. Kashimoto, Ernest Kristof, Barry Sesma, Harry E. Kentzel, Paul B. Silver, Paul B. Silver, Jr.

"Philharmonic" Receiver

(Continued from page 83)

of pressure which will insure perfect contact yet permit smooth and easy tuning-control action in the finished receiver.

To further check for mechanical perfection in the operation of the tuning control, each dial and dial mechanism is mounted on a specially developed test set-up, the mechanical resistance of which is twice that of the variable condenser in the receiver. Even under this double load no slippage is tolerated as the dial is rotated throughout its entire range in both directions.

Space does not permit a description of all of the test made on other parts but the foregoing description of typical tests will convey some idea of the thoroughness with which guesswork is avoided. All of this testing is done before the parts are put in stock. It requires a good deal of time and work to make these tests but it is more economical to cull out substandard material before it goes into a built-up receiver—and likewise safer because some defects, if not caught in preliminary tests might not be evident in the operation of the completed receiver until it has been installed in the owner's home.

Strange as it may seem, there was not a single conventional tube tester in use so far as we could observe. In view of the fact that the "Philharmonic" employs thirty tubes, and in many of the circuits the tube function is extremely critical, this seemed rather odd. Yet the explanation is simple.

When tubes come in from the manufacturer, they are first put in ageing racks where they are operated for twelve hours continuously at filament voltages slightly higher than normal. Experience has shown that not only will many faulty tubes give up the ghost under these conditions, but the good tubes will be stabilized by this process. Beyond this no other preliminary tests are made on tubes because it is believed that the ultimate and conclusive test of a tube is its operation in the receiver. If, after a receiver has been assembled and wired, tests show it to operate up to standard, it is obvious that the tubes must be good. If one or more tubes is faulty, the condition will be shown up by sub-standard operation of the receiver.

The assembly and wiring of each receiver is definitely a hand operation. There are no "production lines" or anything smacking of the mass production of the usual radio factory. Everything is, of course, standardized for the sake of general efficiency and uniformity, just as is the case in the manufacture of the finest Swiss watches, for instance. But individual responsibility of the expert workers is definitely fixed, and pride or workmanship is apparent at every turn. There is none of the hustle and bustle—the forced production—of the conventional shop. Instead there is an atmosphere almost of leisure as the workers painstakingly pursue their handicraft. These are the impressions gained by an outsider visiting the construction laboratory—and that they are correct is evidenced by a glance at the records of the individual workers which show that it is not at all unusual for a man to go through an entire week of chassis wiring, for instance, without overlooking a single connection, without a "cold solder" joint or any other imperfection in the work he turns out.

When the chassis assembly and wiring has been completed it starts through a formidable series of tests. Here are the engineers who are highly specialized in their various functions of testing, aligning, adjusting audio filters, etc. The tubes are inserted in their sockets and these same tubes, used throughout the tests, are the ones that go to the owner in that receiver. After all this checking, double checking and adjustment, the receiver is apparently finished—but it is by no means ready for shipment to its owner. There is still the final "rack" test.

This "rack" test consists of placing the finished chassis and its own power supply unit in normal operation for a period of twelve hours, an hour "on," an hour "off," etc. This alternate heating and cooling represents the final effort to bring out any defect or weakness which may exist, either in tubes or other components. After this 12-hour period the receiver is removed from the rack and again goes back for test. If any of its characteristics have changed, the cause is determined and corrected and then the receiver goes through the entire series of tests again, including the 12-hour rack tests.

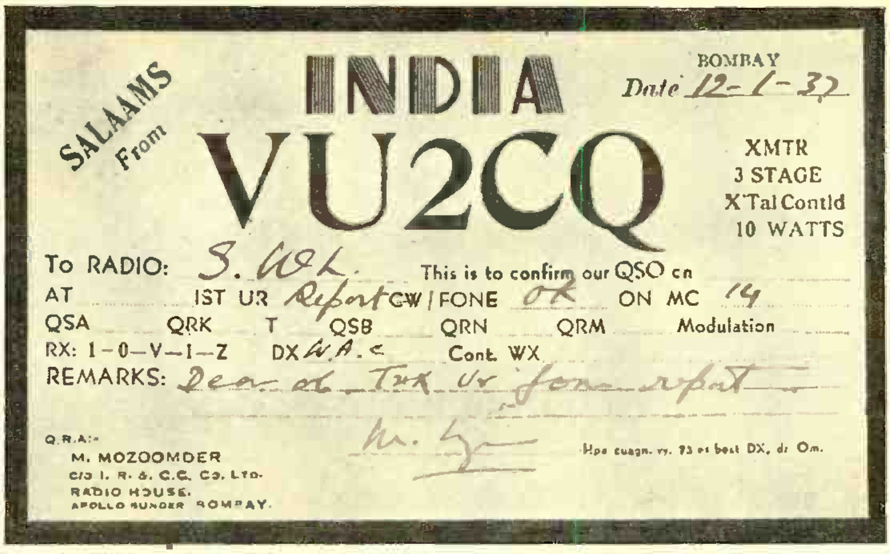
It is then—and then only—that the receiver is ready for its owner. It is as perfect as science can make it, with every possible precaution taken to insure continued perfect operation after it has been installed in the owner's home.

That is the story of this truly "laboratory-built" receiver, told in brief. Actually it goes far beyond this. No mention has been made, for instance, of the collaboration of the Scott Laboratories with tube engineers which has resulted in improving tubes to bring them up to the standard required by these laboratories—improvements which the tube manufacturers were then at liberty to incorporate in their tubes for retail sale, thus benefiting the radio industry as a whole.

Next month a second article will include a technical description of this 30-tube receiver with a record of some laboratory measurements made on it. Following that will be a report of its behavior and accomplishments during the "on the air" tests which are now being conducted by RADIO NEWS.

COMING NEXT MONTH

New Amateur Department for Calls Heard



The "Ham" Shack

(Continued from page 90)

particularly in metropolitan districts where there are many stations operating at one time. By using a good directional array it is possible to almost completely "lick" the interference problem on this band.

Our tests on 5 meters were made with half-wave antennas of types commonly used for transmission and reception. The transmitting antenna was a Johnson "Q" and the receiving aerial a vertical 8-foot rod with a single-wire feeder attached several inches from the top. The receiver used was a super-heterodyne using "acorn" tubes. The major advantage in using the transmitting antenna in this case was that ignition and other forms of electrical interference were almost completely eliminated. However, stations could be heard with the "Q" that were not audible with the other antenna.

In proportion to the improved reception obtained, the incorporation of switching apparatus in the amateur station is well worth while. The electrical system used for accomplishing the change-over from transmitting to receiving positions is governed by both the feeder system used and the amount of money available for equipment. However, at most, the cost is only a few dollars.

Simplest, of course, is a manual change-over switch—a double-pole, double-throw unit. If low impedance feeders are employed insulation is not an important factor. As a matter of fact a so-called "anti-capacity" switch may be used with a twisted pair or concentric feeder line having an impedance in the neighborhood of 72 ohms. If a 600-ohm line is used it is advisable to have greater spacing and more adequate insulation. While not a factor in the case of the matched-impedance line that is without standing waves, in the case of the tuned feeder, the switch should be as near as possible to a current note. If parallel tuning is used on such a line a high r.f. voltage might be applied across the switch necessitating good insulation to avoid high losses.

The most efficient and practical method of providing for antenna change-over is the use of a relay switch that will automatically connect the antenna to the transmitter when the plate power is applied, and to the receiver when the transmitter is switched "off." All commercial manufacturers of relays are now making special units for antenna change-over. They are available in both battery and 110 a. c. models. These units are electrically operated double-pole, double-throw switches and most of them are equipped with silver contacts so that a good connection is made. They may be mounted at the top of the transmitter or any other convenient place in the operating room. A feeder line of the same type, used to link the transmitter with the antenna, should be brought down from the relay to the receiver. The antenna-relay magnet coil may be connected in the same circuit with the plate power switch so the change-over will be virtually automatic. Usually these relays are connected so that they idle in the "receive" position and have current applied when the transmitter is in operation. However, there are other types available will "idle" in either position, it being necessary to press a button to change from either position.

If a single-wire feeder system is used, of course only a single-pole, double-throw switch will be required. However, with this type of antenna, not much improvement over long-wire antennas will be obtained. Due to the lack of cancellation in the feeder circuit, the feeder wire may be free to pick up electrical interference. As a matter of fact this type of antenna will tend to function as a Marconi type when used for reception.

One important consideration when using the transmitting antenna for reception is to provide proper coupling to the receiver. Most modern receivers are equipped for either a doublet-type antenna or a conventional "ant" and "gnd" arrangement. However, it is important to look up the impedance specifications for the "doublet" connections. Most receivers are designed to couple to a 300 or 400-ohm line, and therefore, if the transmitting antenna transmission line is of lower or higher impedance it is necessary to provide a coupling transformer. A simple unit of this type consists of a 30-turn coil wound on a 1-inch form. Taps should be provided at every five turns. If a low-impedance line is used only a small number of turns are used between the feeder wires on the coil; if a high impedance line, more turns are used. The tuning condenser will provide variability that sometimes is helpful, although when once adjusted it is not necessary to vary it for a given band.

Also there are a number of commercial, doublet, coupling transformers available for different types of antenna. Most of these are designed for coupling low-impedance lines to receiver as this type is now almost universally used for receiving doublets. Also if the receiver has no provision for a doublet antenna—merely an "ant" and "gnd" terminals—a doublet coupling transformer may be purchased. Most of these units consist of a primary and secondary. They are essential to the successful operation of a doublet antenna on receivers in this category.

If such a coupling unit is purchased it is advisable to get one equipped with a static shield between primary and secondary windings. This shield will keep out the in-phase signals and noise picked up by the line, while the out-of-phase signals picked up by the antenna itself will pass through to the receiving set.

Practically all amateurs spend much money on their receiving equipment. Common practice today is to buy commercial models. Yet, many who spend more than $100 and in some cases as much as $275 for receiving equipment, use poor aerials with them with the result they frequently are dissatisfied with the results from their "expensive" receiver that some one else recommended so highly they decided to buy one like it. Good receivers need good antennas to perform as the manufacturers claim they will. And all the commercial receivers tested by the writer in the last few years have met these performance ratings when used with a good antenna. The transmitting antenna is usually a carefully designed and cut piece of amateur equipment, so why not use it for reception too?

CALLS HEARD

By M. J. Markuson, Fitzsimons General Hospital, Denver, Colo., on 20-meter 'phone: VK2ABG, VK2HF, VK2ZC, VK3MR, VK4JU, VK4JX, VK4VD, OA4AB, OA4AK, OA4AC, OA4AQ, CE3DW, XE1LN, XE1LC, K6MTZ and K6MVV.

By H. E. Golely, 126 Collyer Avenue, Bognor Regis, Sussex, England, on 20-meter 'phone: W3FIH, W2HTO, W2IXY, W1LO, W3FIU.

By Warner Howard, 632 South Fetterly Street, Los Angeles, Calif., on 20-meter 'phone: PK3WI, PK3EB, PK1PM, PK1ZZ, PK1DX, PK1AR, PK1VM, PK3GD, KA1AP, KA1AN, KA1ER, VK3LA, VK4VD, VK4JU, VK2GU, VK2ABG, VK3MR, VK2LX, VK2ADV, VK2AT, VK2OG, VK3PL, VK3HF, VK2VV, VK4GG, VK2ZC, VK6MW, VK3RW, XU8HW, VS2OA, ZU6P, ZD1JR, LU6BV, LU1BA, LU7AD, CE3DW, HC1ABM, HK3LB, HK3RC, YV1AP, VP1WP, OA4AC, OA4AQ, OA4AK, OA4AB and SM7UC.

Wins Amateur Award

(*Continued from page* 91)

designated permanent custodian of the trophy. Under the terms of the award, the trophy will be presented annually "to that individual who, through amateur radio, in the opinion of an impartial Board of Awards, has contributed most usefully to the American people, either in research, technical development or operating achievement, and to be open to all amateur radio operators in the United States and Canada."

Mr. Stiles' heroic feat began when he received a distress message from the CCC camp's amateur station at Renovo. The town was isolated and badly in need of food, clothing and medical supplies. When wrecked telephone lines prevented relaying the message to the Governor in Harrisburg, young Stiles struck out on his own for Renovo. The local Red Cross collected supplies and a CCC truck and crew was put at the operator's disposal. The equipment of W8DPY was moved aboard and the 68-mile dirt road trip skirting the swelling river was begun. Against terrific odds of washed out bridges and landslides, temporary roads had to be cut out of the mountainsides. Yet, in less than seven hours, the truck was within five miles of the stricken town. The road ahead was washed out and Mr. Stiles plunged into the current to see if the water could be forded. Finding no bottom, he clambered out. By 5 a.m. they reached the town and a half hour later the station began flashing out its relief messages. Sleepless for two previous night, Stiles kept pounding out messages for twenty-four hours. He was in a state of nervous collapse when he was relieved by two relief operators from State College, Pa. He is modest about his feat and prefers to speak of it in terms of his transmitter's rather than his own performance.

W8DPY serves as the net control station of the Army Amateur Radio System for Pennsylvania. Mr. Stiles is technical editor of "The Mason Dixon Stradler," monthly radio publication of the Army Signal Corps. He is a railroad locomotive electrician by profession.

The talk at the presentation luncheon by FCC Chairman Prall was in tribute to all amateurs. Mr. Prall declared that the award symbolized the development and progress of a great service; a service of tremendous importance to the nation.

"The contribution of the amateurs of the radio art," he said, "is not confined to the job they do in emergency communication. Since the early days of radio, the attics and basements of thousands of ingenious amateurs have served as laboratories from which have come many valuable technical improvements."

The FCC chairman pointed out that the U. S. A. has approximately 47,000 amateurs. This number constitutes about three-fourths of the amateurs of the world, he said, and they stand ready to perform whatever service the nation might require.

"Peacetime emergencies," he said, "find them ready and competent to discharge important duties, and in the event of war this nation would again have trained personnel which would provide the most efficient communication call of any nation in the world.

"As chairman of the Federal Communications Commission, I wish to assure the 47,000 amateur radio operators of this country of our sustained interest in their problems and their continued welfare. The Commission has always maintained and I think we will continue to maintain a liberal attitude toward the amateurs. We recognize that the service they have performed and can perform in the future is one of our country's great assets. We will continue to encourage the development of the amateur movement."

In thanking Mr. Paley for the award, the young amateur remarked "I do not consider this as my reward, but a tribute to and recognition of all 'hams'."

The DX Corner (Broadcast Band)

(*Continued from page* 113)

field Avenue, Dubuque, Iowa.

Observer Glover (Ponca City, Okla.): "In a recent issue of RADIO NEWS my name was listed among the observers for Ohio. Would appreciate it if you would see that it is properly listed under Oklahoma hereafter." (This correction will most certainly be made.—Ed.) "Listeners might look for our new local station WBBZ which operates with 250 watts on 1200 kc. each night until midnight, E.S.T. KCMO, 1370 kc., .1 kw. broadcasts a special program every Sunday morning from 1 to 5 E.S.T.

Observer Hunt (Encinitas, California): "The best reception experienced during the season

(*Turn to page* 126)

WHAT'S NEW IN RADIO

WILLIAM C. DORF

(Continued from page 72)

D.C. grid voltage	80- 100 v.	250- 300 v.
Peak r.f. grid voltage	200- 220 v.	290- 320 v.
D.C. plate current	200- 200 ma.	200- 200 ma.
D.C. grid current (approx.)	15- 15 ma.	2- 1 ma.
Driving power (approx.)	45- 50 w.	45- 50 w.
Power output (approx.)	165- 200 w.	165- 200 w.

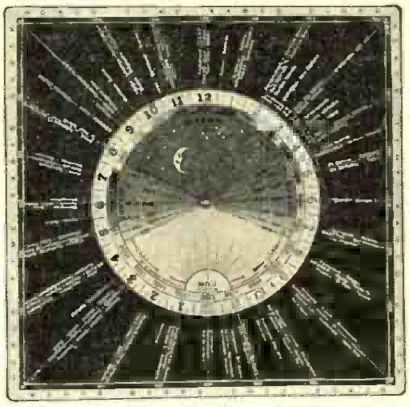
Portable P. A. System

This new portable 5-watt amplifying system a product of the Radolek Company, is particularly suitable for window demonstrations, auction sales, lectures, and all

other applications requiring sound equipment of low power. The amplifier employs a type 6F5G tube in the input high-gain circuit, a type 6B5 dual-triode tube in the output stage and a type 83 tube serves as the rectifier. Field current is provided for an 11 inch, 2,500 ohm dynamic type speaker. The complete system includes the amplifier, tubes, speakers, a double-button microphone mounted on a banquet stand, and all necessary cables and plugs.

New World Time Radio Clock

DX listeners will welcome this simple, inexpensive world-time radio clock just introduced by the Roto Calculating Devices



Company. By revolving an attractively-colored disk, it is possible to determine the correct time in other parts of the world in comparison with the time at the user's station.

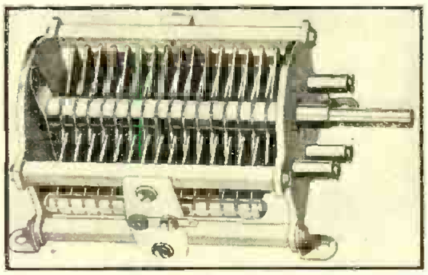
New Dial and Higher Fidelity

A preview of the new 1938 RCA radio receivers, disclosed several advances, which no doubt will receive a great deal of attention and which are in all probability an excellent indication of the trend in radio receiver design for the coming year. One of the most interesting features of the new sets is the "overseas dial" with individual tuning bands for the 49, 31, 25 and 19 meters. Super bandspread scales expand each of the four principle short-wave bands to a total range of 9½ inches. Other new developments include electric tuning with automatic frequency control

and greater perfection in tone quality. The model illustrated is the 813K employing 13 tubes and capable of providing 20 watts output power.

New Line of Variable Condensers

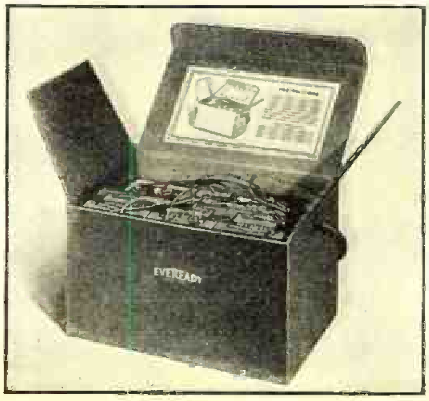
An announcement was recently received from the Hammarlund Manufacturing Company on their new series of transmit-



ting condensers. Known as the MTC series, they are available in both single and split stator units in capacities ranging from 20 to 530 mmfd., and in breakdown voltage ratings from 1000 to 6000 volts. Thorough Isolantite insulation and a silver plated Beryllium contact wiper are used for low loss. The condensers are designed for either panel or base mounting.

A Good Idea

The Eveready "B-C" battery container announced by the National Carbon Company, is made from strong, durable corrugated board and can hold three large size, heavy duty "B" batteries, such as Eveready "Super-Layerbilt" No. 386, and three 4½ volt "C" batteries. All the connections to the battery cable are made inside the



package, the cable passing through a small round hole in one end. The batteries contained in this manner add a finished appearance to the radio installation.

Powerful Portable P. A. System

Here is a compact 6-tube portable sound system manufactured by the Setchell Carlson Company, designed to deliver 25 watts of undistorted power. The amplifier em-

ploys the following type tubes: two 6F5's, one 6N7, and two 6L6's connected in push-pull in the output stage. It has input connection arrangements for 2 microphones and phonograph pick-up. The output impedance is 250 ohms.

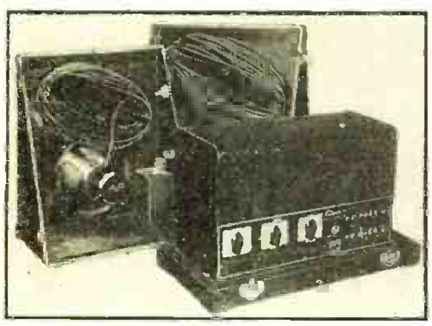
New Test Equipment

Two new test instruments have just been announced by the Radio City Products Company. The tube tester, model 306, is designed not only for present-day tubes but also to be adaptable to virtually any changes in tube engineering likely to be introduced.

The new signal generator, model 701, features a constant impedance, ladder network, 5-step attenuator giving outputs ranging from 1 microvolt to ½ volt, a direct-reading 4½ inch dial with multi-color frequency bands calibrated from 125kc. to 60 megacycles as well as other attractive specifications.

Delivers 35 Watts

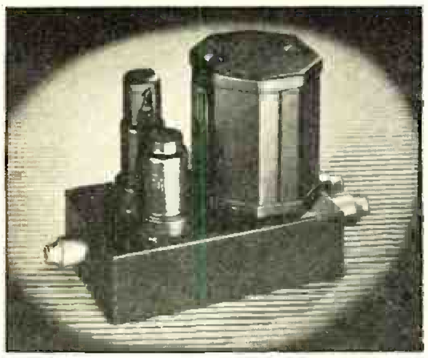
The Clarion model C55 portable sound system, manufactured by the Transformer Corp. of America, features easy installation



and operation The output circuit has provisions for the connection of additional loud-speakers. The amplifier has a rated output of 35 watts peak and it employs 8 tubes in all, including two type 6L6's which are used in the power stage.

Tiny Pre-Amplifier

The United Transformer Corp. introduces the compact preamplifier shown in the accompanying illustration. Operating voltages for the two tubes are supplied from the main amplifier. The tubes employed, comprise a type 6F5 resistance-coupled to a 6C5, and the rated gain is 60 db. The



input circuit is high impedance and the output provide universal line connections. If desired, a separate power supply is available.

Singapore, Malaya—The British Malaya Broadcasting Corp. opened its new broadcasting station on March 1, 1937. The station operates on a wave-length of 225 meters; transmissions are in English, Chinese, Malay and Tamil.

The Technical Review

(*Continued from page* 115)

My1—Service booklet. Readrite Meter Works.
My2—Folder on small motor-driven "Handee" tool. Chicago Wheel & M.g. Co.
My3—Resistor catalog. International Resistance Co.
My4—Instrument manual. Supreme Instruments Corp.
My5—D. Van Nostrand Company's general book catalog.
My6—Volume control guide. Central Radio Laboratory.
My7—Latest parts catalog. Wholesale Radio Service Co.
My8—Condenser catalog. Solar Manufacturing Company.
Je1—Circulars on power equipment. Pioneer Gen-E-Motor Corp.
Je2—Parts Catalog. Allied Radio Corp.
Je3—Radio Receiver Catalog. Modell's*
Je4—Catalog on P. A. equipment. United Sound Engineering Co.*
Je5—Tube Chart Arcturus Radio Tube Co.*
Jy1—Instrument Topics. A new folder published periodically by Clough-Brengle Co.*
Jy2—Instrument Catalog. Triplett Electrical Instrument Co.
Jy3—Catalog on industrial capacitor replacements for refrigerators, etc. Aerovox Corp.*
Jy4—Sound Equipment Guide. Wholesale Radio Service Co.
Jy5—Parts Catalog. Radolek Co.*
Jy6—Latest Catalog on accessories. Radio Corp. of America.*

Radio Hardware Catalog

A 32-page catalog listing over 2,000 different items has just been released by the American Radio Hardware Company. A few of the items included in the book are: Phone plugs, jacks and accessories, clips,

aligning tools, coil mountings with Mycalex insulation, hardware assortments, and many other products. To obtain a free copy of this catalog write to RADIO NEWS, 461 Eighth Avenue, New York City.

DX Corner

(Broadcast Band)

(*Continued from page* 123)

just closed has been that from the trans-Pacific stations. More Australians have been heard than in any previous season. Twenty-one of the JO's have been consistently received this year with JOHK being the best of the lot as usual. Have 60 verifications from 30 different Japanese stations and many reports still out."

Observer Hesterman (Saskatoon, Saskatchewan): "PRF-3 obliged with a very nice verification and a really fine photograph of the station of Sao Paulo. According to the photograph this is a beautiful modern city comparable to the best that Canada can show. With this veri received, I still can say that I have never failed to receive a verification from stations reported to."

Observer Law (Edmonton, Alberta): "A midnight frolic is broadcast by CFRN, 960 kc., .1 kw. from 2 to 3 a.m., E.S.T. and will be continued until further notice, depending on how well reports come in. All correct reports will be verified. The CBC is to build two 50 kw. transmitters, one near Montreal and one 30 miles north of Toronto. It is expected that these two stations will be in operation by October of this year. The chairman of the CBC announces that this Commission will build and control all high powered stations in Canada and has recommended to the Canadian government that all private stations be restricted to 1 kw. The Commission stations will operate 16 hours per day beginning October 1. The two 50 kw. stations mentioned above are the beginning of a trans-continental chain of high powered stations."

Observer Touvenin (Saint-Georges D'Oleron, France): "The North American stations are no longer heard except WCAU and WMAQ. The others are blanketed by the many South American stations which come in up to R9 at this season of the year. Nice Juan les Pins, 1276 kc. has been named "Radio Medítterranée". Reports for PRH2 should be addressed to the Radio Sociedade Farroupilha Ltda, rua Duque de Caxias 1304, Porto Alegre, Rio Grande do Sul, Brasil."

Observer Coales (Hampshire, England): "I like the letter from Charles Hesterman in the April issue and would like to congratulate him on his fine record of foreign reception. I now have 97 DX broadcast-band verifications, 75 of which are from the United States and Canada. The balance are from various countries including Egypt and Palestine. I find the ultra-short waves good fun. W1XAO, 8.4 meters, is heard here R9 plus. W3XES and W9XAZ are also heard here. According to in-

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formation contained in a verification received recently, the power of CMQ, 880 kc., is 20 kw. while PRE-8, 980 kc., uses a power of 80 kw. The address of this latter station, incidentally, is PRE-8, Radio Nacional, Edificio D "A Noite", 22 Andar Praca Mava, 7, Rio de Janeiro, Brazil."

Observer Jurd (Queensland, Australia): "The Postmaster General has announced Australian station changes as follows—

New Stations

4QN	Townsville, Queensland	600 kc.	7 kw.
6GF	Kalgoorlie, Western Australia	720 kc.	2 kw.
6WA	Minding, Western Australia	560 kc.	10 kw.
3LK	Lubeck, Victoria	1090 kc.	2 kw.
3WV	Horsham, Victoria	580 kc.	10 kw.

Frequency Changes

7ZL	Hobart National	590 to 620 kc.
2BH	Broken Hill, N. South Wales	1330 to 1060 kc.
2DU	Dubbo, North South Wales	1060 to 660 kc.
2MO	Gunnedah, N. South Wales	1360 to 1370 kc.
3MA	Mildura, Victoria	900 to 1360 kc.
3SH	Swan Hill, Victoria	1080 to 1130 kc.
3YB	Warrnambool, Victoria	1060 to 1210 kc.
4AY	Ayr, Queensland	1450 to 860 kc.
4MK	Mackay, Queensland	1160 to 1080 kc.
4WK	Warwick, Queensland	900 to 1360 kc.

In addition to the above 3HS of Horsham, Victoria is now off the air. 3YB and 4WK are increasing power from 50 watts to 100 watts. The new address of 5MU is: Advertiser Building, Weymouth Street, Adelaide, South Australia."

Observer Mathic (Hawkes Bay, New Zealand): "2YD, Wellington, New Zealand is a new station operating on 990 kc. It will be on the air daily from 2:30 to 5:30, E.S.T. Beginning April 25 the old 2YA transmitter, which has been remodelled and is rated at 5 kilowatts will operate as 2YC on 840 kc. V.L. King, Station Street, Waipukurau, Hawkes Bay, New Zealand would like to correspond with American listeners who are using Patterson 16-tube all-wave receivers. He owns this type and would like to compare notes with other owners."

Kenneth M. Miller (Chicago, Ill.): "Will you please put my name in the next issue stating that I would like to trade QSL cards and photos, and carry on correspondence with other DX'ers from all over the world? I DX on both the broadcast and short-wave bands." Kenneth's address is 2215 North Campbell Avenue.

Movie Sound

(Continued from page 87)

regulations prohibit anyone but a licensed operator in the projection room while the show is on. Another reason for this argument is that the operator will probably know more about the mechanical part of the equipment than will the serviceman; the operator's training has been with projection machines rather than amplifiers, and sprockets, pad rollers, and take-ups (just to mention a few of the parts) are as familiar to him as a vacuum tube is to a radio expert.

However, these remarks are not intended to guide the serviceman away from the thought of learning this phase of the game. On the contrary, it is recommended that every effort be put into learning all parts of the equipment. Many books are available and, while book knowledge leaves much to be desired from the serviceman's standpoint, good books are an invaluable aid in getting started. (See footnote.)

To return briefly to the mechanical details of the equipment, the drawing of Figure 1, provided through courtesy of the American Telephone and Telegraph company, shows one type of sound unit, that part of the equipment which is the heart of the system. Sound units vary in details, but the essential purpose and method of accomplishing this purpose are similar. Some sound units incorporate a photo-cell amplifier, particularly the older models. Other units have more parts than the one illustrated.

Knowing just when sprockets, pad rollers, tension pads and guide rollers should be renewed is a matter of experience, to be gained only by actual observation. For this reason, the suggestion, previously made, that the operator be allowed to take the responsibility for these parts should be given due consideration. Prevention of trouble from improper lubrication is also the responsibility of the operator; such breakdowns are inexcusable, a fact of which the operators are usually well aware. Overloading of the machinery comes under the same classification and, as it is so often the result of an improper line-up somewhere in the projector head, there is no reason whatever for the serviceman to become embroiled in a problem the solution of which is entirely in the hands of the operators.

When the electrical parts of the equipment enter into the picture, the situation is the exact reverse of that discussed above. Here the serviceman is, or should be, in his element and practically standing alone; very few operators have gone to the trouble of learning "what it's all about" where amplifiers, control equipment and pick up circuits are concerned.

On the assumption that 50 per cent of sound equipment troubles are electrical, 25 per cent of the total (half of all electrical faults) will be found with high line voltage as the cause. This results in blown filter condensers, short-lived tubes, and, as a secondary effect of blown condensers, open windings in the high voltage transformer. These difficulties, and their cause, seem to indicate a profitable field selling voltage regulators, but this is not the case; many theatres are equipped with regulators which are nothing more or less than tapped transformers or variable resistances. These devices, depending as they do upon the willingness and ability of the operators for satisfactory operation, are not satisfactory. Automatic regulators are not available at reasonable prices. However, if the serviceman is ingenious enough to hook up some of the radio line voltage controls—such as the Amperite—in a manner that will give control, there certainly is nothing to be lost by the venture. But, it must be remembered that sound equipment amplifiers represent a heavier load than a radio set, and it will be necessary to "cut and try" in order to obtain really satisfactory results. It might be well to point out here, that the regulator tubes have been known to blow out; the best solution is a double bank of regulators with a throw-over switch.

The foregoing constitutes a general introduction to the subject of servicing theatre sound equipment. The articles to follow in this series will consider specific procedure in considerable detail.

[1]NADELL, AARON, *Projecting Sound Pictures*. New York: McGraw-Hill Book Company.
COWAN, LESTER, *Recording Sound for Motion Pictures*, New York: McGraw-Hill Book Company.

D. C. Amplifier

(*Continued from page 89*)

The high-voltage secondary should deliver approximately 900 volts total, at 100 ma. Some leeway is permitted here and secondary voltages as low as 750 volts have been used successfully but with some sacrifice of power.

The transformer in the model amplifier was a UTC type 14552, which is a special job but still available from U. T. C. It has one 6.3 volt and two 2.5 volt filament windings. So, the first tube is a 6C6 and the output tubes 2A3's.

Another suitable transformer is the Thordarson T7550. It has three 2.5 volt windings and can be used if the input tube is changed to a 57. One of the 2.5 volt windings is not center tapped, this one may be used for the 57 and be center tapped by means of two 50 ohm resistors, or one side may be grounded.

When such high voltages are used it is imperative to employ paper condensers in the filter circuit, as specified.

The fuse lamp is an ordinary pilot light. The parts list shows several alternative types which may be used depending on the amount of light desired, where this is to function both as a fuse and a pilot light.

The photographs show the amplifier supplied with several plugs and sockets. These were provided to make quick changes when designing the amplifier. They have not been included in the diagram since the average constructor would have no need for them. So for instance, in the experimental model, the resistors R5 and R6 were mounted on a tube base, so that they could be removed and replaced by two field coils of the same resistance. There was another plug which permitted the substitution of the output transformer by another one. A third plug serves to connect the speaker to the transformer secondary, while a fourth plug is wired to a 6H6, shielded in terminal connectors and is used for connection to a tuned circuit.

The amplifier will deliver 8 watts with negligible distortion.

More Data On The Single-Ended Amplifier

Constructors making the single-ended amplifier of the May issue should change R_5 in the diagram to 0.1 megohm and R_2 to 0.4 megohm.

Some readers have had difficulty obtaining a suitable transformer. The specifications are: secondary 750-900 volt, c.t., 100 ma.; two different filament windings, both center tapped. These may be either 2.5 or 6.3-volt windings depending on whether 6-volt or 2.5-volt tubes are used. The two transformers mentioned above satisfy the requirements. Other suitable transformers are: U. T. C. Type 21647 (all 6-volt tubes), Philco 32-7430 (6-volt tubes), Kenyon C809, Kenyon K90Y (both call for one 2.5-volt and one 6-volt tube).

Parts List

C1 Cornell Dubilier tubular paper condenser, type DT-4W1, 1 mfd., 400 volts
C2 Cornell Dubilier tubular paper condenser, type DT-4P5, .5 mfd., 400 volts
C3, C4, C5, C6, Cornell Dubilier paper filter condensers, type PE-B6808, 3 mfd., 600 volts
C7, C8 Cornell Dubilier tubular paper condensers, type DT-4S5, .05 mfd., 400 volts
C9 Neutralizing condenser, mica, trimmer, 150 mmfd. maximum
CH1, CH2, UTC Filter chokes, type CS41, 10 henries, 150 ma., 95 ohms.
R1, R4, I.R.C. carbon resistors, type BT½, 500,000 ohms., ½ watt
R2 I.R.C. carbon resistors, type BT½, 1 megohm., ½ watt
R3 I.R.C. carbon resistors, type BT½, 250,000 ohms., ½ watt
R5, R6 I.R.C. wire wound resistors type DG, 3500 ohms., 20 watt
R7 I.R.C. carbon resistor, type BT1, 300,000 ohms., 1 watt
R8 I.R.C. carbon resistor, type BT1, 100,000 ohms., 1 watt
T1 U.T.C. power transformer, type CS 14552, pri.: 110 volts, 60 cycles; secondaries: 900 volts ct. 100 ma., two separate 2.5 volts windings, each 4 amp. ct., 6.3 volts, 3 amp., c.t., 5 volts, 3 amp. c.t., or equivalent.
T2 U.T.C. output transformer, type CS-13. Primary: 8000 ohms. plate-to-plate, secondary for 15, 8, 4, or 2 ohm. voice coil.
Fuse lamp: any one of the following:
3.2 volts, green bead, 350 m.a., normal light dim
6-8 volts, brown bead, 150 ma., normal light bright
6-8 volts, blue bead, 250 ma., normal light fair
6-8 volts, white bead, 540 ma., normally no light
14 volts, GE Xmas light, normal light fair
3 four-prong wafer-type sockets
1 six-prong wafer-type socket
1 tube shield
chassis
2 2A3 tubes
1 83 volt tube
1 6C6 tube
1 single pole single throw toggle switch

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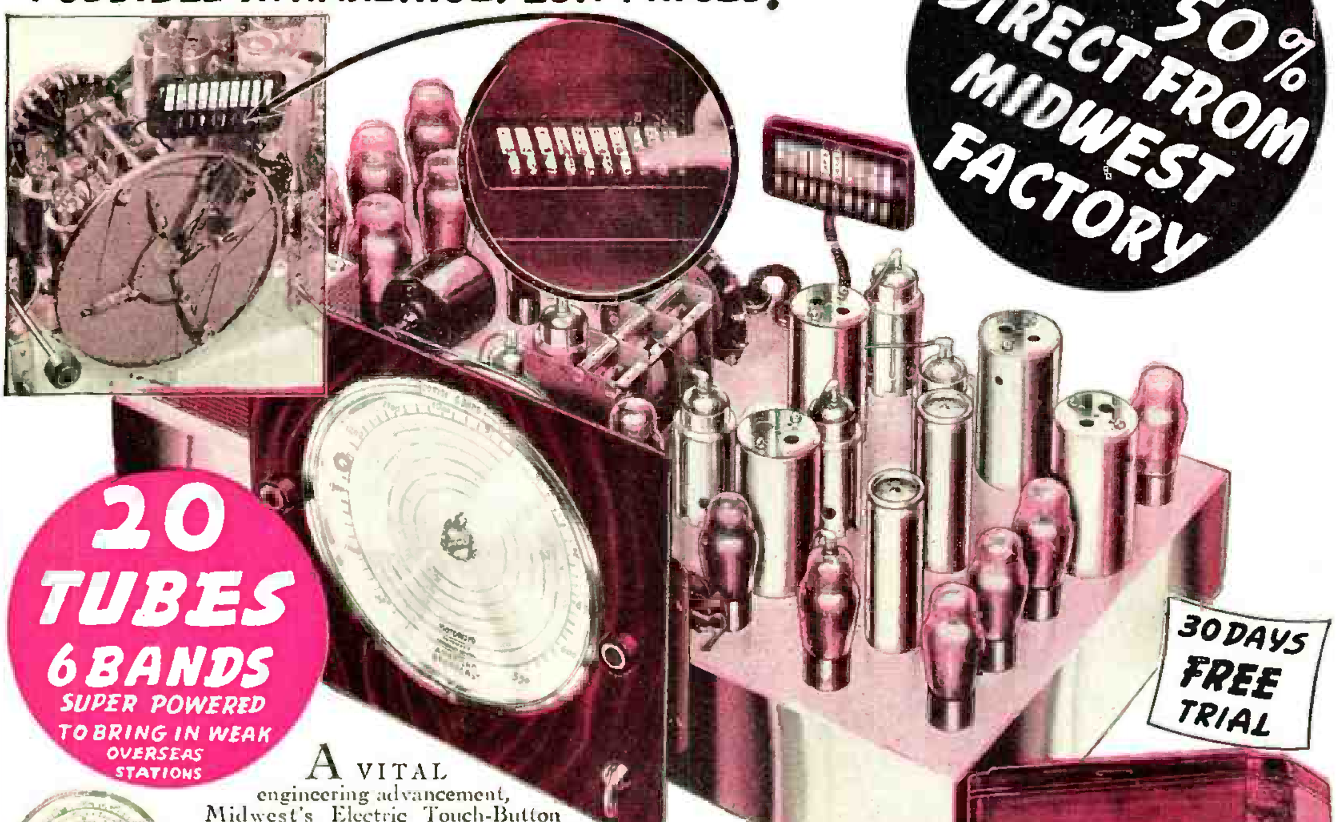

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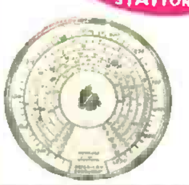

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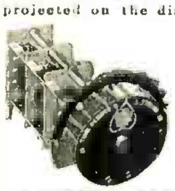

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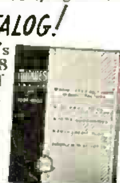

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